COMPETITION COMMISSION

Reference under section 193 of the Communications Act 2003

British Telecommunications plc v Office of Communications

Case 1180/3/3/11

Everything Everywhere Limited v Office of Communications

Case 1181/3/3/11

Hutchison 3G UK Limited v Office of Communications

Case 1182/3/3/11

Vodafone Limited v Office of Communications

Case 1183/3/3/11

and Telefónica UK Limited

Determination

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9 February 2012

Excisions in this determination marked with [✂] relate to commercially confidential information: Schedule 4, paragraph 1, to the Enterprise Act 2002

Members of the Competition Commission who conducted this appeal

Roger Witcomb *(Chairman of the Group)*

Professor John Cubbin

Roger Davis

Richard Taylor

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Chief Executive and Secretary of the Competition Commission

David Saunders

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Section 1: Introduction to the Competition Commission's Determination

Introduction

1.1 In March 2011 Ofcom published its Wholesale Mobile Voice Call Termination statement (the Statement) having conducted a market review in anticipation of the expiry of the previous mobile call termination rate (MTR) charge control and in accordance with the Communications Act 2003 (the Act). The Statement set out Ofcom's conclusions as a result of this market review.[1]

1.2 The previous price control for MTR was set in March 2007, based on long-run incremental cost plus (LRIC+). On 20 May 2009, Ofcom commenced a market review leading to the price control which is the subject of this appeal. Long-run incremental cost (LRIC) and LRIC+ based controls were two of six options on which Ofcom consulted. In April 2010, Ofcom published its second consultation, in which it proposed to regulate the termination charges of the four national mobile communications providers (MCPs) using LRIC. In November 2010, Ofcom published a further consultation on its design of the charge control which it proposed to impose upon those four MCPs. Later that month, Ofcom published a further consultation to assist its consideration of the competitive impacts of the proposals in its April 2010 consultation.

1.3 Ofcom defined a market for call termination on each of 32 'individual mobile networks'. Each market comprised the provision of services to other communications providers for the termination of voice call to UK mobile numbers for which the MCP concerned is able to set the MTR.[2] Ofcom concluded that each of those 32 MCPs had significant market power (SMP) with respect to the termination of calls to that network (ie within their allocated number ranges).[3]

1.4 Ofcom considered in the Statement the harm to consumers that arises in markets where competition does not work effectively (ie where one or more providers have SMP).

1.5 Ofcom concluded that, in the absence of regulation, MCPs would have the ability and incentive to set excessive MTRs. They said that this would result in a structure of prices in retail and wholesale markets that would then be less efficient, distort customer choice, restrict or distort competition and generate adverse distributional impacts. Ofcom did not believe that ex post competition law would be sufficient to address these problems it identified and it therefore proceeded to consider appropriate remedies.[4]

1.6 Ofcom's remedies required all 32 MCPs to provide mobile call termination services (MCT) on fair and reasonable terms, to publish their MTRs, and to give 28 days' notice of changes to their MTRs.[5] In addition Ofcom imposed on the four national MCPs[6] a requirement not to unduly discriminate in relation to the provision of MCT

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[1] These conclusions are summarized in §1.14 of the Statement.
[2] Ofcom Statement, §3.164.
[3] Ofcom Statement, §4.94.
[4] Ofcom Statement, §5.29.
[5] Ofcom Statement, §6.92.
[6] Everything Everywhere, Vodafone, Three and O2.

and a charge control in relation to MTRs.[7] Ofcom's charge control decision limited MTRs for all four national MCPs so that the maximum permitted charge for MCT reached LRIC by 1 April 2014. The MTR cap was set on a four-year glide path by setting a cap with a single maximum charge in each year after a two-month transition period.[8] This approach involved setting mobile termination rates limited to the incremental costs of providing call termination to other communications providers.

1.7 Ofcom concluded that its approach to setting this charge control best promoted efficiency and sustainable competition in the retail mobile market in the UK and conferred the greatest possible benefits on end-users of public electronic communication services.[9] Ofcom said that this approach was consistent with the European Commission's Recommendation on the regulation of Mobile Termination Rates.[10] This approach was a change from that adopted in the 2007 and previous charge controls, where Ofcom had adopted a charge control based upon LRIC+ (which included a mark-up for joint and common costs).[11]

The appeals

1.8 Appeals were brought against the decision of Ofcom contained in the Statement by Everything Everywhere Limited (EE), BT plc (BT), Hutchison 3G UK Limited (Three) and Vodafone Limited (Vodafone) before the Competition Appeal Tribunal (the Tribunal) under section 192 of the Act.[12]

1.9 On 13 June 2011 the Tribunal issued an Order which consolidated the four appeals (the MCT Appeals) and permitted the Interveners to intervene in the proceedings.

1.10 Vodafone and EE each intervened in support of the other's appeal[13] and Telefónica UK Limited (Telefónica) intervened in support of both of those appellants. Three intervened in support of BT's appeal and BT intervened in support of the appeal made by Three. Vodafone, EE and Telefónica intervened in support of Ofcom against the appeals of BT and Three, and Three and BT each intervened in support of Ofcom against the appeals of EE and Vodafone.

The appellate framework

1.11 The Act provides for a specific appellate regime for appeals relating to price controls imposed by Ofcom. It provides, in relevant part:

> **192 Appeals against decisions by OFCOM, the Secretary of State etc.**
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> ...
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> (2) A person affected by a decision to which this section applies may appeal against it to the Tribunal.

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[7] Ofcom Statement, §6.93.
[8] Ofcom Statement, §10.134.
[9] Ofcom Statement, §1.13.
[10] Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2009/396/EC).
[11] Ofcom Statement, §1.8 & fn 3.
[12] Case numbers 1180/3/3/11, 1181/3/3/11, 1182/3/3/11 and 1183/3/3/11 respectively.
[13] Vodafone did not, however, support EE's contention that Ofcom erred in its estimate of the weighted average cost of capital (WACC)—Vodafone SoI, §1.

...

(5) The notice of appeal must set out—

(a) the provision under which the decision appealed against was taken; and

(b) the grounds of appeal.

(6) The grounds of appeal must be set out in sufficient detail to indicate—

(a) to what extent (if any) the appellant contends that the decision appealed against was based on an error of fact or was wrong in law or both; and

(b) to what extent (if any) the appellant is appealing against the exercise of a discretion by OFCOM, by the Secretary of State or by another person.

193 Reference of price control matters to the Competition Commission

(1) Tribunal rules must provide in relation to appeals made under section 192(2) relating to price control that the price control matters arising in that appeal, to the extent that they are matters of a description specified in the rules, must be referred by the Tribunal to the Competition Commission for determination.

(2) Where a price control matter is referred in accordance with Tribunal rules to the Competition Commission for determination, the Commission is to determine that matter—

(a) in accordance with the provision made by the rules;

(b) in accordance with directions given to them by the Tribunal in exercise of powers conferred by the rules; and

(c) subject to the rules and any such directions, using such procedure as the Commission consider appropriate.

(3) The provision that may be made by Tribunal rules about the determination of a price control matter referred to the Competition Commission in accordance with the rules includes provision about the period within which that matter is to be determined by that Commission.

(4) Where the Competition Commission determines a price control matter in accordance with Tribunal rules, they must notify the Tribunal of the determination they have made.

(5) The notification must be given as soon as practicable after the making of the notified determination.

(6) Where a price control matter arising in an appeal is required to be referred to the Competition Commission under this section, the Tribunal, in deciding the appeal on the merits under section 195, must decide that matter in accordance with the determination of that Commission.

(7) Subsection (6) does not apply to the extent that the Tribunal decides, applying the principles applicable on an application for judicial review, that the determination of

the Competition Commission is a determination that would fall to be set aside on such an application.

…

(9) For the purposes of this section an appeal relates to price control if the matters to which the appeal relates are or include price control matters.

(10) In this section 'price control matter' means a matter relating to the imposition of any form of price control by an SMP condition the setting of which is authorised by—

(a) section 87(9);

(b) section 91; or

(c) section 93(3).

…

195 Decisions of the Tribunal

(1) The Tribunal shall dispose of an appeal under section 192(2) in accordance with this section.

(2) The Tribunal shall decide the appeal on the merits and by reference to the grounds of appeal set out in the notice of appeal.

(3) The Tribunal's decision must include a decision as to what (if any) is the appropriate action for the decision-maker to take in relation to the subject-matter of the decision under appeal.

(4) The Tribunal shall then remit the decision under appeal to the decision-maker with such directions (if any) as the Tribunal considers appropriate for giving effect to its decision.

(5) The Tribunal must not direct the decision-maker to take any action which he would not otherwise have power to take in relation to the decision under appeal.

(6) It shall be the duty of the decision-maker to comply with every direction given under subsection (4).

...

1.12 The Tribunal rules referred to in section 193 are the Competition Appeal Tribunal (Amendment and Communications Act Appeals) Rules 2004 (SI 2004 No 2068) (the 2004 Rules). The 2004 Rules provide, in relevant part:

Reference of price control matters to the Competition Commission

3.—(1) For the purposes of subsection (1) of section 193 of the Act, there is specified every price control matter falling within subsection (10) of that section which is disputed between the parties and which relates to—

(a) the principles applied in setting the condition which imposes the price control in question,

(b) the methods applied or calculations used or data used in determining that price control, or

(c) what the provisions imposing the price control which are contained in that condition should be (including at what level the price controls should be set).

…

(5) The Tribunal shall refer to the Commission for determination in accordance with section 193 of the Act and rule 5 every matter which … it decides is a specified price control matter.

…

Determination by Competition Commission of price control matters

5.—(1) Subject to any directions given by the Tribunal (which may be given at any time before the Commission have made their determination), the Commission shall determine every price control matter within four months of receipt by them of the reference.

(2) The Tribunal may give directions as to the procedure in accordance with which the Commission are to make their determination.

(3) The Tribunal may give directions under this rule of its own motion or upon the application of the Commission or of any party.

1.13 The SMP condition, which is imposed by Ofcom in the Statement and is the subject of these consolidated appeals, was imposed pursuant to sections 45 and 87(9) of the Act. Accordingly, the price control matters in the MCT Appeals fell to be referred to us for determination.

The Tribunal's reference

1.14 In the Tribunal's order entitled *Reference of Specified Price Control Matters to the Competition Commission* dated 30 June 2011 (the Reference), and pursuant to Rule 3(5) of the 2004 Rules and section 193 of the Act, the Tribunal referred to the Competition Commission (CC) for its determination the specified price control questions arising in these appeals.

1.15 The Reference required us to determine six questions regarding whether Ofcom had erred for the reasons set out in the appellants' Notices of Appeal. A final question (Question 7) asked us to include in our determination, if the answers to any of the previous questions were 'yes', clear and precise guidance as to how any such error found should be corrected and, in so far as was reasonably practicable, a determination as to any consequential adjustments to the charge controls. The Tribunal required us to determine the issues that had been referred to us on or before 9 February 2012. A copy of the Reference is at Appendix A.

The structure of our determination

1.16 Following this introduction, our determination is divided into seven sections, each dealing with the respectively numbered Reference Questions 1 to 7.

1.17 We set out the main arguments and evidence put to us by the parties and conclude with our assessment and conclusions in determining whether Ofcom has erred for any of the reasons put to us.

1.18 In the remainder of this introductory section, we address the following topics which are intended to provide the legal and broader factual context for this determination:

(a) the legal framework for the regulation of the telecommunications sector in the EU and the UK;

(b) our role, the standard of review we applied and the procedure we followed in preparing this determination; and

(c) a brief background to and outline of Ofcom's Statement against which the parties are appealing.

The legal framework for Ofcom's charge control

1.19 Regulation of the telecommunications sector takes place across Europe under what is known as the European Common Regulatory Framework (CRF). The CRF consists of a number of Directives, the most relevant of which are Directive 2002/21/EC on the common regulatory framework for electronic communications networks and services (the Framework Directive) and Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities (the Access Directive). The CRF imposes on member states the obligation to designate independent national regulatory authorities (NRAs), sets out objectives and principles that the NRAs are to be guided by in carrying out their functions, obliges them to carry out market reviews, and empowers them to impose certain obligations on undertakings with SMP including price controls. Of particular relevance to this appeal are Articles 8 and 13 of the Access Directive and Article 19 of the Framework Directive, which provide, in relevant part:

Access Directive Article 8

Imposition, amendment or withdrawal of obligations

(1) Member States shall ensure that national regulatory authorities are empowered to impose the obligations identified in Articles 9 to 13.

(2) Where an operator is designated as having significant market power on a specific market as a result of a market analysis carried out in accordance with Article 16 of Directive 2002/21/EC (Framework Directive), national regulatory authorities shall impose the obligations set out in Articles 9 to 13 of this Directive as appropriate.

Access Directive Article 13

Price control and cost accounting obligations

(1) A national regulatory authority may, in accordance with the provisions of Article 8, impose obligations relating to cost recovery and price controls, including obligations for cost orientation of prices and obligations concerning cost accounting systems, for the provision of specific types of interconnection and/or access, in situations where a market analysis indicates that a lack of effective competition means that the operator concerned might sustain prices at an excessively high level, or apply a price

squeeze, to the detriment of end-users. National regulatory authorities shall take into account the investment made by the operator and allow him a reasonable rate of return on adequate capital employed, taking into account the risks involved.

(2) National regulatory authorities shall ensure that any cost recovery mechanism or pricing methodology that is mandated serves to promote efficiency and sustainable competition and maximise consumer benefits. In this regard national regulatory authorities may also take account of prices available in comparable competitive markets.

Framework Directive Article 19

Harmonisation procedures

1. Where the Commission, acting in accordance with the procedure referred to in Article 22(2), issues recommendations to Member States on the harmonised application of the provisions in this Directive and the Specific Directives in order to further the achievement of the objectives set out in Article 8, Member States shall ensure that national regulatory authorities take the utmost account of those recommendations in carrying out their tasks. Where a national regulatory authority chooses not to follow a recommendation, it shall inform the Commission giving the reasoning for its position.

1.20 The UK's NRA is Ofcom and the CRF was implemented in the UK by the Act, in which the powers and duties set out in the Directives are reflected. The Act, in line with the CRF, imposes general duties and objectives upon Ofcom. These include, in section 3, duties to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition. Section 4 imposes certain duties on Ofcom for the purpose of fulfilling EC obligations, which, in so far as are relevant, include a requirement to promote competition in relation to the provision of electronic communications networks and services, an obligation to encourage the provision of network service and interoperability for the purpose of securing efficient investment and innovation, and a requirement to take account of the desirability of it carrying out its functions in a manner which, so far as practicable, does not favour one form of electronic communications network, service or associated facility over another or one means of providing or making available such a network, service or facility over another. The Act also requires that Ofcom has regard, in so far as it considers relevant in the circumstances, to the position of a number of categories of consumer, specifically those in need of special protection,[14] people with disabilities, the elderly and those on low incomes,[15] and the different interests of persons in the different parts of the UK, of the different ethnic communities and of persons living in rural and in urban areas.[16]

1.21 Additionally Article 19 of the Framework Directive is reflected in section 79 of the Act which provides that Ofcom must take due account of all applicable guidelines and recommendations which have been issued by the European Commission in pursuance of the provisions of an EU instrument; and relate to market identification and analysis.

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[14] Section 3(4)(h).
[15] Section 3(4)(i).
[16] Section 3(4)(l).

1.22 Section 45 of the Act provides Ofcom with the power to set binding conditions, including SMP conditions (contained in sections 87 to 93). An SMP condition can be applied to a communications provider that Ofcom has determined as having SMP in a specific market (sections 46(7)–(8)), but only if Ofcom is satisfied that the tests found in section 47 are met. Section 47 provides that Ofcom must not set a condition unless Ofcom is satisfied that the condition is objectively justifiable, not unduly discriminatory, proportionate, and transparent.

1.23 Section 87(9) gives Ofcom the specific power to set SMP conditions that impose price controls. The imposition of price controls is subject to section 88, which provides, in relevant part:

88 Conditions about network access pricing etc

(1) OFCOM are not to set an SMP condition falling within section 87(9) except where—

(a) it appears to them from the market analysis carried out for the purpose of setting that condition that there is a relevant risk of adverse effects arising from price distortion; and

(b) it appears to them that the setting of the condition is appropriate for the purposes of—

(i) promoting efficiency;

(ii) promoting sustainable competition; and

(iii) conferring the greatest possible benefits on the end-users of public electronic communications services.

(2) In setting an SMP condition falling within section 87(9), OFCOM must take account of the extent of the investment in the matters to which the condition relates of the person to whom it is to apply.

1.24 EC Recommendation 2009/396/EC on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (the Recommendation) was made under Article 19(1) of the Framework Directive. In the Statement Ofcom said that the Recommendation was relevant to the MCT market review, and that, therefore, it must have regard to it in determining its proposals. It stated that in doing so, it must take account of both the course of action it recommended in relation to setting charge control and cost accounting obligations, and its harmonizing objective or intent.[17]

1.25 We have had regard, in relation to each allegation of error as well as in relation to our overall conclusions, to the CRF and the domestic provisions implementing it. We consider our conclusions to be consistent with the legal framework.

[17] Ofcom Statement, §2.71.

Our role

The standard of review

1.26 In our determinations of the price control reference in *Cable & Wireless UK v Office of Communications*[18] and the consolidated 2009 Calls to Mobiles Appeals[19] we considered the nature of our appellate function under the Act. In this determination we have followed the same approach as in those cases, in particular as set out in paragraphs 1.30 to 1.33 of the Calls to Mobiles Appeals determination:[20]

> 1.30 Section 195(2) of the 2003 Act provides for an appeal on the merits. Section 192(6) shows that appeals can be brought on the basis of errors of fact or law or against the exercise of a discretion. The Tribunal interpreted its role under a section 192 appeal as being one of a specialist court designed to be able to scrutinize the detail of regulatory decisions in a profound and rigorous manner. In our view, our role in determining the specified price control matters that have been referred to us is similar. We note that this is the role that appears to have been contemplated for us by the Tribunal in its Reference Ruling and in the wording of the Reference itself (reference question 8 in particular).
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> 1.31 We also note that the wording of rule 3 of the 2004 Rules envisages a determination of disputes that relate to the principles or methods applied or the calculations or data used in determining a price control, as well as disputes that relate to what the provisions imposing the price control should be including at what level the price control should be set. That also suggests a rigorous and detailed examination of the price control matters subject to appeal.
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> 1.32 We have carried out that examination with the purpose of determining whether Ofcom erred for any of the specific reasons put forward by the parties. In determining whether it did so err, we have not held Ofcom to be wrong simply because we considered there to be some error in its reasoning on a particular point—the error in reasoning must have been of sufficient importance to vitiate Ofcom's decision on the point in whole or in part.
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> 1.33 We have also kept in mind the point made by the Interveners that Ofcom is a specialist regulator whose judgement should not be readily dismissed. Where a ground of appeal relates to a claim that Ofcom has made a factual error or an error of calculation, it may be relatively straightforward to determine whether it is well founded. Where, on the other hand, a ground of appeal relates to the broader principles adopted or to an alleged error in the exercise of a discretion, the matter may not be so clear. In a case where there were a number of alternative solutions to a regulatory

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[18] Determination, Case 1112/3/3/09, 30 June 2010.
[19] *Hutchison 3G UK Limited v Office of Communications* (Case 1083/3/3/07) and *British Telecommunications plc v Office of Communications* (Case 1085/3/3/07).
[20] *Mobile phone wholesale voice termination charges determination*, notified to the Tribunal on 16 January 2009.

> problem with little to choose between them, we do not think it would be right for us to determine that Ofcom erred simply because it took a course other than the one that we would have taken. On the other hand, if, out of the alternative options, some clearly had more merit than others, it may more easily be said that Ofcom erred if it chose an inferior solution. Which category a particular choice falls within can necessarily only be decided on a case-by-case basis.

1.27 The appellants have noted in their challenges the standard of review set out in the decision in *Hutchison 3G UK Ltd v Ofcom*.[21] It is clear from the Hutchison 3G case that the appeal regime set out in sections 192 to 195 of the Act provides for profound and rigorous scrutiny of Ofcom's decisions. The Tribunal stated that: 'The question for the Tribunal is not whether the decision to impose a price control was within the range of reasonable responses but whether the decision was the right one.'[22]

1.28 Vodafone cited *TalkTalk Telecom Group plc v Ofcom.*[23] The Tribunal's judgment, published in January of this year, in the non-price-control matters in relation to Ofcom's 2011 Wholesale Broadband Access charge control decision, as authority for the proposition that the Tribunal (and, hence, the CC) should proceed on the basis that an appeal must succeed if it showed that Ofcom reached the wrong decision or that, in reaching its decision, it applied a methodology which was so unsound as to create a real risk that the decision was wrong. We agree that the proposition largely accords with the matters considered in the Tribunal's judgment in the Wholesale Broadband Access non-price-control judgment. We note, however, that the 'methodology' to which Vodafone refers is in fact the point of process taken in appeal by TalkTalk, rather than the analytical methodology which is subject to scrutiny in the context of these MCT Appeals. Our approach to this analytical methodology is as set out in the principles enunciated below.

1.29 The Tribunal in *TalkTalk* specifically noted (at [73] and [74]) that the proposition in *Hutchison 3G* to which we refer above must be read with two further statements from the *T-Mobile* case in mind:

> ... First, Jacob LJ in T-Mobile (UK) Limited v Office of Communications [2008] EWCA Civ 1373 made absolutely clear that the section 192 appeal process is not intended to duplicate, still less, usurp, the functions of the regulator. In paragraph 31, he stated:
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> After all it is inconceivable that Article 4 [of the Framework Directive], in requiring an appeal which can duly take into account the merits, requires Member States to have in effect a fully equipped duplicate regulatory body waiting in the wings just for appeals. What is called for is an appeal body and no more, a body which can look into whether the regulator has got something materially wrong. That may be very difficult if all that is impugned is an overall value judgment based upon competing commercial considerations in the context of a public policy decision.

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[21] [2008] CAT 11.
[22] *Hutchison 3G UK Ltd v Ofcom,* §164.
[23] [2012] CAT 1 at §§75 & 76 as cited, it appears to us that §78 offers greater support for this proposition.

> Secondly, and following on from this point, in T-Mobile (UK) Limited v Office of Communications [2008] CAT 12, the Tribunal noted (at paragraph 82):
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> It is also common ground that there may, in relation to any particular dispute, be a number of different approaches which OFCOM could reasonably adopt in arriving at its determination. There may well be no single "right answer" to the dispute. To that extent, the Tribunal may, whilst still conducting a merits review of the decision, be slow to overturn a decision which is arrived at by an appropriate methodology even if the dissatisfied party can suggest other ways of approaching the case which would also have been reasonable and which might have resulted in a resolution more favourable to its cause.

1.30 Vodafone also put to us that due to the *ex ante* nature of its analysis and the significance of the decision, Ofcom should be held to the highest standards of care and attention so far as related to its assessment of the pros and cons of different costing methodologies (LRIC+ v LRIC) and to the modelling of mobile network costs.[24] We note the principles in the case law that Vodafone offers in support of this proposition. However, the present appeal requires us to conduct a review on the merits and these principles and those set out above must be addressed in the context of the nature of the question that we must answer under the Tribunal's reference and, necessarily, the nature of the task that Ofcom was performing in the exercise of its functions under the Act. We have been concerned with conducting a rigorous assessment of the matters subject to appeal to determine whether Ofcom erred.

1.31 The parties acknowledged that the role of the CC is to apply profound and rigorous scrutiny to Ofcom's decision. However, Ofcom suggested that the appeals are '...at their core, challenges to Ofcom's regulatory judgement',[25] and set out the principles that it considered should apply in these circumstances. Vodafone challenged this approach, which it described as Ofcom seeking to 'elide the difference between a merits review and judicial review proceedings'.

1.32 The role of the CC is to establish whether Ofcom erred on the merits. We have therefore assessed whether the decision that Ofcom took was correct on the basis of the material in the Statement and the parties' pleadings, including the Defence. We do not believe that the Tribunal's reference or the parties' grounds require us to conduct a principled assessment of the adequacy of reasoning as a basis for error in its own right.

1.33 We have carried out our examination, in respect of Reference Questions 1 to 6, with the purpose of determining whether Ofcom erred for any of the specific reasons put forward by the parties. In determining whether it did so err, we have not held Ofcom to be wrong simply because we considered there to be some mistake in its reasoning on a particular point—the error in reasoning must have been of sufficient importance to vitiate Ofcom's decision on the point in whole or in part. This is the standard set out in paragraph 1.32 of the MCT Determination and we believe it to be the appropriate approach to the matters at issue in these MCT Appeals.

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[24] Vodafone cites *Hutchison 3G UK Limited v Ofcom* [2005] CAT 39 in relation to the need for rigour in prospective analysis and *Tesco v. Competition Commission* [2009] CAT 6 in relation to the significance of the regulatory decision.
[25] Ofcom Defence, §31.

Our procedure

1.34 In April 2011 the CC published its Guidelines to the procedure and conduct of appeals made under the Act.[26] The CC has followed these guidelines during the conduct of the MCT Appeals and has adopted a procedure which, in our view, was suited to the nature of our task. In our First Day Letter of 6 July 2011, we indicated that we would adopt the confidentiality ring established by the Tribunal on 25 May 2011 (and subsequently amended on several occasions). We received financial models used by Ofcom in setting the price control. Ofcom provided an explanation of some of these models in a meeting with Ofcom (attended by all parties). We received written submissions and evidence from the parties, held both plenary and bilateral hearings, issued requests (copied to all parties) where we considered we needed further information, and issued provisional determinations for comment.[27]

1.35 While we have carefully considered all the submissions and evidence received from each party, it would not be practicable to refer to or summarize all of that material in this determination. Instead, in the sections that follow, we have attempted to refer to what we considered to be the key submissions and pieces of evidence in relation to each of the points we considered.

1.36 As regards the comments we received from the parties in relation to our provisional determination of certain reference questions, we have in a few instances addressed particular comments separately as part of our final determination. We have done so only where we considered that the comment or the context warranted a specific response. Generally, we considered carefully the parties' comments on our provisional determination and formulated our final determination of the Reference Questions accordingly.

1.37 In our Determination in Cable & Wireless UK v Ofcom[28] we set out our view that parties should only provide submissions or evidence when required or permitted under the applicable Tribunal Rules or when solicited by us as part of our procedure or, exceptionally, when permitted by us following receipt of a reasoned request that submissions be made or evidence be admitted at some other time.[29] This, indeed, is the approach endorsed by the Tribunal in *Hutchison 3G v Ofcom.*[30]

1.38 There were a number of occasions upon which parties produced unsolicited argument and evidence. We find this unhelpful and undesirable, and it has the potential to frustrate the orderly determination of the Tribunal's reference. We have therefore considered the principle set out in paragraph 136 above and the manner in which the material was produced in deciding how much weight, if any, to accord the material.

1.39 Additionally there have been a number of disputes over the admissibility of material in the course of our determination of these appeals. On 30 September, Ofcom wrote to us contesting the admissibility of the ICM Survey adduced with Vodafone's Notice

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[26] *CC13 Price control appeals under section 193 of the Communications Act 2003: Competition Commission Guidelines,* April 2011.
[27] Our provisional determinations of Reference Questions 2–6 were issued on 14 December 2012 with a Remedies Letter requesting parties' submissions in relation to Reference Question 7. The provisional determination of Reference Question 1 was issued on 21 December 2012.
[28] Case No 1112/3/3/09.
[29] Cable & Wireless UK v Ofcom, §1.52.
[30] [2008] CAT 10 at [114]–[116].

of Appeal (NoA)[31] and on 3 October we wrote to parties advising them to apply to the Tribunal for a direction. On 7 October, Vodafone applied to the Tribunal for a direction in this matter. On 17 October 2011, the Tribunal issued a direction directing the admission of the ICM Survey.

1.40 Ofcom, in its Core Submission (26 September), questioned the admissibility of a witness statement by Mr van der Ham adduced with Vodafone's Statement of Intervention for Ofcom, on the basis the statement covered points raised in Vodafone's own appeal and not in the BT appeal under the auspices of which it was introduced. On 3 October, we invited Vodafone to comment on whether this statement should be excluded in part or in its entirety. On 6 October both Ofcom and Vodafone wrote with reasons as to why it should be admitted or not admitted respectively. On 17 October we wrote to all parties setting out the reasons that we would consider the statement in relation to Reference Questions 4 and 5 but would not consider its contents as support for Vodafone's pleadings under Reference Questions 1, 2 and 3.

1.41 On 14 October 2011 both Ofcom and Three wrote to the CC to object to various pieces of evidence adduced with the parties' core submissions. On 28 October 2011 we wrote to the parties to indicate how we intended to address the challenges to the admissibility of material submitted with the parties' Core Submissions. We noted the complexity of these appeals, the challenging timetable and our commitment to the provision of a provisional determination. We considered that further diversion of our attention to debates over admissibility was likely to be costly and time consuming for ourselves, the Tribunal and the parties. We therefore took the objections into account when considering the weight to give particular pieces of evidence. Parties saw our detailed assessment of their arguments and evidence in the provisional determinations issued in December 2011.

Preliminary matters

1.42 Our provisional determination and the parties' submissions in this regard raised two questions that we consider it helpful to discuss here in this Introduction:

(1) Whether, in arguing that Ofcom erred, Vodafone can rely on alleged deficiencies in the calculation of certain inputs into Ofcom's LRIC+ model in circumstances where the relevant particulars of those allegations were only set out in a witness statement to which Vodafone refers in its NoA and not in the NoA itself.

(2) Whether, even if Vodafone could rely on those allegations in demonstrating deficiencies in Ofcom's LRIC+ model and we found that those allegations were well founded in the context of Reference Question 3 (which addresses alleged deficiencies in the LRIC+ model), such a finding of error would justify adjusting the same inputs into Ofcom's LRIC model in circumstances where:

(a) no error in the LRIC model was alleged expressly in the context of Reference Question 3; and

[31] [2011] CAT 31.

(b) no complaint was made about these alleged erroneous inputs in the context of Reference Question 2 (which addresses alleged deficiencies in the LRIC model).

1.43 We set out in the following paragraphs of this Introduction our decision regarding these two questions, and cross-refer to these paragraphs when we come to consider Reference Questions 2 and 3 later in this Determination.

Whether Vodafone can rely on allegations set out in a witness statement rather than its NoA

1.44 In its skeleton for the remedies hearing on 10 January 2012,[32] Three referred to our provisional finding of errors in respect of the busy/day week split and historic datacard market share, but noted that those errors were not in fact mentioned in Vodafone's grounds of appeal set out in its NoA. Rather, they were alleged in the witness statement of Mr Howard Roche.[33]

1.45 Consequently, Three argued that Vodafone had not properly pleaded the busy day/week split or the historic datacard market share errors and, so, could not rely on any such error in arguing for a remedy before us or the Tribunal. In support of this contention, Three referred to section 195(2) of the Act, which we have cited earlier in this Introduction at paragraph 1.11 above, emphasizing that our determination is to be made by reference to the grounds of appeal set out in the notice(s) of appeal. Three argued that witness statements served with an NoA ought to support the pleaded points but were not themselves pleadings or part of the pleadings, citing *Hutchison 3G UK Ltd v Ofcom* [2008] CAT 10 at [86] as authority for this proposition. In its oral submissions at the remedies hearing, Three confirmed that it maintained this criticism of Vodafone's pleading.[34] Three added that it was entirely unclear what point was being made by Vodafone in its NoA.

1.46 In their oral submissions at the remedies hearing, each of Vodafone, EE and Telefónica argued that the two errors in question were properly pleaded by Vodafone.[35] A large part of their submissions on this issue was directed at the second of the two questions noted above, ie they proceeded on the assumption that the two errors were properly pleaded for the purposes of Reference Question 3 and focused on explaining how Vodafone had also intended its criticisms of Ofcom's approach to the busy day/week split and historic datacard market share to apply to the LRIC model as well. We consider those submissions below in the context of our discussion of that second question. But first we note their arguments in respect of, and then proceed to consider, this first, and logically prior, question.

1.47 Vodafone argued that the case of *Hutchison 3G v Ofcom* was not particularly on point in the present case for two reasons: first, because Vodafone argued that its pleading was clear anyway; and, secondly, because the case concerned a situation in which the appellant was seeking to supplement its original NoA and evidence by introducing new evidence and arguments and trying unsuccessfully to use that new material to supplement matters pleaded in the original NoA. Vodafone noted that,

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[32] Three's written submission for the remedies hearing, 5 January 2012, §§14 to 16.
[33] Vodafone NoA, W/S Roche, §§3.29–3.35 & §§3.41–3.46.
[34] Remedies hearing transcript, 10 January 2012, p43, line10, p44, line 2 and p65, lines 9 to 13.
[35] For Vodafone's arguments, see p15, line7 to p16, line 7 and p55, line 1 to p56, line 15 of the transcript. For EE's arguments, see p29, lines 6 to 22. For Telefónica's brief statement of support, see p35, lines 7 to 9.

had the appellant been permitted to introduce new arguments and evidence in this way, there would have been a serious detriment to other parties who would not have realized that the new points were in issue and were matters to which they should have responded. Vodafone also noted that there was no suggestion of prejudice in the present case because all the arguments were deployed in the original material. Vodafone further noted that there had been no suggestion that its arguments would have been answered differently with additional argument or evidence had it been thought that the arguments went to LRIC (rather than LRIC+).[36]

1.48 EE invited us to take a pragmatic stance, arguing that it was standard practice to incorporate points in witness evidence by express reference rather than by copying them out into notices of appeal or summarising them in said notices in detail. EE explained that this was done for good reason, because, if the parties had not done so, all of their written submissions would have been even longer than they were. EE suggested that this would have been an outcome that the Commission would not have welcomed in the present or future cases.[37]

1.49 In light of these submissions, we have carefully considered the Tribunal's judgment in *Hutchison 3G Limited v Ofcom* [2008] CAT 10, and in particular the Tribunal's finding at [86] that: '... it is unsatisfactory for an appellant to plead an unparticularized statement ... and simply cross refer to a witness statement as particulars. The witness statement is intended to provide evidence in support of matters pleaded, it is not the pleading itself'.

1.50 We accept that, as Vodafone observed in its submissions, the judgment generally concerned the argument that Three's supplemental pleadings and evidence constituted new material and the Tribunal broadly accepted that it would have been prejudicial to the other parties to permit Three to amend its pleadings to include new allegations at that stage of those proceedings: see, for example, [46] to [49]. It was in that context that the issue of prejudice to other parties arose in that case.

1.51 However, we note that the Tribunal in that case expressed itself in general terms in paragraph 86 of *Hutchison 3G v Ofcom* and regard the Tribunal's statement to be a statement of general application, which can and should be understood independently of the broader issues in that case.

1.52 Indeed, the principle expressed by the Tribunal does not strike us as a controversial one: it accords with a basic understanding of the principled distinction between pleadings and evidence. We acknowledge that, under the present jurisdiction, a party's written evidence is to be annexed to its NoA when it is sent to the Tribunal: see rule 8(6)(b) of the Tribunal's 2003 Rules[38] ('the 2003 Rules') . In this respect, it could be said that the relationship between pleadings and evidence is different from that in traditional civil proceedings. But we note that, when invited by counsel for Three in *Hutchison 3G v Ofcom* to accept, because an NoA under this jurisdiction comprises 'both the notice of appeal and the supporting evidence', that the case 'has to be seen as a whole', the Tribunal rejected that argument: see [136] and [137] of that judgment. This tends to reinforce our view that the Tribunal intended the principle at [86] to be one of general application.

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[36] Vodafone transcript, p55, line 23 to p56, line 15.
[37] EE transcript, p29, lines16–22.
[38] (SI 2003/1372).

1.53 Accordingly, we have reviewed Vodafone's pleadings with this point of principle in mind. We have therefore asked whether Vodafone made an unparticularized statement and simply cross-referred to a witness statement as particulars. Reference Question 3 refers us to paragraphs 20A and 58 to 62 of Vodafone's NoA. Paragraph 20A sets out the first general ground of Vodafone's appeal—Ground A—including the general criticism relevant to Reference Question 3, ie that 'Ofcom's calculation of the LRIC+ price ... was incorrect'. Vodafone does not particularize its allegation there. Instead, paragraphs 59 to 62 elaborate on this general allegation.

1.54 Our analysis focuses on paragraph 59 of Vodafone's NoA which we have included below:

> 59 In this part of its appeal, Vodafone relies on the accompanying report of Mr Howard Roche entitled "Commentary on Ofcom's use of the network costing model to derive a cost for the provision of the MCT service". As Mr Roche shows in Section 3 of his report, the Ofcom model is deficient, for the purposes of calculating a robust measure of the LRIC + cost of the MCT service, in the following respects:
>
> 59.1 It overestimates the volumes of datacard services to be provided over the price control period, and the costs of providing such services, with the result that too much of the total network costs is allocated to data services, and too little to voice services (including the MCT service).
>
> 59.2 It uses inappropriate cost drivers, which fail to recognise the relative extents to which voice and data services consume network and spectrum resources. In consequence, too little of the cost of network and spectrum assets is allocated to the MCT service.
>
> 59.3 The model deals incorrectly with the recovery of costs associated with 3G/2G servers, a new asset class which has been introduced into the Ofcom model in the course of the present market review.
>
> 59.4 The model deals incorrectly with the assets employed in providing 2G and 3G coverage, including in respect of area coverage, coverage radii and utilisation.
>
> 59.5 The model fails to take account of the likely migration profile of traffic from the 2G to the 3G network.
>
> 59.6 The model fails to deal correctly with voicemail, a newly-modelled service, supported by new assets, introduced into the Ofcom model in the course of the present market review.

1.55 Section 3 of Mr Roche's report then contains headings dealing with each of the sub-paragraphs listed above. Under the heading of Data service Mr Roche states:

> 3.6 There are several components to the error in respect of data services. These arise from the fact that growth of data traffic since the March 2007 model has not been properly addressed in the current Ofcom Model. The individual components of the error relate

> to: estimates of future datacard growth, the statement of historic datacard growth, the different profile of data traffic across the week from the profile of voice traffic, and the need to reflect the future deployment of faster and less resource intensive HSDPA variants.

The remainder of this material under this heading is broken down into further subheadings dealing with each of these 'components'. Notably none of these components is reflected in sub-paragraph 59.1. In addition, it is clear that points 59.2 to 59.6 themselves vary in the degree to which they particularize the actual nature of the error alleged of Ofcom.

1.56 Consequently, we can see that there is some force in Three's contention that, on the face of Vodafone's NoA, the proper particulars of the claim that Ofcom overestimated the volumes of datacard services to be provided were not sufficiently clear. It may be argued that, since Mr Roche's report clearly advances separate allegations of four particular deficiencies in relation to datacard services, each of these alleged errors should have been particularized in Vodafone's NoA, albeit that the alleged consequence of each of the points supports the more general allegation that the volumes of datacard services were overestimated in the LRIC+ model.

1.57 For the avoidance of doubt, we do not believe a party needs to copy out its detailed evidence into, or even to summarize its evidence in detail in, its NoA. Indeed, we would strongly deprecate such an approach to pleading, and do not anticipate that this is what the Tribunal intended in taking the stance it did in *Hutchison 3G v Ofcom* at [86]. Contrary to what EE suggested in its submissions, such an approach would not be the only or the sensible alternative to the approach adopted by Vodafone in the present case.

1.58 Rather, the parties should include proper particulars of the matters alleged in its NoA so that its grounds of appeal are set out in sufficient detail to indicate *(a)* to what extent (if any) the appellant contends that the decision appealed against was based on an error of fact or was wrong in law or both; and *(b)* to what extent (if any) the appellant is appealing against the exercise of a discretion by Ofcom (or another relevant person), as clearly required by the Act: see section 192(6).

1.59 In the present case, it would have been open to Vodafone to have referred expressly to alleged deficiencies in respect of each of estimates of future datacard growth, the statement of historic datacard growth, the different profile of data traffic across the week from the profile of voice traffic, and the need to reflect the future deployment of faster and less resource-intensive HSDPA variants within paragraph 59.1. An example of how this might be done is found in 59.4 where the relevant particulars include the limbs of the alleged error which Mr Roche then details under separate sub-headings in his report. To have done so would not have significantly extended Vodafone's pleadings. But it would have made clear to the other parties and to the Tribunal and, indeed, to us on the face of its NoA exactly what alleged errors were. For whatever reason, Vodafone did not do so.

1.60 However, we are mindful of the fact that Vodafone, EE and Telefónica have expressed the contrary view. We anticipate that one or more of those parties may seek to persuade the Tribunal that our understanding of what was said in *Hutchison 3G v Ofcom* at [86], as set out in the foregoing paragraphs, is wrong. It would be inefficient and undesirable, particularly given the need expressed by all parties from the outset of these proceedings for an urgent resolution of the matters raised in these appeals, for the Tribunal to have to refer Reference Question 3 back to us for a

supplementary determination, were the Tribunal to disagree with our analysis of its intention in *Hutchison 3G v Ofcom*. We note in addition that it is not our belief that this issue with Vodafone's pleadings resulted in prejudice to any of the parties.

1.61 Accordingly, we have included in our discussion of Reference Question 3 an assessment of each of the alleged errors set out in Mr Roche's witness statement, while not deciding conclusively whether they were properly particularized in Vodafone's NoA and therefore matters falling within the scope of the reasons advanced to support the allegation we are asked to determine in Reference Question 3.

Whether a finding of error in relation to Reference Question 3 would justify adjusting Ofcom's LRIC model

1.62 In our assessment of Reference Question 2, which concerned alleged deficiencies to the LRIC model, we do not find that the appeals should be upheld on any of the points set out in the relevant paragraphs of the appellants' Notices of Appeal and we conclude that Ofcom did not err in determining the level of the charge control based upon LRIC (see paragraph 3.992).

1.63 In a letter to the parties dated 14 December 2011, we invited their submissions on whether, notwithstanding our conclusion with regard to Reference Question 2 regarding the specific reasons advanced there in support of the allegation of error in the LRIC model, our provisional conclusion in Reference Question 3 that there were certain deficiencies in the LRIC+ model justified adjustments to the LRIC model. In particular, we asked whether the structure of the reference and the relevant parts of the Notices of Appeal allowed LRIC to be adjusted in light of errors identified under Reference Question 3. The parties answered in written submissions dated 5 January 2012 and in oral submissions at the remedies hearing on 10 January 2012.

1.64 In its oral submissions, Vodafone argued that, while its NoA sought adjustments to the price control if it was accepted that a LRIC+ approach should be adopted, Vodafone's case was not limited to that. Vodafone stated that it had also pleaded that, if it was decided that a LRIC approach should be adopted, the LRIC estimate should be adjusted to correct for the errors set out in sections 3 and 4 of Mr Roche's first report. Vodafone further argued that sections 3, 4 and 5 of Mr Roche's report were drafted on the basis that adjustments would need to be made regardless of whether a LRIC+ or a LRIC approach was adopted. Vodafone contended that this was also clear from the substance of its NoA at paragraphs 78 to 83.[39] EE took a similar stance. EE recalled that Reference Question 2 concerned whether Ofcom had erred in determining the level of LRIC and that it referred to the reasons set out at paragraphs 20B and 75 to 82 of Vodafone's NoA. EE noted that, at paragraph 76 of its NoA, Vodafone had stated that it relied on the (first) report of Mr Roche in support of this aspect of its appeal and, at paragraph 78, Vodafone had expressly incorporated Mr Roche's argument that LRIC should be calculated in a way that took account of the modelling errors described in sections 3 and 4 of Mr Roche's report. At paragraphs 20B and 82, Vodafone had contended that, if LRIC were adopted, it should be set at a level that was calculated by including corrections for the modelling

[39] Transcript of remedies hearing, 10 January 2012, at p15, line 7 to p16, line 7 and p55, line 3 to p55, line 22.

errors identified in Mr Roche's report.[40] Telefónica agreed with Vodafone and EE on this issue, and BT advanced similar arguments of its own.[41]

1.65 In addition, EE argued that it was entirely right and proper that errors identified under Reference Question 3 should be corrected when determining the appropriate level of LRIC, because Ofcom had not built separate models for the purpose of determining LRIC and LRIC+: LRIC values were only generated using the 'subtractive method' and, hence, could only be generated by using an error-free method of determining LRIC+.[42]

1.66 Three disagreed. Three's primary argument was that the relevant errors were not properly set out in Vodafone's NoA. In the alternative, to the extent that these matters were raised indirectly in Vodafone's NoA in the paragraphs to which Reference Question 2 referred, Three argued that the relevant part of the NoA (particularly paragraphs 75 and 77) invited consideration of alternatives only if Ofcom's LRIC model had been found not to be 'fit for purpose'. Three observed that we had made no such finding in our provisional determination. Three also noted that Reference Question 3 explicitly only requires us to determined whether the relevant matters had an impact on LRIC+, and therefore not on LRIC.

1.67 Our starting point in considering this question has been to review Vodafone's NoA. As noted above, Reference Question 3 expressly refers only to errors in the LRIC+ model and directs us to paragraphs 58 to 62 of Vodafone's NoA. Those paragraphs do not allege any error in the LRIC model arises from the deficiencies set out there. Vodafone's criticisms of the LRIC model are set out at paragraphs 75 to 82 of its NoA: these are the paragraphs to which we are directed by Reference Question 2. At paragraph 77, Vodafone specifically repeats its pleadings from paragraphs 63 to 72 of its NoA, ie the allegation that the Ofcom model cannot produce a robust measure of the LRIC cost of the MCT service. But it is notable that paragraphs 75 to 82 do not cross-refer to or repeat paragraphs 58 to 62 of Vodafone's NoA or otherwise incorporate the particular allegations of deficiency in the LRIC+ model that are set out in paragraph 59.

1.68 Consequently, we consider it untenable to argue that it was clear on the face of Vodafone's NoA that Vodafone intended the alleged errors in respect of the busy day/week split and historic datacard market share to necessitate adjustment to the LRIC model.

1.69 Instead, we note that both Vodafone and EE have argued that this result follows from reading the NoA in conjunction with Mr Roche's report. It is true that paragraphs 75 to 82 refer to Mr Roche's report. However, irrespective of whether it is explained in that report that the allegations of error as to the busy day/week split and historic datacard market share necessitate adjustments regardless of whether a LRIC+ or LRIC approach is taken, it remains the case that paragraphs 75 to 82 do not refer to alleged deficiencies in either the busy day/week split or historic datacard market share.

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[40] See EE's written submissions for the remedies hearing, 5 January 2012, §§3 & 4. See also EE's oral submissions on 10 January 2012: transcript, p29, lines 6–16.
[41] See BT's written submissions for the remedies hearing, 5 January 2012, §16, and Telefónica's oral submissions on 10 January 2012, p35, lines 7–9.
[42] See EE's written submissions for the remedies hearing, 5 January 2012, §5.

1.70 The reliance on supporting evidence to particularize Vodafone's allegations is even more stark in this context than in the circumstances discussed in respect of the preceding question. The emphasis that EE and Vodafone place on the fleeting reference in paragraph 78 to section 4 of Mr Roche's report is too much for it to bear. In our view, this is precisely the kind of circuitous route to pleading of which the Tribunal disapproved in *Hutchison 3G v Ofcom* at [86].

1.71 Nor are we persuaded by EE's alternative argument, which is based on the mistaken premise that there is no separate model for the purpose of determining LRIC. It is not our understanding that the LRIC model is dependent on the LRIC+ model in the way that EE suggests. The LRIC model derives a calculation of LRIC without any reference to the output of the LRIC+ model, it is not a case of generating LRIC+ and then taking away the '+'. The models do start with the same set of data inputs, including the data challenged in the context of Reference Question 3, but then use different methodologies to generate the output.

1.72 In any event, we do not regard the fact that the same inputs are used in both models (or, even if EE were correct, the fact that the same model was used to ascertain both cost standards) as sufficient reason for going beyond the bounds of the grounds of appeal as detailed in the NoA itself and the scope of the relevant Reference Question, as we are invited to do by Vodafone and certain of the other parties to these appeals. We consider it highly desirable that the parties should adhere strictly to the principle that the grounds of appeal should be particularized properly and in sufficient detail in the NoA, not least because the need for expediency in such appeals militates in favour of such discipline and clarity as to the arguments that fall to be determined in each case.

1.73 For these reasons, we would not accept that, even if Vodafone could rely on the allegations regarding the busy day/week split and/or historic datacard market share in demonstrating deficiencies in Ofcom's LRIC+ model, such errors would justify adjusting Ofcom's LRIC model.

1.74 However, for the same reasons as discussed above in paragraph 1.60, we have included in our determination our views as to how any such error would be corrected and the consequential adjustments that would be necessary to the LRIC model and the charge control itself, were the Tribunal to disagree with the position we have taken in relation to this second question.

Section 2: Reference Question 1

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in adopting the pure LRIC cost standard, rather than the LRIC+ cost standard, as the basis for the charge controls (for the reasons set out in paragraphs 41 to 154 of EE's Notice of Appeal (Ground 1), and paragraphs 20(A), 31 to 57 and 63 to 74 of Vodafone's Notice of Appeal).

Contents

Introduction

2.1. In their respective NoAs EE and Vodafone, both supported by Telefónica, argued that Ofcom was wrong to have adopted the LRIC cost standard, rather than LRIC+ network cost standard, as the basis for the MCT charge control. They argued that Ofcom's regulatory objectives would have been better served by the setting of price control by reference to a LRIC+ methodology.[1] These arguments are addressed in Part (i) to this section. In addition, Vodafone argued that Ofcom should have rejected the LRIC methodology, on the basis that Ofcom was unable to implement it in a manner which could produce robust estimates of the LRIC cost of providing an MCT service.[2] This argument is addressed in Part (ii) to this section.

2.2. In the remainder of this introduction we provide a brief background to the matters affecting Ofcom's conclusion on cost standard (paragraph 2.3, summarize Ofcom's reasons for adopting a LRIC cost standard (paragraphs 2.4 to 2.6 and, under a heading of commercial context, explain certain features of the mobile sector relevant to the assessment of Reference Question 1 (paragraphs 2.22 to 2.60). We refer to and develop this information in the following assessment sections.

Background

The Recommendation

2.3. In May 2009, the European Commission issued the Recommendation which recommended the evaluation of efficient costs based on current cost and the use of a bottom-up modelling approach using LRIC as the relevant cost methodology.[3] Whilst

[1] Vodafone NoA, §20A, and EE NoA, §§41 & 42.
[2] Vodafone NoA, §20A.
[3] The Recommendation, Point 2.

the Recommendation is without prejudice to previous regulatory decisions, it recommended that NRAs ensure that termination rates are implemented at a cost-efficient, symmetric level by 31 December 2012.[4]

Meaning of LRIC and LRIC+

2.4. The LRIC cost standard is a method for calculating the average incremental cost per minute terminated to an average efficient operator of providing a call termination service, compared with not providing that service. The Ofcom Statement explained that 'pure LRIC'[5] is not exactly the same as marginal cost, but, for regulatory price-setting purposes, LRIC is an approximation of the economic concept of marginal cost.[6] Ofcom stated that in network industries (such as telecommunications) the marginal cost of a service may be very low or very high depending on whether usage is a long way from, or effectively at, installed capacity. This leads to very low (or zero) marginal cost most of the time, but with short increments over which marginal cost is very high. This is because once the necessary infrastructure (such as sites and equipment) of providing the service has been put in place, there is very little marginal cost associated with carrying the traffic up to the point that capacity is reached. Once capacity is reached, further infrastructure must be provided to carry just one additional call; so there would be a very large cost for that extra call. In regulatory practice, long-run incremental cost has therefore been applied as a proxy for marginal cost, avoiding the volatility implied in setting prices on the basis of marginal cost. The LRIC cost standard measures the average costs per minute terminated of service-specific fixed and variable costs that arise in the long run from the increment of output in question (in this case, all terminated minutes provided to other CPs).[7]

2.5. The LRIC+ cost standard, which Ofcom used in previous price controls, includes a mark-up for joint and common network costs on top of the LRIC.[8]

2.6. Ofcom's calculations of both LRIC and LRIC+ are challenged in these appeals and considered in Reference Questions 2, 3 and 6.

Ofcom's consultations

2.7. Ofcom conducted two consultations in relation to the cost standard it should adopt in its decisions on the 2009 MCT market review. The first consultation, in May 2009, set out six options on approaches to regulating MTRs.[9] Of those six options, Ofcom stated that almost all respondents supported the use of one or other of two: either a LRIC or a LRIC+ cost standard.[10] Ofcom then issued a consultation in April 2010 which stated that, having considered the options and the responses to the first consultation, it thought that capping MTRs, based on some measure of cost, would lead to better outcomes for consumers than alternative approaches. It proposed an MTR price control based on the incremental cost for an average efficient network of terminating calls from other networks (ie LRIC) with maximum charges falling to the level of LRIC over a four-year period.[11]

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[4] The Recommendation, Point 11.
[5] Ofcom used the term 'pure LRIC' which emphasizes the difference from LRIC+. Pure LRIC is the same as LRIC.
[6] We assume that Ofcom was referring to short-run marginal cost.
[7] Ofcom Statement, §1.8 & fn 4.
[8] We describe LRIC+ as used by Ofcom. It is not a precisely defined term.
[9] Ofcom Statement, §1.5.
[10] Ofcom Statement, §1.8.
[11] Ofcom Statement, §1.9.

Ofcom's 'Wholesale Mobile Voice Call Termination' Statement

2.8. The Statement sets out that, having regard to its obligations under section 88 of the Act and Article 13 of the Access Directive,[12] Ofcom considered that LRIC was the standard that would best:

- promote efficiency;
- promote sustainable competition in the retail mobile market in the UK; and
- confer the greatest possible benefits on end-users of public electronic communication services.[13]

2.9. Ofcom stated that, having considered the responses to the first consultation and further evidence, it concluded that LRIC was the better approach as it would maximize the benefits to consumers because it better promoted sustainable competition, was economically efficient and was unlikely to raise material equity concerns.[14]

2.10. Ofcom noted that the LRIC approach was consistent with the Recommendation; and the Statement explained that Ofcom had considered whether there were good reasons to depart from the Recommendation. Ofcom considered whether there were any factors which might lead to a conclusion that the harmonizing objective of the Recommendation was inappropriate in the circumstances of the UK.[15] Ofcom concluded that LRIC was the better approach in light of its statutory duties.

2.11. Ofcom assessed the choice of cost standard against the following criteria:

- economic efficiency—both static (allocative) and dynamic;
- competitive impacts;
- distributional effects on 'vulnerable' consumers; and
- commercial and regulatory consequences.[16]

Economic efficiency

Allocative efficiency

2.12. Ofcom said that allocative (or static) efficiency was concerned with the allocation of existing resources given current technology and consumer preferences. The desirable allocation of resources in an economy was generally achieved by prices that reflected the value to society of the resources used to supply a good or service. Ofcom stated that allocative efficiency was maximized when there was an optimal distribution of goods and services taking into account costs of supply and consumers' preferences.[17]

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[12] Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities. One part of the Common Regulatory Framework.
[13] Ofcom Statement, §1.13.
[14] Ofcom Statement, §8.21.
[15] Ofcom Statement, §8.22.
[16] Ofcom used these criteria in the second consultation and, not having received any responses suggesting that these were not the correct criteria, concluded that they were the correct criteria in the Statement—see Ofcom Statement, §§8.25–8.27.
[17] Ofcom Statement, §8.33.

2.13. Ofcom concluded that allocative efficiency alone did not provide a clear answer as to whether a LRIC or LRIC+ cost standard should be preferred.[18] Ofcom's Statement said that it considered whether evidence on the effect on usage, subscriptions and ownership would shift the argument one way or another under the criterion of allocative efficiency. It concluded that a move from LRIC+ to LRIC seemed highly unlikely to trigger a substantial reduction in ownership and was likely to generate a limited increase in usage.[19]

Dynamic efficiency

2.14. Ofcom said that dynamic efficiency was concerned with changes over time that would lead to better use of resources. The promotion of dynamic efficiency was typically concerned with the incentives to invest and innovate.

2.15. Ofcom stated that to assess the impact on dynamic efficiency, it had to balance the reduction in the transfer of wholesale revenues from the fixed sector (which could reduce returns for MCPs but increase those for FCPs) and the asymmetric impact of high MTRs which potentially negatively affect the profitability of MCPs with fewer subscribers. Ofcom stated that the nature of the reduction in profits MCPs might face from the adoption of LRIC depended largely on the extent of the waterbed effect which allowed them to recover from the retail side of the market what was lost from F2M wholesale revenues.[20]

2.16. Ofcom concluded that, if there was an effect of lower MTRs on incentives for the MCPs to invest, it was likely to be small.[21]

Competitive impacts

2.17. Ofcom considered the impact of the cost standard adopted for setting MTRs on competition between MCPs and competition between MCPs and FCPs. Ofcom concluded that higher MTRs under LRIC+ appeared to dampen competition among MCPs to some degree, as a result of a combination of effects, and that to set MTRs at LRIC would eliminate (or very substantially reduce) these effects.[22] In terms of competition between fixed and mobile networks, Ofcom concluded that there was some competitive interaction between FCPs and MCPs and that the adoption of LRIC would reduce the competitive impact of the difference between MTRs and FTRs.[23]

Effects on vulnerable consumers

2.18. In addition to looking at the interests of consumers in aggregate, Ofcom also considered whether the effect of moving to a LRIC cost standard would be felt disproportionately by vulnerable consumers. Ofcom said that there would be an equity concern if these vulnerable consumers were required to pay more (as they could least afford to do so). However, Ofcom was more concerned about vulnerable consumers who might give up their mobile phones as a result of the MCT price control decision. On

[18] Ofcom Statement, §8.44.
[19] Ofcom Statement, §8.43.
[20] Ofcom Statement, §A 3.101.
[21] Ofcom Statement, §A 3.102.
[22] Ofcom Statement, §8.98.
[23] Ofcom Statement, §8.101.

this basis, Ofcom focused its analysis on the likely extent of loss of access to mobile services (mobile ownership) among vulnerable groups.[24]

2.19. Ofcom considered people on low incomes and/or in lower socio-economic groups to be the most vulnerable, as they could least afford an increase in prices. Ofcom also considered the impact on mobile-only customers as they received no countervailing benefit as customers of fixed services and the loss of their only form of access to telecommunications services would have a more significant impact on their welfare.[25]

2.20. Ofcom concluded that reduced mobile ownership (and to a lesser extent higher mobile prices) among (mobile-only) vulnerable consumers was not likely to be significant, particularly when benefits to other (fixed-only) vulnerable groups were taken into account. Ofcom therefore did not consider equity effects to be a significant factor in the choice between LRIC+ and LRIC.[26]

Commercial and regulatory consequences

2.21. Ofcom said that it gave less prominence to commercial and regulatory considerations in its assessment of the choice between LRIC+ and LRIC. Ofcom said that it did not think the commercial and regulatory consequences would be significantly different between the LRIC+ and LRIC approaches.[27] However, under this heading Ofcom assessed the choice between LRIC and LRIC+ against the criteria of:

(a) compliance with its legal duties;[28]

(b) consistency with previous charge controls;[29]

(c) consistency with the Ofcom position during the development of the Recommendation;[30] and

(d) timing of implementation (glide path).[31]

Commercial context

2.22. This section sets out the material, drawn from the Statement and the parties' pleadings, that we consider to be necessary context to the parties' arguments and our assessment of these arguments under Reference Question 1.

Nature of competition between mobile networks

2.23. MCPs compete for the custom of particular customers, or classes of customer, based on their expected value to the network. MCPs will form expectations on the net present value (NPV) of the contribution to be earned from individual customers, or class of customer, over their period of subscription to the MCP's network. The NPV of such contribution is known as the 'customer lifetime value' (CLV). In calculating CLVs, MCPs will take account of revenues expected to be generated over the range of mobile products and services used by the customer and, for voice services,

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[24] Ofcom Statement, §8.118.
[25] Ofcom Statement, §8.119.
[26] Ofcom Statement, §8.125.
[27] Ofcom Statement, §8.129.
[28] Ofcom Statement, §§8.135–8.139.
[29] Ofcom Statement, §§8.140–8.150.
[30] Ofcom Statement, §§8.151–8.156.
[31] Ofcom Statement, §8.157.

revenues from both outgoing calls which the customer(s) will generate and the incoming calls which they will receive. They will also take account of costs that are directly attributable to those customers (including MCT payments caused by those customers' outgoing calls). MCPs will be prepared to offer more generous terms to attract individual customers, or groups of customer, with higher CLVs.

Impact of changing MTRs on customer lifetime values

2.24. We understand it to be common ground among the parties that, when setting prices, MCPs have regard to the CLV of a customer or group of customers, as discussed above.[32]

2.25. Reducing MTRs can be expected to affect the CLV of different customer groups. Groups who have net inbound calls (involving MCT) will earn net incoming revenue from MCT; hence a reduction in MTRs will reduce the CLV of these groups. Conversely, for groups who make net outbound calls (involving MCT), a reduction in MTRs will reduce the net outward payment and increase the CLV of these groups.

2.26. At various points we refer to 'marginal customers'. Marginal customers are those who value having a mobile phone only slightly more than the cost of having it, and would give it up in response to a small price increase.[33] 'Non-marginal' or 'infra-marginal' customers are those who would not give up their phones in response to a small price increase.

Calling patterns

2.27. In this section we briefly summarize the relevance of two measures of calling patterns and, in broad terms, the patterns we observe:

- The first important measure is the proportion of outbound and inbound calls (or minutes) that are on-net/off-net. This is of interest as networks pay and receive MTRs on off-net calls only.

- The second important measure is the ratio of outbound:inbound calls for different groups of consumers. The primary measure includes only those calls involving MCT: so it includes off-net MTM calls, FTM calls and 'other to mobile' calls,[34] but does not include on-net MTM, MTF or 'mobile to other' calls.[35] In the rest of this section, all references to call ratios include only calls involving MCT (unless otherwise stated).

2.28. Smaller networks will tend to have a higher proportion of off-net calls for both out-bound and inbound traffic. Smaller networks will therefore tend to pay MTRs on a higher proportion of the calls made by their subscribers, but also receive MTRs on a higher proportion of the calls received by their subscribers. Ofcom investigated the relationship between a network's share of subscribers to mobile networks and the proportion of off-net calls. Ofcom found that the proportion of calls that were off-net tended to be less than implied by subscriber share alone. Ofcom considered this to reflect efforts by networks to keep more calls on-net.

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[32] See EE Core Submission, §112, for a summary of statements by the parties on this topic.
[33] The converse also applies: marginal non-customers value the mobile slightly less than the cost of having it and might take it up following a slight cost decrease.
[34] 'Ofcom told us that it did not have a breakdown of all types of call included, but it was likely that a significant proportion of 'Other' represents calls from international numbers. Letter from Ofcom to CC, 20 August 2011.
[35] These categories of calls do include termination fees (such as the fixed termination fee charged by FCPs) but those fees are not being determined in this process and so are not relevant to our use of call ratios.

2.29. Each MCP may have net incoming or net outgoing MTM calls, but the net position between all MCPs is zero, because every incoming call for one operator is an outgoing call for another. Because incoming calls from fixed and other networks are included, but outgoing calls to those networks are not included, MNOs as a whole, and mobile customers as a whole, have net incoming calls, so their ratio of outbound: inbound calls is smaller than 1:1.

2.30. Call ratios differ between groups of customers. EE told us that all four MCPs agreed[36] that, when viewed as groups, pre-pay customers were net receivers of calls and post-pay customers were net makers of calls. None of the parties actively dissented from this view, although we note that some submitted that post-pay users as a group had balanced calls.

2.31. Ofcom published some data on call ratios in its Statement.[37] Due to data limitations, not all MCPs were able to provide data only on calls involving MCT, and so Ofcom's call ratios also included MTF calls. This inflated the volume of outgoing calls and hence overstated the relevant ratio of outbound:inbound calls. Ofcom subsequently discovered a calculation error and revised these call ratios,[38] but was still not able to exclude MTF calls. Ofcom's corrected ratios—which include MTF calls—suggested that pre-pay customers had an outbound:inbound ratio of 0.6:1, post-pay 1.5:1, and all subscribers combined 1.2:1.

2.32. The evidence available to us does not include ratios for all operators for calls involving MCT only, but we have them for Orange and use this to illustrate the difference between Ofcom's ratios and the relevant ratios. We do not claim that Orange's data is representative of all MCPs, but it is the only information we have. EE told us that Orange pre-pay customers had a 'relevant' outbound:inbound ratio of [✂], but including MTF calls gave a ratio of approximately [✂].[39]

2.33. EE told us that Orange and T-Mobile for internal purposes broadly recognized outbound:inbound ratios of approximately [✂] for pre-pay and [✂] for post-pay customers.[40] Vodafone also told us that across its post-pay subscriber base as a whole, the ratio of inbound and outbound calls was approximately [✂].[41]

2.34. Based on the data above and comments by other parties, we believe that the outbound:inbound call ratio of post-pay customers is only a little larger than 1:1 (their calls are almost balanced), whereas the call ratio of pre-pay customers is considerably smaller than 1:1.

2.35. It also appears to be common ground that customers can be further segmented within post-pay and pre-pay. We understand that as a general rule, users who make more outgoing calls have a higher outbound:inbound ratio. Hence it appears that 'high-end' post-pay users have net outbound calls and 'low-end' post-pay users have net inbound calls. 'Low-end' pre-pay users are large net receivers of calls while 'high-end' pre-pay users may be either net makers of calls or roughly balanced (we have insufficient data to be certain). Our view is that this provides a reasonable broad overview of calling patterns, although caution must be applied when inferring properties of particular groups of customers, particularly small groups.

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[36] See EE Core Submission, §113, for a summary of statements by the parties on this topic.
[37] Statement, Annex 4, Table A4.3.
[38] See Ofcom letter of 18 October 2011 in relation to the calculation error in call ratios.
[39] W/S Dunn II, §12. We have inverted EE's reported outbound:inbound ratios so that they are more easily comparable with Ofcom's ratios.
[40] The pre-pay figure differs slightly from the figure in the previous paragraph. EE told us that the figure in the previous paragraph was derived from the data it submitted to Ofcom in response to a section 135 request.
[41] Vodafone Core Submission, §4.79.

The scale of the effects

2.36. The operators terminate calls on their network from other operators and from fixed lines. Table 2.1 sets out our estimate of the off-net calls originated and terminated by each of the operators, and provides a net figure for each.

TABLE 2.1 **Estimated net incoming calls by operator**

million minutes

	Off-net calls originated	*Off-net calls terminated*	*Net incoming minutes*
Three & MVNOs	4,456	[✂]	[✂]
Vodafone	7,130	[✂]	[✂]
O2	10,627	[✂]	[✂]
EE	9,990	[✂]	[✂]
Total	32,202	49,862	17,660

Source: CC analysis from 2009 call volumes, based on data from Ofcom Telecommunications Market Data Updates and Ofcom Statement Figure A3.2.

Notes:
1. [✂]
2. Assumes proportion of outbound minutes that goes to mobiles is consistent across operators.
3. Data for EE (ie treating calls between Orange and T-Mobile as on-net) have only been available for 2010 Q2 onwards. We have therefore estimated data for EE based on Orange and T-Mobile data.
4. From available data we were not able to estimate separate figures for Three or the MVNOs.

2.37. The aggregate net calls terminated by the mobile operators is 17.7 billion minutes. This represents the calls received by mobiles from fixed lines and 'other' (eg international numbers).

2.38. Vodafone, EE and O2 (Telefónica) receive more minutes than their customers make in outbound calls. Three and the smaller operators' customers make more outbound calls (in terms of minutes) than they receive.[42] MCT is therefore a net cost for the smaller operators (in aggregate) but a net income stream for each of Vodafone, EE and O2.

(i) Assessment of regulatory objectives and rationale

Overview

2.39. We turn now to the first limb of Reference Question 1, namely whether Ofcom's regulatory objectives would have been better served by the setting of price control by reference to a LRIC+ methodology.[43]

2.40. Reference Question 1 directs us to determine whether Ofcom erred in adopting the pure LRIC cost standard for the reasons set out in paragraphs 41 to 154 of EE's Notice of Appeal and paragraphs 20A, 31 to 57 and 63 to 74 of Vodafone's Notice of Appeal. In those paragraphs, EE and Vodafone argued that Ofcom's regulatory objectives would have been better served by the setting of the price control by reference to a LRIC+ methodology.[44] EE contended that, properly considered, Ofcom's statutory objectives and considerations supported the adoption of LRIC+ rather than LRIC.[45] Vodafone stated that having regard to all the evidence and considerations addressed by Ofcom in the Decision document, the regulatory objectives and obli-

[42] This is true in aggregate; we do not know whether it is true for individual MVNOs.
[43] See paragraph 2.1
[44] Vodafone NoA, §20A, and EE NoA, §§41 & 42.
[45] EE NoA, §42.

gations imposed by sections 3, 4 and 88 of the Act would have been, and were, attained by the setting of price controls by reference to a similar LRIC + methodology to the methodology used in setting MCT price controls in 2007.[46]

2.41. Having regard to section 192(6) of the 2003 Act, we infer from the paragraphs of their Notices of Appeal to which we are referred by Reference Question 1 that, by this part of their respective Notices of Appeal, EE and Vodafone are appealing against the exercise by Ofcom of a discretion.

2.42. In its Statement, Ofcom assessed its choice of the pure LRIC cost standard by reference to the four criteria set out above. Ofcom concluded that these four criteria were consistent with its legal duties and obligations and, in particular, section 88 of the Act.[47] Ofcom assessed whether to adopt a pure LRIC cost standard by comparing LRIC with LRIC+ against each of those four criteria.[48]

2.43. We note that, while EE's and Vodafone's grounds of appeal are effectively directed towards alleging an error of regulatory judgment on Ofcom's part in respect of the principles applied in setting the MCT charge control,[49] much of the detail of paragraphs 41 to 154 of EE's Notice of Appeal and paragraphs 20A, 31 to 57 and 63 to 74 of Vodafone's Notice of Appeal takes issue with the correctness of particular data used and the particular aspects of the economic analysis applied in assessing pure LRIC by reference to the four criteria Ofcom identified in its Statement.

2.44. Consequently, in considering this aspect of EE's and Vodafone's appeals, we consider whether Ofcom erred in the methods applied and/or data used or otherwise made any material error of fact. In doing so we have borne in mind that Ofcom conducted its assessment to inform the exercise of its judgement. Any suggestion that these limbs of analysis comprise a formula or binary calculation of the appropriate outcome is to be resisted.

2.45. As noted in paragraphs 1.26 to 1.31, when considering whether Ofcom committed any such error, we apply the principles enunciated in our determinations of earlier appeals under the Act jurisdiction and, in particular, we have not held Ofcom to be wrong simply because we considered there to be some mistake in its reasoning on a particular point. The mistake must have been of sufficient importance to vitiate Ofcom's decision—here its application of the principles set out above in assessing its compliance with its statutory duties—in whole or in part.

2.46. We also note that much of EE's and Vodafone's reasoning in the paragraphs to which we are directed by Reference Question 1 is directed towards demonstrating that Ofcom was wrong to have selected LRIC *rather than LRIC+*. While a comparative analysis may be a relevant step in informing Ofcom's assessment of whether the choice of a pure LRIC cost standard was appropriate in light of the duties outlined above, ultimately the question of appropriateness must be assessed by reference to those duties themselves.

2.47. Consequently, having carefully considered the arguments set out in paragraphs 41 to 154 of EE's Notice of Appeal and paragraphs 20A, 31 to 57 and 63 to 74 of Vodafone's Notice of Appeal, our determination as to whether Ofcom erred in adopting the LRIC cost standard is based on considering the extent to which (if at all)

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[46] Vodafone NoA, §20A.
[47] Statement, §§8.25–8.29.
[48] Statement, §§8.33–8.157.
[49] Cf r.3(1)(a) of the Tribunal's 2004 Rules.

those arguments demonstrated any error by Ofcom in the application of the statutory framework to which they are subject when imposing charge controls.

Standard of review

2.48. We have covered the general arguments in relation to the standard of review and the nature of the CC's role in the introduction to this determination in paragraphs 1.26 to 1.33. We set out here the parties' arguments and our views about the nature of our assessment when the question before us is one of regulatory judgement.

2.49. In its core submission Vodafone argued that the CC should determine the Price Control Questions by deciding whether Ofcom's decision was correct—that is, is it the best decision that can be made by reference to the relevant facts and arguments, in pursuit of the objectives laid down in the Act. Vodafone stated that where there was genuinely no good reason to prefer one judgement over another in respect of a particular matter which was in dispute, the CC may decide to prefer Ofcom's judgement, and thus decline to allow an appeal which merely invited the CC to apply a different, and not clearly superior, judgement. But where the CC considered that Ofcom's judgement (whilst not necessarily irrational in judicial review terms) was not the best available, then the CC should adopt what it judged to be the best judgement and apply that instead.[50]

2.50. EE's submissions suggested that there was inherent in the framework a need to balance competing factors. It pointed to Article 8 of the Access Directive as a basis for the proposition that if the relevant objectives point in different directions, proportionality demands that the decision as to which obligations to impose should be taken by balancing those objectives against one another. In addition the need for balancing is also apparent from the fact that the Act requires that in setting the charge control account must be taken of various objectives—which may not point in the same direction.[51]

2.51. EE argued that in the Statement, Ofcom reasoned that pure LRIC 'confers the greatest possible benefits on consumers, as it better promotes sustainable competition, is economically efficient, and is unlikely to raise material equity concerns'.[52] In their appeals, EE, Vodafone and Telefónica contended precisely the opposite, namely that competition, efficiency and consumer considerations all point in favour of LRIC+.[53]

2.52. Telefónica agreed with EE that the CC is required to conduct a balancing exercise. It argued that, in light of the analysis in the provisional determination, the CC could *only* legitimately conclude that the LRIC cost standard was preferable to LRIC+ if it carried out a balancing exercise, weighing the negative effects on allocative efficiency and vulnerable consumers against the claimed pro-competitive effects of the move in cost standard, and concluded that the former were outweighed by the latter. Put another way, the CC could *only* properly dismiss the Appellants' arguments on allocative efficiency and vulnerable consumers as being insufficiently significant to disrupt Ofcom's Decision if it considered its findings on those arguments to be outweighed by its findings on the competition effects.[54]

2.53. Ofcom set out that it considered the challenges to the decisions in the Statement contained in the appeals to consist mainly of allegations of error by Ofcom in the

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[50] Vodafone Core Submission, §2.5.
[51] EE response to CC's provisional determination, §27.
[52] Statement, §8.158.
[53] EE response to CC's provisional determination, §28.
[54] Telefónica response to CC's provisional determination, §3.2.

exercise of its statutory discretion. In such circumstances, it submitted, it was well recognized that the proper role of an appellate court considering an appeal on the merits was to interfere with the decision only where it was shown to be plainly wrong, or to have been made taking account of irrelevant considerations, or failing to take account of relevant considerations.[55]

2.54. This approach applies where the allegation made in the appeal is of errors in appreciation or judgement, or in the estimation of future market developments. These are assessments in relation to which there is no single right or wrong answer, but where the regulator is required to make choices, and to exercise discretion. The CC's task in relation to such issues is not to serve as a 'fully equipped duplicate regulatory body waiting in the wings just for appeals', but is instead to 'look into whether the regulator has got something materially wrong. This may be very difficult if all that is impugned is an overall value judgement based on competing commercial considerations in the context of a public policy decision'.[56]

2.55. Ofcom argued that the specific provisions of relevance to the setting of price controls show a clear intention to confer a broad measure of discretion on Ofcom:[57]

(a) section 87(1) of the 2003 Act provides that, having determined that a person has SMP, Ofcom must 'set such conditions authorised by [section 87] as they consider appropriate to apply to that person ...';

(b) these conditions include '... such price controls as Ofcom may direct in relation to matters connected with the provision of network access ...' and '... such rules as [Ofcom] may make ... about the recovery of costs and cost orientation'; and

(c) section 88 provides that Ofcom may impose a price control where 'it appears to them ... that there is a relevant risk of adverse effects arising from price distortion, and it also appears to them that the setting of the condition is appropriate for the purposes of promoting efficiency, promoting sustainable competition and conferring the greatest possible benefits on end-users ...'.

Assessment of standard of review applicable to Reference Question 1

2.56. Reference Question 1 asks the CC to decide whether the charge controls have been set at levels which are inappropriate because Ofcom erred in adopting the pure LRIC cost standard, rather than the LRIC+ cost standard.

2.57. Ofcom's approach to the question of whether to adopt LRIC or LRIC+ is set out in sections 7 and 8 of its Statement. Section 7 considered the empirical evidence on the likely impact on consumers of a switch from a LRIC+ to a pure LRIC cost standard, in terms of prices, ownership and usage. While section 8 assessed the choice of cost standard against the four criteria.

2.58. In conducting this assessment Ofcom made findings of fact that informed the exercise of its judgement as to the appropriate cost standard having regard to its statutory objectives and considerations. It should be reiterated, however, that even under the limbs of analysis these are arguments of considerable complexity and there remain areas where judgement needs to be applied. It would be a mistake to think that Ofcom could perfectly capture the factors that it needs to weigh in accordance with

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[55] Ofcom Core Submission, §11 citing *Roache v News Group Newspapers* [1998] ECMR 161, at 172 per Stuart-Smith LJ.
[56] Ofcom Core Submission, §12 citing *T-Mobile (UK) Limited v. Ofcom* [2008] EWCA Civ 1373, [2009] 1 WLR 1565, §§30–31 per Jacob LJ.
[57] Ofcom Defence, §32.

its statutory responsibilities under these limbs. It is also a mistake to think that we could, therefore, accord a quantitative measure of the value of the factors under these limbs of analysis by virtue of our assessment of the parties' arguments in this regard.

2.59. The CC agrees that it must determine whether Ofcom made the 'right' choice and that the appeal should succeed if the appellant can demonstrate that Ofcom applied a methodology which was so unsound as to create a real risk that the decision was wrong (as is the case in our answer to Reference Question 6). In determining whether Ofcom's judgement was wrong in relation to the choice of cost standard the CC takes into account all the factors that Ofcom had to weigh. We do not think that it automatically follows that mistakes in findings of fact that are designed to inform this judgement can render the judgement 'wrong' in the round. The question is whether any mistake is of sufficient importance to vitiate Ofcom's decision as to the appropriate cost standard.

2.60. The assessment of the parties' arguments under each of the limbs of Ofcom's analysis that follows should be read with these principles in mind.

Structure of our assessment of Reference Question 1(i)

2.61. The remainder of our assessment of Reference Question 1(i) addresses the arguments in relation to each of the limbs of Ofcom's analysis. We address the arguments concerned with the competition issues (paragraphs 2.62 to 2.524), allocative efficiency (paragraphs 2.525 to 2.823), vulnerable customers (paragraphs 2.843 to 2.919) and commercial and regulatory consequences (paragraphs 2.920 to 2.926). We return to our principled assessment of the implications of these more detailed matters to the question that we have to answer in our conclusion (paragraphs 2.938 and 2.939).

1. Competition effects

Introduction

2.62 Ofcom considered the impact of the cost standard adopted for setting MTRs on competition between MCPs and competition between MCPs and FCPs. Ofcom concluded that higher MTRs under LRIC+ appeared to dampen competition among MCPs to some degree, as a result of a combination of competition effects, and that at a move to set MTRs at LRIC would eliminate (or very substantially reduce) these effects.[58] Ofcom also concluded that there was some competitive interaction between FCPs and MCPs and that the adoption of LRIC would reduce the competitive impact of the difference between MTRs and FTRs (fixed termination rates).[59]

2.63 Vodafone argued that Ofcom erred in its assessment of the relative merits of LRIC+ and LRIC from the standpoint of competition.[60] EE contended that MTRs based on LRIC+ would not lead to any appreciable distortion of competition, such as to support the choice of a LRIC cost standard, and that there were significant competition considerations that favoured the choice of a LRIC+ cost standard.[61] Telefónica intervened in support of EE and Vodafone. Telefónica considered that Ofcom's conclusion that LRIC would lead to a better outcome for consumers with regard to its

[58] Ofcom Statement, Annex 3, §§A3.229 & A3.230.
[59] Ofcom Statement, Annex 3, §A3.255.
[60] Vodafone NoA, §50.
[61] EE NoA, §85.

impact on competition among MCPs could not plausibly be maintained.[62] Three intervened in support of Ofcom.

2.64 We consider first the arguments made by Vodafone, EE and Telefónica in relation to Ofcom's assessment of the impact of the cost standard adopted for competition between MCPs (see paragraphs 2.65 to 2.466). We then consider the arguments made by Vodafone and EE in relation to Ofcom's assessment of the impact on competition between MCPs and FCPs (see paragraphs 2.468 to 2.517).

Assessment of the competition effects between MCPs

2.65 The structure of this section is as follows: we first make some general remarks (see paragraphs 2.67 to 2.89). These are not intended to be a response to the arguments made in relation to Ofcom's assessment of the competition effects between MCPs. Rather the purpose is to set out some background which will assist with understanding later discussion and to summarize briefly Ofcom's reasoning as set out in its Statement and its Defence.

2.66 We then discuss in detail the arguments made by the appellants, Vodafone[63] and EE,[64] and the intervener, Telefónica.[65] Our approach is to consider first those arguments which we consider to be the most important ones (see paragraphs 2.90 to 2.365). These arguments are identified in paragraphs 2.90 to 2.94. We then list and respond to the remaining arguments (see paragraphs 2.366 to 2.461). Finally we consider the arguments made in relation to the materiality of the MTM competition effects (see paragraphs 2.462 to 2.466).

Background remarks

2.67 Setting MTRs at LRIC+, rather than at LRIC, would raise the marginal cost to a network of terminating off-net calls made by its subscribers above the marginal cost of terminating calls on-net. This difference in the marginal cost faced by networks of terminating calls on-net, compared with off-net, would not reflect differences in the resource costs incurred for on-net and off-net termination which are minimal and immaterial in the context of a comparison of LRIC and LRIC+. These points are not contested.[66,67,68]

2.68 Ofcom said that there were two fundamental reasons why setting MTRs above LRIC had the potential to distort competition:[69] first, higher MTRs would increase the expected marginal cost to a network, taking into account the probability that a call will be off-net, of additional calls made by its subscribers; and second, an MCP's decision to cut retail prices could be expected to result in lower net termination

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[62] Telefónica SoI, §20.
[63] Vodafone NoA §§50 & 51, and Schedule 2, Vodafone Core Submission §4.49–4.109.
[64] EE NoA §§82–133 and Walker 1 expert report, section 4, EE Core Submission §§17–70 & 127–145 and Walker 3 expert report, section 3.
[65] Telefónica SoI §§12–20 and Neil Marshall expert report, section 4, Core Submission §§19–42.
[66] EE bilateral hearing transcript, §23, lines 2–10.
[67] Following the bilateral hearing (see letter to CC of 2 November), EE said that, in its view, LRIC+ MTRs did not drive a 'wedge' between on-net and off-net costs. EE said that such an argument ignored the fact that on-net calls must contribute to the common costs of the originating network, in the same way that off-net calls contributed to the costs of the terminating network. However, in the hearing, we asked about the impact of the cost standard adopted on the relative marginal costs to networks of on-net and off-net termination. The marginal costs would not include any mark-up included in retail prices that contribute to the recovery of common costs. Dr Walker agreed that adopting LRIC+ would raise the marginal cost of off-net termination above that of on-net termination.
[68] Vodafone bilateral hearing transcript, §17, lines 1–8.
[69] Ofcom bilateral hearing transcript, §23, lines 3–18.

receipts (higher net payments) as a reduction in call prices could be expected to generate more outgoing calls (on-net and off-net) but not more incoming calls.[70]

2.69 With regard to the second of these points, we agree that for existing subscribers a reduction in call prices would be expected to generate more outgoing calls, on- and off-net, but not more incoming calls. However, new subscribers attracted to a network by a reduction in call prices would bring with them termination payments on the off-net calls that they make and termination receipts on the calls that they receive. Nevertheless we consider it unlikely that a reduction in a network's retail prices would attract a sufficient number of new subscribers who generate net termination receipts for the net effect of a price reduction to be an improvement in the network's termination payment balance.

2.70 Ofcom explained in its Statement[71] that in its assessment of the competition effects it had focused on the impact of the cost standard adopted for setting MTRs on the smaller networks, those with fewer subscribers.

2.71 Smaller networks tend to have a higher proportion of off-net calls essentially because their subscribers represent a smaller proportion of the overall mobile customer base. Smaller networks will therefore pay MTRs on a higher proportion of calls made by their subscribers and will receive MTRs on a higher proportion of calls received by their subscribers. This has not been disputed by the appellants.[72,73,74]

2.72 Ofcom investigated the relationship between an MCP's share of subscribers and the proportion of outbound call minutes that were off-net. Ofcom found an inverse relationship but the networks had fewer off-net calls than might be expected given their share of subscribers. Ofcom considered that this reflected efforts by all MCPs to keep more traffic on-net, including tariffs to attract calling circles.[75]

2.73 Our understanding of Ofcom's position is that this feature of smaller networks would exacerbate the effects described above (paragraph 2.68). In particular, if MTRs are above LRIC, all else being equal:

(a) the smaller networks will face a higher marginal cost (taking into account the probability of a call being off-net) for additional calls made by its subscribers; and

(b) the smaller the network the larger the effect of a reduction in retail prices on its net MTR payment position.

2.74 We consider this to be a source for concern as the cost disadvantage faced by smaller networks does not arise because the smaller networks' own marginal network costs are higher than those of larger networks or because it costs other networks more to terminate an additional call originating on a smaller network.

2.75 In considering the impact of the cost standard adopted on smaller networks we need to bear in mind both the average revenue effect on profitability (and therefore entry and exit) and the marginal effect on pricing decisions. The impact on the profitability of a network will depend on the balance between a network's termination payments and receipts. A smaller network with a similar ratio of outbound-to-inbound off-net

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[70] We recognize that in practice many calls are bought as part of bundles but although this adds some complication it does not lead to a different conclusion.
[71] Ofcom Statement, Annex 3, §§A3.123–A3.125.
[72] Vodafone bilateral hearing transcript, §25, lines 16–23.
[73] EE NoA, Walker 1 expert report, §145.
[74] Telefónica bilateral hearing transcript, §22, lines 6–12.
[75] Ofcom Statement, Annex 3, §A3.149.

calls as other networks would be able to use higher MTR receipts to offset higher MTR payments. The impact on the pricing decisions of networks will also depend on the effect on the marginal costs faced by networks of additional calls made by their subscribers.

2.76 Adopting the LRIC+ cost standard, compared with LRIC, would also impact on the relative attractiveness of different groups of customers. Generally it would increase the customer lifetime value (CLV) of customers who receive more calls than they make and reduce the CLV of those who make more calls than they receive (see Introduction to Reference Question 1, paragraph 2.25).

Summary of Ofcom's approach, reasoning and decision

2.77 Ofcom's approach was to consider whether setting MTRs above LRIC would create barriers to entry and expansion.[76] In particular, Ofcom considered whether LRIC+ based MTRs would disadvantage new entrants or smaller networks by raising the costs of entry and/or gaining market share.

2.78 Ofcom considered the impact of higher MTRs on smaller networks on an 'all else being equal' basis. Thus Ofcom did not take into account other factors which may advantage or disadvantage smaller networks because these would be essentially unaffected by the level of MTRs.

2.79 Ofcom also said that it did not focus on Three as an MCP with fewer subscribers and whether Three would be better off as a result of a move to LRIC, rather it focused on whether the choice of LRIC+ or LRIC would affect the ability of one or more MCPs to enter and expand in the UK retail market.

2.80 Ofcom set out why higher MTRs would put smaller networks at a competitive disadvantage under three headings: retail effects, market-wide effects and the impact on different customer segments.

Retail effects

2.81 Ofcom explained that if LRIC+ based MTRs would result in larger price differentials between retail charges for on and off-net calls, the presence of such differentials could operate to the advantage of the larger networks: if two networks with different numbers of subscribers set the same call prices, subscribers to the smaller network could expect to pay higher average prices as a higher proportion of their calls would be off-net.

Market-wide effects

2.82 Setting MTRs above LRIC would raise the expected marginal cost to an MCP of making calls, as explained above (see paragraph 2.67). The impact would be greater on the marginal costs faced by the smaller networks (see paragraph 2.73).

2.83 Ofcom accepted that if a smaller network had a balanced traffic position—in terms of the ratio of off-net inbound:outbound calls—these effects would not arise. In particular, in these circumstances a smaller network could use its higher receipts with LRIC+ based MTRs to cover higher MTR payments.[77] However, Ofcom considered

[76] Summarized in Ofcom's Defence, Annex A, §§A.242–A.249 and final statement, Annex 3, §§A3.124 & A3.125.
[77] Ofcom Statement, §§A3.157 & A3.158.

that achieving a balanced traffic position would not be commercially costless for smaller networks.[78] Ofcom argued that it was profit-maximizing for Three to target the high-end post-pay customers which would result in a traffic imbalance.[79]

Impact on competition for different customer segments

2.84 As explained above (see paragraph 2.76), setting MTRs above LRIC will impact on the CLV of customers and, for subscribers with similar call patterns in terms of the number of calls made and received, the impact on their CLVs will be greater for those subscribing to smaller networks as more of their calls will be off-net.

2.85 Ofcom said that adopting LRIC+ would give larger networks an advantage in competing for subscribers who made more calls than they received—in that these networks would have the incentive to offer more generous terms than smaller networks to gain these subscribers—an advantage that was not related to the performance of the larger network. By the same token, higher MTRs would give smaller networks an advantage in competing for subscribers who received more calls than they made.

2.86 Ofcom considered that this would put smaller networks at a disadvantage as it was essential for smaller networks to be able to compete for the top-end post-pay customers to gain market share.

Mitigating strategies[80]

2.87 Ofcom said that whilst in theory attracting calling circles[81] could mitigate the competitive disadvantage to smaller networks of higher MTRs, in practice, this might be difficult to achieve in a mature market as it would require all members of a calling circle to coordinate to switch network. Ofcom also noted that the membership of different calling circles seemed likely to overlap. Smaller networks would also be competing with larger networks which would have the same incentive to attract calling circles.

2.88 Ofcom said that the evidence suggested that calling circles were likely to exist to some extent and to have some impact on the proportion of calls that were off-net. Ofcom also said that the proportion of calls by Three subscribers that were off-net suggested that it had had some success in attracting consumers with friends and family on the same network, but that Ofcom had not been able to assess the costs involved for Three. Ofcom concluded that there was little evidence to suggest that calling circles could eliminate the disadvantage to smaller networks of higher MTRs in a mature market as customers might already be organized into calling circles. This might make it more difficult for MCPs to attract new subscribers unless they can win the entire calling circle (or the most important members of that circle).[82]

Materiality

2.89 On materiality Ofcom argued that the negative competition effects of higher MTRs served to reinforce each other.[83] Ofcom said that the emerging evidence was that—either in anticipation of, or as a result of, lower MTRs—smaller MCPs and FCPs had already been able to offer more competitive retail packages. Therefore Ofcom

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[78] Ofcom Defence, Annex A, §A.306.
[79] Ofcom Defence, Annex A, §A.298.
[80] Ofcom Statement, Annex 3, §§A3.197–A3.209.
[81] Ofcom said that a calling circle might be viewed as a network of friends, family and business colleagues whose calls accounted for the majority of calls made by users within that group (see Ofcom Statement, Annex 3, fn 216).
[82] Ofcom Statement, Annex A3, §§3.208 & 3.209.
[83] Ofcom Defence, Annex A, §A.344.

recognized that a move to LRIC+ (that is to 1.61ppm in 2014/15) would reduce the materiality of, but not eliminate, those negative competition effects. Those effects would, however, be eliminated (or very substantially reduced) if MTRs were set at LRIC. If LRIC+ rates were to be set at a higher level as EE and Vodafone argued for, the unresolved competition effects would be correspondingly more significant.

Detailed review

2.90 Vodafone and EE argued that Ofcom had erred in the overall approach taken to the assessment of competition effects. The appellants argued that Ofcom should have had regard to the wider competitive context in considering the effects on competition of the cost standard adopted. The appellants also argued that Ofcom attached too much weight to the experience and views of Three.

2.91 EE argued that the economic literature indicated that generally higher MTRs (in this case LRIC+ based MTRs) would increase competition between networks. Vodafone argued that Ofcom's assessment of competitive effects was incomplete because Ofcom had not taken into account other effects identified in the literature that could offset those effects identified by Ofcom.

2.92 In addition, the appellants gave specific reasons why they considered Ofcom to have erred in its assessment of the competitive effects identified in the Statement. Of these arguments, the following appear to us to be the key ones:

(a) higher MTRs do not favour larger networks as smaller networks could use the higher MTR receipts per subscriber to offset the higher MTR payments;

(b) Ofcom had overstated the prevalence and importance of on-net/off-net price differentials and the relationship between such differentials that there are and the level of MCT charges; and

(c) Ofcom had erred in its assessment of the impact that LRIC+ based MTRs would have on smaller networks in competing for post-pay customers and the resultant effect on competition.

2.93 Vodafone agreed that these issues were key. Vodafone also identified as key that the evidence did not support a finding that Three had been disadvantaged by LRIC+ based MTRs.[84]

2.94 In our assessment we consider first the argument that Ofcom failed to take into account the results of the economic literature (see paragraphs 2.95 to 2.151) and, secondly, the arguments relating to Ofcom's overall approach (see paragraphs 2.152 to 2.177). Thirdly we consider, and in detail, the other arguments that we consider to be key to the appellants' cases (see paragraphs 2.180 to 2.365). We then consider, fourthly, the remaining arguments made by the appellants in the light of the above (see paragraphs 2.366 to 2.461). Fifthly, we consider the arguments made in relation to the materiality of the competition effects (see paragraphs 2.462 to 2.467).

Economic literature

2.95 Vodafone said that the academic literature had identified an additional competition effect which operated in the opposite direction from the competition effects identified

[84] Vodafone, Core Submission, §§4.69–4.74.

by Ofcom and which Ofcom had failed to consider.[85] EE said that the general conclusion of the economic literature was that termination charges above LRIC led to more intense competition between operators in the retail market.[86]

2.96 In the Statement, Ofcom said that care should be taken in drawing broad policy conclusions from the papers cited by the appellants[87] given that the results were driven by specific assumptions which did not accurately describe the current or future development of the UK market.[88]

2.97 In this section we first provide some background information on the relevant economic literature (paragraphs 2.98 to 2.101). We then set out the arguments made by the various parties (paragraphs 2.102 to 2.118). Finally, we give our assessment of these arguments (paragraphs 2.119 to 2.151).

Background

2.98 Vodafone referred in its NoA[89] to the following articles: *Network competition*, Laffont, Rey and Tirole, 1998; *The Theory of Access Pricing and Interconnection*, Armstrong, M, 2002; *Mobile Call Termination*, Armstrong, M and Wright, J, 2008; and *Using bill and keep interconnect arrangements to soften network competition* Gans, J and King, S, 2001.

2.99 A result derived in these articles suggests that MTRs set above cost could lead to more intense competition for subscribers. Armstrong and Wright (2009) explained that the Laffont et al (1998) and the Gans and King (2001) papers had shown that setting higher termination rates could strengthen network effects, thereby making firms tougher rivals, and that these 'tariff-mediated networks externalities' (TMNEs) arise because consumers prefer to join larger networks when it is cheaper to make on-net calls, which in turn increases the incentives of networks to attract subscribers.[90]

2.100 In these articles the positive competition effect was conditional on: *(a)* an assumption that setting MTRs above cost would induce networks to charge higher prices for off-net than for on-net calls; and *(b)* on an assumption that charges take the form of a two-part tariff. The models also assumed just two networks and uniform call patterns (ie that all subscribers call all other subscribers with equal probability).[91]

2.101 In addition to these articles, Three referred to others which developed the literature.[92] We have looked at these articles and followed up on certain cross-references. We refer below to articles in which the authors extended the models to allow for more than two networks, asymmetric competition, calling externalities and non-uniform calling patterns.

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[85] Vodafone, Core Submission, §4.89.
[86] EE NoA, §104.
[87] Gans and King (2001), Carter and Wright (2003) and Armstrong and Wright (2009), Ofcom Statement, Annex 3, §3.186.
[88] Ofcom Statement, Annex 3, §§A3.186–A3.189.
[89] Vodafone NoA, Schedule 2, section 4.
[90] 'The study of MTM termination has led to quite a different focus: whether mobile networks can use a negotiated termination charge to relax retail competition for subscribers. They can do this by setting MTM termination charges below cost. This causes off-net calls … to be cheaper than on-net calls … so that consumers prefer to join the smaller network. This is turn reduces each network's incentive to attract subscribers.' Armstrong and Wright, 2001.
[91] See Armstrong, 2002, paragraphs 4.2.3 & 4.2.4.
[92] Three, Dr Philip Kalmus expert report, section 3.

The parties' arguments

- *Vodafone*

2.102 Vodafone said that the economic literature indicated that in the case of 'two-part tariffs'—ie where operators set a usage price and a fixed fee per subscriber—lower MTRs could be expected to reduce the intensity of competition among MCPs, rather than increase it, resulting ultimately in higher overall retail prices.[93,94]

2.103 Vodafone said that overall, given the tariff structure for pre-pay and post-pay customers,[95] the effect of lowering MTRs would be stronger competition for post-pay customers, as two-part tariffs were more common for this customer segment.[96]

2.104 Vodafone explained that the reason why lower MTRs would reduce the intensity of competition was that attracting a new customer brought not only direct revenues (retail subscription fees and retail usage revenues) but also indirect interconnection revenues due to the calls made from customers of other networks.[97] The presence of such additional indirect revenues had a positive impact on the incentives of MCPs to attract new customers.

2.105 Vodafone provided further explanation in Annex 3 of Schedule 2 to its NoA. Vodafone said that economic theory suggested that reducing MTRs reduced call charges, which increased consumer surplus but, if call charges discriminated between on-net and off-net calls, reducing MTRs led to a weakening of competition between operators, resulting in higher fixed subscription charges. Vodafone said that if the second effect dominated then consumer surplus would decline when MTRs were reduced from LRIC+ to LRIC.

2.106 Vodafone explained that economic theory predicted that MTRs set above LRIC could cause TMNEs and so, all other things being equal, it would be more valuable for a subscriber to be connected to a larger network. Vodafone said that in a differentiated Bertrand framework, the market share of a smaller network would be expected to increase with a reduction in MTRs from LRIC+ to LRIC, because this shift would remove the TMNE.

2.107 Vodafone's case was that, if one were to accept the assumptions Ofcom had relied upon in its assessment of retail effects, Ofcom had failed to take into account a competition effect identified in the economic literature which indicated that lower MTRs had a dampening effect on competition. Vodafone said that these assumptions were the existence of on-net/off-net price differentials in the UK and the relationship between MTRs and on-net/off-net price differentials.[98]

- *EE*

2.108 EE said that the general conclusion of the economic literature was that termination charges above LRIC would lead to more intense competition between operators in the retail market. The basic economics of the waterbed effect was said to demonstrate this: the higher the incoming call revenues, the more strongly operators would

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[93] Vodafone referred us to *The Theory of Access Pricing and Interconnection*, Armstrong, M, 2002, and *Mobile Call Termination* Armstrong, M and Wright, J, 2008.
[94] Vodafone NoA, Schedule 2, §4.2.
[95] We understood Vodafone to be referring to the current situation.
[96] Vodafone NoA, Schedule 2, §4.4.
[97] Vodafone NoA, Schedule 2, §4.3.
[98] Vodafone response to CC's provisional determination, §§4.3 & 4.8.

compete to win this revenue stream, which would have a downward effect on retail prices. EE also said that MTRs set above LRIC would provide operators with a greater incentive to attract additional customers.[99]

- *Telefónica*

2.109 Telefónica said that Ofcom's analysis was at odds with the economic literature on two-way access pricing which showed that competition for subscribers would be intensified when access prices were above the marginal cost of making off-net calls. Telefónica quoted Armstrong and Sappington (2005): 'Since high access payments ensure a high (per-subscriber) profit from providing calls, firms will compete vigorously to attract additional subscribers to their network. They will do so by setting a low fixed charge.'

2.110 Telefónica also argued that if higher MTRs disadvantaged smaller networks, this could be pro-competitive by increasing the incentives of smaller networks to gain market share and overcome any disadvantage they had by cutting prices or competing to attract subscribers.[100]

- *Ofcom's Defence*

2.111 Ofcom made a number of points in response to the appellants' claims.[101]

2.112 Ofcom said that there was a degree of inconsistency in Vodafone's views of two-part charges (with fixed and usage-based elements) and those of Dr Walker (EE's expert witness), who suggested that monthly fixed payments associated with post-pay tariffs were, at least in part, usage charges. Ofcom's view was that it was theoretically correct to regard fixed monthly payments as a combination of fixed fees and payments for usage, and the waterbed effect might mean that MCPs (in response to lower MTRs) would increase retail prices, which could be achieved by increasing the upfront price of a post-pay bundle (and the fixed monthly charge). However, reducing MTRs lowered the marginal cost of providing (off-net) calls to mobiles, and so higher bundle charges might be accompanied by an increase in the size of the bundle. Furthermore, with lower MTRs MCPs (and to some degree FCPs) would be better able to offer larger bundles of calls (particularly smaller operators which were at a disadvantage in doing so under high MTRs), which would enhance rather than diminish the intensity of competition.

2.113 Ofcom said that the results of the models in the literature varied with the specification used. For example, one of the main results from Gans and King (2001) was that MCPs would prefer MTRs set below costs but, when revenues from FTM calls are brought into the model, MCPs would prefer to set MTRs above cost. Similarly, Armstrong and Wright (2009) found that, under certain assumptions, larger MCPs would prefer MTRs set at cost, whereas smaller MCPs would prefer either below or above cost MTRs depending on their net traffic flows.

2.114 Some of the results were said by Ofcom to depend on restrictive assumptions that did not match the circumstances in UK mobile telecoms markets. For example, Ofcom said that the papers generally relied on the assumption that MTRs were below the marginal cost of termination, which was not the case for LRIC, and assumed that every customer called everyone else with the same probability. The literature was

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[99] EE NoA, §§104 & 131.
[100] Transcript of bilateral hearing with Telefónica, §18, lines 2–16.
[101] Ofcom Defence, Annex A, §§A.325–A3.332.

therefore said not to take into account the issue of calling clubs (the term calling club is used to describe the fact that subscribers tend to make the majority of their calls to a limited number of people consisting mostly of friends and relatives).

- *Three's SoI*

2.115 Dr Kalmus summarized the results of the literature for models with two mobile operators of the same size, no fixed termination and balanced traffic flows as follows:[102]

(a) With linear prices only (such as in a traditional pre-pay tariff, ie one where the customer simply pays a set amount per outbound minute) an increase in the termination rate increased profits and retail prices, and reduced consumer welfare. LRIC was unambiguously preferable to LRIC+ on both competition and efficiency grounds. LRIC+ made traffic outflows expensive and therefore dampened the incentive to price aggressively in the retail market.

(b) With two-part tariffs and no on-net/off-net price discrimination, profits were shown to be independent of the termination rate as operators would compete on subscription charges, but welfare was higher under LRIC rather than LRIC+. Dr Kalmus said that the applicable insight from this model was that by competing with usage invariant charges an operator might be able to avoid competition that would result in call outflows.

(c) Operators would only want to engage in on-net/off-net differentiation when termination rates were above LRIC. This was the case since operators priced calls at the perceived marginal cost and the perceived cost of off-net calls was higher under LRIC+. LRIC+ was said to induce an externality: the user's network choice affected the proportion of on-net and off-net calls of other users. This externality was completely driven by termination rates rather than the characteristics of the networks or consumer preferences.

2.116 Dr Kalmus explained that the Laffont, Rey and Tirole (1998) result arose because of two effects of increasing the termination rate. The first effect was that the networks increased their off-net prices since the cost of termination had been raised. The second effect was an increased incentive for operators to build market share as a means of decreasing calling costs, since higher market share resulted in a larger proportion of calls being on-net. The use of LRIC+ therefore generated a competitive effect by making customers (market share) more valuable. In the Gans and King (2001) paper, the increased competition for subscribers outweighed the initial inefficiency of LRIC+.

2.117 Dr Kalmus said that the Gans and King (2001) result could be understood as follows: on-net/off-net price discrimination drove a wedge between networks (it cost extra to call the other network) and this made it more important to users which network they belonged to. In turn, operators competed more intensely for customers to be on their network. The result suggested that with high termination rates customers might become so valuable to networks that operators would want to acquire them even if the acquisition costs led to lower profits than those that would be obtained with low termination rates. Lower termination rates reduced the network effect and therefore made it less important to acquire customers.

2.118 Dr Kalmus did not consider the Gans and King (2001) result to be applicable for the following reasons:

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[102] Three SoI, Kalmus expert report, §§3.41–3.55.

(a) The effect of Gans and King relied essentially on an argument that incompatibility of networks was better for competition, whereas EU and domestic legislatures and regulators required interconnection in order to, among other things, encourage new entry by fixed and mobile telecoms operators.

(b) With LRIC+ network size mattered and in this way on-net/off-net price differentials created an exclusionary problem for entrants. Laffont, Rey and Tirole (1998) noted that a large operator could squeeze a new entrant if it could insist on a high termination rate.

(c) Armstrong and Wright (2009) found that once the fixed sector was introduced into the model, MCP profits increased with LRIC+ due to transfers paid from the fixed to the mobile sector. With the fixed sector included, competition was more intense with LRIC and that LRIC was more efficient for the communications sector as a whole.

(d) Hoernig et al (2007) found that when considering calling circles, profitability increased (and competition decreased) with termination rates above LRIC. Intuitively, when attracting a customer from a calling circle, that customer still originates many off-net calls to their calling circle. In contrast under a balanced calling pattern gaining a customer would induce more on-net calls. With LRIC+, the continued call outflows were expensive and it therefore became less attractive to acquire such a customer and competition was reduced.

(e) The Gans-King result relied on an on-net/off-net price differential. It was inconsistent for the appellants to argue, on the one hand, that competition would intensify with LRIC+ but, on the other hand, to argue that on-net/off-net differentiation was not present, since the result depended on such differentiation.

Assessment

2.119 EE argued that the general conclusion of the economic literature was that MTRs set above LRIC would lead to more intense competition. Vodafone's position was different. Vodafone did not argue that higher MTRs would be unambiguously pro-competitive. Rather, Vodafone's case was that the economic literature showed that lower MTRs could have a potentially material competition dampening effect which could outweigh the pro-competitive effects of lower MTRs that Ofcom had considered.[103]

2.120 We consider that the analysis of the effect that higher MTRs could have on competition depends on the assumptions made. In the literature the assumptions that matter appear to be those made in relation to the structure of charges, the structure of the market and calling patterns. In the remainder of this section we consider first EE's description of the pro-competitive effect of higher MTRs which were said to be driven by asymmetric call patterns (some subscribers make more or fewer calls than they receive) and how this relates to the description in the literature of the TMNE effect. We then consider the implications of the assumptions made on the structure of charges, the structure of the market and calling patterns for the claims made by the appellants in relation to the results of the literature.

[103] Vodafone response to CC provisional determination, §§4.4 & 4.6.

- *Asymmetric call patterns*

2.121 Dr Walker said that the way he thought about the result in the economic literature was that higher termination rates would make any customer who received more calls than they made more attractive and so mobile operators would be willing to compete more strongly for that customer in the sense that they would be willing to charge lower retail prices in order to win them. This was said to be the sense in which MTR rates could directly affect the intensity of competition.[104]

2.122 Vodafone, in its NoA and the main body of the accompanying Schedule 2, described the pro-competitive effect of higher MTRs in much the same way as EE (see paragraph 2.104). However, in Annex 3 to Schedule 2, Vodafone provided further explanation of the TMNEs effect caused by MTRs set above LRIC (see paragraphs 2.105 and 2.106).

2.123 We do not consider EE's statement to be a description of the TMNE result in the literature or one of more intense competitive rivalry. The effect as described in this statement is the impact that the level at which MTRs are set would have on the value to MCPs of customers to MCPs who make more calls than receive, or the other way around and therefore on the terms that mobile networks would be prepared to offer these customers in order to win their custom. We note that the willingness to offer some customers better terms is not therefore being driven by increased competitive rivalry. This is illustrated by the observation that whilst with higher MTRs some customers would become more valuable, there would be other customers who would become less valuable. Absent net transfers of termination payments from fixed to mobile networks, we would not expect any net gain, from the effect described, to retail customers of MCPs from higher MTRs.

2.124 Vodafone made much the same point as we do. In particular, Vodafone said that if different consumer segments generated different patterns of outgoing and incoming calls, then LRIC+ MCT charges would incentivize MCPs to compete on price to win consumers who were likely to generate more incoming calls. Vodafone said that this did not amount to a distortion of competition, but to merely reflect the fact that MCPs competed for the custom of each consumer segment according to its CLV. Vodafone concluded that competition would be just as effective across the board.[105]

- *Structure of charges—on-net/off-net price differentials*

2.125 The potentially pro-competitive effect of higher MTRs described in the literature relied on MTRs set above LRIC inducing MCPs to raise off-net call prices relative to those for on-net call prices. However, both EE and Vodafone argued that on-net/off-net price differentials were now limited and not caused by MTRs set above LRIC (see paragraphs 2.209 to 2.282). Vodafone also said that if we accepted its arguments in relation to the prevalence of on-net/off-net price differentials and their relationship with MTRs, then the positive competition effect of higher MTRs identified in the literature would not arise.[106] EE did not, however, recognize the tension that there is between, on the one hand, its position on the economic literature and, on the other hand, its view that on-net/off-net price differentials are now of limited significance in the UK.

[104] EE bilateral hearing transcript, §26, lines 4–16.
[105] Vodafone NoA, §50.4.
[106] Vodafone Response to CC's provisional determination, §4.4.

- *Structure of charges—two part tariffs*

2.126 The TMNE effect also required retail charges to take the form of two-part tariffs (paragraph 2.100).

2.127 Vodafone recognized this. Vodafone said that overall, given the tariff structure for pre-pay and post-pay customers, the effect of lowering MTRs would be stronger for post-pay customers, as two-part tariffs were more common for this customer segment.[107] The simulation model Vodafone used to demonstrate the potential competitive benefits of setting higher MTRs (see paragraphs 2.438 to 2.448) was based on post-pay subscribers only.[108] EE did not, however, recognize that the pro-competitive effect identified in the literature required a two-part tariff when it made a general claim that the conclusion of the economic literature was that termination charges above LRIC would lead to more intense competition.

- *Structure of the market—number of networks*

2.128 Hoernig[109] said that two obstacles to applying models of telecommunications competition to the real world were that most assumed symmetric networks and/or a duopoly. He found that when the models allowed for multiple networks as the number of networks increased the TMNE effect became less strong. We note that neither appellant commented on the application of the results of the economic literature to markets where there are more than two networks. Vodafone in its simulation model considered a duopoly under two scenarios: two equally sized networks and two asymmetric networks with 60 per cent:40 per cent subscriber shares.

- *Structure of the market—barriers to entry and growth*

2.129 In addition to the potentially pro-competitive effect of setting MTRs above costs, the literature also commented on the potential for higher MTRs to deter entry and disadvantage smaller networks.

2.130 Armstrong (2002) said that much of the analysis assumed symmetric competition between networks and so might be relevant to situations where competition was well established and mature. He said that in the earlier stages of market liberalization competition was likely to be skewed in favour of the incumbent and that the analysis needed to be extended to cover such situations.[110]

2.131 Armstrong and Wright (2009) said that incumbent networks might prefer high MTM termination charges as these could act to deter entry or induce exit of a smaller rival. They explained that by setting above-cost MTM termination charges, incumbent networks could induce network effects which made entry less attractive.

2.132 Harbord and Pagnozzi (2010)[111] said that network based (or on-net/off-net) price discrimination created a barrier to entry and growth for smaller networks. In particular, on-net/off-net price differentials created TMNEs which made larger networks more attractive to consumers than smaller networks and placed smaller networks at a competitive disadvantage. The effect, as described by Harbord and Pagnozzi, is the impact that on-net/off-net price differentials would have on the average call prices

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[107] Vodafone NoA, Schedule 2, §4.4.
[108] Vodafone NoA, Schedule 2, Annex 3.
[109] *Competition between multiple asymmetric networks: A toolkit and applications*, Hoernig, 2009.
[110] Armstrong, 2002, section 4.2.4.
[111] Harbour and Pagnozzi, Network-based price discrimination and 'bill and keep' vs 'cost based' regulation of mobile termination rates, *Review of Network Economics*, 2010.

paid by subscribers to larger and smaller networks. They also said that call externalities reinforced this effect (see paragraph 2.138 below).

2.133 We note that Dr Kalmus said (see paragraph 2.115) that adopting a LRIC+ cost standard would, if associated with on-net/off-net price differentials, create a network effect that is not driven by the technical or cost characteristics of mobile networks or consumer preferences which would make larger networks more attractive to subscribers.

2.134 Vodafone also said that MTRs set above LRIC could create network effects such that, all other things being equal, it would be more valuable to the subscriber to be connected to the larger network, reducing the equilibrium market share of a smaller network.[112] In response to the CC's provisional determination, Vodafone said that it accepted that whilst higher MTRs would strengthen competition among equally-sized networks, it would weaken competition from smaller networks.[113] Vodafone also said that 'this is why [its] simulation model considers *both* of these effects. The model demonstrates that the competition dampening effect among equally sized networks in the UK would far *outweigh* any competition weakening effect resulting from the worsening of the position of a smaller network'.[114] We understand Vodafone's argument to be that even taking into account the potential for setting MTRs above cost to put a smaller network at a competitive disadvantage, overall the effect would be a strengthening of competition. In particular, Vodafone reported that in its model the equilibrium market share of the smaller network with a 40 per cent share of subscribers when MTRs are set at LRIC+) increased by only 0.35 percentage points with a reduction in MTRs to LRIC.

2.135 We consider that Vodafone's model suggests that allowing for asymmetric market size would reduce the size of the TMNE effect. For the scenario modelled by Vodafone (ie with two networks with equilibrium market shares of 40 and 60 per cent share of subscribers when MTRs are set at LRIC+), the competitive disadvantage faced by smaller network as a result of the network effects created by setting MTRs above cost, as measured by the change in market share, would appear to be small. We are not, however, persuaded that the change in market share would be a complete measure of the potential harm to competition or that Vodafone's simulation model would capture the long-term impact on competition resulting from the barriers to entry and growth created by setting MTRs above cost. In addition, we do not have any information on the sensitivity of these results to the assumptions made on market structure as Vodafone did not provide results for other scenarios.

2.136 EE did not acknowledge the statements in the literature on the potential for above cost MTRs to create barriers to entry and growth in making its claim that the general conclusion of the economic literature was that termination charges above LRIC led to more intense competition between operators in the retail market.

- *Allowing for call externalities and calling circle*

2.137 In the NoA Vodafone cited various papers which reported the potential for TMNEs caused by higher MTRs to lead to more intense competition. Vodafone did not make reference to others which considered the robustness of these results to certain assumptions which in our view better reflect the realities of the UK market than the more stylized models cited by Vodafone.

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[112] Vodafone NoA, Schedule 2, Annex 3.
[113] Response to the CC's provisional determination, paragraph 4.8.
[114] Response to the CC's provisional determination, paragraph 4.8.

2.138 Harbord and Pagnozzi (2010) said that call externalities reinforced the competitive harm to smaller networks associated with TMNEs caused by on-net/off-net price differentials. Call externalities arise where subscribers to a network attach value to receiving as well as making calls. They explained that when an incumbent network increased its off-net prices, relative to those for on-net calls, subscribers to smaller networks would receive relatively fewer calls thus reducing the utility from joining a smaller network.

2.139 Harbord and Pagnozzi (2008) also reported that Hoernig (2007) found that with call externalities and asymmetric network size, even assuming uniform calling patterns (ie every customer called everyone else with the same probability), the smaller network would incur a permanent access payment deficit. They explained that in the response to call externalities large networks would charge higher off-net prices and create higher on-net/off-net price differentials than smaller networks, further impeding the ability of smaller networks to compete by creating access deficits which could result in a permanent net outflow of termination payments to larger networks.

2.140 Vodafone said that in the presence of *uninternalized* call externalities larger MCPs could reduce the attractiveness of smaller MCPs by introducing high on-net/off-net price differentials,[115] if this reduced the expected number of calls to be received by subscribers of smaller networks and therefore the attractiveness of subscribing to smaller MCPs. However, Vodafone said that there was no robust evidence on the extent of call externalities in the UK.[116] Vodafone also said that evidence from consumer surveys referred to by Ofcom showed that the price paid by others for being called was not a relevant variable considered by mobile customers in their subscription decisions. Ofcom said that it did not consider the presence of uninternalized call externalities to be an important feature of the UK market.[117]

2.141 It is our view that the results of the economic literature allowing for call externalities is relevant to our assessment of what the literature says about the competitive effects of above cost MTRs, even where these externalities are largely internalized. This is because of the links that there are between the presence of call externalities, the existence of calling circles and costs associated with switching networks when members of calling circles subscribe to the same network. As explained above the term 'calling club' is simply used to describe the fact that subscribers tend to make the majority of their calls to a limited number of people consisting mostly of friends and relatives. The internalizing of call externalities is more likely to take place within groups of people who make frequent calls to one another, or within closed user groups such as families or businesses. This internalization may be achieved in number of ways including coordination on network choice in order to take advantage of lower on-net call prices. Where all, or the majority, of the members of a calling circle subscribe to the same network, this may raise the costs of switching networks to an individual calling circle member.

2.142 As support for this point, we note that Calzada and Valletti (2008)[118] modelled call externalities by assuming that groups of people that tended to call each other more often join the same network. They said that this further increased incumbents' incentives to coordinate on a high access charge in order to deter entry.

[115] Vodafone NoA, Schedule 2, §2.12.1.
[116] Vodafone NoA Schedule 2, §§2.14 & 2.15.
[117] Ofcom Defence, Annex A, §A.332.
[118] Harbord and Pagnozzi, 2010.

2.143 Gabrielsen and Vagstad (2008)[119] showed that when allowance was made for calling circles even symmetric incumbent networks might prefer high access charges. They explained that on-net/off-net price discrimination based on call termination would increase individual switching costs because consumers would be more reluctant to relocate away from their calling club. They concluded that higher termination charges could be a device for reducing competition between the symmetric incumbent networks. Coordinated calling clubs and switching costs were a condition for such a strategy to be profitable. They added that with asymmetries in network size, networks with more subscribers would benefit more.

2.144 Hoernig et al (2011)[120] said that the standard assumption in the literature on competition between communication networks was of uniform calling patterns. Hoernig showed that when calling patterns were no longer uniform the proportion of on-net and off-net calls of the marginal subscriber would be less closely tied to the market shares of the networks, diminishing the role of the TMNEs. Hoernig concluded that when calling patterns were sufficiently concentrated, contrary to previous predictions, jointly profit-maximizing access charges were above marginal cost in order to dampen competition.

2.145 EE said that the evidence was that calling circles were not significant.[121] EE referred to the findings of the Jigsaw research commissioned by Ofcom which were said to show that on-net/off-net price differentials did not play an important role in the choice of network to join.[122] Vodafone said that there was no evidence that calling circles were a very material feature of the UK market.[123] Ofcom said that the evidence suggested that calling circles were likely to exist.[124] Ofcom also found evidence of coordination as the proportion of calls made on-net tended to be higher than implied by a network's subscriber share.[125]

2.146 We do not accept EE's or Vodafone's position on the existence of calling circles. The term 'calling circle' is used simply to describe the fact that customers tend to make the majority of calls to a subset of people, ie non-uniform calling patterns. Vodafone said that a significant proportion of calls were generated by and within 'closed' user groups, such as intra-business or intra-family user groups.[126] It seems to be common sense that an assumption of uniform call patterns is a strong assumption that will not accurately describe customer behaviour. Ofcom found that the proportion of calls made on-net tended to be higher than implied by a network's size which would be consistent with non-uniform calling patterns. Vodafone also said that an assumption that the proportion of on-net and off-net calls was an absolute function of market size was not realistic as calls were not randomly distributed.[127]

Conclusions on the economic literature

2.147 We do not accept EE's claim that the general conclusion of the economic literature is that termination charges set above LRIC would lead to more intense competition in

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[119] *M2M call termination—regulation or competition?* Gabreilsen and Vadstad, 2008.
[120] Heornig allows for non-uniform calling patterns, which account for the fact that customers tend to make most calls to a small subset of people. Equilibrium call prices are distorted away from marginal cost, and competitive intensity is affected by the concentration of calling patterns. Contrary to previous predictions, jointly profit-maximizing access charges are set above termination cost in order to dampen competition, and the resulting on-net prices are below off-net prices, if calling patterns are sufficiently concentrated.
[121] EE Core Submission, Walker 3 expert report, §178.
[122] EE, MW1, §§160 & 161.
[123] Vodafone response to CC's provisional determination, §4.8.
[124] Ofcom Statement, Annex 3, §§3.197–3.209.
[125] Ofcom Statement, Annex 3, §3.149.
[126] See Vodafone's letter to the CC of 31 October.
[127] See Vodafone's letter to the CC of 31 October.

the retail market.[128] Whilst the literature identified a potentially pro-competitive effect of higher MTRs (the TMNEs effect), we agree with Ofcom that this result appears to be sensitive to assumptions that do not accurately describe reality in the UK market. In addition, there are comments in the literature on the potential for higher MTRs to put smaller networks at a competitive disadvantage.

2.148 In addition, we note that the effect that setting higher MTRs would have on competition, as described by EE, is not, in our view, one of more intense competition between mobile networks. EE also failed to recognize the tension that there is between its position on the pro-competitive effects of higher MTRs identified in the literature and that it took in relation to on-net/off-net price differentials.

2.149 Vodafone did not argue that higher MTRs would be unambiguously pro-competitive. Vodafone's case was that the economic literature showed that lower MTRs could have a potentially material competition dampening effect which could outweigh the pro-competitive effects of lower MTRs that Ofcom had considered.[129] Using a simple simulation Vodafone argued that, even allowing for asymmetric networks, TMNEs could have a significant and positive competition effect (see paragraphs 2.438 to 2.448 for further consideration of Vodafone's simulation model).

2.150 For the purposes of considering Vodafone's position on the conclusions that should be drawn from the literature we put to one side comments in the literature concerned with the potential for higher termination rates to create barriers to entry and growth. This is because Vodafone's argument was that Ofcom failed to take into account a competitive effect of MTRs set above LRIC identified in the literature that was additional to those identified by Ofcom which focused on the potential for higher MTRs to disadvantage smaller networks.

2.151 In the NoA Vodafone cited various papers which reported the potential for TMNEs caused by higher MTRs to lead to more intense competition. Vodafone did not make reference to other papers which considered the robustness of these results to certain assumptions. We have reported some of the findings in these papers. These further findings suggest that the results to which Vodafone referred relied on restrictive assumptions and that, even with symmetric networks, more realistic assumptions on the structure of the market and behaviour of subscribers would weaken the TMNE effects and could overturn the earlier results. For this reason, it is our view that it is not a clear result of the economic literature that setting MTRs above LRIC would, putting to one side the potential for this to raise barriers to entry and growth, be otherwise expected to lead to more intense competition. We do not therefore accept Vodafone's argument that the academic literature identified an additional competition effect which operated in the opposite direction from the competition effects identified by Ofcom and which Ofcom had failed to consider.

Ofcom's overall approach

2.152 The appellants argued that Ofcom should have assessed the competitive effects of the cost standard adopted for setting MTRs in a wider market context.[130] In particular the appellants said that: Ofcom should have considered the effect that setting MTRs at LRIC would have on competition between all MCPs more generally and in the context of the UK mobile market being among the most competitive in Europe (see paragraphs 2.153 to 2.159); Ofcom was wrong to have adopted its 'all else equal'

[128] EE NoA, §104.
[129] Vodafone response to CC provisional determination, §§4.4 & 4.6.
[130] The second of the arguments listed in paragraph 2.94 above.

approach and should, for example, have taken into account factors other than the level at which MTRs are set on the ability of smaller networks to compete (see paragraphs 2.160 to 2.174); and Ofcom had attached too much weight to the experience and views of Three (see paragraphs 2.175 to 2.177). We consider these arguments in turn below.

Focus on barriers to entry and expansion

2.153 Vodafone and EE suggested that Ofcom should have considered the impact of the cost standard adopted on competition between all MCPs rather than focusing on the impact of the competition effects identified on smaller networks. Vodafone said that lower MTRs would lead to less intense competition between MCPs for subscribers, all else being equal, an effect that could well counter-balance any potential theoretical dampening effect of higher MTRs on smaller operators' ability to compete.[131] EE said that Ofcom had focused on the competition effects in favour of LRIC, but had ignored potential distortions to competition between MCPs that might be generated by LRIC.[132] In particular, the economic literature indicated that generally higher MTRs would increase competition between networks, and Ofcom's Statement would lead to increased fixed charges levied by MCPs and therefore higher switching costs for customers.[133]

2.154 Vodafone said that the UK market was already among the most competitive in Europe and that it was therefore reasonable to expect that a dampening of the incentives of all operators to compete for mobile subscribers could have a more detrimental effect on competition than any alleged positive effect from a strengthening of the ability of smaller operators to compete with larger operators.[134] Against this background Vodafone considered that departing from LRIC+ could be justified only if the alleged positive effect from the use of LRIC on smaller MCPs could be expected with a very high degree of certainty to lead to better outcomes for consumers. Vodafone considered that Ofcom's analysis and evidence was a long way short of establishing this.[135] (See paragraphs 2.452 to 2.461 for further consideration of this argument.)

2.155 Ofcom recognized in its Statement that the level at which MTRs were set had the potential to impact on the incentives faced by all MCPs. For example, Ofcom concluded that higher MTRs under LRIC+ appeared to have dampened competition among MCPs to some degree due to a combination of effects including the presence of on-net/off-net price differentials and the market-wide effect of high MTRs resulting in a higher retail price floor for voice calls.[136]

2.156 However, Ofcom focused on the potential for the cost standard adopted to distort competition by disadvantaging networks with fewer subscribers. Ofcom explained in its Statement that the impact on competition of its retail and market effects (see paragraph 2.73) could be exacerbated by disadvantaging networks with fewer subscribers.[137] Ofcom also noted the statement in the Explanatory Note to the Recommendation that above-cost termination rates could give rise to competitive distortions between operators with asymmetric market shares and traffic flows.

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[131] Vodafone, Core Submission, §4.89.
[132] EE, Walker 1 expert report, §§208–211.
[133] EE NoA, §104.
[134] Vodafone Core Submission, §4.91.
[135] Vodafone NoA, Schedule 2, §6.3.
[136] Ofcom Statement, Annex 3, §A3.228.
[137] Ofcom Statement, Annex 3, §§A3.134 & A3.159.

2.157 For the reasons given below (see paragraphs 2.158 and 2.159), it is our view that the appellants have not demonstrated that Ofcom was wrong to have focused on the effects of the cost standard adopted on barriers to entry and growth.

2.158 Ofcom did not accept that the economic literature indicated that there were offsetting positive effects on competition between MCPs associated with higher MTRs.[138] For the reasons given above (see paragraphs 2.147 to 2.150), we agree with Ofcom on the conclusion that can be drawn from the economic literature. In particular, we consider that whilst the literature to which the appellants have referred suggests that setting MTRs at LRIC+ could lead to more intense competition between MCPs, we do not agree that this is a clear result of the literature referred to. Ofcom identified competition effects which had the potential to put smaller networks at a particular disadvantage. Ofcom also considered its view to be consistent with the EC view that above-cost termination rates could give rise to competitive distortions by reinforcing the network effects of larger networks and increasing the barriers to smaller operators entering and expanding within markets.[139]

2.159 From a policy perspective, to focus on promoting competition by reducing barriers to entry and growth does not seem to us to be unreasonable. Ofcom had a clear concern that higher MTRs had the potential to put smaller networks at a particular competitive disadvantage by raising barriers to entry and growth. A regulatory decision that would have such an effect would be an understandable concern in a market that Ofcom said continued to be characterized by a small number of players of different sizes, and high barriers to entry including the availability of spectrum, incumbency advantages, and advertising sunk costs that created brand value.[140]

All else being equal

2.160 EE and Vodafone argued that Ofcom should, in its assessment of the competitive effects of the cost standard adopted, have taken account of other factors affecting the ability of smaller networks to compete.

2.161 EE said, for example, that Ofcom was wrong not to take into account other factors affecting the incentives of smaller operators to attract customers from a particular segment,[141] such as the fact that post-pay customers were particularly attractive due to their longer tenure, and that smaller operators and new entrants were in a better position to compete aggressively for these customers given that they were less exposed to losses resulting from existing consumers migrating to low-priced tariffs. That such other factors were significant was said to be evidenced by the fact that Three itself had for a number of years chosen to focus on attracting post-pay customers, rather than pre-pay customers: the opposite of what Ofcom's partial analysis suggested.

2.162 Vodafone argued that Ofcom should have taken account of factors other than the expected price for voice services that influenced a subscriber's choice of MCP such as data services and pricing in its assessment of the retail effects.[142] Vodafone also argued that in its assessment of the impact of higher MTRs on competition for differ-

[138] Ofcom Statement, Annex 3, §A3.187.
[139] Ofcom Statement, Annex 3, §A3.126.
[140] Ofcom Statement, Annex 3, §A3.228.
[141] EE NoA, §114.
[142] Vodafone NoA, Schedule 2, §2.5.3c & §§2.41–2.44.

ent customer segments, Ofcom should have taken into account the lower marginal cost to smaller networks of additional voice minutes.[143]

2.163 Ofcom responded that there were many other factors affecting the competitive outcomes, but for the purpose of choosing between LRIC and LRIC+, the proper focus was on the effect of choosing one or other cost standard for setting MTRs leaving such other factors to one side.[144] Ofcom explained that its approach was aimed at isolating the potential effect on competition of the cost standard adopted.

2.164 It is our view that Ofcom's approach was reasonable. We consider that it would be incorrect in an assessment of the competitive effects of the cost standard adopted for setting MTRs, carried out for the purpose of deciding between LRIC or LRIC+, to take into account factors which whilst affecting competition would have the same effect regardless of the choice of cost standard.

2.165 In response to the CC's provisional determination, EE said that this was not what was demanded by the need to assess competitive effects in context. EE said there were at least two ways in which context could be relevant: first, there might be an interaction effect, ie the effects flowing from a practice might depend on the surrounding circumstances; and second, the significance of the effects would depend on the context.

2.166 With regard to the first of these points, it is not clear whether EE had any particular interactions in mind which Ofcom had failed to recognize or consider. However, an 'all else equal' approach should not exclude consideration of such interactions.

2.167 With regard to the second of these points, EE said that under general competition rules the need to avoid further restrictions to competition was particularly acute where competition was already limited. EE said that a competitive increment was therefore less valuable in an already competitive market such as the mobile market. This argument was made by Vodafone in its NoA and is addressed in paragraph 2.458.

2.168 In addition, we consider that EE was wrong to suggest that an assessment adopting an 'all else equal' approach would fail to consider significance or materiality on an appropriate basis. In our view, an all else equal approach is about the matters that will be included in the assessment of the choice between LRIC and LRIC+. Materiality is a benchmark by which scale and likelihood are judged. The concepts are not related in the way EE appears to be suggesting. Once matters are included in the appropriately framed 'all else equal' assessment, it is then possible to judge whether the effects that are observed are material.

2.169 EE also argued that the correct approach would be to consider whether competition would be appreciably distorted by reference to the full range of services across which the firms compete at a retail level, not to focus on specific services/customer groups.[145]

2.170 Ofcom responded that this was correct in general terms but that it had explained in the Statement why it considered that any disadvantage in voice services had wider implications. Ofcom said that a national network such as Three needed to win a significant share of the top-end customers to be commercially viable in the longer term as: this is essential to building market share; the highest-value consumers will also

[143] Vodafone NoA, Schedule 2, §3.16.
[144] Ofcom Statement, Annex 3, §A3.228.
[145] EE, Walker 1 expert report, §§140, 141 & 185–188.

be the ones that spend the most on other value-added services; and if the contribution from these services is significant it will be impossible for MCPs with fewer subscribers to make up for a lack of high-value customers by increasing their share of lower-value customers where smaller networks may have a small advantage.[146]

2.171 In addition, we consider that EE's proposed approach would be inconsistent with Ofcom's 'all else equal' approach.

2.172 Finally, Telefónica said that MCPs were able to price discriminate in the retail market across several factors in the packages provided to consumers, including the fixed monthly charges, the size of any inclusive bundle of minutes and texts, the handset subsidy. The potential for lower MTRs to increase competition between MCPs through potentially lowering retail prices for off-net outbound calls was said to artificially focus on a single and insignificant aspect of the pricing offer to consumers. In doing so, Ofcom was said to have placed undue and unsubstantiated emphasis on the pricing of off-net calls as a driver of consumer choice.[147]

2.173 Whilst we agree that consumer choice and behaviour would be determined by a range of factors, Ofcom's approach had been to focus on the incremental impact of the level at which MTRs were set on competition. We would expect the marginal cost of additional calls to networks, which will include termination costs, to be one factor that will influence the level and structure of retail charges.

2.174 For the reasons given above (see paragraphs 2.164, 2.171 and 2.173), it is our view that the appellants have not demonstrated that Ofcom erred in adopting its 'all else equal' approach.

Relevance of Three's experience

2.175 EE argued that Ofcom should have focused on the overall competitive process rather than on the prospects of individual competitors or commercial strategies.[148] Ofcom responded that as a general proposition it agreed, although one should not make too much of this point given the limited number of players in the UK. Given its duty to promote competition, Ofcom considered it appropriate to take into account evidence provided by individual MCPs regarding the impact of high MTRs on their ability to compete.[149]

2.176 We agree that generally Ofcom's objective in setting MTRs should be to protect the competitive process rather than to protect or further the interests of particular MCPs. However, we also agree that, in practice, Ofcom had little option but to consider the experience of particular competitors in the market in its assessment of the competitive effects of the cost standard adopted for setting MTRs. There are two reasons for this: first, with only four network providers in the market the sources of information available to Ofcom were limited; and second, in a market with a few players and high barriers to entry, Ofcom should have regard to the impact its regulatory decisions would have on the MCPs that are operating in the market.

2.177 Nevertheless, the competition effects identified by Ofcom are based on a consequence of setting MCT charges above LRIC (ie that the effect is to raise the marginal cost of terminating off-net calls above the marginal cost of terminating on-net calls) and a feature of smaller networks (ie that they will tend to have a higher proportion of

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[146] Ofcom Defence, Annex A, §A.247, and Ofcom Statement, Annex 3, §A3.184.
[147] Telefónica SoI, Neil Marshall expert report, §4.16.
[148] EE NoA, Walker 1 expert report, §142.
[149] Ofcom Defence, Annex A, §A.244.

off-net calls) (see paragraph 2.71) that do not rely on the experience of particular networks. We therefore consider that the experience of Three, and other networks, was used by Ofcom as supporting evidence.

Interim conclusions

2.178 To summarize the above, we are of the view that: Ofcom was not wrong to focus on the impact that the cost standard adopted would have on barriers to entry and growth; Ofcom was not wrong to adopt its 'all else equal approach'; and Ofcom was not wrong to take into account the experience of particular MCPs in assessing the impact that the level at which MTRs are set would have on competition.

2.179 The following paragraphs 2.180 to 2.265 deal with the third set of arguments identified in paragraph 2.94 above, these being, in turn, the arguments identified in paragraph 2.92 above. Those arguments are:

(a) higher MTRs do not favour larger networks as smaller networks could use the higher MTR receipts per subscriber to offset the higher MTR payments;

(b) Ofcom had overstated the prevalence and importance of on-net/off-net price differentials and the relationship between such differentials that there are and the level of MCT charges; and

(c) Ofcom had erred in its assessment of the impact that LRIC+ based MTRs would have on smaller networks in competing for post-pay customers and the resultant effect on competition.

Smaller networks with a balanced MTR position would not be at a competitive disadvantage

2.180 The appellants argued that higher MTRs would not disadvantage smaller networks as whilst a larger proportion of calls made by subscribers to smaller networks will attract MTR payments the network will also receive MTRs on a larger proportion of incoming calls. Smaller networks can use higher MTR receipts to offset higher MTR payments.

2.181 Ofcom did not accept this argument.[150] In particular Ofcom said that this required smaller networks to have a balanced position in terms of off-net incoming and outgoing calls, and that achieving this position would not be costless.

2.182 Below we summarize the arguments made by the appellants and Ofcom's response as set out in its Defence. We then give our assessment of this point.

Vodafone

2.183 Vodafone said that customers of smaller MCPs would be expected to generate more incoming termination revenues per subscriber than customers of larger MCPs, and this can be used to offset any disadvantage from having a relatively higher share of outbound calls.[151]

[150] Ofcom Defence, Annex A, §A.269.
[151] Vodafone NoA, Schedule 2, §2.10.

2.184 Vodafone also said that the argument in Ofcom's Statement that on-net/off-net price differentials in retail prices favour larger networks had been wrong for this reason.[152] Vodafone illustrated the point with reference to a simplified example which was said to show that the 'average price' paid by a subscriber of a smaller MCP would be the same as the 'average price' paid by a subscriber of a larger MCP, when off-net call prices were higher than on-net prices if, as it is reasonable to expect, MCPs compete away profits from termination in the retail outbound market.[153]

EE

2.185 EE said that, to a significant extent, the arguments relating to competition among MCPs turn on the fact that, relative to customers of larger MCPs, customers of smaller MCPs (ie those with fewer customers) were likely to make more off-net calls than on-net calls.[154] If MTRs were above marginal cost, the average cost of an out-going call would be higher for smaller MCPs than for larger MCPs because a greater proportion of calls would incur above marginal cost MTRs.

2.186 EE said this was uncontroversial. For EE the important question was whether higher MTRs would therefore put smaller MCPs at a competitive disadvantage. EE's view was that they would not as the increased revenue from incoming off-net calls would cancel out the increased cost of outgoing off-net calls. As a result, there would be no net revenue effect from higher MTRs to be passed on by smaller operators to customers in the form of higher off-net call charges (or call charges more generally).

2.187 EE said that for this reason a small operator could compete fairly in the presence of on-net/off-net price differentials.[155] In relation to Ofcom's market effects, EE said that smaller operators could use their higher MTR receipts per subscriber to subsidize their retail pricing, as had been demonstrated by Three.[156]

2.188 EE also said that the only situation in which this netting off effect would not operate fully would be if smaller MCPs tended to have customers with above-average outbound/inbound calling ratios.[157]

Ofcom's Defence

2.189 Ofcom responded: that high MTRs could force MCPs into a position of balanced traffic or other mitigation strategies which is not necessarily a costless exercise;[158] if a balanced traffic position was attained, this would limit the incentives of MCPs to compete as aggressively as this typically would result in an imbalanced traffic profile (ie a net outflow of traffic); and for Three, higher MTR revenues would not fully counter the effect of higher MTR costs.

2.190 Ofcom said that this point went to the heart of the competition concern.[159] If Three or other smaller MCPs adopted a commercial strategy in order to attain a balanced traffic profile (for example, by not competing as strongly on price for customer segments with a high ratio of outbound to inbound calls) they would indeed not suffer a traffic imbalance or interconnection deficit. But accepting this argument (as Vodafone

[152] Vodafone NoA, §50.1.
[153] Vodafone NoA, Schedule 2, §2.10.
[154] EE NoA, Walker 1 expert report, §§145 & 146.
[155] EE NoA, §§93 & 94.
[156] EE NoA, §102.
[157] EE NoA, Walker 1 expert report, §150.
[158] Ofcom Defence, Annex A, §A.269.
[159] Ofcom Defence, Annex A, §A.270.

and EE seemed to do) clearly showed that the level of MTRs affects the way in which MCPs decide to compete with each other.

2.191 Ofcom said that it had presented evidence in its Statement that in Three's case avoiding a traffic imbalance would have required it to forego profit. Ofcom said that it was profit-maximizing for Three (or other smaller players) to try to attract some of the top-end post-pay customers and that this would create a MTR deficit.[160] Three told Ofcom that it needed to attract post-pay customers in order to make its business commercially more viable. [✂]

2.192 Ofcom also said that one way to achieve a balanced traffic position (ie to gain a compensating benefit of high MTRs by attracting consumers with more inbound minutes) would be to attract calling circles.[161] Ofcom noted, however, that such actions could be costly to achieve particularly in a saturated market where customers might have already organized themselves into calling circles (see paragraph 2.88).

Three

2.193 Three said that EE's and Vodafone's argument was a static accounting construct that ignored competitive effects on traffic flows, namely that cutting retail prices would tend overwhelmingly to increase outgoing off-net call costs relative to incoming off-net call revenue.[162]

2.194 Three also said that greater MTR revenue would only partly offset the greater MTR cost facing smaller MCPs.[163] It did not change the underlying problem that high MTRs limited pricing flexibility, especially for smaller MCPs, and weakened smaller MCPs' ability to price competitively and thereby gain market share and ultimately achieve long-term commercial viability.

Assessment

2.195 It is uncontroversial that we would generally expect smaller networks to have a higher proportion of off-net calls, incoming and outgoing, and therefore to have proportionally higher termination costs and revenues per subscriber than other networks.[164]

2.196 Vodafone and EE argued that smaller networks would not be disadvantaged by LRIC+ based MTRs as we could expect higher MTR payments to be offset by higher MTR receipts. Vodafone said that,[165] as a matter of principle, a smaller network would receive proportionately more incoming termination revenues which it could use to 'neutralize' the relatively higher average outbound cost it faced in order to compete with larger networks.

2.197 For the reasons set out below, we do not accept this argument.

2.198 First, we do not understand why we should necessarily expect any network, including smaller networks, to have a balanced position. We consider that the traffic patterns of any operator will depend on a range of factors including some that will be outside its

[160] Ofcom Defence, Annex A, §A.298.
[161] Ofcom Defence, Annex A, §A.303.
[162] Three SoI, §6.38.
[163] Three SoI, §6.41.
[164] Vodafone NoA, Schedule 2, §§2.9 & 2.10; EE NoA, Walker 1 expert report, §§145 & 146.
[165] Vodafone Core Submission, §4.70.

control. One such factor would be the commercial strategies adopted by rival networks.

2.199 Second, we agree with Three that the need to maintain a balanced traffic position (or, more specifically, an average or lower than average ratio of off-net outbound-to-inbound minutes), in order to avoid being put at a competition disadvantage by higher MTRs, has the potential to constrain the commercial strategies available to a smaller network and, in so doing, to put it at a competitive disadvantage.

2.200 Third, we think it is wrong to suggest that smaller networks can avoid, or eliminate, a competitive disadvantage that might arise with higher MTRs by seeking to maintain a balanced traffic position (or, more specifically, average or lower than average ratio of off-net outbound-to-inbound minutes). This can be illustrated by considering the options available to a smaller network with a profit-maximizing strategy that would result in higher payments than receipts. Faced with LRIC+ based MTRs, such a network would have two options: *(a)* continue with a strategy that would result in a net termination deficit and either absorb the higher net termination costs or pass the higher costs on to their subscribers as higher retail charges; or *(b)* adopt a less profitable strategy that would deliver a more balanced traffic position. Either way the higher termination charges would put the smaller network at a disadvantage compared with its larger rivals.

2.201 In response to the CC's provisional determination, Vodafone said that in relation to whether one should expect MCPs to have an interconnection traffic balance or not, the CC's position was confusing. Vodafone said that whilst a smaller network, with a profit-maximizing strategy that would result in higher receipts than payments would be constrained under LRIC+, a smaller network with a profit-maximizing strategy that would result in higher receipts than payments would be constrained under LRIC. Vodafone said that in order for the CC's argument to succeed, the CC would have to prove what it is assuming, ie that it is a profit-maximizing strategy for a smaller network to have an interconnection traffic deficit. Vodafone said that this would only be the case if the CC could prove that for a smaller network to be able to compete effectively, it must have a relatively higher proportion of subscribers who make more calls than they receive.

2.202 We agree that setting MTRs at LRIC+ could operate to the advantage of a smaller network, in terms of its net termination position, if its profit-maximizing strategy would result in net termination payments. Nevertheless, our point is not that adopting the LRIC+ cost standard would inevitably disadvantage smaller networks, but that there is a risk that this would be the case. This potential for the cost standard adopted to distort competition by operating to the disadvantage (or advantage) of smaller networks, by virtue of the direction of its traffic balance, but unrelated to the cost efficiency of the network, is avoided by setting MTRs at LRIC.

2.203 Finally, as explained above in paragraphs 2.82 and 2.83, Ofcom's market effects were concerned with the impact of setting MTRs above LRIC on the incentives of larger and smaller networks to reduce prices at the margin. At the margin we would not except increased termination payments to be offset by increased termination receipts (see paragraph 2.69) Even if a smaller network had a balanced traffic position, the effects at the margin would therefore remain.

2.204 In response to the CC's provisional determination, Vodafone said that its understanding on the CC's argument in relation to the market-wide effects identified by Ofcom was that there were two ways in which such effects could manifest themselves: the

first related to competition *at the margin* and the second related to whether one should expect smaller networks to have interconnection traffic deficits.[166]

2.205 Vodafone said that for there to be an effect at the margin two conditions must hold: *(a)* a smaller network in order to be effective in attracting subscribers from other networks would need to lower the price of calls; and *(b)* when a smaller network reduced the price of calls subscribers would react by making more calls, leading to an interconnection traffic deficient at the margin. Vodafone submitted that we could not draw any conclusions on the basis of the evidence before us on the relationship between usage and price in the UK.

2.206 With regard to the first of these conditions, the suggestion is that any disadvantage to smaller networks in competing on price might not impact on competition in the retail market for subscribers as smaller networks could compete on other elements of its retail offer. We consider the retail prices charged by networks to be an important element of their retail offer in competing for subscribers and that any disadvantage faced by smaller networks in the incentives to reduce prices would therefore have the potential to distort competition in the retail market.

2.207 With regard to the second of these conditions, for existing subscribers we consider it to be clear that a reduction in retail prices would be expected to result in increased termination payments, but not increased termination receipts. We recognize that a reduction in retail prices might also attract new subscribers who would generate for a network both additional termination payments and receipts. However, for the reasons given above (see paragraph 2.69), we consider it unlikely that the net effect of a reduction in retail prices would be an improvement in a network's termination payment balance.

2.208 With regard to whether one should expect smaller networks to have an interconnection deficit, we have responded to this point above in paragraph 2.198.

Prevalence and importance of on-net/off-net price differentials (retail effects)

2.209 We now turn to consider the second of the three arguments identified in paragraphs 2.92 and 2.179 above. Vodafone said that the difference between retail charges for on-net and off-net calls had diminished over time,[167] the significance of such differentials in the UK market today was, at best, marginal,[168] and the significance of any disadvantage which, for example, Three might have suffered as a smaller MCP was de minimis. Vodafone also said that on-net/off-net price differentials in the UK were not driven by incumbent/larger MCPs or motivated by competition considerations but by other factors such as marketing.[169]

2.210 EE argued that:[170]

(a) Ofcom's 'retail effects' would be a concern only if there were material differentials between on-net and off-net call charges, but the proportion of contract plans containing such differentials was limited.

(b) The 'retail effects' rely on subscribers when selecting an operator taking into account not only what they would expect to pay to make calls, but also the cost

[166] Vodafone response to the CC's provisional determination, §4.11.
[167] Vodafone NoA, §50.3.
[168] Vodafone NoA, Schedule 2, §2.18.
[169] Vodafone NoA, Schedule 2, §2.18.
[170] EE NoA, §§95–97.

to others of calling them. This was said to be contradicted by Ofcom's own evidence.

(c) The differentials between on-net and off-net call charges were not determined by the level of MTRs. They generally existed for marketing rather than cost reasons.

2.211 Ofcom concluded that the observed on-net/off-net price differentials could still provide a competitive advantage to MCPs with a larger share of subscribers.[171] Ofcom expected that a move to lower MTRs under either cost standard would reduce some of the observed differences and most likely LRIC could almost, if not fully, eliminate them.

2.212 We consider below the arguments made and the evidence submitted in relation to the following: first the continued extent of on-net/off-net price differentials (see paragraphs 2.213 to 2.257); second the extent to which these tariffs are related to MTRs that are above LRIC (and therefore whether we would expect LRIC-based MTRs to result in fewer tariffs with such differentials or smaller differentials) (see paragraphs 2.258 to 2.282); and finally the importance of on-net/off-net price differentials to the choice of network (see paragraphs 2.283 to 2.292). In our conclusions to this section (see paragraphs 2.293 to 2.299), we consider the arguments made on the materiality of Ofcom's retail effects.

Evidence on the continued extent of on-net/off-net price differentials

2.213 The discussion was largely concerned with the tariffs available to non-business customers. Some arguments were made in relation to the tariffs offered to business customers which are considered separately (see paragraphs 2.253 to 2.257).

Ofcom's Statement[172]

2.214 Ofcom said that it had looked at available evidence from Pure Pricing's UK Mobile Pricing Factbook (Q3 2010) which provides a monthly analysis of the UK mobile operators' price plans.

2.215 For contract (or post-pay) plans, Ofcom found examples of differences between on-net and off-net call prices including plans with significantly higher off-net prices for out-of-bundle calls and plans offering bundles with more on-net minutes than off-net minutes. Ofcom noted that many available contract plans provided consumers with a large number of inclusive any network minutes, and to the extent that these consumers did not fully utilize their monthly allocation of minutes then they might not have to pay different prices for on-net and off-net calls.

2.216 Ofcom also found that: contract plans often included 'bolt-ons' offering free calls to elected on-net friends and family numbers; and where there was no differentiation between the on-net and off-net call prices in a particular contract plan, the (single) call price was always higher than the on-net call price in other packages where there was a difference in on-net and off-net call prices.

2.217 For pre-pay plans, Ofcom found examples of pre-pay plans offering lower call prices for on-net calls longer than a certain duration and 'bolt-ons' with higher bundles of minutes for on-net calls relative to off-net calls. Ofcom also said that pre-pay

[171] Ofcom Statement, Annex 3, §§A3.135–A3.138.
[172] Ofcom Statement, Annex 3, §§A3.128–A3.138.

providers often gave top-up 'rewards' of free calls to all or selected customers on the same network subject to minimum monthly top-ups.

2.218 For SIM-only plans, Ofcom found packages that offered significantly more on-net than off-net minutes.

Vodafone[173]

2.219 Vodafone said that it had conducted a comprehensive review of the tariffs available in 2010 Q3. Vodafone concluded that Ofcom had overstated both the prevalence (ie the number of tariffs that contained on-net/off-net price differentials) and the importance (ie the likelihood that customers would, in practice, face such differentials) of such differentials in post-pay and pre-pay tariffs.[174]

2.220 For post-pay tariffs (which accounted for 41 per cent of connections and 71 per cent of call minutes in 2009), Vodafone found no tariffs that charged different rates for on-net/off-net calls within the inclusive bundle of minutes. The differentiation was said to take two forms: different per minute charges for out-of-bundle on-net and off-net minutes; and more on-net minutes within the bundle than off-net minutes (the tariff plans include both a minutes allowance for any network/any time calls and a minutes allowance for on-net calls). Vodafone said that the latter typically included a larger number of minutes than the any network/any time minutes allowance.[175]

2.221 Vodafone found 31 out of 115 post-pay tariffs that had higher off-net than on-net prices for out-of-bundle calls. Three and Vodafone offered this type of tariff, O2 and EE (comprising T-Mobile and Orange) did not. However, Vodafone said that both its own experience and third party research suggested that the majority of customers did not make more calls than their bundles allowed and so most customers were unlikely to face such differentials in practice.[176]

2.222 Vodafone also found that 36 out of the 155 post-pay tariffs included additional within-bundle on-net minutes. A total of 55 out of the 115 plans had higher off-net than on-net prices for out-of-bundle calls and/or additional within bundle on-net minutes.[177]

2.223 In addition, O2, EE and Vodafone offered post-pay customers the opportunity to pay for a 'bolt-on' that allowed for additional (sometimes unlimited) on-net calls. [✂][178] [179]

2.224 In relation to pre-pay tariffs, Vodafone found one that directly charged a different price for on-net/off-net calls (offered by T-Mobile), and one (offered by O2) where customers would have a lower on-net price after 3 minutes on the telephone (in Vodafone's experience, the average duration of a pre-pay call was 2 minutes).[180]

2.225 Vodafone found that with the exception of Orange and Virgin Mobile, mobile operators offered 'rewards' that allowed pre-pay customers to make a large number of (sometimes unlimited) on-net calls for 'free' for a time-limited period, when they top-up their mobile phone by a minimum amount. Three had the lowest minimum top-up criterion of £5 top-up compared with £15 top-up for O2. Vodafone said that in [✂].

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[173] Vodafone NoA, Schedule 2, §§2.20–2.23 and Annex 2.
[174] Vodafone NoA, Schedule 2, §2.21.
[175] Vodafone email to CC of 24 November 2011.
[176] Vodafone email to CC of 24 November 2011.
[177] Vodafone email to CC of 24 November 2011.
[178] Vodafone, NoA Schedule 2, §2.21.
[179] Vodafone, transcript of bilateral hearing, §40, lines 18–25.
[180] Vodafone, NoA Schedule 2, §2.21.

2.226 Vodafone found that 19 out of 57 SIM-only tariffs had higher off-net than on-net prices for out-of-bundle calls. Three of the four SIM-only plans of Three had this feature. Vodafone was the only larger MCP to have SIM-only plans of this type (16 tariffs plans).

EE

2.227 EE said that Ofcom had not analysed the proportion of customers who were affected by on-net/off-net price differentials. The Orange and T-Mobile plans listed by Ofcom as containing such differentials were said to be of limited significance and [✂].[181]

2.228 EE said that the exercise undertaken by Vodafone showed that on-net/off-net price differentials were largely irrelevant to competition for post-pay customers.[182] Such differentials were a feature of the pre-pay offers of some operators (although [✂]) but higher MTRs were more likely to advantage, than disadvantage, a smaller operator in competing for pre-pay customers.

2.229 EE said that Orange had, in around 2005, removed all conventional differentials between on-net and off-net pricing across both post and pre-pay customers. The only remaining differentials were said to be Orange's 'magic numbers' whereby customers can designate a handful of numbers on the same network that can be called at a lower rate:

(a) Pre-pay customers could designate up to three other Orange numbers which they can call for up to an hour for 20p compared with the standard price for calls, both on-net and off-net, of 20ppm. Approximately [✂] per cent of pre-pay customers designate at least one 'magic number' and on average around [✂] per cent of all outbound calls by these customers are made to such numbers.

(b) Post-pay customers received one magic number upon joining and then one every six months that they remained on the Orange network. Approximately [✂] per cent of customers designate at least one 'magic number', and on average around [✂] per cent of all outbound calls by post-pay customers were made to such numbers.

2.230 EE said that the take-up of 'magic numbers' was [✂], but those customers who did designate 'magic numbers' tended to make a lot of calls to those numbers. Pre-pay customers who designated one or more 'magic numbers' made [✂] minutes of calls to those numbers each month.

2.231 EE said that T-Mobile traditionally had more differentials between on-net and off-net prices, but that [✂]. There were said to be no T-Mobile post-pay tariffs with differentials between on-net and off-net prices as standard.

2.232 For pre-pay around [✂] per cent of T-Mobile's active customers were said to be on 'mates rates' plans which had lower call and text charges to other customers on the T-Mobile network. Current call prices were 10ppm for on-net and 25ppm for off-net. A handful of other T-Mobile pre-pay plans contained differentials, but these were said to be legacy tariffs accounting for [✂] consumers. T-Mobile's other pre-pay plans had the same price for on-net and off-net calls.

[181] EE NoA, W/S Dunn, §108.
[182] EE Core Submission, Walker 3 expert report, Table 2 and §122.

2.233 EE said that shortly [✂] customers would be on plans which did not contain differentials, and it hoped that many existing customers currently on 'mates rates' plans would move over to the new tariffs.

Telefónica

2.234 Telefónica said that on-net and off-net price differentials were now of trivial significance.[183]

2.235 For post-pay customers, none of Telefónica's current tariffs differentiated between on-net and off-net minutes. All inclusive voice minutes within tariff bundles applied to calls to fixed telephones, as well as on-net and off-net calls to other mobile phones. For calls made outside of a customer's inclusive bundle of minutes, Telefónica applied a single rate of 35ppm for on-net, off-net and fixed calls.

2.236 Telefónica customers could buy a 'Family Bolt-on', which enabled a specified number of Telefónica customers to make unlimited calls and send texts to each other for free on their mobile phones. [✂]

2.237 Telefónica told us that its pre-pay tariffs did differentiate between on-net and off-net calls to the extent that for certain price plans call charges for on-net calls are the same as for off-net calls for the first 3 minutes of a day then reduced for the rest of the day.

Ofcom's Defence[184]

2.238 Ofcom said that Vodafone ignored or did not contest the fact that post-pay tariffs often (although not always) offered more inclusive on-net minutes than off-net minutes. In addition, each of the main MCPs had offers for free on-net calls as 'add-ons' that were accessible to the vast majority of their customers on numerous tariffs, for example: Orange via 'magic numbers' and 'your group'; T-Mobile via 'Flexible booster' and Telefónica via free on-net calls to subscribers who sign up online. With SIM-only deals, Three and Vodafone applied different rates for out-of-bundle on-net and off-net calls and T-Mobile and Telefónica offered free on-net calls.

2.239 Ofcom also said that, for pre-pay customers, the larger MCPs offered on-net discounts: Telefónica had different on-net and off-net rates for all tariffs and the option of free on-net calls for top-up; Orange offered 'magic numbers' discounts for on-net calls subject to minimum top-up; and T-Mobile offered 'mates rates' (with different on-net and off-net rates) and free on-net, weekend calls with minimum top-up.

2.240 Ofcom said that it did not assess how many consumers had taken up the individual tariff packages of particular MCPs. Ofcom took the view that this would have been disproportionate given that on-net/off-net price differentials had been a feature of the market for a number of years and the evidence showed that they still persisted at the time of the Statement.

Assessment on the continued extent of on-net/off-net price differentials

2.241 The appellants argued that on-net/off-net price differentials were no longer a feature of the UK market. Vodafone said that whilst on-net/off-net price differentials exist,

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[183] Telefónica SoI, §16 and W/S Wardle §§58–62.
[184] Ofcom Defence, Annex A, §§A.262–A.267.

they were only relevant for a very small share of mobile calls,[185] EE said that plans containing such differentials were of limited significance,[186] and Telefónica that they were now of trivial significance.[187]

- *Post-pay*

2.242 The appellants argued that there were no post-pay plans with an on-net/off-net price differential for bundled minutes (see paragraphs 2.220, 2.229, 2.231 and 2.235 above). We note that Ofcom does not appear to dispute these claims (see paragraphs 2.215 and 2.216). The differentials that there are take the form of higher call charges for out-of-bundle off-net calls; packages that offered more inclusive on-net minutes than off-net minutes; and 'bolt-ons' which offer lower call prices for on-net calls to selected numbers (for example, family & friends).

2.243 As Ofcom said, in its Defence, the appellants did not contest that post-pay tariffs often included more inclusive on-net minutes than off-net.

2.244 Vodafone identified 55 out of a total of 115 post-pay plans which included higher off-net call prices for out-of-bundle minutes and/or more within bundle on-net minutes. We do not consider this proportion—over 45 per cent—to be of limited significance. We are, however, aware that we do not know the number of subscribers to these plans, the value of the calls made within the plans or the volume of out-of-bundle calls.

2.245 Vodafone also said [✂] third party research suggested that the majority of post-pay customers did not make more calls than allowed by their bundles and so most customers were unlikely to face differentials in practice. In particular:[188]

(a) The Jigsaw Research (carried out for Ofcom in September 2008) showed that half of the sample usually used less than their allocation of bundled minutes, with only 15 per cent saying they usually exceeded it.

(b) [✂]

(c) The ICM survey commissioned by Vodafone found that 72 per cent of post-pay customers reported not exceeding their bundle limit.

2.246 These results do not suggest to us that higher prices for out-of-bundle off-net calls would be as unimportant to customers as implied by Vodafone. In particular, with the Jigsaw survey, 51 per cent of respondents said that they usually used less than their inclusive minutes which leaves open the possibility that sometimes these people may have used more (although we do not know how often this happened). For the 19 per cent who said that the amount was about right, they could have been facing higher off-net prices if they made more calls, and this may have acted as a constraint. Finally, 15 per cent of respondents usually exceeded their limit and for a further 12 per cent usage varied.

2.247 For this latter group, estimating usage may be difficult and so they may be more likely to exceed their bundled minutes (or purchase larger bundles than they generally needed to avoid paying higher off-net prices). Ofcom said that, even if customers did not regularly breach their limits in practice, out-of-bundle tariffs might still affect

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[185] Vodafone NoA, Schedule 2, §2.18.
[186] EE NoA, §95.
[187] Telefónica SoI, §16.
[188] Vodafone NoA, Schedule 2, Annex 2.

their choice of MCP.[189] This was because they might consider the fact that larger MCPs offering discounted on-net rates for out-of-bundle calls would offer a better safety margin (in case they were to breach their monthly allowance).

2.248 It also appears that family & friends type 'bolt-ons' were available for subscribers to O2, EE and Vodafone. [✂] and [✂] (see paragraphs 2.223 and 2.236). However, in its bilateral hearing [✂] (see paragraph 2.223). EE said that [✂] per cent of calls made by Orange post-pay customers were on such designated numbers (see paragraph 2.229).

2.249 Based on this evidence we are not persuaded that the availability and take-up of plans that include some form of on-net/off-net price differential for post-pay customers was, at the time Ofcom issued its Statement, as limited as suggested by the appellants. The evidence presented suggests that whilst traditional on-net/off-net price differentials for all calls were no longer a feature of the market, bundles often included more on-net than off-net minutes and two networks—Vodafone and Three—had plans with differentials for out-of-bundle minutes (see paragraphs 2.221 and 2.222). The survey and other evidence to which Vodafone referred did not suggest to us that such differentials would be of limited relevance to customers. Finally, family & friends and other bolt-ons were offered by three of the four networks. The take-up of these plans was low for two networks, [✂] and [✂] of Orange calls by post-pay customers were made to designated on-net numbers (see paragraphs 2.223 and 2.229).

- *Pre-pay*

2.250 EE said that around [✂] of T-Mobile's pre-pay customers were on 'mates rates' plans which had lower call and text charges of 10ppm for on-net calls compared with 25ppm for off-net calls, although [✂] T-mobile customers would be on plans which would not contain such differentials (see paragraphs 2.232 and 2.233). In addition, some O2 tariffs had lower on-net prices after the first 3 minutes of calls in a day (see paragraph 2.237). Vodafone also found that with the exception of Orange, MCPs offered 'rewards' that allowed pre-pay customers to make a large number of (sometimes unlimited) on-net calls for 'free' for a time-limited period when they topped up their mobile phone by a minimum amount (see paragraph 2.225). [✂] We do not have data on the take-up of these offers for other networks.

2.251 Family & friends type bolt-ons were also available to Vodafone, Orange and T-Mobile pre-pay customers. The take-up seemed to vary considerably between networks. Orange said that only [✂] per cent of Orange pre-pay customers designated one or more 'magic numbers', but they also said that those subscribers made [✂] calls to those numbers (see paragraphs 2.229 and 2.230). Vodafone said that [✂] per cent of its pre-pay customers purchased its family & friends bolt on (see paragraph 2.223).

2.252 Again, it appears to us that on-net/off-net price differential were declining but continued to be available to pre-pay customers in the form of traditional on-net/off-net call price differentials, rewards for top-ups and bolt ons. From the evidence that is available, the take-up of these plans and offers does not appear to be insignificant, as the appellants had suggested.

[189] Ofcom Defence, Annex A, §A.267.

- *Business*

2.253 With respect to business customers, Ofcom found that contract plans for business consumers often offered unlimited on-net minutes and that business consumers also often faced higher call prices for out-of-bundle off-net calls compared with on-net. Ofcom also found that some MCPs offered business SIM-only plans with unlimited on-net calls.

2.254 Vodafone said that on-net/off-net price differentials to business customers take two forms: unlimited on-net calls as part of all of their business tariffs; and different prices for on-net and off-net calls made outside of the inclusive bundle of minutes for all their plans. SME customers are said to value certainty over their spend and consequently, inclusive bundles had been developed typically offering on-net and off-net (mobile and fixed) calls as in the consumer segment of the market. [✂]

2.255 Vodafone also said that there was nothing preventing any MCP from offering such packages to attract those business customers that value highly a low cost of on-net mobile calls between their employees.[190]

2.256 EE made a similar point. EE said that it had been likely that many companies provided subscriptions to a single network for all their employees but an efficient smaller operator could compete just as readily for businesses where most calls were between employees as a larger operator.[191] More generally, some businesses may be net recipients of calls to their mobiles while others have balanced traffic or make more calls than they received. As such, EE did not believe it was reasonable to argue that smaller operators generally faced a disadvantage in competing for business customers.

2.257 Based on what Vodafone said we do not have grounds for thinking that Ofcom was wrong to conclude that on-net/off-net price differentials continued to be a feature of business contracts. However, Vodafone's and EE's key argument seems to be that smaller networks were equally able to replicate the business tariffs offered by larger networks. We consider that the retail effects identified by Ofcom were likely to be limited to domestic subscribers.

Relationship between on-net/off-net price differentials and MTRs

2.258 We now turn to consider the second argument identified in paragraph 2.212 above. In its Statement[192] Ofcom said that it expected that a move to lower MTRs under either cost standard would reduce some of the observed retail price differentials and considered it most likely that LRIC could almost, if not fully, eliminate them. The appellants questioned the link between MTRs and any remaining on-net/off-net price differentials. They said that these were not driven by MTRs, and that a reduction in MTRs could not therefore be expected to result in a reduction or elimination of such differentials.

- *Vodafone*[193]

2.259 Vodafone said that on-net/off-net price differentials in the UK were not driven by incumbent/larger MCPs or motivated by competition considerations, and that

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[190] Vodafone NoA, Schedule 2, §2.25.5.
[191] EE Core Submission, Walker 3 expert report, §117.
[192] Ofcom Statement, Annex 3, §3.137.
[193] Vodafone NoA, Schedule 2, §§2.45–2.48.

Ofcom's argument was not consistent with the history of the introduction of such differentials, both inside and outside the UK.

2.260 Vodafone said that there had been no systematic tendency for on-net/off-net price differentials to be more prevalent in the tariffs of larger operators compared with smaller operators.[194]

2.261 Vodafone gave examples of on-net/off-net price differentials being introduced by the smaller/later entrant networks: in Germany, E-Plus, the third entrant, launched with off-net/on-net price differentials in 1994. The two existing operators then introduced similar differentials six months later; in Ireland, Digifone launched in 1997 with off-net/on-net price differentials. Eircell responded with similar differentials two years later; and in the UK, on-net/off-net price differentials were first introduced in 1993/94 by One2One and Orange when these networks launched their services. Vodafone introduced such differentials in 1998 and BT Cellnet in 1999.

2.262 Vodafone said that the recent evolution of on-net/off-net price differentials demonstrated that larger MCPs had relied less on this pricing policy. Vodafone explained that it had developed a number of different post-pay bundle-based offers and that over the years the range of call types included in the bundles had broadened to include off-net calls to other mobile and fixed-line operators, and text messages and data services. These propositions were introduced in response to an increasing awareness that consumers valued the certainty of knowing exactly how much they would pay each month, and bundle-based tariffs offer that certainty, provided that the subscriber chose a bundle of a size and composition sufficient to cover his or her likely consumption of mobile services.

- *EE*[195]

2.263 EE said that differentials between on-net and off-net call charges were not determined by the level of MTRs.[196] EE explained that if a plan had differentiated charges, this should have allowed the operator to set on-net charges below the single charge that would be set on a flat tariff. This allowed the operator to highlight a low price when marketing the plan which might stick in the mind of some consumers when they were comparing the plans of different operators.

2.264 EE added that a small minority of consumers knew to which mobile network the people they called most often subscribed, and that the ability to make calls to that group at a price that was both cheap and certain might influence their choice of operator and tariff. If a network had a customer of this type on a plan with on/off-net price differentials, or which entitled them to select 'magic numbers', this might have encouraged the customer's friends and family to join the same network (or encouraged the customer to persuade them to join).

2.265 EE also said that while these marketing possibilities were the cause of on/off-net price differentials, it was important not to overstate their significance. The vast majority of customers did not know what network they were calling when they called a mobile, and were not sensitive to the cost of calls to specific numbers.

2.266 That on-net/off-net price differentials were not driven by MTR was said to be supported by US experience where mobile termination charges were relatively low and

[194] Vodafone NoA, Schedule 2, §2.20.2.
[195] EE NoA, §97.
[196] EE, W/S Dunn, §§110–120.

yet on-net and off-net price differentials appeared pervasive. The largest US mobile operators were said to offer unlimited on-net calls on their standard post-pay plans (as well as unlimited calls between 9pm and 6am and on the weekend), but limited off-net calls. EE said that Ofcom reported that 90 per cent of the US market was post-pay and, in any event, the largest operator Verizon's 'pre-pay' plans included unlimited on-net calls but limited off-net calls.

- *Telefónica*[197]

2.267 Telefónica said that even in relation to such differentials as remain, Ofcom had provided no evidence or analysis to establish (or even suggest) any causal link between those differentials and higher MTRs.

- *Ofcom's Defence*[198]

2.268 Ofcom said that smaller MCPs had introduced on-net/off-net price differentials at a time when the market circumstances and regulatory context had been very different from that today (in particular in relation to the levels of mobile penetration). Ofcom said that it was difficult to suggest that later entrants could have offered such differentials as successfully in current UK market conditions.

2.269 Ofcom also said that Vodafone's pricing policy underlined one of the benefits of lower MTRs, smaller MCPs and FCPs were more likely to bundle together inclusive any network calls where they faced lower costs of calling other mobile networks. The fact that Vodafone (as a larger MCP) seemed to be able to do this, did not mean that a smaller player, faced with high MTRs on off-net calls, could have done so at a similar price without this affecting its margins (other things being equal).

2.270 With regard to the US experience, Ofcom said that most post-pay (and some pre-pay) plans in the USA offered unlimited on-net calls. Once the allowance of off-net calls was used up, there was an effective difference in prices of on-net calls (which were always free) and off-net (charged at a flat rate beyond the allowance). Ofcom considered that, in practice, the bundle sizes were so large that off-net calls were effectively unlimited and so the price differential was close to zero (or entirely eliminated) for most users.

2.271 Ofcom accepted that on-net/off-net price differentials were not determined solely by cost differences associated with MTRs. Ofcom noted that strategic pricing behaviour (eg to encourage club effects) rather than differences in on-net and off-net costs may have been another motivation for lower on-net retail prices. Ofcom considered, however, that if larger MCPs were successful in attracting consumers via the club effect then smaller MCPs would have to offer more attractive call packages overall, which high MTRs would restrict them from doing.

- *Core Submissions*

2.272 Vodafone[199] examined whether there was any relationship between the existence of on-net/off-net price differentials and the market share of smaller operators. The analysis was said to show that there was no apparent relationship between the

[197] Telefónica SoI, §28.
[198] Ofcom Defence, Annex A, §§A.286 & A.287–A.290.
[199] Vodafone Core Submission, §4.92.

relative market share of smaller networks and the prevalence of larger operators' tariff plans with on-net/off-net price differentials.

2.273 EE said that Ofcom had missed the main implication of the US tariffs—if customers had to take into account on-net/off-net price differentials this would be likely to influence what size bundle they bought. EE also said that it was not the case, as Ofcom seemed to imply, that the cheapest US plans offered so many off-net minutes that most customers would never buy a more expensive plan.[200]

2.274 Finally, EE said that when an operator such as Three set an off-net call price of 25ppm and an on-net call price of 10ppm[201] then it was hard to see how termination charges (around 4–5ppm) were responsible for such differences.

- *Assessment*

2.275 Ofcom accepted that on-net/off-net price differentials were not determined solely by cost differences associated with MTRs. Given this, we would not expect a move to LRIC to have the effect of eliminating all such differentials.

2.276 However, for the reasons given below (see paragraphs 2.277 to 2.281), it is our view that the appellants have not establish that there has been no relationship between the level of MTRs and the continued presence of on-net/off-net price differentials.

2.277 Vodafone suggested that if there was a relationship between MTRs and on-net/off-net price differentials, one would expect such differentials to have been more prevalent in the tariffs offered by the larger networks. We do not accept that this would be the case. Ofcom's retail effects are not the result of strategic exclusionary behaviour on the part of the larger networks. Rather, the potential disadvantage to smaller networks arises from the response of networks—large and small—to higher costs of terminating calls off-net than on-net with LRIC+ based MTRs. Contrary to Vodafone's suggestion, if the observed on-net/off-net differentials were, to some extent, at least, a reflection of the level of MTRs at the time, we might expect observed differentials to be more prevalent in the tariffs offered by smaller networks which would have been more exposed to the higher cost of off-net calls.

2.278 We agree with Ofcom that the historic examples given by Vodafone of new entrants introducing on-net/off-net price differentials may not be informative. All the examples cited were at least a decade old when the market and regulatory context was very different from that today. One difference is that termination rates were much higher than they are now. Smaller networks would have been more exposed to the potential cost of call imbalances and, unlike the larger networks, may have been unable to offer off-net calls at the same price as on-net call prices.

2.279 Neither are we convinced that the US experience is informative. The US system is different from that in the UK given the Bill & Keep arrangements.[202] Also, the prevalence of on-net/off-net differentials in the USA may be for reasons unrelated to the level of MCT charges. (We consider the arguments made in relation to the US experience further below—see paragraphs 2.413 to 2.419.)

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[200] EE Core Submission, Walker 3 expert report, §§132 & 134.
[201] Ofcom Statement, Table A3.1.
[202] In the USA, telephone networks have Bill and Keep arrangements (B&K) which means that the originating network keeps whatever it charges the caller and the terminating network routes the call to the destination free of charge to the originator network. As a result, in the USA, mobile operators charge mobile users for incoming calls.

2.280 That Vodafone moved to offer more inclusive bundles with MTRs set above LRIC in response to demand and EE's use of on-net/off-net price differentials in marketing tariffs are illustrations of other factors that networks would take into account in determining the structure of their tariffs. These explanations do not preclude the possibility that the level at which MTRs are set would also be a factor that would be taken into account.

2.281 To summarize, we would not expect a move to LRIC to result in the elimination of any remaining on-net/off-net price differentials. However, neither are we persuaded that there is no relationship between the differentials that remain and the level at which MTRs have been set. For example, for post-pay customers, we may expect bundles to include relatively more off-net call minutes and/or a reduction in the differential between out-of-bundle on and off-net call prices. For pre-pay, we may expect fewer, or less attractive, offers for on-net call 'bolt-ons' and rewards.

2.282 In response to the CC's provisional findings Vodafone said that the CC had failed to have regard to Vodafone's evidence on the factors which had led to the substantial elimination of on-net/off-net differentials and that the CC appeared to conclude that the abandonment of on-net/off-net differentials was attributable to a reduction in MCT charges. We do not accept this argument. We do not agree with the appellants that there has been a substantial elimination of on-net/off-net differentials. Nor do we conclude that there had been an abandonment of on-net/off-net differentials attributable to a reduction in the absolute levels of MCT charges.

Importance of on-net/off-net price differentials to the choice of network

2.283 We turn now to consider the third of the arguments identified in paragraph 2.212 above. Ofcom said that the presence of significant differences between on-net and off-net call prices may have placed MCPs with fewer subscribers at a disadvantage because of the potential 'club effect': a new subscriber only had to select the leading operator in order to call and be called at cheaper rates.[203] The appellants argued that the presence of on-net/off-net price differentials was not an important consideration in driving the choice of network. In its Defence Ofcom explained that a smaller MCP would find it more difficult to attract subscribers in a retail market in circumstances where on-net/off-net price differentials were material and calling clubs mattered.[204] This was because the incentive to switch MCP would be more limited unless other members of the calling circle could be convinced to switch at the same time which was clearly more complicated.

- *Vodafone*[205]

2.284 Vodafone said that there was no evidence that customers considered the price paid by others for calling them in their subscription decision. Evidence from consumer surveys referred to by Ofcom showed that the price of being called was not a relevant variable considered by mobile customers in their subscription decisions.

2.285 Vodafone also said[206] that if the existence of on-net/off-net price differentials was a factor influencing subscriber decisions then it would be reasonable to expect MCPs to advertise their network size, other than when such operators are targeting business customers that form closed user groups.

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[203] Ofcom Statement, Annex 3, §3.134.
[204] Ofcom Defence, Annex A, §A.271.
[205] Vodafone NoA, Schedule 2, §§2.14–2.17.
[206] Vodafone NoA, Schedule 2, §2.39.2.

- *EE*[207]

2.286 EE said that Ofcom's theory of harm assumed that on-net/off-net price differentials played an important role when consumers were deciding which network to join. In particular, it relied on the fact that a subscriber selecting an operator would not only take into consideration the different tariff plans available on the market and what they would pay, but might also take into account the fact that people calling them could pay less. This proposition was said to be contradicted by Ofcom's own evidence as to why customers chose different MCPs and on their awareness of different call prices.

2.287 The Jigsaw Research survey was said to have found that only 24 per cent of respondents knew to which mobile network a number subscribed and only 30 per cent had any idea of the price of calling other MCPs, and only 7 per cent stated that they knew it exactly.[208] The survey was also said to have found that mobile subscribers did not consider the cost to others of calling them to be an influential factor when choosing their MCP.

- *Telefónica*

2.288 Telefónica said that the Jigsaw Research survey showed that the majority of consumers were unaware of which mobile network they were calling and were unaware of the price of calling other networks. Telefónica therefore considered it unlikely that on-net/off-net price differentials were a significant driver of consumers' choice of network.[209]

- *Ofcom Defence*[210]

2.289 Ofcom responded that it agreed that the survey evidence suggested that the price of being called was a factor of limited importance in the choice of MCP. Ofcom did not, however, accept that this created a contradiction with its description of club effects. Ofcom explained that the most important consideration would be the price a subscriber faced to call others. In its Statement Ofcom had focused in particular on the impact of the retail price of on-net and off-net outgoing calls. Hence, Ofcom did not focus on the importance of the price others would pay to call a user in the choice of MCP in its analysis of competitive effects.

2.290 Ofcom noted that the survey also suggested that 45 per cent of all respondents (and 61 per cent of mobile only) knew to which MCP people they called the most subscribed. It also highlighted that the cost of calling others was a key driver of MCP choice (29 per cent of all respondents and 34 per cent of mobile users) and the most often stated factor determining MCP choice. Ofcom said that a more complete reading of this evidence did not therefore contradict the view that on-net/off-net price differentials were a factor, among others, affecting competition.

2.291 In response to Vodafone's argument that if on-net/off-net price differentials were a factor influencing subscriber decisions, it would be reasonable to expect MCPs to advertise their network size, Ofcom said that consumers would in general have some sense of the customer base of different brands;[211] and some consumers would know

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[207] EE NoA, §96.
[208] EE NoA, Walker 1 expert report, §161.
[209] Telefónica SoI, Neil Marshall expert report, §4.11.
[210] Ofcom Defence, Annex A, §§A.275–A.277.
[211] Ofcom Defence, Annex A, §A.283.

at least the MCP used by their friends and family. This, Ofcom said, suggested that there were a number of consumers with sufficient knowledge of the MCP of their closest contacts that MCPs did not need to advertise the size of their customer base.

- *Assessment*

2.292 We agree with Ofcom that its description of club effects did not rely on subscribers taking into account the cost of being called, as well the cost of making calls, in deciding to which network to subscribe. Nor do the club effects require callers to be aware of which network they are calling, in particular whether a call is on-net or off-net. It is sufficient that subscribers would form an expectation that they would pay higher average call prices if they subscribed to a smaller network or switch network. For the reasons explained by Ofcom, a subscriber may expect to make more off-net calls if they subscribe to a smaller network or switch network (or learn by experience when they do so) and, in the presence of on-net/off-net price differentials, to therefore pay higher average retail call charges. A network may seek to mitigate this effect by attracting calling circles, but in a mature market with high levels of subscription we agree with Ofcom that this could be difficult as it requires all (or almost all) members of the calling circle to switch networks (see paragraph 2.88).

Materiality of Ofcom's retail effects

2.293 Vodafone said that the evidence available from today's UK mobile market suggested that the retail effects identified by Ofcom had a non-detectable or negligible impact and that, if these effects were negligible at the current level of MTRs, it was reasonable to expect them to be non-existent in 2014/15.[212]

2.294 EE said that there did not seem to be any good evidence that on-net/off-net price differentials were affecting competition for subscribers in the UK or that reducing MTRs would eliminate such differences.[213] EE said that: on-net/off-net price differentiation was not pervasive in the UK; consumers did not seem to make network choices on the basis of such differentials; and the US evidence indicated that such differentials could be pervasive even when MTRs were very low.

2.295 Telefónica concluded that Ofcom had failed to provide a robust basis for concluding that the retail effects driven by MTRs above LRIC would have any materially distorting effect on competition between MCPs.[214]

2.296 In its Defence Ofcom said that while Vodafone, Telefónica and EE had sought to present on-net/off-net price differentials as completely immaterial, the evidence showed that they remained available in some form for most consumers. But even if the 'retail price' competition effect was not significant in isolation, Ofcom considered that it needed to be assessed in conjunction with the other competition factors. The reduction in the level of MTRs would be expected to bring about larger bundles of 'any network' minutes further reducing any remaining differentials. As such, the relevance of the competition effect would be reduced in future under either cost standard as MTRs decline, but particularly so under LRIC.[215]

[212] Vodafone NoA, Schedule 2, §2.50.
[213] EE NoA, Walker 1 expert report, §164.
[214] Telefónica SoI, Neil Marshall expert report, §4.12.
[215] Ofcom Defence, Annex A, §A.291.

2.297 Three argued that on-net/off-net price differentials were not essential to the retail effects, but an exacerbating factor.[216] Three said that LRIC+ MTRs would limit retail price competition between all MCPs because such competition normally generated net call outflows and a termination deficit. This effect was particularly severe for smaller or new entrant MCPs because they needed to cut retail prices below the level of incumbents to gain market share and overcome barriers to entry and expansion (eg brand recognition). This restriction on retail competition was further aggravated by the impact of on-net/off-net cost and pricing differentials, which were often internalized in MCP calling bundles.

- *Assessment*

2.298 Three argued that on-net/off-net price differentials were not essential to the retail effects but an exacerbating factor in its description of the retail effects. Whilst we agree with Three that LRIC+ based MTRs would have the effect described by it (see paragraph 2.297), we consider that this effect is captured by Ofcom's market-wide effects, in particular, its reasoning on the impact that higher MTRs would be expected to have on the incentives faced by networks at the margin to reduce prices (see paragraphs 2.82 and 2.83). We understand Ofcom's retail effects to be concerned specifically with the impact on barriers to entry and growth of the presence of on-net/off-net price differentials to the extent that these may be a result of setting MTRs above LRIC.

2.299 Overall, we do not consider that the appellants demonstrated that Ofcom's retail effects in competition for domestic subscribers are immaterial. In particular, the appellants have not, in our view, demonstrated that on-net/off-net price differentials were no longer a feature of the UK market or were of no significance. Ofcom accepted that there were reasons, other than differences in the cost of terminating calls on-net and off-net, why operators may offer tariffs that have some form of preferable rate for on-net calls. This suggests that Ofcom could not reasonably expect the adoption of the LRIC cost standard to result in the elimination of on-net/off-net price differentials. However, in our view, neither have the appellants demonstrated that there was no link between the level at which MTRs have been set and the continued presence of such differentials. Finally, we consider that whilst the retail effects may be stronger if subscribers took into account the cost of being called, as well as the cost of making calls, we agree with Ofcom that this is not necessary for the retail effects to arise.

Impact of LRIC+ based MTRs on competition in different customer segments

2.300 We now turn to consider the argument identified in paragraph 2.92*(c)* above. Ofcom considered the impact that LRIC+ based MTRs would have on the incentives of MCPs to compete for particular segments: in particular on the incentives for smaller MCPs to compete for the high-end post-pay customers who tend to have high outbound/inbound calling ratios, leading to large net out payments for MCPs with fewer subscribers.[217]

2.301 It was uncontroversial that adopting the LRIC+, compared with the LRIC, cost standard would increase the CLV of customers who receive more calls than they make and reduce the CLV of those who make more calls than they receive. There was also

[216] Three SoI, §6.2a.
[217] Ofcom Defence, Annex A, §A.239c and Ofcom Statement, Annex 3, §§A3.162–3.165.

general agreement that the effect would for smaller networks be greater as they tend to have a higher proportion of off-net calls, both incoming and outgoing.

2.302 Using its Illustrative model Ofcom calculated the absolute difference in the per subscriber contribution for networks with different shares of subscribers with LRIC+ based MTRs, for the pre-pay and post-pay customer segments. Ofcom concluded that higher MTRs would give larger networks an advantage in competing for subscribers who make more calls than they receive. Ofcom considered that this would put smaller networks at a disadvantage as it was essential for smaller networks to be able to compete for the top-end post-pay customers to build market share.[218]

2.303 Vodafone and EE said that there would be no overall effect on competition as the disadvantage to smaller networks in competing for the post-pay customers would be compensated for by the advantage that smaller networks would have in competing for pre-pay customers.

2.304 Vodafone also criticized Ofcom's illustrative model. In particular, Vodafone said that there were two key assumptions, made by Ofcom that exaggerated the size of the estimated contribution margin difference for high value post-pay subscribers: the inclusion of mobile-to-fixed traffic; and the assumption about the incremental cost of calls for a smaller network.[219] EE made similar points regarding the inclusions of MTF traffic.

2.305 Ofcom did not dispute that the inclusion of MTF traffic had this effect in the illustrative model. However, Ofcom also produced a theoretical model using industry-level data which was said not to include MTF traffic. This version of the model was discussed in paragraphs A3.169 to A3.176 of the Statement.

2.306 Vodafone concluded that Ofcom had thus been unable to provide evidence on the materiality of its claim that setting MTRs based on LRIC+ would make it harder for smaller MCPs to compete for certain consumer segments, notably post-pay subscribers.[220]

2.307 EE said that the results of the Illustrative model should be expressed as a percentage of total contributions and/or sales as this would provide a more meaningful indicator of any potential impact on competition than the absolute contribution per customer.[221] Vodafone made a similar point.[222]

2.308 We consider these points in turn: we consider first the argument that the effects described by Ofcom would have no overall effect on competition (see paragraphs 2.309 to 2.323); secondly we consider the criticisms of Ofcom's model (see paragraphs 2.324 to 2.349); and thirdly we consider the arguments concerned with the materiality of any effects (see paragraphs 2.350 to 2.363).

Overall impact on competition

2.309 EE and Vodafone argued that such effects would have no overall competitive effect as whilst smaller networks might be at a disadvantage in the post-pay segment they would have an advantage in the pre-pay segment.

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[218] Ofcom Statement, Annex 3, §A3.184.
[219] Vodafone NoA, Schedule 2, §§3.16–3.18.
[220] Vodafone NoA, Schedule 2, §3.23.
[221] EE NoA, §111.
[222] Vodafone NoA, Schedule 2, §3.5.

- *Vodafone*

2.310 Vodafone said it was true that, if different customer segments generated different patterns of outgoing and incoming calls, then LRIC+ MCT charges would incentivize MCPs to compete on price to win consumers who were likely to generate more incoming calls. They would offer less attractive prices to win customers who were likely to generate fewer incoming calls. Vodafone said that this did not amount to a distortion of competition, but reflected the fact that MCPs competed for the custom of each consumer segment according to its CLV, and the CLV of different segments varied according to its profile of outbound/inbound traffic. With LRIC+ based MTRs, competition was just as effective as under LRIC but prices were differentiated.[223]

- *EE*

2.311 EE said that relative to other possible standards, the fact that any single cost standard would provide some categories of MCP with some incentive to attract some categories of customer and some disincentive to attract others did not in itself constitute a distortion of competition.[224]

2.312 EE said[225] that the logic of arguments advanced by Ofcom was that LRIC would: *(a)* reduce the net MTR payment deficit associated with attracting MMCs ('make more calls' customers who make more calls than they receive), who tended to be high-end post-pay customers, thereby improving their CLV and strengthening MCP incentives to compete intensively for this group; and *(b)* reduce net MTR revenue associated with attracting RMCs ('receive more calls' customers who receive more calls than they make), who tended to be low-end pre-pay customers, thereby reducing their CLV and weakening MCP incentives to compete for this group.

2.313 EE said that even assuming that this change in incentives would lead to increased competition and lower prices for high-end post-pay MMCs, and reduced competition and higher prices for low-end pre-pay RMCs, this outcome would not be beneficial even from a narrow competition perspective. EE also considered the overall mobile retail market to be competitive, and that overall competitiveness would not be improved by a change that increased the incentive for competition in one area of the market but diminished it in another.[226]

2.314 EE also said that smaller networks would not be at any overall disadvantage as any reduction in market share as a result of being at a disadvantage in the post-pay segment could be offset by a gain in market share in the pre-pay segment where a smaller network would have an advantage. In particular, EE said that a smaller operator could grow its customer base by acquiring pre-pay customers and customers with relatively balanced traffic, and that such customers represented more than half the UK market. EE said that as this operator achieved a similar share of overall customers to the larger operator it would no longer be disadvantaged in competing for those post-pay customers who tended to make more calls than they received.[227]

2.315 EE said that even if it were considered relevant to focus on competition for particular customer segments,[228] cutting MTRs was more likely to harm, than promote, competition within the mobile market. EE said that the direct effect of cutting MTRs would

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[223] Vodafone NoA, §50.4.
[224] EE NoA, §115.
[225] EE Core Submission, §§44–49.
[226] EE Core Submission, §46.
[227] EE Core Submission, Walker 3 expert report, §102.
[228] EE Core Submission, Walker 3 expert report, §88.

be to reduce the contribution margins earned on pre-pay customers while increasing the contribution margins on high-spending post-pay customers. At the margin, EE said that this could be expected to reduce operators' incentives to compete for pre-pay customers while increasing their incentives to compete for post-pay customers. However, as Three had historically not competed vigorously in the pre-pay segment, EE said that the use of LRIC would shift competition away from the segment where Three had not been particularly active towards the segment where all operators vigorously competed.

- *Three*

2.316 Dr Kalmus said that the effect would be a concentration into niches reducing the substitutability of the networks.[229] He said that in interconnection economics, prices depended on substitution and that the less substitution there was between operators, the more market power each of them had. He deduced that LRIC+ charges would reduce overall competitive intensity by forcing each operator to focus on a niche in which it was profitable, thereby generating a reduction in substitutability between operators. He believed that LRIC-based charges could contribute to increasing the substitutability between operators by opening up all call origination market segments to all operators, including the high user segment.

- *Assessment*

2.317 For the reasons given below (see paragraphs 2.318 to 2.323), the appellants have not, in our view, demonstrated that the impact on the CLV of different customer segments of adopting LRIC+ would have no overall effect on competition.

2.318 The appellants did not appear to dispute that an effect of setting MTRs at LRIC+ would be to put smaller networks at a disadvantage in competing for customers who make more calls than they receive (MMC), and that such customers tend to be in the post-pay segment and to include the higher value users of mobile voice and data services.

2.319 Setting MTRs at LRIC+ would therefore reduce the competition from smaller networks to larger networks for MMC customers. EE appears to accept this. In particular, EE said that adopting LRIC+ would result in a reduction in the competition faced by larger networks from new entrants or smaller networks in the post-pay segment until such time as smaller operators achieved a similar share of customers to the larger operators (see paragraph 2.314). We consider that absent any offsetting competition effects, the result would, for a period at least, be weaker competition within the post-pay customer segment than might otherwise be the case.

2.320 The appellants suggested that new entrants would be able to overcome any disadvantage in the post-pay segment by focusing on customer groups that accounted for about half of the UK market (ie the pre-pay segment and post-pay customers with more balanced traffic profiles). In our view if setting MTRs at LRIC+ would disadvantage smaller networks in such a way that to overcome this they would need to focus their efforts as suggested by the appellants, then adopting this cost standard would distort competition by restricting the strategies available to new entrants.

2.321 In addition, we do not believe that the appellants have shown that it would be possible for smaller networks to overcome a disadvantage in competing for 'MMC' cus-

[229] Three SoI, Kalmus expert report, §§4.85–4.97.

tomers by focusing on 'RMC' customers. The appellants did not appear to dispute that RMC customers tend to be in the pre-pay segment and include the lower value/ light users of mobile services whereas, the MMC customers tend to be in the post-pay segment and include the higher value customers who were heavy users of voice and data services. It is not therefore clear to us that an advantage in competing for the RMC customers would compensate for a disadvantage in competing for MMC customers.

2.322 Vodafone said that a smaller network was not at a disadvantage under LRIC+ in the market overall,[230] if it was able to achieve the same share of subscribers in all market segments, and that there was therefore no reason in principle to expect that with lower MTRs, smaller operators would be in a stronger position to compete: whereas the reduction in MTRs would reduce the advantage larger networks had in the post-pay segment, it would also reduce the advantage a smaller network had in the pre-pay segment. However, in our view, it has not been shown why we should expect a smaller, or any other, network to achieve the same share of subscribers in all market segments. Furthermore, a requirement for smaller networks to do so, in order not to be at a competitive disadvantage, would appear to be restrictive.

2.323 Finally, we do not accept EE's characterization of the competition effect identified by Ofcom. EE said (see paragraph 2.312) that the argument advanced by Ofcom was that the effect of moving to LRIC would be to increase competition for the high-end post-pay customers and to weaken competition for the low-end pre-pay customers. This is, in our view, an incomplete description of Ofcom's argument. Ofcom also argued that the effect of adopting LRIC+ would be to put smaller networks at a disadvantage in competing for a group of customers that were important to the mobile networks, in particular to market share, the post-pay customers who were heavy users of voice and other services.[231]

Criticisms of Ofcom's illustrative model

2.324 We now turn to consider the second of the points listed in paragraph 2.308 above.

- *Ofcom's illustrative model and results*

2.325 In its Statement Ofcom estimated that with LRIC+ based MTRs the contribution a post-pay customer would make to a network with a 5 per cent share of subscribers would be £3 a year lower in 2014/15 than that to a network with a 25 per cent share.

2.326 Ofcom revised these results following corrections made to call ratio figures.[232] Ofcom said that the changes to the reported call ratios would not have affected its overall conclusion that LRIC was the appropriate cost standard for the MCT charge control.

[230] Vodafone NoA, Schedule 2, §3.3.
[231] Ofcom Statement, Annex 3. §A3.184.
[232] See Ofcom letter to CC of 31 October 2011.

TABLE 2.2 **Table A3.3 (corrected version)**

Difference in contribution margins for different pricing scenarios and shares of subscriber

Consumer segment	*LRIC+ in 2010/11 (4.18ppm)*		*LRIC+ in 2014/15 (1.61ppm)*	
	5% vs 25%	*1% vs 40%*	*5% vs 25%*	*1% vs 40%*
Pre-pay	2	3	0	1
Post-pay	–7	–14	–2	–4

Source: Ofcom.

Base case assumptions: MTR = 4.18ppm (2010/11) and 1.61ppm (2014/15), incremental termination/origination costs = 0.69ppm. All prices in real 2008/09 terms.

2.327 Vodafone made a number of criticisms of Ofcom's illustrative model.[233] Vodafone said that if the Illustrative model was adjusted to take account of these, at the least, the disadvantage faced by smaller networks would be smaller than estimated by Ofcom.

2.328 Following its bilateral hearing Vodafone explained that the critical errors in Ofcom's modelling assumptions were as follows:[234]

(a) the theory that the split for on-net/off-net traffic for both inbound and outbound calls reflected the market share of an MCP;

(b) the failure to recognize that not all off-net calls would attract MTRs (ie that some would attract an FTR); and

(c) the failure to recognize that the incremental cost of an additional call of all MCPs would not necessarily be identical.

2.329 Vodafone presented revised results. We consider these criticisms and Vodafone's revised results below (see paragraphs 2.330 to 2.349).

◦ *Traffic input assumptions*

2.330 Vodafone said that Ofcom's model included MTF traffic, when such traffic would not be expected to affect the specific effect that Ofcom was trying to quantify. Vodafone said that the inclusion of MTF traffic in the model was inappropriate, since the modelling assumed that the distribution of off-net and on-net traffic was directly related to MCP market size. Vodafone said that the proportion of MTF traffic of an MCP had nothing whatsoever to do with that MCP's market size, and should have been separately analysed in the Illustrative model. Vodafone said that the available evidence suggested that the share of an MCP's traffic that was MTF was around 35 per cent. The correction of this error would reduce the reported differential caused in the illustrative model by MCP market size.

2.331 EE also said that Ofcom's revised results were affected by the inclusion of MTF traffic which meant that they could not be considered as a reliable basis on which to draw conclusions about the effects of reductions in MTRs on the relative competitive position of operators with respect to MTM calls that might result from differences in on-net/off-net call percentages.[235] EE said that in considering MTM traffic (and

[233] Vodafone NoA, Schedule 2, §§3.16–3.22.
[234] See email from Vodafone to CC of 31 October.
[235] EE NoA, §116.

assuming that prices and costs were equal across operators), any advantage that a larger operator had in competing for one type of customer must be counter-balanced by the advantage that a smaller operator would have in competing for the other customer type as each outgoing minute from one mobile operator must be paired with an incoming minute of another mobile operator. Thus Ofcom's results which purported to show a significant advantage for larger operators in competing for post-pay customers but no material offsetting advantage for smaller operators in competing for pre-pay customers was simply a consequence of including traffic data which was not relevant to assessing operators' relative competitive positions with respect to MTM traffic.

2.332 In its Defence Ofcom said that the traffic data it received from MCPs during the market review had substantial limitations and it was not possible to remove the MTF and FTM volumes.[236]

2.333 Ofcom also said that the addition of MTF volumes should not alter the relative difference in contribution margins in each consumer segment for MCPs with different subscriber shares (even if Vodafone was correct to argue that it affects the absolute contribution margins in each consumer segment)—because it was reasonable to assume that consumers in a particular market segment were just as likely to make voice calls to fixed customers irrespective of the market size of their MCP.

2.334 Ofcom concluded that while the theoretical model was exclusively about MTM traffic, the data available to Ofcom also included MTF traffic so Ofcom made it very clear in the Statement that the available data (including MTF traffic) was presented as a simple cross-check.[237]

2.335 Following the bilateral hearing, Vodafone provided further explanation of its view that Ofcom's illustrative model relied on assumptions that were wrong as follows.

2.336 Vodafone said that assuming that the proportion of on-net and off-net calls was an absolute function of market size was not realistic. Vodafone said that calls were not randomly distributed. A significant proportion of calls was generated by and within 'closed' user groups, such as intra-business or intra-family user groups. Vodafone said that any mobile operators, irrespective of their market share or size, could develop propositions to attract these customers. There was therefore no clear basis for simply assuming that calling patterns will inherently vary with the overall market size of the network operator, even if all other calls outside these 'closed' user groups are totally randomly distributed between potential customer pairs. Vodafone did not adjust for this in its version of the model but said that this factor would tend to reduce the absolute size of any 'contribution margin' difference based on market share.

2.337 Vodafone also said that the model assumed that all off-net calls would attract an MTR, but that the volumes used in Ofcom's model included calls to fixed operators. Vodafone said that there was no reason why these calls should vary in their proportion to total outbound calls with the size of the mobile operator: also these calls would not attract an MTR cost. MTF calls should thus be identified in the calculation as a first step before allowing the remaining volumes of outbound MTM calls to be split between on-net and off-net using the Illustrative model's basis of market size. Vodafone estimated that 35 per cent of all outbound calls were to destinations other than UK mobile customers, ie were to UK fixed networks, international destinations, non-geographic destinations etc.

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[236] Ofcom Defence, Annex A, §§A.318–A.320.
[237] Ofcom Defence, Annex A, §A.319.

2.338 For the reasons given by Vodafone (see paragraph 2.330), it appears to us that the inclusion of MTF traffic had the potential to, at least, distort the results and, in particular, to exaggerate the disadvantage faced by smaller networks for post-pay customers. As explained by Vodafone all MTF calls would be off-net and did not therefore contribute to any differences between smaller and larger networks due to smaller networks having a higher proportion of off-net calls. In addition MTF calls do not attract MTRs.

2.339 In response to the CC's provisional determination, Ofcom said that it did not dispute that the inclusion of MTF traffic had the potential to distort the results and exaggerate the disadvantage faced by smaller networks. Ofcom also said that it had produced a theoretical model using industry-level data which did not include MTF traffic and that this version of the Model was discussed in paragraphs A3.169 to A3.176 of the Statement.

2.340 It is also not clear to us why Ofcom's results suggest that smaller networks would be at a disadvantage in the post-pay sector (where on average subscribers make slightly more calls than they receive), but did not suggest that smaller networks would have an advantage in the pre-pay segment (where on average subscribers receive more calls than they make (see Introduction to Reference Question 1, paragraph 2.30). We agree with EE that this may be a result of the inclusion and treatment of MTF traffic.

2.341 Finally, regarding the proportion of calls that were assumed to be off-net and the relationship with network size, as explained above Ofcom investigated this relationship and found an inverse but not a one-to-one relationship. Ofcom would therefore have been aware that its model was based on a simplifying assumption. We note that Vodafone applied the same simplifying assumption.

2.342 In summary, we have some reservations, for the reasons given by the appellants, about the precision or reliability of the results of Ofcom's illustrative model. We note, however, that Ofcom's model was intended only to be illustrative of the potential effect.

- *Incremental costs*

2.343 Vodafone said that Ofcom assumed that the (average) incremental cost of the provision of call services was the same irrespective of the size of the network. Vodafone said that it was reasonable to expect the incremental cost of a smaller network to be lower as a larger share of a smaller MCP's network costs would be accounted for by the need to provide coverage, and hence would not be traffic driven.

2.344 Ofcom said that an MCP with a smaller share was not likely to have a full coverage network as Vodafone asserted; and that where smaller MCPs did offer full national service coverage it was likely in the first instance to be provided by national MCPs. If the latter were capacity constrained then the wholesale roaming rates paid by the smaller MCPs to the national MCPs should reflect the capacity constraints experienced by the incumbents.[238]

2.345 Ofcom also said that it would not be appropriate to reflect any such differences in costs in the model.[239] The purpose of the model was to assess the impact of higher MTRs on competition for different consumer segments, holding everything else

[238] Ofcom Defence, Annex A, §A.320.
[239] Ofcom Defence, Annex A, §A.320.

equal. Therefore to make adjustments for different operator costs which may arise for many different reasons (including choice of technology, efficiency and the extent of geographic roll-out) would not be testing the particular impacts arising from MTRs in isolation from other factors.

2.346 We agree with Ofcom that it would not be appropriate to make adjustments to the illustrative model to allow for any differences between networks of different sizes in the marginal costs of handling additional traffic volumes. To do so would be inconsistent with the 'all else equal' approach and, for the reasons given above (see paragraph 2.174), we did not accept the appellant's arguments that Ofcom had erred in adopting such an approach.

° *Vodafone's revised figures*

2.347 Vodafone provided revised estimates of the difference in contribution margins applying—individually and in combination: Ofcom's revised volumes, Vodafone's assumption that 35 per cent of the outbound traffic were MTF calls, Vodafone's assumptions on lower incremental costs for smaller networks and Vodafone's estimates of LRIC and LRIC+ based MTRs.

2.348 For the reasons given above (see paragraph 2.346), we agree with Ofcom that it would not be appropriate to adjust for any differences in marginal costs of additional calls between networks. Neither have we taken into account Vodafone's results using its estimates of LRIC and LRIC+ based MTRs; any such adjustments would have to be made in the light of our assessment of Reference Questions 2, 3, and 6. We have therefore looked only at results applying revised volumes and/or the 35 per cent assumption for MTF traffic.

2.349 Vodafone said that the effect of applying Ofcom's revised volumes and/or the 35 per cent assumption for MTF traffic would be to dampen the estimated disadvantage faced by smaller networks in the post-pay segment with LRIC+ based MTRs whilst strengthening the advantage in the pre-pay segment. Vodafone's results are given in Table 2.3. Vodafone said that the results suggested that smaller networks would be at an overall disadvantage in the post-pay segment, but that the figure was smaller than estimated by Ofcom, and have a similar advantage in the pre-pay segment.

TABLE 2.3 **Vodafone's revised results for Ofcom's illustrative model using revised Ofcom volumes and assuming that 35 per cent of outbound mobile traffic is MTF**

	Difference in contribution margin between pairs of operators			
£ margin	*4.18 LRIC+*		*1.61pm LRIC+*	
	5% vs 25%	*1% vs 40%*	*5% vs 25%*	*1% vs 40%*
Pre-pay	4	7	1	2
Post-pay	–2	–4	–1	–1

Source: Vodafone email to CC of 15 November.

Materiality of the impact on competition in different customer segments

2.350 We turn now to consider the materiality arguments as referred to in paragraph 2.308 above. Vodafone and EE made a number of points related to the materiality of Ofcom's position.

2.351 EE said that in considering whether wholesale prices distort retail competition, Ofcom should have examined whether any effect was material given the nature of competition in the market, including the size of the overall market and the scale of the investments required to participate in it. EE said that the size of the estimated differences in contribution margins between MCPs with different shares of subscribers produced by Ofcom's illustrative model was very small, particularly by 2014/15.[240]

2.352 EE also said that when implemented and interpreted properly, Ofcom's competition effects model illustrated that there were no material adverse competition effects.[241]

2.353 Vodafone and EE argued that contribution margins should be considered in relative rather than absolute terms.

2.354 Ofcom accepted that expressing the estimated contribution margins in proportion to the average value of consumers in each segment had merit. However, Ofcom said that it did not have the data to do this analysis and that even if the data were available there was a risk of relying on cost allocation assumptions across segments—assumptions which were likely to be arbitrary.[242]

2.355 Ofcom did not agree with EE that a more appropriate comparison would be the contribution margins relative to the total sales revenues.[243] Ofcom said that comparing the relative contribution margins to the average (expected) revenues per segment could be misleading because it would be comparing a margin contribution to revenue figures.

2.356 More generally the appellants argued that Ofcom had not shown that LRIC+ based MTRs would put smaller networks at a material disadvantage. Vodafone said that the available evidence showed that Three, the smallest UK MCP, had been more successful in attracting the type of customers that Ofcom's illustrative model predicted it should be least well placed to attract: approximately two-thirds of its active customers were post-pay and they included the higher-end voice subscribers.[244] Vodafone said that this was consistent with the evidence on Three's ability to offer competitive packages. Vodafone concluded that whilst there may be various explanations for the inroads of Three in the post-pay market, the fact that Three had been so successful in the post-pay market called into serious question the materiality of the effect argued by Ofcom.

2.357 Ofcom said that its position was based on the estimated differences in contribution margins between MCPs with different shares of subscribers; but that the materiality of this effect would be substantially reduced with the estimates for LRIC+ in 2014/15. Ofcom noted that, as the difference between the levels of the estimates under either of the costs standards (LRIC or LRIC+) declined, the materiality of the impact declined accordingly. To the extent that there remained a material concern, this seemed more likely to be confined to the competition for post-pay consumers.[245]

2.358 EE said that Ofcom accepted that the more effective an MCP was at attracting calling circles,[246] the weaker would be the competition impact identified. EE noted that Ofcom's illustrative model assumed that an operator with a 5 per cent market share would have 95 per cent of its outgoing calls being off-net. EE said that, in fact, the

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[240] EE NoA, §110.
[241] EE response to CC provisional determination, §37.
[242] Ofcom Defence, Annex A, §A.315.
[243] Ofcom Defence, Annex A, §A.317.
[244] Vodafone NoA, Schedule 2, §§3.8 & 3.13.
[245] Ofcom Defence, Annex A, §332.
[246] EE NoA, §117a.

evidence showed that for Three, which had a market share of '[✂] per cent', only around [✂] per cent of outgoing calls were off-net. This was said to show that smaller operators could be very effective at attracting calling circles, and that Ofcom's illustrative model significantly overstated any actual competition effect.

2.359 Three said that the results of Ofcom's illustrative model were a significant under-estimation of the effect of call imbalances and that the real constraint faced by Three cannot be observed in this way.[247] Three said that it needed to roughly achieve a call balance overall in order to avoid significant termination payment outflows, and it could not therefore offer the tariffs that it would like to have offered due to the high termination rate. For this reason, Three considered that a current investigation only revealed a constrained picture. Three said that it might wish to offer tariffs that would generate a significantly higher call imbalance, which would show a higher contribution margin gap to the other users, but was constrained from offering such a tariff due to high termination rates.

- *Assessment*

2.360 The appellants argued that the results of Ofcom's model, particularly if presented in the appropriate context, did not support a conclusion that smaller networks would be at a material disadvantage in the post-pay segment. EE said that the size of the alleged absolute effects appeared immaterial when considered in the competitive context.[248]

2.361 We observe that both Ofcom's and Vodafone's revised results for the illustrative model suggest that by 2014/15 with LRIC+ based MTRs, the disadvantage to smaller networks in the post-pay segment would be small. However, as set out above, Ofcom's model was only intended to be illustrative of the potential for setting MTRs at LRIC+ to disadvantage smaller networks in the post-pay segment. It is our view that Ofcom's illustrative model was a fairly blunt tool for examining these effects as it examined the average impact across two broad groups of mobile subscribers, pre-pay and post-pay customers. This division of subscribers was rather arbitrary and also not helpful in identifying the effect described. What was of interest was the impact on customer segments with different patterns of outbound to inbound calls. However, on average it appears that for post-pay customers this ratio was only a little above 1:1. Within the pre-pay and post-pay segments we would expect there to be more marked variation in call volumes and patterns. Vodafone has said that overall post-pay customers did not make more calls than they received, but that there were also post-pay subscribers with a tendency to make large volumes of outbound calls within a large contractual bundle and being high usage subscribers, made more calls than they received.[249] For these reasons we consider that not much weight can be attached to the results of the illustrative model as constructed.

2.362 The appellants do not dispute the underlying idea that, compared with LRIC, setting MTRs at LRIC+ would decrease the CLV of MMC customers and increase the CLV of RMC customers, and that these effects would be larger for smaller networks which tend to have a higher proportion of off-net calls, both incoming and outgoing. Nor do they appear to dispute that an effect of setting MTRs at LRIC+ would be to put smaller networks at a disadvantage in competing for MMC customers, and that such customers tend to be in the post-pay segment and include the higher-value users of mobile voice and data services. EE said that when implemented and interpreted

[247] Three SoI, Kalmus economic expert report, §§4.64 & 4.65.
[248] EE, MW1, §179.
[249] Vodafone Core Submission, §§4.78 & 4.79.

properly, Ofcom's illustrative model should show no material adverse competition effects. EE was, however, referring to the criticisms of the model discussed above (see paragraphs 2.324 and 2.349). Ofcom and Vodafone submitted revised results for the illustrative model and all the results reported suggested that the potential disadvantage to smaller networks in the post-pay segment would be small. However, EE's comment does not address our point. Our view is that such results are to be expected in a model that has only two categories of subscriber, pre-pay and post-pay, and that the results of this model are not particularly informative on the potential for MTRs set at LRIC+ to disadvantage smaller networks.

2.363 EE and Vodafone argued that the results of Ofcom's illustrative model should be reported relative to the value of certain customers and/or sales revenue. Ofcom agreed that it would be desirable to present the differences in contribution as a percentage of the average value of subscribers, but said that it did not have the information needed to do this. Ofcom also said that it would not be appropriate to present differences in contribution margins relative to total sales revenues (see paragraph 2.355). We note that there is agreement that the results of a model such as Ofcom's Illustrative model would be better reported relative to the total margin, but we agree with Ofcom that it would not be informative to report results as a percentage of sales. However given our views on the model (see paragraph 2.361) a different presentation of the results would not lead us to different conclusions.

Interim conclusion on the assessment of the key arguments

2.364 To summarize our assessment so far: we do not agree with the appellants that the economic literature indicates that higher MTRs would increase competition between MCPs, or that there was a pro-competitive effect to be balanced against the effects identified by Ofcom; we do not agree with the appellants that Ofcom's approach to the assessment of the competitive effects of the level at which MTRs are set, for example, its 'all else equal' approach, was flawed; and we do not agree with the appellants that smaller networks could have avoided any disadvantage associated with higher MTRs by maintaining a balanced traffic position.

2.365 In addition to this: we do not agree that on-net/off-net price differentials were insignificant in the UK market and of limited importance to subscribers; and it is our view that the appellants have not demonstrated that the impact that MTRs would have on the value of different customer groups would have no material impact on competition.

Other arguments

2.366 In this section we consider the other arguments made by the appellants (see paragraphs 2.367 to 2.461) being the fourth set of arguments identified in paragraph 2.94 above. We consider these, in the light of our assessment, as set out above, of what we consider to be the appellants' key arguments.

Other EE points of general approach

2.367 In addition to the general points discussed above (see paragraphs 2.153, 2.161 and 2.175), EE made two further points.

2.368 First, EE said that transfers between operators or types of operator did not distort efficient competition if they were in line with efficient cost recovery.[250] EE said that

[250] EE NoA, §86.1.

mobile termination payments were not arbitrary transfers of resources between undertakings; they reflected the fact that when making calls to a mobile, consumers relied on and benefited from the existence of the receiving party's mobile network (and therefore the investment costs incurred in building and maintaining it) and also imposed some incremental costs on the mobile network.

2.369 We consider that EE was wrong to suggest that the LRIC cost standard for determining MTRs did not include the investment costs incurred by mobile networks in providing termination services to subscribers of other networks. The LRIC cost standard includes the incremental cost to an average efficient network of building and maintaining the additional mobile network capacity required to provide off-net termination services, including a reasonable return to the network on this investment.

2.370 EE also said in relation to Ofcom's market-wide effects that if LRIC+ was allocatively efficient, then prices based on LRIC+ could not be said to be 'too high'.[251]

2.371 In response, Ofcom said that it did not agree that allocative (static) efficiency alone provided a clear answer to the question whether a LRIC or LRIC+ cost standard should be preferred.[252] Ofcom also said that, in any event, in practice competition and efficiency considerations were linked, so it was somewhat artificial to attempt to rank these cost standards on efficiency considerations alone without having regard to the implications for competition.

2.372 We agree with Ofcom. In deciding on the cost standard to adopt in setting the MCT price control, Ofcom was required to take into account a number of considerations. For example, under section 88 of the Act, price controls set by Ofcom must be appropriate for the purposes of promoting efficiency, promoting sustainable competition, and conferring the greatest possible benefits on end-users of public electronic communications. The factors to be considered in the assessments of these considerations are different. Ofcom had to exercise its judgement as to whether LRIC or LRIC+ was appropriate for the purposes listed, in a situation where it found that it had no clear answer in favour of LRIC or LRIC+ in respect of parts of the statutory test but a clear answer in favour of LRIC in another. Overall Ofcom believed that LRIC conferred the greatest possible benefits on consumers largely because it better promoted sustainable competition.[253]

2.373 Second, EE said that Ofcom suggested that the particular LRIC+ based MTRs in the previous charge control period overestimated termination costs. EE said that even if that were the case, the correct response should be to set efficient LRIC+ based MTRs for the future, rather than to respond to a past mistake by making another one.[254]

2.374 Ofcom responded that EE's argument was based on a misconception. In setting MTRs based on LRIC, Ofcom was not seeking to adjust in any way for MTRs in the past being out of line with actual costs under the 2007 Price Control.[255]

2.375 We agree with Ofcom. The MCT prices set for this price control period were determined entirely by reference to Ofcom's estimate of the LRIC cost benchmark in 2014/15 and its assessment of the appropriate path for moving from the level of charges at the start of the period to the 2014/15 level. There was no element of

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[251] EE NoA, §100.
[252] Ofcom Defence, Annex A, §A.245.
[253] Ofcom Statement, §8.158.
[254] EE NoA, §86.2.
[255] Ofcom Defence, Annex A, §A.246.

correcting for any past error. Past decisions were relevant only in so far as they determined the level of charges at the start of the price control period.

Conclusions to be drawn from Three's support for LRIC

2.376 In its Defence Ofcom said that the most compelling piece of real world evidence on the competitive effects of the cost standard adopted for setting MTRs was the position taken by Three. Ofcom also said that Three's support for LRIC would only be rational if the adverse competition effects of higher MCTs were judged by Three to be significant.[256]

2.377 Vodafone argued that the fact that Three advocated lower MTRs did not constitute evidence of a competition problem from setting MTRs based on LRIC+. Vodafone considered that Three's position was driven by its need to minimize the adverse effect of its past commercial strategy.[257]

2.378 EE made a similar point. EE said that Three had a strong commercial incentive to support Ofcom's position. EE said that with MTM volumes rising rapidly and FTM volumes falling rapidly, Three would soon be experiencing a significant overall net termination deficit and Three's unusual commercial strategy was said to have resulted in a very significant net MTR deficit in relation to rival MCPs. BT was also said to have an obvious incentive to support Ofcom's position: Ofcom estimated that the adoption of LRIC would save fixed operators £200 million in the final year.[258]

2.379 We agree with the appellants that Three's support for LRIC did not necessarily provide support for Ofcom's competition effects. We agree that there may be other reasons why LRIC would be beneficial to Three. We do, however, consider, for the reasons given above (see paragraphs 2.175 to 2.177), that the impact of the cost standard adopted would have on Three, as an example of a smaller network, to be a relevant consideration in Ofcom's assessment of the competitive effects.

Three had been permitted to levy higher MTRs so as to be able to 'catch up'[259]

2.380 Vodafone said that Ofcom erred in its assessment of the relative merits of LRIC+ and LRIC from the standpoint of competition as until the new price control came into effect, the smallest MNO, Three, was permitted to levy higher MCT charges than other MNOs, so as to be able to 'catch up' with them.

2.381 Vodafone is correct that Three had in the past been allowed to charge higher termination rates.[260] In this price control period, all networks will be subject to the same price control. Ofcom's reasons for moving to a symmetric control were set out in its Statement.[261] In summary, Ofcom believed that a single cap on MTRs would: benefit consumers as they would be more likely to face the same charge for the same service; help ensure that MCPs and other potential traders of spectrum had efficient incentives to trade spectrum; and be consistent with the Recommendation.

2.382 Ofcom also said that MCPs that operated below the efficient scale could be a reason for setting different caps. Ofcom explained that the Recommendation envisaged

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[256] Ofcom Defence, Annex A, §A 243(b).
[257] Vodafone Core Submission, §4.75–4.83.
[258] EE Core Submission, §132.
[259] Vodafone NoA, §50.2.
[260] Three's termination rates were not regulated until March 2008. For the price control period April 2007 to March 2011, the regulated MCT charge control applying to Three was higher than that which applied to the other networks.
[261] Ofcom Statement, §§9.25–9.32.

asymmetric MTRs to allow time for an entrant to reach an efficient scale but recommended that this should be limited to four years after market entry. Ofcom said that allowing Three time to reach an efficient scale was one of the reasons why it had been granted a higher MTR cap during the 2007 to 2011 charge control period. Ofcom concluded that all four national MCPs (including Three) had now been present in the market long enough for no further allowance for differences in scale to be required in the level of the charge control, with immediate effect.

2.383 Our understanding of Vodafone's argument was that Three had been given preferential treatment in the past in order to allow it to catch-up and that no further consideration of Three's position as a smaller network was therefore justified in assessing the merits of LRIC v LRIC+ based MTRs.

2.384 We consider that whilst Ofcom was of the view that Three had been in the market long enough for no further allowance for differences in scale to be required in the level of the charge control, Ofcom did not say that Three had 'caught up' with the other networks.

2.385 More importantly, Ofcom's stated approach to the assessment of the competition effects of the cost standard adopted in setting MTRs was not whether Three would be better off as a result of a move to LRIC, rather whether the cost standard adopted would affect the ability of one or more MCPs to enter and expand in the UK retail market. In its Statement Ofcom drew on the experience of Three, and other networks, but this was unavoidable if Ofcom was to make use of current and historic market information in its assessment.

Three had been successful in winning post-pay customers

2.386 Vodafone said that the market outcomes did not bear out Ofcom's concern.[262]

2.387 Vodafone said that if the retail and market effects identified by Ofcom were operating and had had an impact on Three, then the expectation would be that Three's average call prices would be higher than those offered by the larger operators, and/or that subscribing to Three would lead to a higher expected level of expenditure, given the current levels of on-net/off-net price differentials in the market.[263]

2.388 Using information on mobile tariffs with on-net/off-net pricing differentials provided by Ofcom, Vodafone calculated average call prices that a subscriber would pay under each plan, for out-of-bundle minutes.[264] The average call price of the packages offered by Three was said to be below the average price of most of the packages of the other larger MCPs.

2.389 Vodafone also examined evidence on MCPs' average call prices by undertaking a comparison of the average price of the plans offered by Three and the other MCPs. Vodafone concluded that Three's average price per minute was comparable and more competitive than those of its competitors.[265]

2.390 Vodafone said that the available evidence showed that Three, the smallest UK MCP, had been more successful in attracting the type of customers that Ofcom's model predicted it should be least well placed to attract.[266] This it said was consistent with

[262] Vodafone NoA, §5.05.
[263] Vodafone NoA, Schedule 2, §2.33.
[264] Vodafone NoA, Schedule 2, §2.35.
[265] Vodafone NoA, Schedule 2, §2.38.
[266] Vodafone NoA, Schedule 2, §3.38.

the evidence on Three's ability to offer packages that were as competitive, and often more competitive, than some of the larger MCPs. Three's promotional activity in the post-pay segment, with the prevalence of discounted plans with selected handsets, was said to have allowed Three to outperform other MCPs in terms of volume and revenue share for new contract handsets in the last year.[267]

2.391 Vodafone also noted that in its 2010 assessment of the T-Mobile and Orange merger the European Commission found that Three had offered very competitive tariffs and had the lowest priced tariffs to post-pay and business customers.

2.392 Finally Vodafone said that, if Three's churn rate was high, the reason was its weakness across a number of competitive dimensions that had little to do with MTRs.[268]

2.393 EE made a similar point. The evidence of Ms Dunn was said to show that for post-pay plans with similar prices, Three had been offering much bigger bundles of inclusive minutes over the last few years.[269] EE said that if Three had not been able to grow, despite pricing so far below other MCPs, it suggested that there were some other factors constraining its growth. A Which? survey was said to have found that Three was ranked last by customers on overall performance reflecting poor customer service, a limited range of handsets, high cost to use abroad and relatively low accuracy and clarity of bills. This impression was said to be further supported by a regular customer satisfaction survey (by JD Power) and Ofcom data on complaints.

2.394 EE specifically argued that [✂].

2.395 Ofcom responded that it was incorrect simply to look at whether Three or other smaller MCPs could match particular retail packages and check that they were still in the market in order to conclude that there was no evidence of a competitive concern. The evidence Ofcom had received from Three showed that it had been costly for it to offer competitive packages to mitigate this competitive disadvantage. Three and other smaller MCPs also suffered from the need to convince, in some situations, entire calling circles to switch in a saturated market where on-net/off-net price differentials were material.[270]

2.396 Ofcom also said that when considering competition effects, it was necessary to look beyond the present ability to match the offers of others, and consider the profitability and commercial viability of those offers over time. Three and other smaller MCPs could certainly match the retail offers of competing MCPs but with high MTRs this was at a cost to their margins, and the analysis was about the effect of lower MTRs *all else being equal*. There were many other factors affecting the actual competitive outcomes observed, but for the purpose of choosing between LRIC and LRIC+, the proper focus was on the effect of the cost base adopted leaving such other factors to one side.[271]

2.397 For the reasons given above, we agree with Ofcom that the proper focus of its analysis was the effect of the cost base adopted leaving other factors that may impact on the competitiveness of Three, or another smaller network, to one side (see paragraphs 2.161 to 2.164). It is also our view that it is difficult to draw conclusions, based on Three's historic ability to offer competitive rates and its success in competing for certain types of subscribers, on the potential for the cost standard adopted in setting

[267] Vodafone NoA, Schedule 2, §3.11.
[268] Vodafone NoA, Schedule 2, §§2.25.5 & 2.26.
[269] EE Core Submission, Walker 3 expert report, §113.
[270] Ofcom Defence, §§A.272 & A.282.
[271] Ofcom Defence, §§A.272 & A.282.

symmetric MTRs to distort competition. As Vodafone pointed out, Three had in the past been allowed to charge higher MTRs. Ofcom said that there were many factors that could have influenced the competitiveness of Three, and other networks. The appellants have identified other factors that may have operated to Three's advantage such as the lower marginal cost of terminating calls (see paragraph 2.343). Ofcom's approach was to attempt to isolate the effects of the cost standard adopted in setting MTRs.

2.398 For the reasons give above, we do not agree with the appellants that Three's performance could be considered to be inconsistent with Ofcom's competition concerns.

Three's traffic imbalance

2.399 Ofcom said that as a general proposition, it was possible that MCPs with fewer subscribers could achieve a broadly balanced position such that higher outbound call costs would be offset by higher inbound receipts.[272]

2.400 Vodafone and EE argued that Three's traffic imbalance was a problem of its own creation and should not therefore be taken into account in considering the cost standard for determining MCT charges.

2.401 EE said that Three's MTR deficit was a product of its commercial strategy, in particular its decision to focus on attracting post-pay customers.[273] EE said that Three had for a number of years chosen to focus on attracting post-pay customers, rather than pre-pay customers.[274] EE also said that Three was unusual in the UK market in focusing on post-pay customers and that there was no fundamental reason why Three should not be able to grow its pre-pay customer base in future.[275]

2.402 EE also said that Three had conceded that its imbalance was caused by the fact that, since its launch, it had focused predominantly on attracting high-end, post-pay consumers. Three said that these customers were the most attractive customer group for MCPs: they were the most profitable; they made monthly contract payments providing regular guaranteed income; they switched providers far less frequently than pre-pay customers; and they tended to buy associated services, such as data services.[276]

2.403 Vodafone said that there were a number of reasons related to Three's commercial strategy that explained why Three had a material interconnection traffic deficit with other MCPs, notably Three's commercial decision to target predominantly post-pay subscribers. Vodafone said that there was no reason for Three to be targeting such subscribers as a result of the fact that it was a smaller operator and MTRs were set on the basis of LRIC+.[277]

2.404 Vodafone explained that Three had been able to charge higher MTRs than other MCPs since it entered the market which, all else being equal, would mean that the CLV of any customers it attracted would be higher than for any other MCP. Three's strategy had been to use this advantage to offer deep price discounts (price plans with very large inclusive bundles of minutes) targeted at post-pay subscribers. This was said to have resulted in Three attracting a disproportionately large number of a

[272] Ofcom Statement, Annex A, §A3.158.
[273] EE NoA, Walker 1 expert report, §151.
[274] EE NoA, Walker 1 expert report, §188.
[275] EE Core Submission, Walker 3 expert report, §7.
[276] EE Core Submission, §36.
[277] Vodafone NoA, Schedule 2, §2.31.

certain type of post-pay subscribers relative to the other MCPs, with a tendency to make large volumes of outbound calls within a large contractual bundle.[278]

2.405 Ofcom responded that it had set out in its Statement why it was profit-maximizing for Three or other smaller players to try to attract some of the top-end post-pay customers and why this created a traffic deficit. [✂][279]

2.406 Three said that, in effect, Vodafone contended that because MTRs were set on the basis of LRIC+, a small MCP should not attempt by competitive tariffs to win high-end post-pay customers. Such an MCP should confine its attempts to compete within those parts of the market where it was unlikely to generate a traffic imbalance.[280]

2.407 Three also said that in order to be commercially viable it was necessary for a smaller or new entrant MCP to be able to win all mainstream customer groups, not excluding high-end post-pay customers. These customers were not just profitable in terms of high usage, they had other favourable characteristics (eg lower churn and greater propensity to purchase other products) which made them particularly attractive.

2.408 It is our view that whether Three's termination deficit might be regarded as somehow its own fault, or symptomatic of problems faced by smaller networks, is irrelevant to the assessment of Ofcom's retail and market effects. Ofcom observed, in its assessment of the market effects, that the relative advantage that Three had from receipts on inbound calls did not fully counter its relative disadvantage on outbound calls,[281] in response to the appellants' argument that smaller networks could use higher termination revenues to 'neutralize' their higher termination costs. For the reasons given above (see paragraphs 2.180 to 2.208), we do not agree that we can generally expect smaller networks to be able to use higher termination receipts to offset higher termination costs. We also considered that if adopting LRIC+ would put a smaller network with more off-net outbound than inbound calls at a competitive disadvantage, by raising its average net wholesale costs relative to those of larger networks, this in itself was evidence of the potential for the cost standard adopted to distort competition. In the light of this conclusion, we do not need to take of view on whether Three's MTR deficit was somehow a problem of its own creation.

2.409 However, the debate over Three's strategy is, in our view, illustrative of the more general point. In particular, our understanding of Ofcom's arguments is that, whilst Three may have adopted a strategy that would have avoided a termination deficit, the result would have been lower market share and profits. One way or another the effect of LRIC+ based MTRs would be to disadvantage Three—either it could avoid a net termination deficit but accept lower profitability and market share, or it could seek to compete for customers who bring with them a traffic imbalance.

2.410 Vodafone's argument that Three's deficit was a reflection of the incentives created by asymmetric termination rates was, in our view, also illustrative of the potential for high termination rates to distort the commercial incentives of MCPs.

MCPs would be able to offer larger bundles with LRIC which would enhance competition

2.411 Vodafone disagreed with Ofcom that lower MTRs would mean that MCPs would be better able to offer large bundles of calls, particularly smaller MCPs who were at a

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[278] Vodafone Core Submission, §4.78.
[279] Ofcom Defence, Annex A, §A.298.
[280] Three SoI, §6.80.
[281] Ofcom Statement, Annex 3, A3.158.

disadvantage in doing so under high MTRs.[282] Vodafone did not accept that the provision of large, or larger, bundles of calls would enhance the intensity of competition, and said that Ofcom had not provided any evidence of this effect with the exception of Three's submissions. Vodafone said that its experience was of limited consumer demand for the largest bundle packages and, where consumers bought relatively larger bundles, the vast majority tended to stay within their bundle.

2.412 We do not consider this to be a key point. That lower MTRs may enable smaller networks to offer larger bundles was an example of the additional flexibility that lower termination rates might give networks and, in particular, smaller networks in their product offering. This is also not, in our view, an unreasonable expectation for Ofcom to have since lower MTRs would reduce the expected marginal cost of additional outbound calls for all networks and therefore the incremental cost of, for example, including more minutes in a bundle, and for smaller networks, this reduction in marginal cost would be greater.

Relevance of US experience

2.413 Vodafone said that the economic literature suggested that below cost MTRs would lead to off-net retail call prices being below on-net prices.[283] Vodafone noted that in its Statement Ofcom had said that this result was contradicted by evidence from the US where there was no evidence of off-net prices being below those on-net. Vodafone responded that there were economic models in the literature (Berger, 2005) under which a reduction in MTRs led to a dampening of competition without requiring lower off-net prices than on-net (even under the US Bill & Keep arrangements).

2.414 In its Defence Ofcom said that the results in the Berger (2005) paper did not give strong support for Vodafone's argument.[284] Ofcom said that the paper contained limited discussion of the intensity of competition arising from MTRs. Instead, the main result of the Berger paper was that—under assumptions of (uninternalized) call externalities and symmetric market share—the jointly profit maximizing (collusive) and socially optimal access charge (MTR) would be below marginal cost and below the on-net prices. The paper also suggested that Bill & Keep was welfare improving compared with cost-based pricing for termination. Ofcom also said that the assumptions (eg symmetric market shares) in these models were restrictive and seemed to be largely driven by the presence of uninternalized call externalities, which Ofcom did not consider were an important feature of the UK market.

2.415 Vodafone said that its general point was that off-net and on-net price differentials were affected by many factors apart from MTRs, such as the existence of calling clubs, the need to recover fixed and common costs, etc. This implied that on-net/off-net price differentials observed in practice would not be expected to mimic the differentials that would arise under simplified academic models, such as the model of Gans and King. Notwithstanding this, Vodafone said that the implications of the simplified model were still relevant to understanding the effects associated with changes in the level of MTRs, as long as the other relevant variables affecting the on-net/off-net price differentials did not exert a countervailing effect.[285]

2.416 EE said that US experience was further evidence that the level of termination charges did not drive on-net/off-net price differentials as mobile termination charges

[282] Vodafone Core Submission, §4.90.3.
[283] Vodafone NoA, Schedule 2, §§4.10 & 4.11, and Core Submission, §4.90.5.
[284] Ofcom Defence, Annex A, §A.332.
[285] Vodafone Core Submission, §4.90.5.

were low in the USA and on-net/off-net price discrimination more prevalent than in the UK.[286]

2.417 EE said that Ofcom had missed the main implication of the US tariffs—if consumers take into account on-net/off-net price differentials this would be likely to influence what size bundle they bought. The cheapest standard plans in the USA offered unlimited on-net calls thus, whether a US customer should buy a more expensive plan with more minutes would depend on the number of off-net minutes the customer was likely to make.[287]

2.418 EE said that it was not the case, as Ofcom seemed to be implying, that the cheapest US plans offered so many off-net minutes that most customers would never buy a more expensive plan. Ofcom had reported a figure of average usage in the USA of 678 minutes per month. Post-pay plans of the three largest US operators had standard bundles of 450, 900 minutes and unlimited minutes per month for Verizon and AT&T; while T-Mobile offered bundles at 500 minutes as well as unlimited minutes. Thus many, and probably most, US mobile customers would have been better off paying for a larger plan (say, the Verizon 900-minute plan for $59.99 per month) than purchasing the cheapest 450-minute plan (for which Verizon charged $39.99 per month) and being forced to pay punitive out-of-bundle call rates (eg Verizon charged 45 cents per minute for out-of-bundle calls).

2.419 It appears to us that the key point that Vodafone and EE sought to make in referring to US experience was that it provided further evidence that factors other than MTRs were relevant to the presence, or otherwise, of on-net and off-net price differentials. Ofcom accepted this to be the case (see paragraph 2.271). This did not therefore seem to be a matter in dispute. We do not therefore consider these arguments further.

Ofcom's market effects are not a valid concern

2.420 Vodafone said that the fact that higher MTRs resulted in a higher floor price, by reference to which MCPs would set retail charges, was not a competition concern. Ofcom's argument was said to be equivalent to an argument that an increase in underlying costs, which must be factored into prices, dampened competition. Vodafone's view was that it did not. Vodafone said that across the board increases in the price of a wholesale input to a retail service would not generally dampen competition at the wholesale or retail levels of the market. Vodafone added that, if it was otherwise efficient to set MTRs at LRIC+ levels, then the benchmark by reference to which the effectiveness of competition was to be judged was one in which retail prices reflected such wholesale MCT costs, and such prices could not be said to 'dampen' competition.[288]

2.421 EE and Telefónica made a similar point.

2.422 EE said that one interpretation of Ofcom's market effect was that by shifting common cost recovery from termination, retail off-net calls that used termination would be cheaper to provide and that any resulting price reduction could be considered as an increase in competition. EE said that reducing MTRs would simply decrease the costs that are recovered from some services and increase the costs to be recovered

[286] EE NoA, Walker 1 expert report, §163, and Core Submission, Walker 3 expert report, §§131–133.
[287] EE Core Submission, Walker 3 expert report, §§132–134.
[288] Vodafone NoA, §50.6.

from other services and that this could not be described as a change in the level of competition.[289]

2.423 Telefónica said that Ofcom's market effects argument was based on a premise that competition in a market was stronger when prices were lower—even when those lower prices were driven by lower variable costs. This was said to be an incorrect premise that did not reflect sound economic principles.[290]

2.424 We consider these statements to be an inaccurate and incomplete description of Ofcom's market effects argument. Ofcom's argument is that higher MTRs would increase the expected marginal cost to a network of an additional outbound call, which was not disputed, and that the increase in marginal cost would be proportionally greater for smaller networks, which was also not disputed. The competition concern arises because this would weaken the ability of smaller networks to compete on price with larger networks.

2.425 Vodafone also said that the application of a higher floor price would not favour larger networks. Ofcom was said to have placed emphasis on a concern that,[291] if MTRs charges were higher, the differential between on-net and off-net prices would widen, so that a smaller MCP (whose subscribers generate relatively more off-net than on-net outbound calls) would incur a higher average outbound call cost. Vodafone considered this to be misplaced as it considered that higher termination costs for smaller networks would be 'neutralized' by higher receipts. For the reasons given above (see paragraphs 2.195 to 2.208), we do not accept this argument.

2.426 EE said that the gist of Ofcom's argument was that, if MTRs were based on LRIC, MCPs might set off-net retail call charges below the level at which they would be set with MTRs based on LRIC+.[292] EE considered this possibility to be unrealistic given that current call charges were significantly above the level of current MTRs, and this was likely to remain the case as MTRs fell as a result of falling costs (including under LRIC+).

2.427 In addition, EE said that Ofcom had overlooked that there was an inescapable price floor to a firm's pricing, namely its overall cost. EE said that Ofcom's proposals simply shifted common cost recovery away from termination to retail services and increased the price floor to mobile operators' overall retail pricing as these prices must recover all of the operators' common costs. EE said that this would tend to place an upward pressure on call prices. Ofcom was said to, in effect, have ignored the waterbed effect.

2.428 We do not accept these two EE arguments. For the reasons given in paragraph 2.507, we would expect marginal cost to be a relevant factor for MCPs in determining their tariff structures. More specifically, and for example, we would expect the marginal cost to mobile networks of additional calls, which will include the cost of termination, to be relevant to pricing decisions on, for example, add-ons and bolt-ons (ie offers that allow additional minutes to be added to existing bundles).

2.429 EE said that it was wrong to say that higher MTRs would result in higher marginal costs that would vary by MCP depending on their traffic balance. EE agreed that the level of MTR was a marginal cost of an off-net call, but said that all operators would face the same MTR for off-net calls to another operator's customers and that the

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[289] EE Core Submission, Walker 3 expert report, §77 & 78.
[290] Telefónica SoI, Neil Marshall expert report, §4.17.
[291] Vodafone NoA, §50.7.
[292] EE NoA, §§101 & 103.

level of MTRs would not lead to differences in the marginal costs of on-net calls between operators (as MTRs were not paid on on-net calls).[293]

2.430 We agree with EE that the marginal termination cost of an off-net call would be the same for all networks and that the on-net cost would not depend on MTRs. However, it is our view that the expected marginal cost of an additional call would depend on the network's traffic balance. A network in estimating the marginal cost of a call would have an expectation as to the proportion of calls that would be on-net and the proportion that would be off-net. The higher the proportion of the off-net calls the higher the expected marginal cost of an additional call. If EE was correct that on-net/off-net price differentials were now of limited significance, it would be the average expected marginal cost of additional on- and off-net calls that would be more relevant to an operator.

2.431 Finally Telefónica said there were numerous tariffs that charged a marginal price of zero for outbound calls, as demonstrated by the proliferation of retail post-pay tariffs with a large bundle of 'free any network' minutes for a fixed monthly fee, and that this indicated that MTRs did not invariably result in a price floor for outbound calls.[294]

2.432 We do not accept this argument. We agree that for consumers with bundles the (short-run) marginal cost to them of making an additional call, as long as they do not exceed the allowance, would be zero. However, the marginal cost to a network of additional calls will not be zero and the expected marginal cost to a network of an additional off-net (and/or on-net) call will be relevant to the design and pricing of these packages (see paragraphs 2.411 and 2.412 above).

UK market structure

2.433 Vodafone argued that the potential significance of the retail and market effects identified by Ofcom would depend on market structure.[295] Vodafone said that the UK market was characterized by a non-concentrated distribution of subscribers, among the MCPs. Using recently available market research information, Vodafone estimated (applying a simplified assumption that the expected likelihood of making an off-net call reflects subscriber market shares) that the expected likelihood of a post-pay subscriber making off-net calls would be: 86 per cent with Three; 89 per cent with T-Mobile; 81 per cent with Vodafone; and 80 per cent with Orange.

2.434 Ofcom responded that it had better data on on-net and off-net traffic which showed that the proportion of off-net traffic was in fact lower than predicted by simply assuming that each call had an equal chance of being off-net and on-net.[296] Ofcom also said that the comparison Vodafone made between networks was erroneous as it missed out O2 and did not treat T-Mobile and Orange as a combined entity.

2.435 Our understanding of Vodafone's argument was that Three would not be at a disadvantage with LRIC+ based MTRs in competing for post-pay customers as the proportion on off-net calls made by these subscribers was unlikely to be particularly high compared with other networks. For the reasons given by Ofcom, we are not persuaded that Vodafone's analysis provides a reliable basis for drawing such conclusions. Also, as argued by Ofcom, the proportion of on-net calls may reflect efforts by networks to increase the proportion of on-net calls in response, among other things, to higher MTRs, a strategy that may not be costless. More importantly, Ofcom's

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[293] EE Core Submission, Walker 3 expert report, §138.
[294] Telefónica SoI, Neil Marshall expert report, §4.15.
[295] Vodafone NoA, Schedule 2, §2.39.
[296] Ofcom Defence, Annex A, §A.304.

assessment of the competition effects was concerned with the impact of the cost standard adopted for barriers to entry and growth for any network and not specifically the impact on Three (see paragraph 2.79).

2.436 Vodafone also said that the market structure of the UK's mobile market reduced significantly the expected materiality of any potential disadvantage for a smaller operator from use of LRIC+ given the growing importance of mobile data services compared with traditional voice services. Vodafone said that data services and their pricing,[297] which although unaffected by MTRs, were likely to also play a role in subscription decisions.[298]

2.437 We were persuaded by Ofcom's response[299] that it had to choose between two ex ante remedies and for that purpose its approach was to isolate and test the hypothesis that lower MTRs were better at promoting competition. Ofcom reiterated therefore that its assessment was of the competition effects of MTRs all else being equal.

Vodafone's simulation model[300]

2.438 Vodafone argued that Ofcom had not given any weight to a potential dampening competition effect from moving from LRIC+ to LRIC. Vodafone explained that MTRs set above LRIC could create TMNE effects such that, all other things being equal, it would have been more valuable to the subscriber to be connected to the larger network.

2.439 Vodafone used a simulation model to assess the impact of the reduction in MTRs from 1.61ppm to 0.69ppm.[301] In particular, Vodafone said that the purpose of the model was to seek to estimate the materiality of the specific dampening effect on competition of lower MTRs.

2.440 Vodafone said that model was based on a differentiated Bertrand competition model. Vodafone said that it calibrated the model for a typical current post-pay customer, who made around 160 minutes of MTM calls and 50 minutes of MTF calls per month. Call demand was assumed to have a constant price elasticity of –0.3. Vodafone had assumed that competition intensity was sufficient to generate operating profits which just covered fixed and common costs with call charges set on the basis of current MTRs. Vodafone compared two scenarios: one with MTRs set at 4.3ppm and one with MTRs set at 1.84ppm. Vodafone modelled these scenarios for a symmetric network, with two equal-sized operators, and for asymmetric networks, with equilibrium market shares of 60:40 per cent with MTRs set at 4.3ppm.

2.441 Vodafone said that its simulations indicated that the intensity of competition effect would outweigh the benefit to consumers of lower call charges. Vodafone found that reducing MTRs from 4.3ppm to 1.84ppm (equivalent reduction today, of moving from 1.61ppm to 0.69ppm in 2014/15) led to a reduction in consumer surplus as a result of this competition effect of around £1.75 per post-pay subscriber per month. With 33 million post-pay subscribers, this was equivalent to a cost of around £700 million a year. The equilibrium market share of the smaller network increased by 0.35 per cent with the reduction in MTRs.

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[297] Vodafone NoA, Schedule 2, §2.41.
[298] Vodafone NoA, Schedule 2, §2.44.
[299] Ofcom Defence, Annex A, §A.279.
[300] Vodafone NoA, Schedule 2, Section 4, and Core Submission, §4.71.
[301] Vodafone NoA, Schedule 2, Annex 3.

2.442 Vodafone said that these results were only indicative and might be sensitive to the precise calibration of the model, but that they provided an indication that the detrimental impact of lower MTRs on the intensity of competition might be material. In particular, Vodafone said the indication here was that consumer surplus could be significantly reduced by a 57 per cent reduction in MTRs, while the benefit to smaller networks of reducing the impact of the TMNE effect would be very small.

2.443 Ofcom responded that Vodafone had not explained many of the assumptions made and that it could therefore provide only limited comments on Vodafone's simulation model at that stage.[302] Ofcom said that it appeared that the model was based on restrictive assumptions and a particular model of competition that was unlikely to exist in practice. Therefore, Ofcom was not persuaded that any weight should be placed on it. Ofcom gave the following examples:

(a) Ofcom said that it was not clear what assumptions had been made regarding the impact of on-net/off-net price differentials on the intensity of competition and the mechanism by which this affected subscription charges;

(b) Vodafone used a call price elasticity of –0.3 which appeared to be an industry-wide elasticity estimate. Ofcom noted that a number of industry commentators considered that it could be higher; and

(c) Ofcom considered that neither of the two scenarios were particularly realistic given O2's and EE's market shares vis-à-vis Three and other smaller operators.

2.444 Vodafone in turn responded that:[303]

(a) The assumptions used to generate the results had been set out in Annex 3 to Schedule 2 of Vodafone's NoA. These included the form of competition assumed, the market shares of the different operators, and all the assumptions made about the inputs in order to calibrate the model so that it mimicked, to the extent possible, the situation in the UK market.

(b) The simulation model was not intended to provide a complete and accurate description of all the potential impacts that lowering MTRs could be expected to have on the intensity of competition. The purpose was to seek to estimate the materiality of a specific dampening effect on competition from lower MTRs, using a 'standard' competition model calibrated to reflect the current levels of MTRs in the UK, and the proposals of Ofcom. The results indicated that this effect could be material. None of Ofcom's criticisms were said to have addressed this point.

(c) Ofcom itself used a similar modelling exercise to examine the potential effects of different level of MTRs on different consumer segments. Most if not all of the models used in the economic literature assumed two operators, as this was typically considered sufficient to capture most of the key features that the analysis sought to evaluate.

(d) Ofcom had not attempted to provide even an indicative or illustrative estimate of the potential effect of the alleged competition effects it had identified.

2.445 We agree with Ofcom that Vodafone had not provided sufficient documentation of the model. Vodafone provided only a brief description of the purpose of the model, its approach and inputs, as set out above, in Annex 3 to its NoA Schedule 2. Following

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[302] Ofcom Defence, Annex A, §A.333.
[303] Vodafone Core Submission §4.93.

its bilateral hearing, Vodafone provided a copy of the spreadsheet but no further documentation of the assumptions and formula. We do not have a sufficient understanding of the model to allow us to make an independent assessment of the results.

2.446 In addition, these countervailing effects require there to be on-net/off-net retail price differentials. Vodafone did not say what assumptions were made in the model on current or future differentials, or the basis for these assumptions.[304] In response to the CC's provisional determination, Vodafone said that the model sought to evaluate a specific competition dampening effect under the same assumptions underlying Ofcom's retail effects which included an assumption that on-net/off-net price differentials existed. The same assumptions were said to underpin Vodafone's simulation model.[305] Vodafone did not say, however, what figures it attached to an assumption that there were such differentials and what the source of these inputs was.

2.447 Finally, Vodafone used this model to estimate the size of the positive competition effect identified in the economic literature associated with setting MTRs above LRIC (the TMNE effects). We considered the appellants' arguments in relation to this literature above in paragraphs 2.95 to 2.151. We conclude that we are not persuaded by Vodafone's argument that a clear conclusion of the literature is that the competitive effects identified by Ofcom must be balanced against otherwise pro-competitive effects of higher MTRs.

2.448 For the reasons set out in paragraphs 2.445 to 2.447, we consider that we cannot attach much weight to the results of Vodafone's simulation model.

Effect of lower MTRs on switching costs

2.449 EE argued that, to the extent subscription and upfront charges were raised above the marginal cost of subscriber acquisition (to recover a greater share of common costs), then switching costs would increase and this could reduce the level of churn[306] in the market. This would mean that the level of switching would be expected to fall below the efficient level.[307]

2.450 Ofcom responded that consumers' switching decisions will be a balance between switching costs on one side and the difference in benefits between different offers on the other side. Ofcom said that it was not immediately obvious why the absolute level of fixed charges (subscription and upfront charges) should be relevant to the level of switching.[308]

2.451 It is our view that EE did not demonstrate that an effect of setting MTRs by reference to LRIC, rather than LRIC+, would be an increase in up-front charges that would be above marginal cost. In addition, for mobile subscribers who make more calls than they receive an effect of a reduction in MTRs would be an increase their CLV (see paragraph 2.76). For these customers the effect of setting MTRs at LRIC could be a reduction in switching costs.

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[304] Core Submission, §4.71.
[305] Vodafone response to CC's provisional determination, §4.9.
[306] The churn rate is the percentage of subscribers in a given time period that cease to use a company's services for one reason or other.
[307] EE NoA, §133 and Walker expert report, §211.
[308] Ofcom Defence, Annex A, §§A.334 & A.335.

Ofcom failed to make a link between competition effects and welfare[309]

2.452 Vodafone argued that Ofcom had failed to set out any clear explanation of the link between the competition effects it had identified and consumer welfare.

2.453 Vodafone said that even if Ofcom was correct that LRIC+ based MTRs would disadvantage smaller MCPs, removing this disadvantage would be justified only if it led to a consumer welfare increase in the long term. This was said to be quite important as setting MTRs based on LRIC+, rather than LRIC, could be considered economically more efficient, both on static (allocative) and dynamic efficiency grounds, and lower MTRs could be expected to have a dampening effect on competition for mobile subscribers.[310]

2.454 Vodafone also said that any potential competition strengthening effect through the assistance of smaller MCPs needed to be put in the context of the level of competition that currently existed in the UK market. Vodafone noted that both Ofcom and the European Commission had recently concluded that the UK mobile market was competitive. Vodafone said that to depart from the use of a LRIC+ standard to set MTRs in what was arguably one of the most competitive mobile markets internationally could be justified only if the alleged positive effect from the use of LRIC on smaller MCPs could be expected with a very high degree of certainty to lead to better outcomes for consumers. Vodafone considered that Ofcom's analysis and evidence fell a long way short of establishing this.

2.455 Ofcom responded that a reduction of competition in a market with four large players and very high barriers to entry and growth would, almost by definition, lead to consumer detriment.[311] Ofcom said that there was an obvious implicit link to consumer welfare based on its assessment of the impact high MTRs would have on the intensity of competition and prices.

2.456 Ofcom also said that its principal statutory duty was to further the interests of consumers in relevant markets, where appropriate by promoting competition. Ofcom said that its conclusions showed that it attached weight to the competition effects and that moving to LRIC conferred the greater benefits on consumers. It submitted that this explanation was both clear and cogent.

2.457 Vodafone in turn responded that Ofcom had only examined the relationship between MTRs and the position of Three.[312] Ofcom had not examined the relationship between MTRs and the intensity of competition between MCPs more generally. Vodafone said that the argument that lower MTRs could be expected to provide incentives for MCPs to price off-net MTM calls at a lower level provided no proof that lower MTRs were beneficial to competition overall, or that they could be expected to lead to lower mobile prices overall.

2.458 We do not agree with Vodafone's suggestion that the benefits to be had from promoting competition by removing any disadvantage to smaller MCPs from setting LRIC+ based MTRs were uncertain when Ofcom and the EC had agreed that the UK mobile industry was already competitive. That the market was competitive does not, in our view, preclude the possibility that it could have been more competitive. As Ofcom noted, this remains an industry with four networks and characterized by high barriers

[309] Vodafone NoA, Schedule 2, section 6, and Core Submission, §4.95.
[310] Vodafone NoA, Schedule 2, §6.2.
[311] Ofcom Defence, §§249 & 340–342.
[312] Vodafone Core Submission, §4.95.

to entry and growth, and adopting a LRIC+ cost standard had the potential to put one of these networks at a competitive disadvantage.

2.459 Furthermore, as explained in paragraphs 2.157 to 2.159, we do not accept Vodafone's argument that Ofcom erred in focusing its analysis of the competitive effects of the cost standard adopted on the potential for higher MTRs to create barriers to entry and growth.

2.460 In addition, Vodafone's argument relied on there being other reasons why higher MTRs would benefit customers which would be weighed against the benefits to competition identified by Ofcom (see paragraph 2.453). In particular, Vodafone said that higher MTRs would be more economically efficient on allocative and dynamic efficiency grounds. Our findings on allocative efficiency and dynamic efficiency are set out in paragraphs 2.823 and 2.842 respectively. We have found that Vodafone and EE have not established that LRIC+ is preferable to LRIC on either of these grounds. As a result we do not agree with the premise to Vodafone's argument on the link between competition benefits and consumer welfare.

2.461 For these reasons we do not accept Vodafone's argument that Ofcom erred in failing to make a link between the competition benefits it identified and consumer welfare.

Overall materiality of the competition effects identified by Ofcom

2.462 We turn now to consider the fifth and final set of arguments identified in paragraph 2.94 above. Vodafone and EE argued that the competition effects identified by Ofcom are immaterial. Ofcom did not accept this.

2.463 Vodafone said that the tariffs observed in the market did not bear out Ofcom's concern.[313] Vodafone said that the difference between retail charges for on-net and off-net calls had diminished over time, and the significance of any disadvantage which, for example, Three might have suffered as a smaller MCP was de minimis. Three was also said to have offered tariffs that implied lower average call prices than Vodafone.

2.464 EE considered that LRIC+ based MTRs would not generate any material adverse competition effects and, on the contrary, it would have been more likely that competition would be dampened by basing MTRs on LRIC.[314]

2.465 In its Defence Ofcom responded that it did not consider the competition effects identified to be immaterial.[315] In particular, Ofcom said:

(a) the competition effects served to reinforce each other. These effects appeared to have had an impact on competition historically—as evidenced by Three's experiences and its willingness to argue for lower MTRs, despite the loss of FTM MCT revenues that would result;

(b) the evidence was that—either in anticipation of or as a result of lower MTRs—smaller MCPs and FCPs had already been able to offer more competitive retail packages;

(c) [✂]; and

[313] Vodafone NoA, §50.3.
[314] EE NoA, Walker 1 expert report, §135.
[315] Ofcom Defence, Annex A, §A.343.

(d) a move to LRIC+ would reduce the materiality of, but not eliminate, these competition effects. Those effects would, however, be eliminated (or very substantially reduced) if MTRs were set at LRIC. If LRIC+ rates were to be set at a higher level as EE and Vodafone argue for, the unresolved competition effects would be correspondingly more significant.

2.466 We consider that the appellants' arguments on materiality are best considered together with their substantive arguments. We set out above our assessment of the arguments that we consider to be most important to the appellants' cases. In summary, we consider these to be (see paragraphs 2.92 and 2.94): that Ofcom did not properly take into account the results of the economic literature which indicated that a lower termination rate would dampen competition; that smaller networks would not be disadvantaged by higher MTRs as they would receive, as well as pay, higher termination charges on a higher proportion of calls; that on-net/off-net price differentials were no longer a significant feature of the UK market; and that Ofcom's assessment of the impact that LRIC+ based MTRs would have on competition for different customer segments was flawed.

2.467 For the reasons given above (see paragraphs 2.95 to 2.363), we do not agree with the appellants on these points. In the light of these conclusions, we are also of the view that the appellants have not shown that the positive competition effects of setting MCT charges at LRIC, rather than LRIC+, were immaterial.

Assessment of the competition effects between fixed and mobile networks

Introduction

2.468 Ofcom concluded that there was some competitive interaction between FCPs and MCPs, and that adoption of LRIC would reduce the competitive impact of the current difference between MTRs and FTRs.[316]

2.469 Ofcom said that using LRIC for MTRs would reduce substantially the current absolute asymmetry of MTRs and FTRs and hence any competitive distortions between mobile and fixed networks that arose from asymmetries in mark-ups would be reduced. Setting MTRs to LRIC would remove any mark-up on MTRs but a small mark-up would remain on FTRs. Ofcom noted that LRIC may in future also be applied to FTRs.[317]

2.470 Ofcom said that the argument might be less clear-cut if examined from a demand-side perspective. Ofcom said that common costs in both types of networks might still be more efficiently recovered via a fixed fee rather than a traffic-related fee, but that this left open the question as to from which side of the market should fixed and common costs be recovered. Ofcom said it may have been more efficient to do so from the retail side where price discrimination was easier to implement.[318]

2.471 EE and Vodafone challenged this conclusion and reasoning. BT intervened in support of Ofcom. In this section we first summarize the arguments made by Vodafone and EE in their Notices of Appeal and Core Submissions, by Ofcom in its Defence and by BT in its SoI (in support of Ofcom) (see paragraphs 2.472 to 2.483); we then set out our understanding of the areas of dispute (see paragraphs 2.484); and finally we give our assessment (see paragraphs 2.486 to 2.516).

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[316] Ofcom Statement, Annex 3, §A3.255.
[317] Ofcom Statement, Annex 3, §§A3.250 & A3.251.
[318] Ofcom Statement, Annex 3, §A3.250.

Summary of the arguments

Appellants' arguments

- *EE*

2.472 EE argued that Ofcom's approach was flawed for the following reasons:[319]

(a) Mobile services offered additional functionality compared with fixed services—a user could call someone who is on the move—the cost of which should be taken into account.

(b) The cost drivers of the two types of network were different. The costs of a fixed network increased when additional subscribers joined the network, but were not affected by the number of calls made to fixed subscribers. In contrast, a proportion of mobile network costs must have been incurred in order to have offered a viable mobile network, regardless of the number of subscribers and further increments to capacity will be driven by call volumes.

(c) Ofcom's proposition that competition at the retail level may have been distorted if the prices paid for the two different wholesale services of fixed and mobile termination were not the same was misconceived: different levels of charges for different wholesale services would not distort competition if they were cost based.

(d) Ofcom's concern about the contributions from FTM and MTF calls was actually an argument in favour of LRIC+. If all the common costs of mobile networks were recovered in retail charges and MTRs were based on LRIC, then MTF calls would be priced higher than FTM calls. This would be an odd outcome given that the cost of the two types of call was essentially the same.

(e) Ofcom overlooked the efficiency reasons for the current structure of prices:

(i) The cost of the fixed access network, ie local loops, was recovered in fixed (line rental) charges because the cost of the local loop did not vary with the number of calls carried over it. This was different from mobile networks where carrying a larger number of calls required more spectrum or sites or, where these were limited, created an opportunity cost in terms of capacity not being available for other callers and services. The cost of the mobile access network, unlike the fixed access network, should efficiently have been recovered in mobile termination charges as there was a traffic-related cost to the use of the mobile access network. Prices should not have been equalized where there were differences in the efficient structure of costs being recovered. To do so would have harmed efficiency and overall welfare.

(ii) Allowing FTM callers to 'free-ride' on the investments of mobile networks, thereby forcing up the price of MTF calls (and mobile calls more generally), was likely to lead to an inefficient over-consumption of FTM calls and an inefficient under-consumption of mobile calls, including MTF calls.

2.473 Finally EE said that Ofcom had emphasized that there may have been some competitive interaction between mobile and fixed services, but the fact that the two ser-

[319] EE NoA, §§120–124.

vices were not sufficiently close substitutes to warrant inclusion in the same product market would tend to mute any effect on competition between MCPs and FCPs.[320]

- *Vodafone*

2.474 Vodafone argued that Ofcom's analysis started from a false premise that the costs of coverage in a mobile network were the equivalent to the costs of access in a fixed network, and that it would therefore have been efficient for such costs to be recovered from mobile customers, and not from other operators, as in fixed termination. Vodafone said that it was the end customer's decision to connect to the fixed networks which caused the fixed networks to incur the costs of the access network and that it was efficient that the line rental recovered the cost of accessing the network from the final customers.[321]

2.475 Vodafone said that there was no such thing as an access network in mobile telephony, since there were no network elements exclusively dedicated to the provision of an access service to a mobile customer. What BT and Ofcom considered to be the access network for mobile services (eg the coverage network) was a common cost between termination and origination services, and as a result it was in general efficient for it to be recovered from the charges of both services.[322]

2.476 Vodafone also said that fixed subscribers, just like mobile subscribers, would have benefited from being able to reach any mobile subscriber wherever they were as a result of the existence of the mobile radio access network, and as such there was no reason for such subscribers to have made no contribution to the recovery of the fixed and common costs of the mobile network.[323]

2.477 For these reasons, Vodafone considered that it was economically efficient for MTRs to have made a contribution to the recovery of fixed and common costs from all subscribers, both fixed and mobile.[324] In addition, Vodafone said that whilst Ofcom alleged that there may have been some overlap in competition between FCPs and MCPs, it had failed to provide compelling evidence to support its claim about the extent of competition between communications providers that continued to operate in separate markets or to have provided any indication of the materiality of any potential distortion.

Ofcom's Defence

2.478 Ofcom said that there were substantial differences in the mark-ups on traffic-related FTRs and MTRs.[325] Under LRIC, fixed callers made no contribution to the coverage costs of a mobile network, but they did make a contribution to the access network costs (to the extent these were driven by incremental terminating traffic). This was not distortive as it was related to the costs incurred at the margin of providing that service.

2.479 Ofcom said that the argument boiled down to the question of whether a portion of the traffic-invariant (coverage) costs of a mobile network should only be charged to mobile users (LRIC) or to mobile users and fixed callers to mobile users (LRIC+).[326]

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[320] EE NoA, §§120–124.
[321] Vodafone NoA, Schedule 2, §5.4.
[322] Vodafone NoA, Schedule 2, §5.7.
[323] Vodafone NoA, Schedule 2, §5.9.
[324] Vodafone NoA, Schedule 2, §5.10.
[325] Ofcom Defence, Annex A, §A.337.
[326] Ofcom Defence, Annex A, §A.338.

Ofcom said that the answer to this question was not simple. While the distributional effect and the commercial impact on different MCPs and FCPs was clear and LRIC allowed greater competition between MCPs and FCPs, the efficiency assessment was complex as it depended on the pass-through of lower (or higher) revenues for the different MCPs (and FCPs). Ofcom's view was that given the complexity of the assessment and the uncertain impact on efficiency, this was a factor that should be accorded less weight in the overall assessment than factors whose effect was more clear-cut.

2.480 In relation to the competition between FCPs and MCPs, Ofcom said that it provided detailed evidence about fixed/mobile competitive interactions, including the fact that the markets were converging, considerations from its fixed retail narrowband market review on those interactions, and references to the Recommendation where the potential for such distortions was discussed.[327]

BT

2.481 BT said that LRIC+ based MTRs would offend the principle of technological neutrality and distort competition,[328] since it would have required fixed customers to contribute to the mobile networks' access network costs, even though mobile customers made no contribution to the fixed operators' access network costs.

2.482 BT said that all communications networks comprised access and core elements:[329] the access network enabled customers to connect to the network so that they could make or receive calls, and the core network switched the calls and transmitted them to the access network of the called party. The fixed access network used a copper-based technology while the mobile access network used a radio-based technology but they served the same technical and economic function in that they enabled customers to access the network.

2.483 BT also said that fixed access costs had always been completely excluded from the calculation of fixed termination rates (which instead covered just the costs of carrying calls across the core network plus a contribution to the administration costs directly incurred to support wholesale customers).[330] If Ofcom had opted for LRIC+ it would have allowed the continuation of a regime whereby fixed customers bore the whole cost of the fixed access network and made a contribution towards the cost of the mobile access network, while mobile customers made no contribution to the cost of the fixed access network and enjoyed access to the mobile network that was subsidized by fixed customers.

Our assessment

2.484 We consider that the arguments made by the appellants are concerned with the following:

(a) the evidence on the extent of competition between mobile and fixed networks and therefore the potential for MTRs to distort competition (see paragraphs 2.473 and 2.477);

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[327] Ofcom Defence, Annex A, §A.339.
[328] BT Sol, §14.
[329] BT Sol, §15.
[330] BT Sol, §16.

(b) whether it was correct to consider the mobile coverage network as comparable or equivalent to the fixed access network and, therefore, whether it was reasonable for FTM calls to contribute to mobile network coverage costs when MTF calls did not contribute to fixed access network costs (see paragraphs 2.472*(b)*, 2.474 and 2.475);

(c) whether LRIC+ based MTRs would result in mobile and fixed retail call prices that were more cost reflective as a move to LRIC would result in higher retail prices for MTF calls than FTM calls when the costs of these two types of call were essentially the same (see paragraphs 2.472*(c)* and 2.472*(d)*); and

(d) whether there were demand-side reasons for FTM calls to have contributed to the coverage costs of mobile networks. This includes the argument that mobiles offered an additional functionality that came at a cost from which callers from fixed lines benefited (see paragraphs 2.472*(e)* and 2.476).

2.485 We consider each of these points in turn below.

The extent of competition between fixed and mobile networks

2.486 Vodafone said that whilst Ofcom alleged that there may have been some overlap in competition between FCPs and MCPs,[331] it had failed to provide compelling evidence to support its claim about the extent of competition between communications providers that continued to operate in separate markets or to provide any indication of the materiality of any potential distortion.

2.487 EE made a similar point. EE said that the fact that the two services were not sufficiently close substitutes to warrant inclusion in the same product market would have tended to mute any effect on competition between MCPs and FCPs.[332]

2.488 Ofcom said that market definition was an exercise to frame an assessment of market power and to identify circumstances where ex-ante regulation may have been necessary.[333] A finding of services being in separate markets did not preclude some material degree of competitive interaction between the markets. It only meant that the degree of constraint was insufficient to include fixed and mobile services in the same economic markets.

2.489 In its Statement Ofcom explained[334] that in its Fixed Retail Narrowband Market Review it had recognized increasing competition for fixed and mobile calls, such that for many consumers the two services could have been substitutes, but had remained of the view that the relevant economic market was for fixed calls and that the market definition should not be extended to include mobile calls. Ofcom referred to the following statement in the review:

> With 79% of UK consumers having both mobile and fixed line access most consumers clearly have a degree of choice as to whether to make a call on their fixed line or mobile. Although there will be circumstances where consumers can either only use a mobile or landline or where they have a strong preference for using one over the other, in general mobile and fixed calls are substitutable for each other.

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[331] Vodafone NoA, Schedule 2, §5.9.
[332] EE NoA, §§120–124.
[333] Ofcom Statement, Annex 3, §A3.242.
[334] Ofcom Statement, §4.46.

2.490 Ofcom also referred to the statement in this market review 'it is also clear from the evidence that the degree of substitution between mobile and fixed calls varies considerably depending on the nature of the mobile contract and the nature of the calls made'. Given some uncertainty and variation between consumers, Ofcom concluded that:

> We consider that it is appropriate to take a conservative view of the market boundaries. As discussed in the introduction, the purpose of market definitions is mainly to support analysis of market power. The exclusion of mobile calls from the market sets a higher hurdle, in any analysis, in establishing that that market is effectively competitive. This strengthens the robustness of our finding of no SMP for the UK (excluding Hull).

2.491 We agree with Ofcom that the exercise of defining economic markets was carried out for the specific purpose of framing an assessment of market power. It is, in our view, incorrect to suggest that a conclusion that mobile and fixed networks comprise separate economic markets implies a degree of competitive interaction between the providers of fixed and mobile network services that is so limited that we would not be concerned about the impact of the cost standard adopted on this competition. It only suggested that the extent of competition was not sufficient for the two products to have been included in the same market. In particular, it did not suggest that from the consumer's perspective there was no substitutability between fixed and mobile services.

2.492 We do not accept that Ofcom failed to provide evidence in support of its conclusions on the extent of competition between fixed and mobile services. In its Statement Ofcom referred to the following:[335]

(a) Evidence of technological convergence, for example, MCPs increasingly employing fixed technologies to terminate mobile calls, and convergence in business models such as C&W's Fixed Mobile Convergence service that competes for fixed voice consumers using mobile voice technology.

(b) BT's submissions that the relative prices of calls from fixed and mobiles had some bearing on consumers' choice of service. In particular:

(i) Customers who have made a mobile call were often within easy reach of a fixed line and so the two types of call may have been direct substitutes.

(ii) The decline in fixed geographic calls and the increase in mobile calls and mobile-only households suggested that consumers were also making choices between the two technologies.

(c) Ofcom's September 2009 statement in the Fixed Retail Narrowband Market Review in which it recognized that for many consumers fixed and mobile services could have been substitutes.

(d) The Recommendation which discussed the potential for competitive distortions between MCPs and FCPs.

[335] Ofcom Statement, Annex 3, §§A3.243–A3.246.

2.493 It is our view that Vodafone did not explain why it considered this evidence to be insufficient for Ofcom to conclude that there was some competitive interaction between mobile and fixed networks and that this was increasing.

Whether the mobile coverage network was comparable to the fixed access network

2.494 Vodafone said (see paragraph 2.474) that Ofcom's analysis started from a false premise that the costs of coverage for a mobile network were equivalent to the costs of access for a fixed network. Vodafone also said (see paragraph 2.474 and 2.475) that there were good reasons, related to the different cost drivers for fixed and mobile networks, why the costs of the fixed access networks were efficiently recovered from line rental and the costs of the mobile coverage networks should in part be recovered from MTRs.

2.495 It appears to us that the argument that the mobile coverage network should have been considered as equivalent to the fixed access network was made by BT and not Ofcom (see paragraph 2.482). Ofcom said that the adoption of LRIC for MTRs would reduce concerns related to the different treatment of the recovery of common costs between fixed and mobile services.[336] Ofcom also said that there were concerns arising from the fact that MCPs recovered the common cost of the access network as a mark-up on MTRs from mobile and fixed subscribers whereas FTRs had not included a common cost mark-up for the access network. Ofcom did not, however, argue that mobile access (or coverage) networks should be regarded as comparable to the fixed access network.

2.496 Ofcom also recognized that the cost drivers for these elements of fixed and mobile networks were different and that this would have implications for the efficient recovery of these costs.[337] Ofcom said that coverage costs had not existed in fixed networks and that in mobile networks coverage was a significant cost-driver.

2.497 Ofcom also noted that adopting a LRIC cost standard for MTRs would not result in fixed-line users making no contribution to the costs of the radio access network.[338] Rather under LRIC while callers from fixed networks would make no contribution to the coverage costs of a mobile network, they would make a contribution to the radio access network costs driven by the incremental (terminating) traffic.

2.498 Ofcom's concern was that there were substantial differences in the mark-up on incremental costs between fixed and mobile termination rates and the potential for this to distort competition between fixed and mobile networks.[339] Ofcom explained in its consultation document that high MTRs might impact on competition between fixed and mobile networks as they would transfer resources from the fixed to the mobile sector and that given already strong competition for at least some call types, for at least some consumer groups,[340] the adoption of LRIC would reduce its concerns in relation to this transfer of resources.

2.499 Ofcom also suggested that LRIC-based MTRs would have been more cost reflective. In particular,[341] Ofcom said that under LRIC, whilst fixed callers made no contribution to the coverage costs of a mobile network, this was not distortive as it related to the costs incurred at the margin of providing that service.

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[336] Ofcom Statement, §8.95.
[337] Ofcom Statement, Annex 3, §A3.232.
[338] Ofcom Statement, Annex 3, §A3.253.
[339] Ofcom Defence, Annex A, §A.337.
[340] Ofcom Consultation, Annex 12, §A12.100.
[341] Ofcom Defence, Annex A, §A.337.

2.500 In summary, it is our view that, contrary to Vodafone's argument, Ofcom's reasoning in relation to the effects on competition between fixed and mobile networks of LRIC+, compared with LRIC, based MTRs was not based on a view that the mobile coverage networks and fixed access networks were equivalent. Rather, it appears to us that Ofcom's argument was a more general one that LRIC+ based MTRs would have included a substantial mark-up on incremental costs whereas this mark-up was small with current FTRs, and that this would result in a transfer of resources from fixed to mobile networks. It was also Ofcom's view that adopting a LRIC cost standard would result in differences between MTRs and FTRs that were more cost reflective.

Implications of the cost standard adopted for FTM vs MTF retail call prices

2.501 EE referred to the statement in Ofcom's Statement that FTM calls made a larger (ppm) contribution to network costs than MTF calls and that a move to LRIC would have reduced the asymmetry in absolute levels between MTRs and FTRs.[342] EE said that this was a very odd argument as competition would have been welfare-enhancing where fixed and mobile services competed based on their respective characteristics and costs.[343] EE said that cost reflective MTRs should have been above cost reflective FTRs and it would be economically inefficient to set them at the same level. EE suggested that it was Ofcom's position that it would have been desirable on competition grounds for MTRs and FTRs to have been set at the same level.[344]

2.502 We do not accept EE's presentation of Ofcom's position. In particular, that efficiency would have required mobile and fixed termination charges to have been the same is not our understanding of Ofcom's position. We consider that a more detailed reading of Ofcom's reasoning, as set out in its Statement and Defence, suggests that Ofcom's concerns arose from differences between MTRs and FTRs that were the result of differences in the mark-up on incremental costs.[345]

2.503 EE also said[346] that Ofcom's concern about the contributions from FTM and MTF calls was actually an argument in favour of LRIC+. EE said that if all the common costs of mobile networks were recovered in retail charges and MTRs were based on LRIC, then MTF calls would be priced higher than FTM calls. This was said to be an odd outcome given that the cost of the two types of call were essentially the same.

2.504 EE developed its point using a simple model with one mobile network and one fixed network.[347] The model assumed the same marginal cost for all MTM, FTF, FTM or MTF calls. EE explained that under LRIC each network would have to recover all of its common costs from its own retail charges and, as a result, the mobile network would have to load all of its common cost recovery on to MTM and MTF calls. In this model, with LRIC, the price for an FTM call was half that of a MTF call. EE said that this was because fixed users free-ride on the significant investment costs of providing a mobile network (despite gaining the benefit of it when making the call). Based on the results of this model EE said that with LRIC+ retail prices for MTF and FTM calls would be the same and that a move to LRIC would result in MTF retail call prices that were higher than those for FTM calls.

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[342] EE NoA, Walker 1 expert report, §199.
[343] EE NoA, Walker 1 expert report, §201.
[344] EE NoA, Walker 1 expert report, §200.
[345] Ofcom's Statement, Annex 3, §§A3.250 & A3.251.
[346] EE NoA, §123.
[347] EE NoA, Walker 1 expert report, §§199–207.

2.505 We note that in the EE model MTF and FTM calls made a greater contribution to common cost recovery than MTM calls. In the model MTF (and FTM) calls made the same contribution as an MTM call to the mobile network common costs and, in addition, a contribution to the fixed network common costs. Given that EE set the marginal costs of these calls to be the same, this suggested a larger mark-up on marginal cost, for example, for MTF calls than MTM calls. EE did not explain why this would be desirable.

2.506 We consider EE's model to be overly simplistic. The model assumed that all common costs were recovered from wholesale and retail call charges (with LRIC+) or just retail call charges (with LRIC), on a per call basis. This would not necessarily be the case. Common costs may also have been recovered from fixed charges eg fixed fees for packages of services or minutes. In particular, the EE model assumed that an originating network would set the retail price for a call to be equal to the marginal network cost (in the case of an FTM or an MTF call this was the sum of the marginal cost to both the fixed and mobile networks) plus any contributions to common costs. For example, with LRIC+ based MTRs the price of each MTF call for a mobile user was 2.5, consisting of: 1 (the incremental cost incurred by the mobile and fixed networks) + 1.2 (contribution towards mobile common costs) + 0.3 (contribution towards fixed common costs). The price of each FTM call was also 2.5. This does not, in our view, adequately reflect the complexity of the structure of charges for mobile services particularly for post-pay customers.

2.507 Where a network charges a two-part tariff, we would expect the marginal cost to a network of an additional call made by a subscriber to be a factor in determining the structure of a charge. In EE's model the marginal cost faced by a mobile network of an additional MTF call would be lower than that faced by a fixed network for an additional FTM call. In particular, the marginal cost faced by the mobile network for an additional MTF call would be its own marginal network cost plus the FTR. If the FTR was the sum of the fixed network's marginal cost and a contribution to fixed common costs, then the marginal cost faced by the mobile network for an MTF call would be the total network marginal costs plus a contribution to fixed network common costs. This would be 1.3 in the EE model. With LRIC+ based MTRs, the marginal cost faced by the fixed operator for a FTM call would be higher, 2.2 in the EE model. For this reason alone we do not accept EE's claim, illustrated using its model, that LRIC+ based MTRs would result in the same retail call charges for FTM and MTF calls.

2.508 In addition, EE assumed that all call minutes by all subscribers would make the same contribution to common costs. We also consider this to be unrealistic. In practice, given that customers differ in their characteristics and preferences, we would expect networks to differentiate their retail offers accordingly.

2.509 Neither do we accept EE's suggestion that LRIC+ based MTRs would be more cost reflective (see paragraph 2.503). In EE's model, with LRIC+ based MTRs, the difference between the marginal cost faced by a mobile network of an additional MTF call (1.3 in EE's model) and the marginal cost faced by a fixed network of an additional FTM call (2.2 in EE's model) did not reflect any difference in the incremental costs incurred in handling these calls. In EE's model the marginal cost of these calls was the same, but LRIC+ based MTRs would result in fixed networks facing a higher marginal cost of an additional FTM call than a mobile network would have faced for an additional MTF call.

2.510 Finally EE said that rather than allowing for greater competition between MCPs and FCPs, adopting LRIC would weaken competition.[348] EE noted that currently mobile call prices were higher than those for fixed retail calls. EE said that this model demonstrated that adopting LRIC would lead to an increase in mobile call prices and reduce the competitive pressure imposed on fixed call prices from mobile services.

2.511 This conclusion was based on the results of the EE model which we consider to be flawed for the reasons given above. We also consider that it is difficult to predict the impact of the cost standard adopted on the relative charges for mobile and fixed services. We agree that adopting a LRIC cost standard could for some customers result in an increase in the average cost of mobile services relative to the average cost of fixed line services. However, although the average cost of mobile and fixed services may be relevant to competition for subscribers, for people who subscribe to both the impact of the cost standard adopted on the marginal cost of making more calls may be more relevant to the substitutability of these services. In our view, it is not clear that a reduction in MTRs would lead to an increase in the retail cost of an additional mobile call relative to the cost of an additional fixed line call. This is because lower MTRs would have no impact on the wholesale cost to fixed or mobile networks of an additional call to a fixed number and would affect the wholesale cost of an additional mobile or fixed line call to a mobile number to the same extent.

2.512 To summarize, EE said that adopting a LRIC cost standard would result in higher retail prices for MTF calls than FTM calls, and that this would be an odd outcome given that the cost of the two types of call was essentially the same. We consider that EE's model did not demonstrate that LRIC+ based termination rates would result in the same retail call prices for MTF and FTM calls. In addition, we consider that the marginal costs faced by mobile and fixed network operators for MTF and FTM calls, respectively, would be more cost reflective with LRIC-based termination rates. Finally, we do not accept that the effect of adopting LRIC would be reduced competition between fixed and mobile services.

Demand-side considerations

2.513 Ofcom said (see paragraph 2.479) that the key argument was whether a proportion of the traffic invariant coverage costs of mobile networks should only have been charged to mobile users (LRIC) or to mobile and fixed calls to mobile users (LRIC+). Ofcom said that the answer to this question was not simple. Ofcom concluded that given the complexity of the assessment and the uncertain impact on efficiency, this was a factor that should be accorded less weight in the overall assessment than factors whose effect was more clear.

2.514 The arguments made by EE and Vodafone were concerned with the benefits fixed-line users derived from being able to call people on their mobile phones and the extent to which fixed-line operators may have been expected to pass through lower MTRs to their subscribers. We do not consider these arguments to be concerned with the competition effects of the cost standard adopted for setting MTRs.

2.515 EE said that using LRIC would risk a distortion between the prices of FTM and MTF calls,[349] and thereby competition between FCPs and MCPs, as it would allow FTM callers to free-ride on the substantial investment costs associated with mobile networks. For the reasons given above we do not accept EE's arguments that adopting LRIC would have distorted competition. In particular we did not agree that the

[348] EE Core Submission, Walker 3 expert report, §163.
[349] EE NoA, §132.

effect would be to distort efficient price signals to mobile and fixed networks in setting retail tariffs.

2.516 Vodafone said that fixed subscribers,[350] just like mobile subscribers, benefitted from being able to reach mobile subscribers wherever they were and as such there was no reason for fixed-line subscribers not to have contributed to the recovery of the fixed and common costs of mobile networks. Again we do not consider this to be an argument about the impact of the cost standard adopted on competition between mobile and fixed networks.

Conclusion

2.517 For the reasons given above, we do not agree with EE and Vodafone's challenges in relation to Ofcom's assessment of the impact of the cost standard adopted on competition between MCPs and FCPs.

Conclusion on competition effects

2.518 Ofcom considered the impact of the cost standard adopted for setting MTRs on competition between MCPs and competition between MCPs and FCPs. Ofcom concluded that higher MTRs under LRIC+ appeared to dampen competition among MCPs to some degree, as a result of a combination of competition effects, and that at a move to set MTRs at LRIC would eliminate (or very substantially reduce) these effects.[351] Ofcom also concluded that there was some competitive interaction between FCPs and MCPs and that the adoption of LRIC would reduce the competitive impact of the difference between MTRs and FTRs.[352]

2.519 Vodafone argued that Ofcom erred in its assessment of the relative merits of LRIC+ and LRIC from the standpoint of competition.[353] EE contended that MTRs based on LRIC+ would not lead to any appreciable distortion of competition, such as to support the choice of a LRIC cost standard, and that there were significant competition considerations that favoured the choice of a LRIC+ cost standard.[354]

2.520 With regard to Ofcom's assessment of the effect of the cost standard adopted on competition between MCPs, EE argued that the economic literature indicated that generally higher MTRs (in this case LRIC+ based MTRs) would increase competition between networks. Vodafone argued that Ofcom's assessment of competitive effects was incomplete because Ofcom had not taken into account other effects identified in the literature that could offset those effects identified by Ofcom. For the reasons set out in paragraphs 2.119 to 2.151, we do not accept these claims.

2.521 Vodafone and EE also argued that Ofcom had erred in the overall approach taken to the assessment of competition effects and that Ofcom had attached too much weight to the experience and views of Three. As set out in paragraph 2.178, we conclude that: Ofcom was not wrong to focus on the impact that the cost standard adopted would have on barriers to entry and growth; Ofcom was not wrong to adopt its 'all else equal' approach; and Ofcom was not wrong to take into account the experience of particular MCPs in assessing the impact that the level at which MTRs are set would have on competition.

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[350] Vodafone NoA, Schedule 2, §5.9.
[351] Ofcom Statement, Annex 3, §§A3.229 & A3.230.
[352] Ofcom Statement, Annex 3, §A3.255.
[353] Vodafone NoA, §50.
[354] EE NoA, §85.

2.522 In addition, the appellants gave specific reasons why they considered Ofcom to have erred in its assessment of the competitive effects identified in the Statement. In our assessment of the key arguments (see paragraphs 2.364 and 2.365): we do not agree with the appellants that smaller networks could have avoided any disadvantage associated with higher MTRs by maintaining a balanced traffic position; we do not agree that on-net/off-net price differentials were insignificant in the UK market and of limited importance to subscribers; and it is our view that the appellants have not demonstrated that the impact that MTRs would have on the value of different customer groups would have no material impact on competition.

2.523 In relation to Ofcom's assessment of the effects of the cost standard adopted for competition between MCPs and FCPs, EE and Vodafone argued that Ofcom had not provided evidence of competitive interaction between mobile and fixed networks, and that people making F2M calls benefit from the investment in mobile networks and should therefore contribute to the mobile network coverage costs. For the reasons given in paragraphs 2.486 to 2.493 and 2.513 to 2.516, we did not accept these arguments. Vodafone also argued that Ofcom's reasoning was based on a false premise that mobile coverage networks and fixed access networks were equivalent, and EE that LRIC+ based MTRs would result in more cost-reflective charges for F2M and M2F calls and more competition between MCPs and FCPs. For the reasons given in paragraphs 2.494 to 2.500 and 2.501 to 2.512, we do not accept these claims.

2.524 Accordingly, we do not agree with the appellants that Ofcom erred in its assessment of the relative merits of LRIC and LRIC+ from the standpoint of competition. Nor that MTRs based on LRIC+ would not lead to any appreciable distortion of competition, such as to support the choice of a LRIC cost standard, and that there were significant competition considerations that favoured the choice of a LRIC+ cost standard.

2*(a)* Allocative efficiency

Introduction

2.525 Ofcom introduced its consideration of allocative efficiency by remarking that 'Allocative efficiency is maximized when there is an optimal distribution of goods and services taking into account costs of supply and consumers' preferences'.[355] We agree with Ofcom[356] that, as a general principle, in the absence of fixed or common costs and externalities, allocatively efficient outcomes would be reached if all products were priced at marginal cost. If prices are set above marginal cost (commonly referred to as a 'distortion') then there is a generally a consumer who would be willing to pay more than the product costs to produce, but less than the price, and hence an efficient trade does not take place. So, as a general principle, any price set above marginal cost is a 'distortion' which reduces efficiency.

2.526 Ofcom then recognized that allocative efficiency in the mobile sector is considerably more complicated, since fixed and common costs are substantial, even if one tries to allocate them to individual services as far as possible.[357] In order for mobile operators to be viable as commercially run businesses, common costs have to be recovered via a mark-up on one or more of the services they offer, so at least one price must be

[355] Ofcom Statement, §8.33.
[356] Ofcom Statement, §8.34.
[357] Hence the use of LRIC as a proxy for marginal cost. As discussed in the introduction to Question 1 (paragraph 2.4), we generally treat LRIC as being a good proxy for marginal cost when considering efficiency. Although this is a simplification, we do not anticipate that this approach will be controversial, not least because this is the approach adopted by the parties in their pleadings (see, for example, Statement, fn 573, and Kalmus expert report, §§3.17 & 3.18).

above marginal cost. Ofcom said that if MTRs are set equal to LRIC, all common costs would have to be recovered from retail services.[358] However, setting MTRs above LRIC leads to distortions in the fixed sector. The question that Ofcom addressed was how common costs can most efficiently be recovered, taking into account distortions in both mobile and fixed sectors.

2.527 In principle, the optimal result (ie the most efficient outcome) is achieved if common costs are allocated in such as way as to minimize the total distortion across each service. Several of the parties have referred to 'Ramsey pricing principles', which (in a simple model) suggest that bigger mark-ups are placed on services with the most inelastic demand. In theory, with enough information and a sufficiently comprehensive model, it may be possible to calculate the optimal charge for each mobile service, including MCT, which would generate the most allocatively efficient outcome.[359] For practical reasons, in the Statement Ofcom restricted the options for the charge control to a choice between pure LRIC and LRIC+.[360]

2.528 Ofcom's approach in the Statement was to look first at conceptual arguments as to how MTRs could best contribute to common cost recovery.[361] Ofcom then went on to consider the impacts of choosing between LRIC and LRIC+ on mobile ownership and usage and on the fixed sector.[362] The pleadings, in general, followed this same structure.

2.529 In this section, we broadly follow the same structure. In so far as they fall within the scope of this part of our consideration of Reference Question 1, various parties have made arguments under a number of headings, but we consider that they can be grouped into two broad questions: whether the theoretical cost standard methodology which most efficiently contributes to the recovery of common costs is closer to LRIC or LRIC+; and whether the effects of moving from LRIC+ to LRIC will be bad for allocative efficiency. The latter includes considerations such as impacts on prices, ownership and usage of mobile and fixed services.

2.530 The level of MTRs chosen will have distributional consequences (in terms of which consumers benefit and which lose). We do not address those here directly, but they are considered in the section on vulnerable customers.

2.531 In all of these considerations, we have in mind the statutory framework within which Ofcom was required to make its decision, in particular the test in section 88(1)(b) of the Act that the setting of the MCT charge control be appropriate for the specified purposes. We also reiterate that it is for the appellants to prove their cases against Ofcom's exercise of discretion, within that statutory framework, of selecting LRIC over LRIC+.

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[358] And/or from unregulated wholesale services such as domestic roaming. Ofcom Statement, §8.35.
[359] In practice, the information and computation requirements are likely to be prohibitive. A further problem is that only MCT is regulated, whereas MCPs will set the prices of all other services to maximize their own profits. Therefore the level of MTR in the optimal outcome may not be the best MTR to set: once we allow for MNOs setting their other prices in response to the regulated MTR, taking account of the firm-level demand elasticities they face rather than industry-level elasticities that would be taken into account by a regulator setting all prices, it is likely that some 'second best' MTR will generate the best attainable outcome.
[360] Ofcom Statement, §§A3.7–3.10.
[361] Ofcom Statement, §§A3.45–3.70.
[362] Ofcom Statement, Section 7.

Efficient recovery of common costs

Summary of Ofcom's rationale and methodology

2.532 Ofcom said that 'abstracting from competition considerations, there could be a *theoretically optimal* level of common cost recovery from termination which sits between pure LRIC and LRIC+ … which would be set according to Ramsey pricing principles'.[363] Ofcom noted that retail price flexibility was an important argument in this discussion. However, Ofcom said that calculating this optimal level using Ramsey pricing principles would be computationally very difficult and data-intensive and highly prone to regulatory error, because:[364]

(a) MCPs engage in price discrimination using non-linear pricing structures (for example, a consumer entering into a post-pay contract may pay an upfront fee, a fixed monthly charge and additional usage charges);

(b) MCT is a wholesale service and the MTR of one operator affects the marginal costs and retail pricing of other MCPs; and

(c) the regulator sets MTRs but all other prices are unregulated and set by firms (as noted above).

2.533 Ofcom said that two vital issues were whether it was practical to implement Ramsey pricing and the risk of regulatory error.[365] For these reasons, it did not attempt to calculate the 'optimal' level of MTRs. Instead it attempted to evaluate whether there were reasons to prefer LRIC or LRIC+.

2.534 Ofcom stated that Ramsey pricing principles alone suggested that at least some fixed and common costs should be recovered from MTRs, which could favour some kind of LRIC+ cost standard.[366] However, Ofcom also took into account the nature of retail prices. It observed that there was a substantial (though not perfect) degree of price discrimination at the retail level, in the form of non-linear pricing. It stated that MCPs could and did engage in extensive price discrimination.[367] Hence it expected a switch to LRIC to lead to MCPs recovering common costs from the retail side of the market without causing significant inefficiencies.[368]

2.535 In principle, this would suggest setting MTRs at LRIC. However, Ofcom recognized that price discrimination was not perfect, and that as a result this argument did not suggest that all common costs should necessarily be recovered from retail services.[369]

2.536 Our understanding of Ofcom's thinking is that in an ideal world, if retail prices were set at allocatively efficient levels (marginal cost), consumers would engage in the efficient level of consumption but many consumers would earn a surplus (ie they would pay less than their total consumption of mobile services is worth to them). If MCPs can price discriminate effectively, they may be able to charge consumers a fixed fee (up front or a monthly fee) to extract that surplus and these fixed fees would contribute to common cost recovery, but would not distort consumers' consumption decisions because marginal prices could be set equal to marginal costs. The reality is

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[363] Ofcom Statement, §A3.45.
[364] Ofcom Statement, §§A3.45–3.48.
[365] Ofcom Statement, §A3.45.
[366] Ofcom Statement, §8.35.
[367] Ofcom Statement, §A3.66. Ofcom claimed that the diversity of offers in the retail market was self-evident.
[368] Ofcom Statement, §A3.63.
[369] Ofcom Defence, Annex A, §15d.

likely to be more complex, but the principle is that to some degree, MCPs can recover a contribution to common costs from fixed fees without much distortion compared with the distortion caused by a surcharge on MCT (where there is no price discrimination).

2.537 Ofcom did not draw an explicit conclusion on the use of these theoretical principles, but Ofcom's overall conclusion on allocative efficiency and its summary in the Defence suggest that Ofcom did not draw support for either LRIC or LRIC+ on these grounds alone.[370]

Views of the parties

EE's challenge

2.538 EE made five specific arguments in regard to Ofcom's approach to these issues:[371]

(a) Ramsey principles could, in theory, be adapted to non-linear pricing.[372]

(b) It is allocatively inefficient for MTRs to make no contribution to common cost recovery, since this requires prices of other services to be inefficiently high.

(c) Ofcom was wrong not to take account of the fact that price discrimination is also possible on the fixed retail market; if FCPs would recover MTRs through fixed charges with no impact on demand, then it would be optimal for all common costs to be recovered via MTRs. Ofcom had not analysed this in adequate depth.[373]

(d) It would only be efficient to recover all common costs through subscription charges if demand for subscription were perfectly inelastic, which it is not.

(e) Ofcom should have examined the available evidence on likely pricing under MTRs set at LRIC since the prices MCPs will actually set depend on their commercial incentives.

2.539 EE also contended that Ofcom's reasoning was deficient in so far as it did not explain why its assessment of allocative efficiency had changed since its 2007 MTR Statement.[374]

2.540 In its Core Submission, EE argued that Ofcom's principles were based on the recovery of lost MTR revenue exclusively or predominantly by raising post-pay subscription charges; and that post-pay subscription charges were not invariant to usage (indeed they are 'to a large extent usage charges').[375] EE's argument was that LRIC can be the efficient level of MTRs only if all common costs can be recovered from the retail side of the market without any distortions, and in practice from fixed fees (since any cost recovery from usage charges would distort usage).[376]

2.541 EE also argued that LRIC was known to be the wrong answer, and that LRIC+ was a reasonable estimation of the correct answer.[377] Dr Walker argued that LRIC+ was the

[370] We infer this conclusion from Ofcom Statement, §§8.43 & 8.44, and Ofcom Defence, Annex A, §15d.
[371] EE NoA, §§57–61.
[372] See, for example, Walker I expert report, §§41 & 42.
[373] Argument expanded in Walker I expert report, §48.
[374] EE NoA, §55.
[375] EE Core Submission, §170.
[376] Walker I expert report, §46, and Walker III expert report, §§35–37.
[377] EE Core Submission, §179.

better measure because it 'is at least squarely within the plausible range of correct answers'.[378]

2.542 Finally EE argued that if it was not clear that savings from MTRs would be passed through to fixed customers, LRIC was unlikely to be allocatively efficient.[379]

Ofcom's Defence

2.543 Ofcom responded to EE's arguments as follows:

(a) Ofcom had recognized that Ramsey principles could in principle be adapted to non-linear pricing, but to do so would add to the complexity and risk of error.[380]

(b) Ofcom did not seek to argue that LRIC was the optimal level of MTRs from an efficiency perspective.[381]

(c) Ofcom had considered the possibility of price discrimination on the fixed retail market but believed that LRIC+ would still generate a deadweight loss and would affect competition between FCPs and MCPs.[382]

(d) Ofcom had not argued that setting MTRs at LRIC would cause all common cost contributions which were previously earned from MCT to be recovered through subscription charges. Ofcom noted that they could also be recovered through quasi-fixed charges or other wholesale services. Ofcom did not dispute that there may be a theoretically optimal '+' involving some cost recovery from MCT.[383]

(e) Ofcom had analysed in detail MCPs' likely commercial responses.[384]

2.544 Ofcom denied any deficiency in its reasoning as to the consistency of its approach and conclusions in 2007 and 2011.[385] Ofcom said that its conclusion in 2007 was 'that there may be a theoretical "+" that maximized allocative efficiency but that it is computationally very difficult to calculate', which 'is aligned with Ofcom's current view'. Ofcom did not directly address the reasons for a change in its conclusion on allocative efficiency.

Assessment

2.545 None of EE's arguments lead to us to conclude that LRIC+ would be superior to LRIC on allocative grounds. Most of EE's arguments imply that LRIC is not (or at least is unlikely to be) the level of MTRs that maximizes allocative efficiency; but this is not Ofcom's contention. Ofcom has addressed the question of whether LRIC or LRIC+ is the more efficient level, and has not found sufficient reason to prefer either one. The arguments EE has made would be relevant to calculating the *most efficient* level, but they do not provide logical grounds to conclude that LRIC+ is *more efficient than* LRIC. Each of the five arguments in EE's NoA (see paragraph 2.538 above) therefore fails to demonstrate that LRIC+ is more efficient than LRIC. EE's further argument that LRIC+ is a reasonable estimation of the most efficient level appears to

[378] Walker III expert report, §34.
[379] EE Core Submission, §181.
[380] Ofcom Defence, Annex A, §§17–22.
[381] Ofcom Defence, Annex A, §§23–25.
[382] Ofcom Defence, Annex A, §§26 & 27.
[383] Ofcom Defence, Annex A, §§28–32
[384] Ofcom Defence, Annex A, §§33–35.
[385] Ofcom Defence, Annex A, §221.

be pure assertion which, in the absence of any supporting evidence or further argument, we do not accept.

2.546 We take a similar view of EE's argument that MCPs' fixed charges are in large part usage charges. There is self-evidently a usage element to at least some fixed charges, but Ofcom's argument is based only on there being *some* degree of price discrimination that does not distort usage (or does not distort it much). Again, the degree would affect the optimal level, but EE's argument does not imply that LRIC+ is superior to LRIC.

2.547 We consider pass-through of MTR cuts to fixed-line users below,[386] but we note that Ofcom's reasoning does not rely on full pass-through.

2.548 Ofcom's reasoning in 2007 took a different approach to that in 2011 and did not explicitly reach a conclusion on allocative efficiency. Even if we agreed with EE that Ofcom had changed its conclusions on allocative efficiency, that would not in itself prove that Ofcom should have preferred LRIC+ on allocative grounds, still less that Ofcom erred in deciding that LRIC was appropriate for the purpose of promoting efficiency and other statutory objectives in section 88(1)(b).

Vodafone's challenge

2.549 In its NoA, Vodafone argued that:

(a) setting MTRs at LRIC would result in over-consumption of fixed services and suboptimal consumption of mobile services;[387] and

(b) setting MTRs at LRIC would require MCPs to know how responsive customers are to retail price levels, subscription and usage charges.[388]

2.550 In its Core Submission, Vodafone argued that it could not be presumed that the optimal level of MTRs necessarily lay below LRIC+; it said that this was an entirely empirical question.[389]

2.551 Vodafone also argued that Ofcom had misunderstood the mechanism of the water-bed effect and thus exaggerated the extent to which the possibility of retail price discrimination would mitigate the detrimental impact of reducing MTRs.[390]

2.552 Finally, Vodafone argued that Ofcom had acknowledged that the theoretically optimal level is unlikely to be LRIC but did not take into account the implication that setting MTRs at LRIC was inefficient from an allocative efficiency standpoint.[391]

Ofcom's Defence

2.553 Ofcom responded to the first point (paragraph 2.549*(a)*) by noting that it had never sought to claim that LRIC provided the optimal outcome from an allocative efficiency perspective.[392] In response to the second point (paragraph 2.549*(b)*), Ofcom noted that MCPs spent considerable effort and resources in identifying, and marketing their

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[386] See the section beginning at paragraph 2.789.
[387] Vodafone NoA, §48.3. EE made a similar point in its discussion of competitive effects at EE NoA, §§124.2 & 132.
[388] Vodafone NoA, §48.4.
[389] Vodafone Core Submission, §4.14.2.
[390] Vodafone Core Submission, §4.14.1.
[391] Vodafone Core Submission, §4.16.
[392] Ofcom Defence, Annex A, §37.

products to, different consumer segments; and that Ofcom did not claim, and did not rely on the proposition, that MCPs could perfectly price discriminate.[393]

Assessment

2.554 We agree with Ofcom on Vodafone's first two points: they are similar to most of EE's arguments, in that they would affect the determination of the optimal level of MTRs but do not prove that LRIC+ would be more efficient than LRIC. We consider that Ofcom's argument on the first point also addresses the last of Vodafone's arguments above,[394] and we do not find Vodafone's argument persuasive.

2.555 We agree with Vodafone that the optimal level of MTRs is an empirical question. However, it is a question that has not been addressed empirically by any of the parties to these appeals. We agree that it cannot be assumed that the optimal level definitely lies below LRIC+, but Ofcom's reasoning that it is likely to lie below LRIC+ is sound. Even if the appellants established beyond doubt that the optimal level *may* lie above LRIC+, that would not be sufficient to demonstrate that LRIC+ is more efficient than LRIC; it would be necessary to establish that the optimal level actually lies at or above LRIC+. Without establishing that, the appellants can only argue that the optimal level is *more likely* to lie closer to LRIC+ than to LRIC, but we are not persuaded by any party's arguments that this is the case. Ofcom's position[395] that these considerations did not provide strong support for either LRIC or LRIC+ does not rely on a conclusion that the optimal level must lie below LRIC+. We believe that the optimal level *could* lie above LRIC+, but we have not seen convincing arguments that the optimal level is likely to lie closer to either LRIC or LRIC+.

2.556 We discuss the mechanism of the waterbed effect (in the sense of the effect on retail prices of changing MTRs) below.[396] In summary, we agree with Vodafone that Ofcom has misunderstood the mechanism, and it may be true that this has consequences for the extent to which MCPs can respond to a change in MTRs by using price discrimination. However, this does not imply that MCPs cannot recover *any* contribution to common costs through price discrimination; we view it as an argument about what happens when MTRs change, not about the theoretical optimum. This is in effect similar to one of EE's arguments,[397] and like that argument, it does not demonstrate that LRIC+ is more efficient than LRIC.

Telefónica's intervention in support of EE and Vodafone

2.557 Telefónica and its expert witness Mr Marshall contended that the allocatively efficient price was likely to lie *above* LRIC+, and that LRIC+ must therefore be closer to this efficient price than LRIC was.[398] Mr Marshall first contended that the efficient price must lie somewhere between LRIC and some figure above LRIC+ (rather than between LRIC and LRIC+). Mr Marshall argued that if all services using the common infrastructure had the same elasticity of demand, then Ramsey principles would set MTRs at LRIC+ (he contended that LRIC+ was equivalent to equi-proportionate mark up (EPMU), and hence setting the price of each service at its own LRIC+ would recover all direct and common costs).[399] Mr Marshall argued that the other services

[393] Ofcom Defence, Annex A, §38.
[394] See paragraph 2.552 above.
[395] See paragraph 2.537 above.
[396] Starting at paragraph 2.595.
[397] See paragraph 2.540 above.
[398] Telefónica SoI, §10; Marshall expert report, section 3.
[399] Telefónica SoI; Marshall expert report, §§3.11 & 3.15.

that used the common infrastructure were likely to have more price-elastic demand[400] than termination, which implied that the mark-up on termination should be larger than the 'plus' in LRIC+. Therefore LRIC+ would be closer to the most allocatively efficient outcome than LRIC.

2.558 Telefónica argued in its Core Submission that Ofcom accepted that the optimal price *could* have been above LRIC+, but 'does not address the corollary that if the optimal level of Ramsey prices for MCT were above LRIC+, and not bound by LRIC+ as claimed in the Decision, then Ofcom's assessment of the extent of the inefficiency in pricing structures arising from pure LRIC would potentially be biased'.[401]

2.559 In its Core Submission, Telefónica again argued that the upper bound for optimal MTRs lay above LRIC+, and that this should have informed Ofcom's assessment of whether to 'err on the high or low side'.[402]

2.560 Telefónica argued that Ofcom's conclusion was based on a premise that neither LRIC+ nor LRIC generated a greater inefficiency than the other at either the retail or wholesale levels, and that in order to reach this conclusion, Ofcom must show that the benefits at the retail level cancelled out the costs, which Telefónica said it had failed to do.[403]

2.561 Telefónica also argued that MCPs were already price discriminating, and a move to LRIC would not increase their ability to do so; hence it was not clear how MCPs could generate a further 'efficiency gain' when moving from LRIC+ to LRIC.[404]

Ofcom's Defence

2.562 Ofcom argued that Telefónica's case for the optimal level lying above LRIC+ due to relative elasticities failed to take into account *(a)* the fact that the only service subject to price regulation was MCT, and *(b)* the extensive price discrimination possible in the retail market.[405]

2.563 Ofcom further argued that as to whether the optimal level could be above LRIC+, this was possible in theory, but *(a)* LRIC+ based on equiproportional mark-ups for the different services had been regarded as appropriate in the past by Oftel, Ofcom, the CC and the MMC; and *(b)* Telefónica failed to have regard to the possibility of efficiency gains through price discrimination. Ofcom therefore considered Telefónica's argument to be irrelevant in practice.[406]

Assessment

2.564 We agree with Ofcom that Telefónica's theoretical argument is too simple: it fails to take into account relevant features of the sector and therefore cannot demonstrate that LRIC+ is more efficient than LRIC.

2.565 As noted above,[407] we do not consider that the optimal level of MTRs *must* lie below LRIC+. However, as we discussed, the possibility that it *may* lie above LRIC+ is not

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[400] Using superelasticities (ie taking into account all cross-elasticities of demand between different products as well as their own-price elasticities).
[401] Telefónica Core Submission, §12.
[402] Telefónica Core Submission, §11, quoting Ofcom Defence, Annex A, §20.
[403] Telefónica Core Submission, §15.
[404] Telefónica Core Submission, §16.
[405] Ofcom Defence, Annex A, §44.
[406] Ofcom Defence, Annex A, §45.
[407] Paragraph 2.555.

sufficient to demonstrate that LRIC+ is necessarily superior to LRIC. Nor do we consider that it should have informed a judgement on whether to 'err on the high or low side': Ofcom has not made such a judgement. Ofcom has not argued that these considerations point in favour of LRIC, so it was not 'erring on the low side'; Ofcom's conclusion was that these considerations did not point strongly in favour of either cost standard. However, we note that the fact that equiproportional mark-ups have been endorsed in the past does not lend any support to Ofcom's claim that LRIC+ is an upper bound.[408]

2.566 Telefónica's argument that Ofcom must show that gains are perfectly balanced against losses on the retail side goes too far. This argument could have force if Ofcom had claimed that LRIC and LRIC+ lead to the *same* level of welfare, but Ofcom did not do so.

2.567 We take into account Telefónica's argument that Ofcom needs to recover more costs from a pricing structure which already generates price discrimination below when we consider the effects of moving from LRIC+ to LRIC, since it seems to relate to practical issues from starting at LRIC+ rather than to determination of the theoretical optimum.

Interventions in support of Ofcom

2.568 Three and BT intervened in support of Ofcom and said that there were strong arguments on these grounds in favour of setting MTRs at LRIC. We have assessed these arguments as they provide a counterposition to the appellants' arguments that allocative efficiency considerations favoured LRIC+. We note, however, that Ofcom's conclusion was not that LRIC was preferred on allocative efficiency grounds but rather that allocative efficiency did not provide strong support for either LRIC or LRIC+.

2.569 BT argued that LRIC+ would distort competition. We addressed this in detail in the section on competition effects above.

2.570 Three claimed that the least efficient way to seek to recover fixed and common costs was by a mark-up on the LRIC of termination, for several reasons:[409]

(a) First, Three argued that at an industry level, MTM MTRs payments netted out so did not lead to any recovery of fixed and common costs, and any contribution to the recovery of common costs must come from fixed operators. Dr Kalmus argued that since all profits of a terminating operator appeared as losses of an originating operator, what remained was the effect that setting MTRs above marginal cost induced allocatively inefficient pricing.[410]

(b) Second, applying a mark-up to LRIC leads to double marginalization[411] and causes unnecessary distortion of retail prices; hence LRIC+ causes mobile retail call prices to increase, reducing usage and distorting mobile ownership and subscription.[412]

[408] This point is made by Dr Walker on behalf of EE in Walker III expert report, §23. We note that in this determination, Ofcom has set MTRs at LRIC while acknowledging that the optimal level is likely to be higher.
[409] Three SoI, §§7.4–7.8, repeated at Three Core Submission, §§5.4–5.9.
[410] Three SoI, Kalmus expert report, §3.31. This argument was also made by BT in its SoI at §13.
[411] This is a point also made by Three and its witness Dr Kalmus in another context. See Three SoI, §7.31a, and Kalmus I expert report, §5.25.
[412] Three Core Submission, §§5.5 & 5.6.

(c) Third, because there is substantial competition and price discrimination at the retail level, Three argued that even if retail price discrimination was not perfect, it was more allocatively efficient for MCPs to seek to recover their fixed and common costs at the retail level than by way of a wholesale charge in a monopoly market with a single price point.[413]

(d) Fourth, Three argued that LRIC was more likely to reduce mobile retail prices overall and increase mobile usage (compared with LRIC+), and to remove distortions in the fixed market.[414]

(e) Fifth, Three argued that pre-pay customers would benefit overall from lower MTRs, and if there was an adverse impact on a particular customer segment this would be better addressed through a specific measure.[415]

2.571 Three also argued that:

(f) setting MTRs equal to LRIC maximized allocative efficiency if the marginal mobile customer[416] did not generate externalities and MCPs would not exit the retail market as a result.

2.572 Dr Kalmus for Three argued that:

(g) LRIC was preferable to LRIC+ in a simplified framework.[417]

Assessment

2.573 Three's last two arguments did not affect our assessment. Three did not explain argument *(f)* and provided no evidence that the marginal customer does not generate externalities,[418] and hence we have not considered it further. As to *(g)*, we are wary of applying results from simplified frameworks to the highly complex reality of the mobile industry and hence we have not given weight to this in our assessment.

2.574 We consider *(d)* and *(e)* to be assertions that are unsupported by proper reasoning or evidence. Given the widely-held view that there is a waterbed effect,[419] we are not persuaded that setting MTRs at LRIC would reduce mobile retail prices overall, and it is not clear that doing so will increase mobile usage.[420] We agree that setting MTRs above LRIC causes distortions in the fixed market, but this is not necessarily bad for allocative efficiency if it reduces distortions in the mobile market (since MCPs' fixed and common costs must be recovered somewhere). We consider the effect on pre-pay customers below,[421] and we think it is unlikely that they will benefit overall (abstracting from competitive effects which we have discussed separately). We assume that the argument *(e)* relates to vulnerable customers and we deal with it in

[413] Three Core Submission, §5.7.
[414] Three Core Submission, §5.8.
[415] Three Core Submission, §5.9.
[416] The marginal customer is one who would give up their phone in response to a very small price increase.
[417] Three SoI, Kalmus I expert report, §5.2.
[418] We asked Three about this in its hearing. The argument Dr Kalmus made in response was that the CC did not choose to apply a 'network externality surcharge' in the last charge control. We note that the CC made this decision for a number of reasons (including the fact that the '+' in LRIC+ acted as a surcharge already), but did not conclude that there was no network externality.
[419] We discuss this in more detail below; see paragraph 2.595.
[420] See paragraphs 2.759–2.765 below.
[421] See paragraph 2.658 below.

the section on vulnerable customers.[422] Hence these arguments do not assist our consideration.

2.575 We consider that Three's first three arguments (see paragraph 2.570*(a)* to *(c)*) have some force, but Three has not demonstrated that the force is sufficient to conclude that LRIC is the most appropriate cost standard. First, Three was right to say that within the mobile industry MTR payments net out, but we think the implications of that are more subtle than Three suggested, for two reasons:[423]

(a) The mobile industry does not exist in a vacuum, so MTRs do lead to some cost recovery and it may be allocatively efficient for fixed operators to contribute. This point can be debated but Three's assertion is not sufficient.

(b) MTR payments net out between mobile operators, but that does not mean that they will not affect the structure of prices. If MTRs are passed on to customers, then customers who make calls to a particular operator are contributing to that operator's costs. In general, in a structure with non-linear prices, we might expect higher MTRs to lead to higher call prices and lower subscription prices.[424] The impact of different structures of retail prices on mobile ownership depends on the price sensitivity of marginal consumers. Again, it can be debated whether this mechanism holds and is desirable, but we do not accept an assertion that it is not desirable.

2.576 We agree that LRIC+ causes double marginalization, but it is not clear that this is undesirable in this context. Double marginalization is generally viewed as undesirable because both a wholesaler (in this case the network terminating a call) and a retailer (in this case the network originating the call) charge a margin on top of the cost of providing the service, leading to prices above the optimal level. In other words, double marginalization is undesirable because it produces retail prices that are too high. However, this market is unusual. Given the general consensus that there is a waterbed effect, we cannot simply assume that the overall level of retail prices would be lower under LRIC than under LRIC+. So although both operators involved in a call are earning a margin under LRIC+, the retail price may be lower. Therefore without further reasoning, we do not accept that double marginalization per se is necessarily bad for allocative efficiency. We would expect LRIC+ to lead to higher retail prices in the fixed sector than would LRIC, as we discuss in more detail below,[425] and this needs to be set against outcomes in the mobile sector.

2.577 Three also argued that competition should take place at the retail level, where there was competition and price discrimination, rather than at the wholesale level, where there was neither. We agree that in general it is preferable for costs to be recovered where there is competition, so that regulated firms have the appropriate incentives to minimize their costs and behave efficiently. While that argument may not be as compelling in this case, since most of the costs in question are common to a number of services which are exposed to relatively strong competition, giving MCPs good incentives to behave efficiently, more competition would give stronger efficiency incentives. The argument that common costs can be recovered most efficiently where price discrimination is possible is the same as that made by Ofcom (and with which we agree), but Ofcom recognized its limitations: MCPs cannot perfectly price discriminate and it may not be possible or efficient to recover all common costs in this

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[422] See, for example, paragraph 2.917 below.
[423] These are similar to comments made by Vodafone in its Core Submission, §§4.64 & 4.68.
[424] This is broadly consistent with Ofcom's view.
[425] See paragraphs 2.789–2.798 below.

way.[426] Therefore we consider that these arguments point in favour of setting MTRs at LRIC, but are not sufficiently strong on their own to warrant the conclusion that LRIC is the optimal level of MTRs.

Overall assessment on efficient recovery of common costs

2.578 We have seen no arguments that persuade us that considerations on efficient recovery of common costs necessarily point in favour of either LRIC or LRIC+ as superior for the purposes of recovery of common costs. EE, Vodafone and Telefónica have argued that the optimal level of MTRs lay between LRIC and some level above LRIC+, whereas Ofcom concluded that it lay below LRIC+ once the possibility for price discrimination was taken into account, and Three argued that LRIC might be the optimal level.

2.579 The appellants and interveners made competing arguments based on economic theory and simplified models. We are wary of relying on such models unless it can be demonstrated that the simplifications do not affect their relevance to the highly complex mobile market. No party has demonstrated that to our satisfaction and hence we have not placed weight on the predictions of these competing models. Instead we assess the force of the arguments made in relation to the general economic principles that inform them.

2.580 The mere possibility that the efficient level could be higher than LRIC+ is not sufficient to conclude that LRIC+ is more efficient than LRIC, or even that it is likely to be more efficient. Hence these considerations provide no support for the appellants' case. We agree with Ofcom that they provide no strong support for either LRIC or LRIC+.

Effects of moving from LRIC+ to LRIC

Summary of Ofcom's rationale and methodology

2.581 Having decided that theoretical considerations around efficient common cost recovery did not contribute to a choice between LRIC and LRIC+, Ofcom moved to consider the effects of moving from LRIC+ to LRIC. Ofcom appeared to consider this to be more important than the theoretical considerations, since in its Core Submission Ofcom summarized its conclusions on allocative efficiency as follows: 'a move from LRIC+ to pure LRIC would seem *(a)* highly unlikely to trigger a substantial reduction in ownership, and *(b)* likely to generate only a limited increase in usage'.[427]

2.582 In the Statement (and the Defence), Ofcom broke down the analysis and arguments into the following subjects:

- the effect of lower MTRs on mobile retail prices;[428]
- the effect of lower MTRs on mobile ownership and subscriptions;[429]
- the effect of lower MTRs on mobile usage;[430] and

[426] Ofcom Defence, Annex A, §15d.
[427] Ofcom Core Submission, §32a.
[428] See paragraphs 2.584–2.662 below.
[429] See paragraphs 2.663–2.750 below.
[430] See paragraphs 2.751–2.765 below.

- the effect of lower MTRs on fixed-line prices and usage.[431,432]

2.583 We follow that structure in this section. We then comment on the implications of changes in usage for allocative efficiency.[433] Although Ofcom referred to 'lower MTRs' (and 'higher MTRs') in discussing this subject, it was concerned specifically with the difference between LRIC+ and LRIC in the final year of the charge control. We follow the same convention. Hence if, for example, we suggest that lower MTRs may confer a benefit on some particular ground, that statement should only be taken to apply to MTRs within the range of LRIC and LRIC+; it would not necessarily follow that zero (or negative) MTRs would be better still.

Effects on mobile retail prices

2.584 Almost all of the parties—including Ofcom[434]—agreed that (abstracting from competition issues) the overall level of mobile retail prices will be higher as a result of a move from LRIC+ to LRIC.[435] The main area of contention was what price changes would fall on which group(s) of customers. In broad summary, Ofcom predicted that post-pay customers would receive the most substantial price rises, with little or no impact on pre-pay customers (unless particular tariffs became unprofitable, in the sense that the revenues earned from the customers on a tariff no longer covered the direct costs incurred by those customers). EE, Vodafone and [✂] believed that price changes would reflect changes in costs and revenues for different customer groups, which would mean that [✂], would face the bulk of price rises, with [✂] impact on post-pay customers as a whole.

Ofcom's position

2.585 Ofcom noted that under LRIC MCPs would receive less revenue for terminating non-MTM calls, the effect of which Ofcom estimated to be around £0.2 billion on all MCPs combined in the final year of the charge control. In Ofcom's description, the waterbed effect means that all MCPs will try to recover this shortfall in revenue from their own retail customers by adjusting their retail charges. Ofcom predicted that some charges, and the general level of mobile retail prices, would rise (or would fall more slowly than they would otherwise have done, if other factors caused a general trend of falling prices).[436] MCPs would receive less revenue for terminating off-net MTM calls under LRIC, but they would also pay less when their own subscribers make off-net MTM calls. Within the industry, this would net off, although the structure of prices may be affected and individual MCPs may be better or worse off.[437]

2.586 Ofcom predicted that post-pay users would see an increase in subscription charges and a decrease in usage charges.[438] Ofcom was less confident about the effect on pre-pay charges; it believed that MCPs would avoid increasing fixed charges for consumers who were sensitive to paying a recurring access charge, and it noted that many consumers were moving away from pre-pay tariffs and the market might be shifting more towards bundles of minutes.[439] Ofcom concluded that pre-pay tariffs

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[431] See paragraphs 2.766–2.798 below.
[432] This formed two separate sections in the Ofcom Statement but are grouped together in the Ofcom Defence.
[433] See paragraphs 2.799–2.812 below.
[434] See, for example, Ofcom Defence, Annex A, §82e.
[435] Three appeared to disagree: see, for example, its Core Submission, §5.8.
[436] Ofcom Statement, §7.49.
[437] Ofcom Statement, §7.53.
[438] Ofcom Statement, §7.70.
[439] Ofcom Statement, §§7.73 & 7.74.

were likely to be selectively affected, as MCPs encouraged consumers to select other tariffs or raised call or handset prices.[440]

2.587 Ofcom noted that, according to economic theory, in order to raise revenue from a price increase, demand must be inelastic. It said that the degree of price elasticity is likely to vary considerably between consumers and groups of consumers, and Ofcom claimed that some pre-pay users would be highly sensitive to (subscription and usage) prices, while others (most post-pay users) would be relatively unresponsive to price changes.[441]

2.588 Ofcom therefore said that MCPs would target price increases as far as possible towards those with less elastic demand for subscription and usage (Ofcom described this group as post-pay users), and would limit or avoid price increases for those who were more sensitive to price changes ('such as some pre-pay users').[442] Ofcom explicitly rejected the argument that competition would intensify for consumers who had net outgoing MCT flows (ie high-usage customers), and the corollary that price increases would fall on lower-usage customers, on the grounds that all MCPs would face the same incentives. Ofcom concluded that price increases to less price-sensitive customers might be possible because other MCPs would also raise their prices.[443]

2.589 Ofcom said that some pre-pay users might become unprofitable over the course of their 'lifetime', but noted that the ongoing costs of keeping a customer on the network were low (once acquisition costs had been incurred) and so these consumers would still be worth serving in the short term. In the long run, consumers would need to replace their handsets and new consumers would enter the market. At this point, MCPs would alter their offers to either increase revenue or reduce acquisition costs.[444] Ofcom suggested that this effect might be mitigated by falling handset costs.[445]

2.590 In its Defence, Ofcom grouped the appellants' arguments in this area into several subheadings:

- the strength of the waterbed effect;
- evidence on likely mobile retail price changes;
- the likely impact on subscription and usage charges;
- EE's evidence about its response to MTR reductions; and
- handset costs (and prices).

2.591 We follow that structure below (although we consider all MCPs' responses to price changes in the fourth point).

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[440] Ofcom Statement, §7.91.
[441] Ofcom Statement, §7.101. Ofcom did not cite any evidence in support of these claims.
[442] Ofcom Statement, §7.103.
[443] Ofcom Statement, §7.103.
[444] Ofcom Statement, §§7.105 & 7.106.
[445] Ofcom Statement, §7.107.

Arguments by the appellants about the strength of the waterbed effect

2.592 Vodafone agreed with Ofcom that the waterbed effect was likely to be strong but stated that the evidence did not rule out the possibility that the waterbed effect was complete or almost complete.[446] Vodafone criticized Ofcom's reliance on statements from executives of MCPs about their ability fully to recoup lower MTRs,[447] and criticized Ofcom's reliance on reports by investment analysts on the grounds that they either shed no light on the scale of the effect or that they did not cite evidence for their views. Vodafone also criticized Ofcom's reliance on papers by Genakos and Valletti.

Ofcom's Defence on the strength of the waterbed effect

2.593 Ofcom agreed with Vodafone's view that the evidence did not rule out the waterbed effect being complete or almost complete,[448] but said that it placed appropriate weight on the evidence[449]—including the executive statements which, they said, provided useful evidence of how the MCPs and FCPs believed that changes in MTRs would play out[450]—and maintained that its conclusion of a strong but incomplete effect was reasonable.[451] In particular, Ofcom said that the two papers by Genakos and Valletti were 'the most recent and reliable attempt … to estimate the size of the waterbed effect in retail mobile markets'.[452]

Arguments by interveners on behalf of Ofcom on the strength of the waterbed effect

2.594 Three disagreed that the waterbed was as strong as Ofcom thought, but submitted that Ofcom's view was reasonable. Three cited telecoms operators and analysts who had suggested that reduced MTRs led to reduced revenues and profits.[453]

Assessment on the strength of the waterbed effect

2.595 We do not consider Vodafone to have demonstrated that the waterbed effect is likely to be complete, and therefore we find that Ofcom's view of a strong but incomplete waterbed effect is reasonable based on the evidence made available to us. It is reasonable for Ofcom to attach some weight to statements made by executives of MCPs. We find that none of Vodafone's criticisms of the papers by Genakos and Valletti imply that the waterbed effect is complete.

Arguments by the appellants about evidence on likely mobile retail price changes

2.596 EE said that Ofcom's prediction of reduced or unchanged usage charges for all users and increased subscription charges for post-pay users was inconsistent with the available evidence. EE referred to both the papers by Genakos & Valletti, and to observed price changes following previous MTR changes in the UK.[454]

2.597 EE said that Ofcom relied on Genakos & Valletti's finding that fixed payments tended to increase following MTR reductions. EE said that these charges were in part usage

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[446] Vodafone NoA, Schedule 1, §§2.3–2.8.
[447] Vodafone NoA, Schedule 1, §2.5.
[448] Ofcom Defence, Annex A, §60.
[449] Ofcom Defence, Annex A, §§62–68.
[450] Ofcom Defence, Annex A, §62.
[451] Ofcom Defence, Annex A, §60.
[452] Ofcom Defence, Annex A, §64.
[453] Three SoI, §§7.57–7.61.
[454] EE NoA, §66; Walker I expert report, §§84–100.

charges. EE also argued that Ofcom downplayed Genakos & Valletti's findings that MTR reductions led to increases in pre-pay usage charges.

2.598 EE claimed that the history of MTR regulation in the UK showed that MTR cuts were followed by pre-pay charges rising relative to post-pay charges.

Ofcom's Defence on evidence on likely mobile retail price changes

2.599 Ofcom claimed that it accepted in the Statement that some usage prices might increase for pre-pay.[455] In its Defence, Ofcom said that the impact on different groups of users within pre-pay and post-pay would vary.[456]

2.600 Ofcom claimed that Genakos & Valletti's findings showed that a reduction in MTRs was associated with an increase in the subscription/fixed component but not in the usage component, in line with Ofcom's view.[457] In this regard, Ofcom reported that Genakos & Valletti acknowledged and attempted to respond to data issues regarding the extent to which subscriptions charges are fixed or related to usage.[458] Ofcom said that there would be a longer-term effect on pre-pay customers once they came to replace their handsets.[459]

2.601 In response to Dr Walker's arguments (for EE) about historical price changes following MTR reductions, Ofcom said that it would be inappropriate to place too much weight on the impact of any one change in MTRs, particularly if that was more than ten years ago; that other evidence pointed in the opposite direction; that Dr Walker's use of evidence was selective; that it was more appropriate to look at charges over time in the whole retail market, rather than charges for customer segments whose size and composition had changed over time; and that costs may be expected to continue to fall, and hence even if prices were higher under LRIC than LRIC+, this might manifest as a *slower reduction*, rather than an actual increase, in retail prices.[460]

The appellants' reply about evidence on likely mobile retail price changes

2.602 Dr Walker maintained his view that Ofcom misinterpreted the conclusions of Genakos & Valletti, saying that they found no significant difference between the effects on pre-pay and post-pay waterbeds unless they constrained their analysis to prevent consumers switching between pre-pay and post-pay. He also argued that Genakos & Valletti restricted their data set (by only using price data where at least 50 per cent of the customer's total bill belonged to the variable component), leading to the exclusion of large amounts of data, including 49 out of 52 data points on the UK market.[461]

2.603 Vodafone also criticized the work of Genakos & Valletti on the grounds that it treated pre-pay customers as purchasing only MTM calls at a single ppm rate; whereas in practice pre-pay users also purchased handsets and other services, and did not pay a simple uniform rate for calls. Vodafone, like EE, criticized the restriction on move-

[455] Ofcom Defence, Annex A, §67a.
[456] Ofcom Defence, Annex A, §68.
[457] Ofcom Defence, Annex A, §72.
[458] Ofcom Defence, Annex A, §72.
[459] Ofcom Defence, Annex A, §75.
[460] Ofcom Defence, Annex A, §§77–83.
[461] EE Core Submission, Walker III expert report, §§39–50.

ment between pre-pay and post-pay, noting that in 2007 [✂] per cent of its pre-pay customers that switched moved to post-pay contracts.[462]

Assessment about evidence on likely mobile retail price changes

2.604 In general we find that the evidence submitted by the parties on historical price changes, including the econometric evidence referred to by Ofcom, are of limited use in determining the effect of the proposed change in MTRs on retail prices, for the reasons explained below.

2.605 EE argued that Ofcom placed too much weight on the work of Genakos & Valletti, and in particular on the implications of their results for pre-pay and post-pay users. We find that there is some merit to the latter point.

2.606 In considering how much weight to place on the papers by Genakos & Valletti, we acknowledge the difficulty of carrying out this kind of empirical work across countries where mobile services are consumed in different ways. Some of the restrictions that Genakos & Valletti had to place on certain aspects of their work—both theoretical restrictions on the choices consumers make and restricting data sets[463]—lead us to be cautious about placing too much weight on certain conclusions, especially on splits between pre-pay and post-pay. We consider that the work of Genakos & Valletti provides a certain degree of support for Ofcom's position, especially on the overall scale of the waterbed effect, but should not take the place of other evidence and reasoning.

2.607 We note the difficulties inherent in looking at historical evidence of pricing in a complex and evolving sector with continuous technological change, particularly when some of those claims relate to changes a number of years ago. In particular, MTRs are only one of many factors that may influence prices over time, and a simple comparison of MTRs and prices over a period when many of those factors are likely to have changed must be treated with appropriate caution. Therefore we find it difficult to draw robust conclusions on the points raised by Dr Walker, EE and Vodafone.

2.608 We note that we were not persuaded by two points in Ofcom's Defence. First, Ofcom appeared to rely on the launch of Three's One Plan as an example of evidence in favour of Ofcom's reasoning,[464] whereas we consider that the launch of the One Plan actually supports EE's argument, as we explain below.[465] Secondly, we note that it is not clear that Ofcom did accept in the Statement that some pre-pay usage prices may rise; the references it gave are far from explicit on this point, contrary to the claim in Ofcom's Defence.[466]

Arguments by the appellants about likely impact on usage and subscription charges

2.609 EE made a number of arguments in this area, [✂]. EE argued that:

- Even if MCPs were to respond in the way Ofcom envisaged, monthly bundle charges are charges for usage.[467]

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[462] Vodafone Core Submission, §4.30.
[463] As noted by Dr Walker; see paragraph 2.602 above.
[464] Ofcom Defence, Annex A, §78c.
[465] We address this below when we consider the response to MTR reductions in paragraph 2.647.
[466] Ofcom Defence, Annex A, §67a, citing Ofcom Statement, §§7.79, 7.94, 7.95 & A3.3.05.
[467] EE NoA, §64.1, Walker I expert report, §§54–63, W/S Dunn I, §§101 & 102.

- If MCPs are currently optimizing the structure of their retail prices, a reduction in MTRs is unlikely to lead to a significant change in the structure of prices (ie a large increase in the importance of fixed subscription charges).[468]

- Increases to pre-pay customers are more likely as they tend to make more (relevant) calls than they receive, unlike post-pay customers who (as a group) tend to have balanced or slightly outgoing call profiles, and hence the reduction in profits will fall mainly on pre-pay customers as a group.[469]

- MCPs require tariffs to be profitable overall and customers to be profitable over their lifetimes.[470] Low-value pre-pay customers are the main category of customers rendered unprofitable by MTR cuts and hence MCPs are likely to raise prices to this group.[471] EE argued that [✂] million customers would be rendered unprofitable by reducing MTRs from 4.3ppm to 0.5ppm.[472] (EE did not estimate the number rendered unprofitable by moving from LRIC+ to LRIC.)

  — [✂][473] [474]

- MCPs are unlikely to have a commercial incentive to introduce price increases for non-marginal customers in order to keep unprofitable customers on the network. Any attempt to increase prices to non-marginal customers would lead to those customers defecting to other MCPs,[475] or migrating to pre-pay tariffs.[476] This point is also made by Vodafone and Telefónica.[477]

- MCPs are unlikely to increase prices for post-pay customers because competition is particularly fierce for those customers. Ms Dunn further argued for EE that MCPs were not *able* to increase prices to many existing post-pay customers as this would allow them to cancel their contracts without penalty.[478] This argument was also made by Telefónica.[479]

  — [✂][480] We assessed this argument under Competition Effects, where it was more appropriate to consider it.[481]

- MCPs have limited ability to recoup lost MTR revenues by reducing handset subsidies for pre-pay users and hence are unlikely to be able to recoup all lost revenue in this way.[482] In other words, we understand EE to argue that usage charges will have to increase for pre-pay customers. Dr Walker for EE argued that reduced handset subsidies were likely to slow the rate of handset replacement and might slow the adoption of new technology such as LTE.

2.610 Vodafone argued in its Core Submission that Ofcom had fundamentally misunderstood the mechanism of the waterbed effect. Vodafone illustrated that argument with

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[468] EE NoA, §64.2, Walker I expert report, §70.
[469] EE NoA, §64.3, Walker I expert report, §§77 & 171–173, W/S Dunn I, §§23, 24, 33, 38, 42 & 71.
[470] We interpret EE as saying that each customer is ex ante expected to be profitable.
[471] EE NoA, §64.4; Walker I expert report, §77; W/S Dunn I, §§37 & 38.
[472] EE NoA; W/S Dunn I, §32.
[473] Telefónica SoI, §§25 & 26.
[474] [✂]
[475] EE NoA, §64.5.
[476] EE NoA, §64.8; Walker I expert report, §§71 & 72; W/S Dunn I, §§47 & 98–100.
[477] Vodafone NoA, §47.1; Marshall expert report, §5.22.
[478] EE NoA, §§64.6 & 64.7; Walker I expert report, §§76 & 71; W/S Dunn I, §§44 & 48–56.
[479] Telefónica SoI, §23.
[480] W/S Dunn I, §54.
[481] See paragraphs 2.394 to 2.398 above.
[482] EE NoA, §64.9; Walker I expert report, §74; W/S Dunn I, §§40, 68, 78 & 79. We understand EE to be saying that handset subsidies for pre-pay users are already very low or non-existent.

paragraph 100 of Annex A of the Defence, where Ofcom said that it did not attempt to calculate the profit impact of reducing MTRs on different customer segments, because fixed and common costs could be allocated in a number of ways and so such an analysis would be largely arbitrary. Vodafone submitted that the profit impact could be estimated in a straightforward way because a reduction in revenues from incoming calls for a customer segment was equivalent to an increase in the marginal cost of serving that segment.[483] Vodafone predicted that the possibility of price discrimination would not shield consumers with more elastic demand from retail price increases,[484] saying that MCPs might have the ability to target price increases at particular customer segments, but they did not have an incentive to recover lost termination revenues from one group by increasing prices to a different group.[485]

2.611 Similarly, [✂] argued that MCPs' response to the reduction in MTRs would depend on whether they viewed the change as an increase in common costs that must be recovered from retail customers, or as changes in costs that were specific to individual customer groups. It argued that Ofcom did not consider the latter reaction.[486]

2.612 Vodafone appeared to be arguing that reducing MTRs would amount to an increase in the marginal cost of serving every customer which would result in a price increase for every customer,[487] but clarified in its hearing that this effect was offset against the reduced marginal cost of providing outgoing calls, and so the net effect was that customers with net incoming calls would tend to see price rises whereas customers with net outgoing calls would tend to see price reductions.[488] This is consistent with the theory advanced by EE and Telefónica.[489]

2.613 Vodafone also addressed the question of the size of price increases. Ofcom argued that it was wrong to assume that the CLV of each customer segment would be preserved at today's levels.[490] Vodafone disagreed, arguing that since competition between MCPs was strong for both pre-pay and post-pay customers, MCPs would change their prices for each customer segment, on average, in line with the change in CLV caused by a reduction in MTRs.[491] We note in this context that Vodafone did not believe that LRIC had competition benefits over LRIC+, and therefore it has not addressed the issue of whether increased competition under LRIC would affect this argument.

Ofcom's Defence on likely impact on usage and subscription charges

2.614 Ofcom did not dispute that fixed monthly payments may be regarded as a combination of fixed fees and usage payments.[492] However, Ofcom believed that there was more scope to recover common costs from monthly subscription charges—even if they reflected usage allowances—than from out of bundle usage charges, which were less predictable.[493]

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[483] Vodafone Core Submission, §§4.20 & 4.21.
[484] Vodafone Core Submission, §4.24.2.
[485] Vodafone Core Submission, §4.25.
[486] Marshall expert report, §§5.13–5.18.
[487] Vodafone Core Submission, §4.24.2.
[488] Vodafone referred to the part of its submission that said 'retail prices would be expected to increase for all customers' as 'loose language'. Vodafone bilateral hearing transcript, pp55 & 56.
[489] See, for example, EE Core Submission, §§149–151, and Telefónica SoI, §26.
[490] Ofcom Defence, Annex A, §§100b & 101b.
[491] Vodafone Core Submission, §4.32.
[492] Ofcom Defence, Annex A, §88.
[493] Ofcom Defence, Annex A, §90b.

2.615 Ofcom noted that lower MTRs meant that MCPs could, all else equal, offer cheaper off-net calls, which were increasingly provided in more inclusive bundles rather than in the form of lower ppm charges.[494] Ofcom viewed this as a continuation of an ongoing trend rather than a radical shift.[495]

2.616 Ofcom accepted that the profitability of some tariffs relied on MTRs being above LRIC (in the long term, taking into account handset subsidies).[496] It noted that other tariffs, [✂], only became profitable with lower MTRs.[497] Ofcom agreed that MCPs would not allow the forward-looking CLV of any segment to be negative, but did not consider that the CLV must necessarily remain at the same levels or that the segment must remain at the same level of profitability.[498] Ofcom also argued that MCPs gained extra benefits from having consumers on their networks, such as calling circles, implying that pushing one consumer out of the market (eg a low-spending grandmother) would reduce the value of the offer for other consumers (eg family members who valued the ability to make on-net calls to her).[499]

2.617 Ofcom rejected EE's quantification of the number of customers becoming unprofitable on the grounds that, Ofcom said, it was not based on the appropriate comparison, which was the difference between MTRs set at LRIC rather than LRIC+.[500] Ofcom also noted that on a forward-looking basis the costs of continuing to serve an existing customer were very low since acquisition costs were sunk, although once a low-value customer came to renew or replace their subscription, MCPs would seek to increase revenue or reduce acquisition costs.[501]

2.618 In response to EE's claim that it would not be profitable to increase prices to post-pay customers because of the fierceness of competition for them, Ofcom did not dispute that this would be true for any individual MCP if other MCPs' prices did not change. However, Ofcom said, since all MCPs will face pressure to increase retail prices, in the longer term they would be able to increase prices.[502] In economics terminology, Ofcom was saying that the MCPs' reaction functions would shift and the new equilibrium involved higher prices for post-pay customers. Ofcom noted Ms Dunn's point about MCPs' ability to change prices for existing customers but noted that changes could be made gradually as existing customers came out of contract.[503] We infer that Ofcom was saying that all prices could be adjusted within two years since that was the maximum contract length.

2.619 In response to Telefónica's claim that Ofcom did not consider how MCPs would react to cost changes for different customer groups, Ofcom said that this was 'a logical way of considering the issue', suggested that MCPs would have regard to the price elasticities of different groups, and claimed that it considered this possibility when it acknowledged that tariffs which became unprofitable would be modified. Ofcom therefore rejected the assertion that it did not consider this reaction.[504]

2.620 Ofcom said that MCPs' ability to levy higher fees on post-pay tariffs would depend on the extent to which customers would switch to pre-pay tariffs, but expected MCPs to

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[494] Ofcom Defence, Annex A, §90a.
[495] Ofcom Defence, Annex A, §90c.
[496] Ofcom Defence, Annex A, §95.
[497] Ofcom Defence, Annex A, §95.
[498] Ofcom Defence, Annex A, §101.
[499] Ofcom Defence, Annex A, §102.
[500] Ofcom Defence, Annex A, §96.
[501] Ofcom Defence, Annex A, §§98 & 100.
[502] Ofcom Defence, Annex A, §104.
[503] Ofcom Defence, Annex A, §105.
[504] Ofcom Defence, Annex A, §103.

take this into account in tariff design.[505] We understand Ofcom's view of price changes to be that different user groups have different elasticities of demand, and hence if there are customer groups within post-pay that are relatively price elastic (as revealed by their willingness to switch to pre-pay tariffs), it is consistent with Ofcom's view that MCPs would impose relatively small price increases on such groups relative to other post-pay groups with less elastic demand.

2.621 Ofcom recognized that MCPs had more than one possible response to lower MTRs (including charging for SIMs), and noted that EE and Vodafone seemed to have substantially reduced handset subsidies as part of their reaction. However, it rejected Dr Walker's argument that there was likely to be a strong effect on new technologies (partly since take-up of them was often driven primarily by post-pay users).[506]

Arguments by interveners on behalf of Ofcom on likely impact on usage and subscription charges

2.622 Three submitted that MTRs set at LRIC would cause mobile retail prices to decrease because *(a)* increased competition will put downward pressure on prices, *(b)* LRIC will remove double marginalization, and *(c)* LRIC will increase usage, which will generate further origination revenue for MCPs, some of which will pass into lower prices.[507] As regards specific effects, Three thought it most likely that pre-pay customers would see lower call charges; post-pay customers would either get more minutes or pay less for their bundle; subscription fees for less price-sensitive customers, especially post-pay customers, would increase; and 'inefficient' handset subsidies and acquisition costs would fall.[508]

2.623 Dr Maldoom, on behalf of BT, argued that any increase in prices would be relatively modest. He also noted that when changing prices, MCPs must take into account the cannibalization of their own packages as customers switched between them—so 'tariffs operate holistically and must be optimized jointly'.[509]

Assessment on likely impact on usage and subscription charges

2.624 We understand Ofcom's position to be that retail price rises will be focused primarily on post-pay customers (and especially high-usage post-pay customers), whereas the appellants' views are, broadly, that price rises will be focused on customer groups with net incoming calls, namely pre-pay customers (and especially low-usage customers) and to some extent low-usage post-pay customers. For the reasons explained below, we agree with the appellants.

2.625 We do not believe that any party disputes the position that the MCPs have regard to CLVs when setting prices.[510] It also appears to be common ground that pre-pay customers as a whole are net receivers of (relevant) calls, that post-pay customers as a whole are either roughly neutral or net makers of calls, and that (as a general rule) within both groups the ratio of outbound to inbound calls tends to be larger among heavier users (ie those who make most outgoing calls and who have the greatest monthly expenditure).[511] We regard this last point as plausible when applied at a high

[505] Ofcom Defence, Annex A, §111.
[506] Ofcom Defence, Annex A, §§113 & 114.
[507] Three SoI, §7.49.
[508] Three SoI, §7.52.
[509] Maldoom I expert report, §34c.
[510] See EE's Core Submission, §112, for a summary of statements by all parties.
[511] See EE's Core Submission, §§113 & 114, for a summary of relevant statements by all parties.

level but are wary of applying it in detail (for example, we are wary of applying it to smaller groups of users in the absence of supporting evidence[512]).

2.626 We find strength in the arguments of Vodafone and [✂], in particular, that the clear implication of this is that pre-pay customers (as a group) will become less profitable as a result of MTR cuts, while the profitability of post-pay customers (as a group) will be unchanged or slightly enhanced. Within these broad groups, heavier users will typically have greater value to MCPs as a result of MTR reductions, and light users will typically have less value. Hence, and consistent with the proposition that CLVs are important to competition, we would expect MCPs to have the incentive to offer better terms to customers who have become more valuable and worse terms to customers who have become less valuable.

2.627 The effects on prices of these changes in the value of customers may come in various forms—including call prices, monthly charges, handset subsidies, acquisition costs and other charges—but we would expect the overall effect to be higher prices for pre-pay users, especially low-usage pre-pay customers; lower prices for high-use post-pay customers; and probably higher prices for low-use post-pay customers.

2.628 Therefore we agree with Vodafone that Ofcom seems to have misunderstood the mechanism of the waterbed effect. As Telefónica argued, Ofcom did not consider how MCPs' incentives would change, and how prices would change, in reaction to changes in the CLVs of different customer groups (except to the extent that it considered the effects of certain customer groups becoming unprofitable). To treat a reduction in MTR revenue as a sum of money to be recovered in the most efficient way does not engage with the complexities of a market with, in Ofcom's own characterization, heterogeneous consumers and sophisticated retail price discrimination.

2.629 We also note that Ofcom's theory assumes that certain groups are more price elastic than others. This appears to be assertion, since Ofcom does not justify it by reasoning or evidence. It is uncontroversial that different groups of customers have different demand functions for mobile phone services, but the elasticity of demand typically[513] varies as consumers move along their demand curves. In other words, it is plausible that a 'high-user' type of consumer has more inelastic demand than a 'low-user' type when both are consuming the *same amount* of mobile phone services. But if we compare a 'high user' consuming a lot of services on a post-pay contract with a 'low user' consuming a small amount of services on a pre-pay contract, it is not obvious that they would have a significantly different elasticity of demand (at least for usage).

2.630 Dr Maldoom for BT summarized this point as follows:[514]

> Price elasticity for any customer segment is not a fixed quantity, but rather a function of the prices charged and the alternative tariffs on offer from the MCP. Increasing prices within a particular tariff plan will at some point lead customers to switch to alternative tariff plans from the same provider (if they do not switch provider).
>
> Because tariffs are *already* highly optimised, we cannot expect any segment of customers to be *especially relatively* price insensitive, as it would likely have been more profitable for the MCP to charge more to these customers and less to other customers. By the same logic, we

[512] We examine relevant evidence in the section beginning at paragraph 2.710 below.
[513] Except in the special case of constant elasticity demand functions.
[514] Maldoom I expert report, §35, emphasis in original.

cannot expect any particular segment to be *especially relatively* price sensitive (relative to other customer segments).

2.631 We acknowledge that there will likely be second-round effects (for example, to the extent that changing tariffs encourages customers to switch between pre-pay and post-pay, MCPs may adapt tariffs to reflect this). We would not expect this to affect the direction of the changes.

2.632 We do not believe it likely that MCPs will increase prices for high-end post-pay users in order to keep unprofitable pre-pay users on their networks, and Ofcom has not convinced us that it had fully considered whether it would be profitable to increase prices to the former group *at all* (regardless of possible price changes to other groups of customers). Ofcom is in principle correct to say that reaction functions will shift. Hence there is no argument to be made along the lines of: 'If it were profitable to increase prices to post-pay customers, the MCPs would have done so already.'[515] But Ofcom failed to consider the reasons why reaction functions will shift. For each group of customers, if a cut in MTRs makes them *more* profitable under any given set of retail prices, as is likely to be the case for high-end post-pay customers, all MCPs should be willing to charge them *lower* prices. So Ofcom's logic does not apply to customers who become more valuable.

2.633 Ofcom drew an analogy with retail gas companies when wholesale gas prices rise.[516] It argued that all companies needed to raise their retail prices to maintain retail profits, so although the first company to raise prices might lose customers, eventually they would all raise prices. But this analogy illustrates the problem with Ofcom's reasoning. Ofcom has treated the change in MTRs as if it were a cost increase for *all* customers. In fact, it is effectively a cost increase for some and a cost decrease for others.

2.634 For these reasons, we find force in the appellants' arguments that Ofcom's reasoning on retail price changes is not sufficient to support its conclusions. Having considered the evidence on this point, our conclusion is that we agree with the appellants' arguments that prices will rise for pre-pay customers as a whole (especially low-usage customers) and for low-usage post-pay customers, while prices for high-usage post-pay customers will tend to fall.

2.635 A number of other arguments made by the appellants and interveners were less persuasive. We agree with Ofcom that EE's claims as to the number of its customers that will become unprofitable are not relevant to the choice between LRIC and LRIC+, and that EE has not provided evidence relevant to that choice. We discuss this further below.[517]

2.636 We note Dr Walker's argument that reduced handset subsidies for some customer groups are likely to slow the rate of handset replacement for those groups, but it is not clear that this is undesirable. We are not convinced that this would significantly slow the adoption of new technology.

2.637 We were not convinced by Three's arguments. At a high level, its argument about increased competition has been assessed separately;[518] it did not demonstrate that its argument about double marginalization holds in the mobile sector;[519] and its argu-

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[515] This is effectively the argument that EE and Telefónica made when they said that competition was fierce for post-pay customers and MCPs would not be able to increase prices to those customers.
[516] Ofcom Defence, Annex A, §107.
[517] See in particular paragraph 2.739 below.
[518] We addressed this in detail in the section on competition effects above.
[519] See paragraph 2.576 above.

ment about increased usage seems at best circular (since it assumes an increase in usage, which will depend on price changes).

2.638 Three argued that post-pay customers would see lower bundle prices but higher subscription prices.[520] By this, Three apparently meant that the difference in prices between packages with different numbers of minutes would diminish (ie incremental minutes would become cheaper) but the notional subscription element would become more expensive (which presumably implies that small bundles would become more expensive). This appears to be consistent with our view that low usage post-pay packages would become more expensive and high usage post-pay packages would become cheaper.

Arguments by the appellants about evidence on responses to MTR reductions

2.639 EE argued that Ofcom's analysis was inconsistent with the way EE had actually responded to the cut in MTRs, as it planned to [✂].[521]

2.640 In its Core Submission, EE referred to evidence adduced by all four national MCPs, including Three, that they had raised their pre-pay prices in light of the reduction in MTRs. It noted that MCPs had generally sought to mitigate the effect of price increases for higher-spending pre-pay customers, which it referred to as pre-pay customers with a 'more balanced call ratio'.[522]

Ofcom's Defence on evidence on responses to MTR reductions

2.641 Ofcom argued that the changes both Orange and T-Mobile had made to their pre-pay tariffs was to price discriminate, by increasing prices for low-use customers but giving higher-use pre-pay customers a chance to make mitigating savings. Ofcom asserted that Orange and T-Mobile 'appear … to be targeting some pre-pay segments which are less price elastic'.[523] Ofcom therefore appeared to be claiming that this was consistent with its assessment, although implicit in this is that Ofcom was claiming that *low-value pre-pay* customers are 'less price elastic', whereas in the Statement Ofcom identified less price-elastic customers with post-pay customers, and especially *high-use post-pay* customers.

2.642 Ofcom further noted that this was just EE's initial reaction, and that its approach might evolve over time as other MCPs changed their prices; and that this was the response of a single MCP and other MCPs with a different customer profile might act differently.[524]

2.643 In addition, Ofcom said that:[525]

(a) EE's discussion was premised on a drop in MTRs from 4.3 to 0.5ppm and it was unclear how much was driven by the much smaller difference between LRIC+ and LRIC;

(b) price changes were not driven solely by MTR cuts:

(i) [✂];[526] and

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[520] Three SoI, §7.52.
[521] EE NoA, §§47 & 67; W/S Dunn I, §§39 & 40; Walker I expert report, §82.
[522] EE Core Submission, §§115 & 116.
[523] Ofcom Defence, Annex A, §117.
[524] Ofcom Defence, Annex A, §118.
[525] Ofcom Defence, Annex A, §120.

(ii) for T-Mobile in particular, [✂];[527] and

(c) Ms Dunn had, in Ofcom's view, reported that low-value pre-pay customers were not particularly price elastic.

Assessment on evidence on responses to MTR reductions

2.644 We find force in EE's argument that the evidence of actual responses to the new level of MTRs is not consistent with Ofcom's prediction that price rises would be mainly focused on post-pay users.

2.645 The evidence is broadly consistent with price rises for pre-pay customers, especially lower-usage customers (with some mitigation for higher-usage customers in the form of add-ons), and not for post-pay customers. This is not consistent with Ofcom's prediction. We note that Ofcom did not have access to this evidence at the time of the Statement, but we still consider it useful in assessing whether Ofcom's conclusions were correct.

2.646 We note that Three said in its SoI that it had no plans to 'make its pre-pay offers less generous or to try to target [pre-pay price] increases' at net receivers of calls,[528] but according to the witness statement of Mr Ness,[529] Three had already made changes to its pre-pay tariffs at least partly as a result of the anticipated reduction in MTRs, and between April 2010 and April 2011, it increased the price of calls on its main pre-pay tariff from 20 to 26ppm, with the introduction of add-ons for which would allow customers to buy cheap bundles of minutes, text messages and/or data. Three characterized this as 'rebalancing' or 'segmenting' pre-pay prices.[530] The effect of the change is to increase price for low spenders, although the price at the margin for heavy users may have declined (and the effect on average prices will depend on the individual's level of usage).

2.647 Ofcom cited the launch of Three's One Plan as evidence in support of its proposition in general.[531] The One Plan includes a very large allowance of minutes, texts and data for a price lower than has historically been offered by any MCP for a comparable package. We would characterize it as a substantial price cut for high-use post-pay subscribers. It therefore undermines, rather than supports, Ofcom's use of it as evidence in this context.

2.648 We do not find Ofcom's arguments in this respect convincing. In particular, Ofcom seems to be arguing that a price increase targeted at low-use pre-pay customers is consistent with Ofcom's theories about the pattern of price increases. Ofcom's conclusions about the number of consumers who will give up their mobile phones, and the effects on vulnerable customers, are premised on exactly the opposite. Hence we find force in EE's argument.

2.649 Ofcom also claimed in its Defence that EE's price changes, which seemed to contradict Ofcom's theory, were just an initial reaction and that further price changes may follow. This is effectively a claim that MCPs' commercial reactions to the change in MTRs provide no information about their rational long-term reactions. It would be reasonable to suggest that the initial reactions may understate the scale of the long-

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[526] [✂]
[527] [✂]
[528] Three SoI, §9.99.
[529] W/S Ness, §4.16.
[530] Three bilateral hearing transcript, §§44 & 45
[531] For example, Ofcom Defence, Annex A, §95, where Ofcom said that [✂]—in other words, the reduction in MTRs has led to the introduction of a lower-priced tariff aimed at high-use post-pay customers.

term reaction or to apply some caution in drawing conclusions on causality from MTR changes to price changes. However, if the short-term reaction is completely different to that predicted by Ofcom, then Ofcom is implicitly claiming that MCPs will first do one thing and then, later, do something else entirely. For these reasons, we give some weight in our analysis to the pattern of price changes observed since MTRs were set under the current charge control. These price changes broadly support the position put forward by the appellants and do not appear consistent with Ofcom's theory.

Arguments by the appellants about handset prices

2.650 Vodafone argued that Ofcom erred in its reasoning in concluding that MCPs would be able to resist increasing their retail prices by virtue of disregarding the sunk costs of acquiring their existing customers. Vodafone said that the sunk costs of acquiring customers were relevant to MCPs' pricing decisions, and that increases in charges would not be offset by reductions in the costs of serving them. It specifically argued that:

(a) In the long run, MCPs would not be able to disregard the sunk costs of consumer acquisition when setting their prices, because in the long run all customers would need to replace their handsets.[532]

(b) Ofcom had failed to quantify reductions in the cost of serving customers over time (Vodafone appeared to be referring to falling costs of handsets; Ofcom pointed out[533] that it had estimated cost changes in network equipment).[534]

(c) Ofcom had failed to take into account the trend towards 3G handsets, which are more expensive than 2G.[535]

(d) These costs would fall regardless of the level of MTRs, and were not caused by falling MTRs, that customers would benefit from them in any event and hence any cost reductions would not neutralize the effect of falling MTRs.[536]

2.651 In its Core Submission, Vodafone further argued that [✂], and that pre-pay subscribers were increasingly migrating to smartphones (and were being encouraged to do so by MCPs).[537]

Ofcom's Defence on handset prices

2.652 On the first point, Ofcom claimed to have taken it into account, saying that it did not conclude that MCPs would be able to disregard customer acquisition costs in the long run.[538] In response to the second and third points, Ofcom made a number of arguments about the move towards 3G handsets, the most pertinent of which was that Ofcom had focused on the underlying cost effect whereas Vodafone had focused on the mix effect. In other words, what matters to Ofcom's argument is that the same handset can be provided more cheaply in the future.[539] As to Vodafone's fourth point, Ofcom contended that when considering the effects of lower MTRs on handset prices

[532] Vodafone NoA, §47.3.
[533] Ofcom Defence, Annex A, §124.
[534] Vodafone NoA, §47.4.
[535] Vodafone NoA, §47.4.
[536] Vodafone NoA, §47.5.
[537] Vodafone Core Submission, §4.33.
[538] Ofcom Defence, Annex A, §122.
[539] Ofcom Defence, Annex A, §125.

(ie affecting the upfront price that a customer paid to join a network) and consequently on number of subscriptions, an increase in price which led to a reduction in ownership had very different welfare implications from a slower price decrease leading to a slower growth in ownership.[540]

Assessment on handset prices

2.653 Vodafone claimed, and Ofcom appeared to agree, that customer acquisition costs were relevant to pricing in the long run, with the implication that if reducing MTRs caused certain groups of customers to become unprofitable once acquisition costs are taken into account, MCPs would raise prices to those customers. What is in dispute is whether handset costs are falling and whether this will mitigate the effect on subscriber numbers. As we explain below, we agree with Ofcom that handset prices are falling but we think Vodafone is probably correct to say that this does not neutralize or mitigate the effect of falling MTRs, and Ofcom's Defence on this point is not convincing.

2.654 On the issues of falling handset prices, we agree with Ofcom that Vodafone's argument is focused on the mix effect. We have no reason to believe that Ofcom is wrong to say that the costs of any given handset are falling and will likely continue to fall. We note Vodafone's argument that, over time, there is a shift towards more advanced handsets which, at any point in time, will cost more than less advanced handsets; but the choice to offer consumers better handsets rests with the MCPs and is part of the competitive dynamic. In particular, if our ultimate concern is whether handset prices will affect the level of subscribers (since it should not affect usage other than via number of subscribers), the most important factor is whether MCPs continue to supply cheap handsets to consumers who place little value on being a subscriber.[541] A reduction in the cost of the cheapest handsets seems more relevant to this than the mix effect (unless the cheapest handsets are no longer available to operators, and we have seen no evidence of this).

2.655 However, we find force in Vodafone's argument that handset costs would fall regardless of changes in MTRs (which Ofcom has not challenged) and that customers would benefit from them in any event. This implies that cost reductions would not neutralize or mitigate the effect of falling MTRs on subscriber numbers. We are not persuaded by Ofcom's Defence that falling handset costs are a significant mitigating factor when prices increase. Since these costs would fall regardless of the level of MTRs, this argument to some extent goes against Ofcom's principle that the choice between LRIC and LRIC+ should be made on an 'all other things being equal' basis. The argument relies on there being an asymmetry in the effects of *(a)* prices rising, and *(b)* prices falling less quickly, which is possible in theory but has not been demonstrated.

2.656 In particular, Ofcom's line of reasoning involved the endowment effect.[542] Ofcom characterized this as 'it is more difficult to give up an item once you have owned and experienced it'. This would seem to imply that current mobile phone owners would be reluctant to leave the network (when their handset needs replacing), and so *fewer* people would leave the network if handset prices rose, than would join the network if handset prices fell. This implies that falling handset costs would exacerbate the effect

[540] Ofcom Defence, Annex A, §126.
[541] We do not contend that this is the only factor; we accept that some consumers may only be willing to subscribe if they receive a modern handset with a high level of functionality. We do think that the factor we describe is likely to be the most important.
[542] See Ofcom Defence, Annex A, fn 237.

on subscriber numbers of reducing MTRs, rather than mitigate it as Ofcom argued.[543] Therefore we conclude that falling handset costs will not mitigate the effects of lower MTRs.

Overall assessment on effects on retail prices

2.657 Based on the arguments and evidence assessed in the preceding sections, we found that the appellants' depiction of the effects of MTR changes on marginal costs, revenues and thus CLVs for different customer segments is well aligned with both basic economic principles and the available evidence on the pricing responses of all MCPs to the reductions in MTRs. We therefore agree with Vodafone's view that Ofcom has misunderstood the mechanism by which the waterbed effect operates and the likely effects on prices, and we summarize our reasoning below.

2.658 The evidence on calling ratios seems to demonstrate that pre-pay customers as a group will become less profitable and their CLVs will fall, acquiring them will become less attractive to MCPs, and MCPs will accordingly do one or both of two things:

(a) reduce acquisition expenditure (including handset subsidies) to reflect the lower CLV of new pre-pay customers; or

(b) increase prices to increase the CLV of new and existing pre-pay customers.

2.659 It seems likely that the effect on the CLVs of *higher-use* pre-pay customers is a smaller negative or positive; we would expect them to face smaller price rises or even reduced prices. Given that there is relatively little scope for offering different basic tariffs to pre-pay users, this may come in the form of effective two-part tariffs (where high users or those who top up credit regularly are given rewards, reducing the effective average price they pay for usage) or by varying acquisition costs (for example, by offering higher subsidies on particular types of handset—such as smart-phones—which are associated with higher-use customers). This pattern of price changes is supported by the price changes we have observed since the start of this price control.

2.660 Similarly, high-use post-pay customers will become more profitable and MCPs will increase acquisition expenditure and/or reduce prices to this group. Given the wide variety of price plans offered to post-pay users, we might expect a greater degree of segmentation among all post-pay user groups, and it is possible that lower-use post-pay customers will see some form of price rise. Again, this finding is supported by recently observed price changes.

2.661 It is more difficult to predict the exact scale of price changes. Vodafone argued that due to the process of competition, following a change in CLVs, MCPs would seek to adjust prices to match. Ofcom argued that, where a customer group became unprofitable as a result of changes in MTRs, MCPs would increase prices so that the group was not loss-making but would not necessarily restore it to the same level of profitability. MCPs require each price plan to be profitable[544] and—at least in the long

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[543] For example, in the most extreme case of the endowment effect, nobody would give up their phone in response to a price increase. So a price increase has no effect on ownership, whereas a price cut would induce an increase in ownership. So a reduction in MTRs leading to a price increase would have no effect on ownership. Now suppose that costs are falling by enough to balance out the price increase due to MTR cuts. Prices remain the same, but the effect of MTR cuts is to prevent an expansion in ownership. This intuition generalizes to less extreme cases.

[544] Ofcom argued (Statement, fn 618, & Defence, Annex A, §102) that in some cases MCPs might be happy to keep customers who were not profitable purely on the basis of their current costs and revenues. Ofcom's example concerns calling circle effects—see discussion in paragraph 2.616 above. Another example would be the chance subsequently to upgrade customers who are currently unprofitable (an analogy would be bank accounts for students), although given the high level of switching

term[545]—they need to earn back acquisition costs on each subscriber. We have discussed[546] that under the CLV model, and with strong competition between MCPs, MCPs are willing to pay up to the value of a customer's CLV in order to attract that customer. This would imply that the profitability of each retained customer would not be greatly changed, and hence that price increases would match the effect on profits; although if some previously profitable customers give up their mobile phones, overall MCP profitability might be reduced. It is also possible that MCPs would seek to increase prices in this way, but increased competition caused by lower MTRs would mitigate price rises. Either or both of these possibilities seem consistent with Ofcom's finding of a strong but incomplete waterbed effect. Therefore we see some attraction in Vodafone's argument about how MCPs would seek to adjust prices, and its logic fits our other conclusions.

2.662 We discuss the likely size of price increases for different consumer groups in the following section.

Effects on mobile ownership and subscriptions

2.663 We turn now to consider the second subject listed in paragraph 2.582 above. In this section we present the arguments made by the parties on the type and scale of effects that reducing MTRs from LRIC+ to LRIC would have on the levels of mobile ownership and subscriptions. We then present and comment on a range of relevant evidence submitted to us by the parties. Finally, we give our assessment of the likely effects on ownership and subscriptions.

Ofcom's position

2.664 Ofcom's overall position was that the effect of lower MTRs on ownership was 'likely to be limited' since demand was 'generally inelastic' and any retail price increases were likely to be directed towards those post-pay and pre-pay users who were less price sensitive.[547]

2.665 Ofcom's position reflects the large number of multiple subscriptions in the UK[548] and the greater value that Ofcom placed on ownership rather than subscriptions.[549] Much of the evidence submitted by Ofcom and the other parties relates to the number of subscriptions rather than the number of subscribers, since many consumers now have more than one handset and/or subscription. In other words, the implication of a consumer giving up their only phone are not the same as the implications of a consumer giving up a second subscription (although the latter is not necessarily insignificant[550]). There was also a large number of inactive or barely active subscriptions in the UK (some of which may also be second subscriptions). Ofcom's Statement included an estimated breakdown of the difference between active subscribers and total subscriptions (reproduced below).[551]

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between MCPs and short consumer lifetimes, this effect is likely to be small. Hence we allow for this possibility in theory but consider that its effect, if any, will be small in practice.

[545] We acknowledge that MCPs' accounting practices may currently allocate a certain amount of overhead to each consumer as a guide to whether they are profitable. That allocation seems essentially arbitrary and we have focused on economic profitability, taking acquisition costs that have already been incurred as sunk in the short term.

[546] See paragraphs 2.23 to 2.26 above.

[547] Ofcom Statement, §7.149, repeated in Ofcom Defence, Annex A, §129.

[548] See Figure 7.7 of the Ofcom Statement, reproduced as Figure 1.1, and discussion in §§7.132 & 7.133.

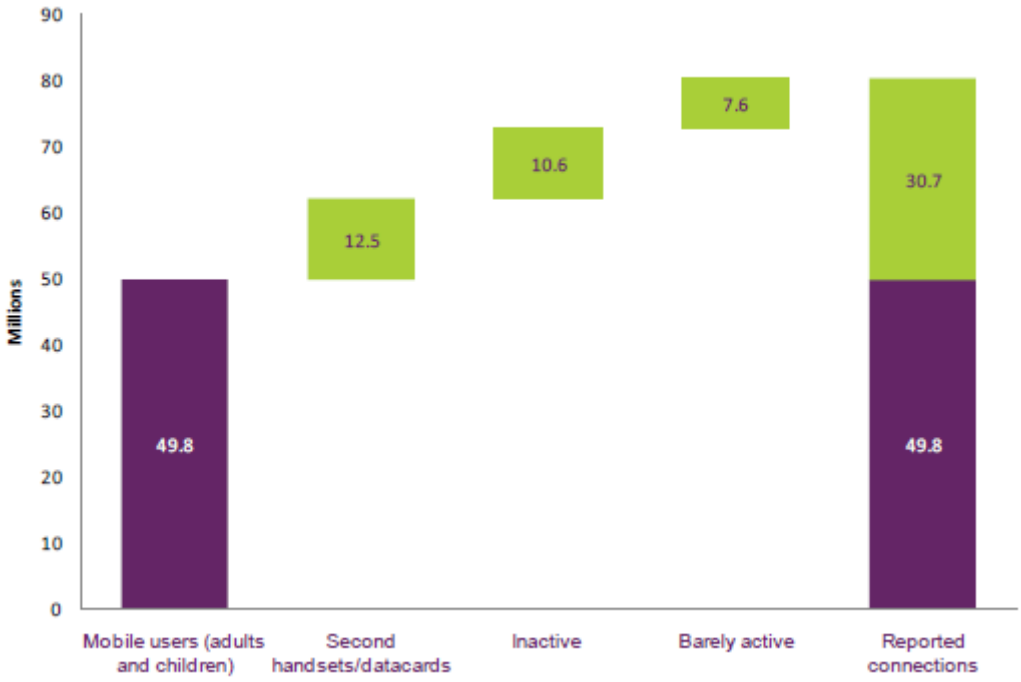
[549] Ofcom Statement, §7.132.

[550] As Ofcom acknowledged in, for example, Ofcom Defence, Annex A, §149.

[551] Ofcom Statement, Figure 7.7.

FIGURE 2.1

Breakdown of the difference between mobile users and reported mobile connections



Source: Statement Figure 7.7, based on Enders Analysis, Mobile user survey 2010: *The rise and rise of smartphones*, July 2010.

2.666 Ofcom also believed that the size of likely price increases may not be sufficient to influence consumers' decisions on whether to have a mobile phone, calculating that the net lost revenue to MCPs from reducing MTRs to LRIC rather than LRIC+ was on average £2.50 per subscription per year.[552]

Views of the appellants

2.667 EE argued that the adoption of LRIC would lead to a material reduction in the level of mobile ownership and subscription. EE advanced seven reasons for this in its NoA:[553]

(a) Higher mobile prices would be likely to deter some consumers from taking up a mobile for the first time.

(b) It was unlikely that all or most price-sensitive customers would be shielded from a price increase.

(c) Ofcom did not have any evidence to support the proposition that demand for mobile subscriptions was sufficiently inelastic to support its conclusions.

(d) Ofcom's customer survey suggested that 9 per cent of pre-pay customers would give up their mobile phone in response to a £10 increase in handset prices.

[552] Ofcom Statement, §7.135. Ofcom wrote 'per subscriber' but fn 432 indicates that it used the number of subscriptions.
[553] EE NoA, §§71 & 72.

(e) Even if on average price increases would be small (which EE disputed), the more price-sensitive consumers would be likely to face above-average price increases. Dr Walker, for EE, contended that inactive and barely active subscribers were unlikely to contribute to cost recovery, so the actual increase per active consumer would need to be larger than the £2.50 cited by Ofcom. He also questioned whether the impact would be evenly spread across all subscribers, arguing that differences in call balances made that unlikely.[554]

(f) International evidence suggested that lower MTRs were associated with lower levels of mobile penetration.

(g) Dr Walker also contended that Ofcom should be more concerned about potential reductions in subscriptions. He argued that in the absence of evidence on ownership elasticities, subscription elasticities were a reasonable alternative; that there may well be consumer detriment from giving up a second phone; and that there were grounds to expect the number of mobile owners to fall.[555]

2.668 Vodafone alleged that Ofcom had not assessed the evidence in a balanced way, arguing that:[556]

(a) Ofcom should have given more weight to a study by CEG.[557]

(b) Ofcom should not have dismissed survey evidence altogether, since it was the only evidence specifically designed to assess the reaction of subscribers to a price increase, and Ofcom's other evidence could not be regarded as superior to it.

(c) The second survey commissioned by Vodafone from ICM suggested that Ofcom's decision would result in a significant reduction in mobile ownership.

(d) The data on general consumer preferences was of limited relevance and did not support Ofcom's conclusions since it could also be used to argue the opposite conclusion.

(e) Ofcom had failed to analyse properly whether historical ownership and subscription levels were affected by price changes and had failed to justify its suggestion that they may be less responsive to price changes now due to the 'endowment effect'.

(f) Ofcom had overstated the relevance of second subscriptions when considering the likely consumer impact, because survey evidence indicated a significant fall in ownership, and because Ofcom had not demonstrated that the marginal benefit of a second subscription for a consumer with both business and personal phones was lower than the marginal benefit of a first subscription for other consumers.

2.669 In its Core Submission, Vodafone argued that even if the effect on mobile ownership was 'limited', it was misleading to consider that in isolation; what mattered was its relative size compared with any consumer benefit from increased usage.[558] We note that it should properly be compared with *any* other benefits and costs from adopting LRIC generally, which we take to be Vodafone's point, although it is not explicitly made.

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[554] EE NoA, Walker I expert report, 103.
[555] EE NoA, Walker I expert report, §102.
[556] Vodafone NoA, Schedule 1, §§3.1–3.23.
[557] We discuss this study below.
[558] Vodafone Core Submission, §4.34.

2.670 Vodafone also explained its justification for comparing the 'profit neutral' level of MTRs (3.7ppm) with the LRIC level in, for example, its survey evidence. Vodafone claimed that from an allocative efficiency perspective the relevant issue was the welfare implications of reducing MTRs by more than projected reductions in termination costs, thereby affecting the level and structure of retail prices. The fact that some of this would happen anyway if Ofcom were to adopt LRIC+ does not mean this would necessarily be a good thing, because the optimum level of MTRs does not necessarily lie below LRIC+.[559]

Ofcom's response

2.671 Ofcom responded to each of the points from EE's NoA in turn:[560]

(a) Ofcom submitted that the difference in entry-level pre-pay offers between a LRIC+ and a LRIC scenario was 'likely limited' and thus the effect was 'highly unlikely to be material'. Ofcom cited the current offers of [✂] and referred again to a difference of £2.50 per subscriber per year between scenarios. Ofcom also argued that very marginal existing users and those who did not have a mobile cited lack of need as the main reason for not having a mobile phone.

(b) Ofcom argued that price-sensitive customers would be shielded from price increases, so long as they remained profitable, because MCPs would not want them to give up their subscriptions. Ofcom noted that the average effect was £2.50 and, by its logic, might be lower for more price-sensitive subscribers.

(c) Ofcom referred to its summaries of relevant evidence in the Statement[561] and noted that although demand for mobile subscriptions may not be perfectly inelastic (which would be necessary for there to be *no* effect of a price rise), it was relatively inelastic. This, combined with an average £2.50 per subscriber per year effect, suggested that 'the effect on mobile subscriptions is *likely to be limited*; and that there will be *no significant effect* on ownership'.[562] Ofcom did not quantify what it would consider to be a 'limited' or 'significant' effect.

(d) Ofcom noted that the results of the survey it commissioned from Jigsaw were 'markedly out of line with other research' and hence it did not rely on them.[563] Ofcom also noted that the price increases used in the survey were significantly higher than £2.50 per year.

(e) Ofcom argued that 'EE cannot have it both ways': if inactive and barely active consumers should be excluded from any calculation of financial impact (as Dr Walker argued), then these subscribers should also be excluded from any quantification of the numbers at risk of giving up their subscription in response to a price increase. Ofcom argued that the average price change per active user was roughly £4 per year which was 'still a relatively modest change'. Finally, Ofcom replied that it did not assume that the impact would be spread equally across all subscribers, but viewed it as a useful illustration.

(f) Ofcom noted that it was difficult to draw simple cross-country comparisons as there were many differences between the UK and countries with low MTRs

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[559] Vodafone Core Submission, §4.35.
[560] Ofcom Defence, Annex A, §§132–147, numbered 1–6, which matches our designation of *(a)*–*(f)*, and §§148–152, which responds to *(g)*.
[561] Ofcom Statement, §§7.139 & 7.140.
[562] Ofcom Defence, Annex A, §136, emphasis in original.
[563] Ofcom Defence, Annex A, §139.

(including the USA, Canada, Hong Kong and Singapore), notably differences between 'calling party's network pays' and 'bill and keep'. Ofcom noted that retail prices were currently at 'relatively affordable levels' and the average price increase should be relatively low.

(g) Ofcom said that it was reasonable to believe that the elasticity of demand for subscriptions was different from that for usage; that Ofcom had never concluded that there was no benefit from an extra subscription, though it was likely to be lower than the benefit of the user's first subscription; and that any reduction in mobile ownership would be small. Ofcom did not deny that there might be some loss of consumer welfare from reduced subscriptions but had focused on ownership.

2.672 Ofcom responded to each of the points from Vodafone's NoA in turn:[564]

(a) Ofcom denied that it rejected the CEG findings, noting that it applied a number of caveats in interpreting them.

(b) Ofcom noted that the price rises used in the surveys submitted to it did not correspond to a reduction in MTRs from LRIC+ to LRIC, and concluded that there were also significant methodological weaknesses with those surveys.

(c) Ofcom considered that the first criticism in *(b)* also applied to the second ICM survey for Vodafone, and also made a number of specific criticisms of the survey methodology.

(d) Ofcom claimed that it had drawn a simple conclusion that mobiles were highly valued and not easily given up by many users, which was not undermined by Vodafone's arguments.

(e) Ofcom's main argument appears to be that it could not infer how sensitive *ownership* was to relatively small retail price changes, and it noted that MCPs had, in previous rounds of regulation, argued that reductions in MTRs would lead to substantial loss of ownership, since which MTRs had materially decreased and ownership materially increased. Ofcom argued that the endowment effect,[565] which was well-established in the academic literature, would limit reductions in ownership.

(f) Ofcom acknowledged that the value of a second subscription was likely to depend on the use to which it was put, but noted that *some* subscriptions may confer relatively little value (for example, a second SIM that a consumer used to make cheaper on-net calls in the presence of ONON PDs). Ofcom also noted that there were a large number of inactive and barely active subscriptions, but did not consider that their cancellation would result in any material consumer detriment.

Evidence on mobile ownership and subscriptions

2.673 We have been shown three types of evidence which are directly relevant to assessing the effects of price increases:

[564] Ofcom Defence, Annex A, §§156–171, designated *(a)–(e)*, which matches our designation above, and covering a separate point which we have designated *(f)*.
[565] See paragraph 2.656 above.

- The first is studies showing the elasticity of demand for mobile subscriptions and usage. There is a body of research on this subject, although it is complicated by not knowing what form price increases will take.[566]

- The second is survey evidence.[567] In this case, there have been several surveys, the most robust being ICM's second survey for Vodafone, which nevertheless may be difficult to apply.

- The third is a piece of work commissioned from CEG by Ofcom investigating the relationship between MTRs and subscription levels across various countries.[568]

2.674 We also discuss relevant evidence on:

- the level of handset subsidies;[569]

- calling patterns by different customer groups;[570] and

- the ongoing costs of retaining customers.[571]

2.675 Ofcom and others also pointed to historical data on overall penetration and ownership rates, which Ofcom said 'indicated that past changes in MTRs have not had a dramatic impact on subscription penetration rates', although Ofcom noted that 'care is needed in reaching conclusions from simple comparisons of past trends, given that many other factors could have affected take-up of mobile subscriptions over this period'.[572] Given the context of rapid take-up of mobile phones over the last 15 years, changes in the competitive dynamic and increasing use of various mobile services, simply looking at trends of headline prices and subscriber numbers does not provide any reliable evidence on the effects of reducing MTRs. Therefore we do not discuss these arguments further.

2.676 Ofcom also presented survey evidence showing how much consumers in general valued their mobile phones. For example, Ofcom found that 45 per cent of adults considered a mobile phone to be their main method of making and receiving telephone calls and that when asked what they would cut first from their household budgets, less than one-fifth of consumers placed their mobile phone in the top three items.[573] We place relatively little weight on this evidence: as a hypothetical example, demonstrating that 60 per cent of mobile phone users highly value their phone would tell us little, if anything, about how the other 40 per cent of users would react in response to a price increase. It is generally well established that the preferences of infra-marginal customers are of limited relevance to behaviour at the margin. For the same reason, Ofcom's 'simple conclusion' that mobiles are highly valued and not easily given up by many users does not persuade us that there may not be a significant number of users who would give up their mobile.

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[566] See paragraphs 2.677–2.680 below.
[567] See paragraphs 2.681–2.695 below.
[568] See paragraphs 2.696–2.699 below.
[569] See paragraphs 2.702–2.709 below.
[570] See paragraphs 2.710–2.724 below.
[571] See paragraphs 2.725–2.730 below.
[572] Ofcom Statement, §7.116.
[573] Ofcom Statement, §§7.141 & 7.142.

- *Elasticities*

2.677 In response to Ofcom's consultation in April 2010, EE cited a range of studies which find that the industry-wide elasticity of demand for subscriptions is, on average, –0.44.[574] In its April 2010 consultation, Ofcom cited a number of papers which found that the elasticity was around –0.5 or less.[575] Ofcom noted that this figure indicated inelastic demand and so the change in subscriptions would be relatively small. EE argued that even though demand may be inelastic, a figure of around –0.44 might still indicate a significant change in subscriptions.[576]

- *Assessment of evidence on elasticities*

2.678 The studies cited by Ofcom and EE suggest that demand for subscriptions is relatively inelastic, with most studies suggesting that it is less elastic than –0.5 (ie between 0 and –0.5). These estimates are the response of the entire market to a price change, which is difficult to interpret, because we expect different groups to see different price rises (in both absolute and percentage terms) whereas the estimated elasticities represent the response across the entire market to an average price rise.

2.679 For the purposes of illustration, we explored this evidence to get a sense of the scale of subscription changes it would imply. If we take the elasticity of demand for ownership to be –0.44 for pre-pay subscriptions, noting that the estimates reported apply to all subscriptions, and suppose that there is a price rise of £5 per subscriber per year,[577] then under reasonable assumptions this might translate to a loss of around 800,000 pre-pay subscriptions, or around 1 per cent of all mobile subscriptions.[578,579]

2.680 However, this is not a very satisfactory estimate. The estimates of elasticity of demand are for all users; we do not know if they are the same for pre-pay users, let alone subgroups of pre-pay users.[580] Low users pay a small amount each year and so even relatively small price increases may represent a large percentage price increase. Traditional elasticities of demand are not well suited to the question before us. Therefore we place little weight on them.

- *Survey evidence*

2.681 Several surveys were carried out for the purpose of investigating the effects of lower MTRs on subscriptions, and we describe each briefly below. Ofcom noted that it was 'sceptical of over-reliance on surveys as a reliable method of estimating the impact of

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[574] Ofcom Statement, §7.138.
[575] Since elasticity of demand is normally negative, this means an elasticity of between 0 and –0.5. Ofcom Statement, §7.139.
[576] EE SoI, §71.4.
[577] We discuss the justification for this in paragraph 2.737 below.
[578] Suppose that the average pre-pay subscriber pays £10 per month or £120 per year. We did not have readily available figures for average expenditure. The average pre-pay user made 61 minutes of outbound calls per month in 2009 (Ofcom Communications Market Report 2010, Figure 5.73 and accompanying text). Current prevailing prices appear to be around 25ppm for pre-pay calls (although they were lower in 2009). This suggests that a figure of £10 per month may be conservative. This would imply a percentage price rise of around 4.2 per cent. That would translate to a loss of subscriptions of just under 2 per cent. There are around 80 million subscriptions in the UK (Ofcom Statement, Figure 7.7), of which around 55 per cent (or 45 million) are pre-pay (Ofcom—'Consumer Experience 2010' Figure 17, submitted as Exhibit MW36). A loss of 2 per cent translates to around 800,000 subscriptions, or around 1 per cent of all mobile subscriptions.
[579] In response to our provisional determination, EE suggested that applying a price increase of £8 per active user implied a loss of around 1.3 million pre-pay subscribers. EE appears to have based this calculation on the number of all pre-pay subscribers, rather the number of active subscribers. If that is corrected, we estimate that the number remains around 800,000. However, we would be wary of assuming—as EE implicitly does—that active and inactive subscribers have the same elasticity of demand, not least because it is difficult to define a meaningful elasticity of demand for barely active or inactive subscribers who are currently paying very little or zero.
[580] As we discussed above when assessing the likely impact on prices, we believe it is plausible that in equilibrium all groups of customers have a similar elasticity of demand, which would imply that this may be a good approximation. In practice, we would be wary of making a strong assumption (especially when comparing active and inactive users).

changes in the structure of prices on subscription decisions, due to the difficulties in extrapolating consumers' actual behaviour from their stated behaviour'.[581] Ofcom was critical of each piece of survey evidence before it and ultimately decided to rely on none of them, even the relevant part of the survey Ofcom commissioned.

◦ *Jigsaw survey for Ofcom*

2.682 Ofcom asked consumers about responses to hypothetical price increases as part of a survey it commissioned from Jigsaw Research during the consultation process, but ultimately decided not to rely on the answers.[582]

◦ *GFK survey for Everything Everywhere*

2.683 EE arranged for questions to be added to GfK NOP's weekly face-to-face UK omnibus survey of a representative sample of the UK population. [✂]

- [✂]
- [✂]
- [✂]
- [✂]
- [✂]

2.684 The survey found that [✂][583]

- [✂]
- [✂][584] [✂]
- [✂]
- [✂]
- [✂]

2.685 Ofcom criticized this survey on a number of grounds:[585]

- price change scenarios were the same for all customers;
- it included respondents with pre-pay on a secondary phone;
- inclusion of non-bill-payers (although Ofcom noted that the impact of this would be limited);
- the structure of questions might lead to systematic overstatement of responses; and

[581] Ofcom Statement, §7.116.
[582] Ofcom Statement, fn 396.
[583] See exhibit Dunn §13.
[584] There is some ambiguity in the presentation over whether this was a 3ppm or a 5ppm price increase.
[585] Ofcom Statement, Annex 5, §§A5.32–5.41.

- response scenarios were 'unrealistic and not clearly explained'.

◦ *ICM surveys for Vodafone*

2.686 The third survey we have considered is ICM's 2011 survey for Vodafone. We note that Ofcom did not have access to this survey at the time it made its decision. Vodafone had submitted a similar survey from ICM during the consultation process; Ofcom criticized certain aspects of that survey and decided not to place any weight on it; and Vodafone revised the survey to respond to those criticisms. However, Ofcom had received Vodafone's previous survey and explained why it did not consider that survey to be useful. If the survey in principle provides useful evidence, Ofcom could have commissioned its own survey to gather similar information. Therefore we have taken into account this revised survey in our assessment, but the weight we place on it reflects the circumstances in which it was submitted.

2.687 Vodafone explained that it had calculated likely price increases for different groups of its customers, based on their usage patterns and MCT payments and receipts. It then asked customers within each group how they would react to these price changes. In calculating price changes, Vodafone used the effects of reducing MTRs from the prevailing level[586] to LRIC.

2.688 The main results were:[587]

(a) Price increases would cause a 2.2 per cent reduction in ownership (2.9 per cent of pre-pay) if subscription charges increased without an offsetting increase in bundle size.

(b) Price increases with an offsetting increase in bundle size[588] would cause a 1.5 to 1.8 per cent reduction in ownership (amounting to 720,000 to 864,000 users with only one subscription, of which 97 per cent are pre-pay).

(c) Those who would give up their phones are predominantly low-spending pre-pay customers (59 per cent spend less than £10 per month, or 69 per cent with offsetting minutes); and 38 per cent belong to social group DE (or 48 per cent with offsetting minutes).

(d) Around two-thirds of those who would stop using their mobile phone stated that the main reason was that they did not use their phone much anyway.

2.689 Ofcom made several criticisms of the new survey in its Defence, principally that 'it cannot be assumed that everyone who *says* they intend to act in a particular way will actually do so and it is unclear to what extent Vodafone has attempted to down-weight the responses in its new survey to take account of this fact'.[589] Dr Maldoom for BT also made a number of specific criticisms of the survey methodology.[590] The ICM supporting documentation explained, and the ICM annex to Vodafone's Core Submission clarified, that ICM had asked a follow-up question about how likely respondents were to stop using their phone, which gave them confidence that

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[586] Vodafone took 'prevailing prices' to be those associated with an MTR of 3.7ppm, which it refers to as a 'profit neutral MTR'—calculated by taking into account 'natural reductions in costs' from the level under the previous charge control. See Vodafone bilateral hearing transcript, p81.
[587] Schedule 1 to Vodafone's NoA, §§3.12–3.14, and ICM supporting documentation (NoA Tab 3). Vodafone considers these numbers to be lower bounds since some owners with multiple subscriptions were not asked whether they would cancel all of them.
[588] Explained below in paragraph 2.693.
[589] Ofcom Defence, Annex A, §353c.
[590] Maldoom expert report, §135e & Annex C.

responses were not greatly overstated. ICM also defended its survey against the other criticisms as part of Vodafone's Core Submission.[591]

- *Assessment of survey evidence*

2.690 We agree with Ofcom that the relevant sections of the Jigsaw survey commissioned by Ofcom appear to have methodological problems and have produced implausible results, and accept that no weight should be placed on it.

2.691 We did not think that Ofcom's criticisms of GFK survey for EE necessarily implied that no weight should be placed on it. We note that price changes were not uniform for customers in all scenarios (and, given the limited range of pre-pay tariffs, this may not be unrealistic anyway), and that respondents with a second SIM were separated out in some results. We note Ofcom's criticisms of the framing and structure of the questions, and interpret the evidence in light of them (also noting that there is typically no single correct way to frame a question). We also apply some caution in interpreting results because the sample was relatively small—434 respondents—and subcategories were necessarily smaller. We also note that the scale of price increases was generally quite high compared with those we might expect (particularly the minimum daily charges). Hence the absolute size of customers' responses is probably uninformative. Nevertheless this survey may provide some useful information on, for example, the relative effects of different types of price increase, and the relative response of low-income households.[592]

2.692 We reviewed the criticisms of ICM's methodology in its second survey for Vodafone and we found that ICM's approach was reasonable, and that ICM conducted sensible research that is indicative of what customers would do when faced with a price rise. It is always possible to argue that respondents may not behave exactly as they say they would. While we should not treat survey results as definitive, we believe that a well-designed survey can provide useful and reliable evidence on consumer behaviour.

2.693 There are two impediments to interpreting Vodafone's survey. The first is the way it imposed price increases. Vodafone grouped customers according to monthly spend (and by pre-pay and post-pay), and for each group calculated the average number of incoming and outgoing minutes involving MCT each month. Vodafone increased each group's monthly expenditure by the lost incoming MCT revenue (so Vodafone's income per customer from each customer group would be unchanged); but then increased the number of minutes in customers' bundles according to its savings on outgoing minutes (so Vodafone's MCT costs per customer for each group would be unchanged).[593] The interpretation of these two effects combined is unclear, especially for pre-pay users: it appears to increase respondents' expenditure and consumption, while not necessarily increasing the per-minute charges they effectively pay (we note that the effect of lower MTRs on profitability of the post-pay group as a whole is [✂][594]). Raising prices by the *net* loss of MCT revenues would have been a simpler approach and the results would have been easier to interpret.

[591] Vodafone Core Submission, Annex 1.
[592] Further care is necessary when interpreting the effects of price increases on low-income households, since their reaction relative to other households may vary according to the size of the price increase.
[593] We believe that the intent of this approach is that the combined changes are both revenue neutral and profit neutral for Vodafone. However, we have not seen any justification of this as a realistic response to MTR changes.
[594] Vodafone response to CC questions, 1 November 2011.

2.694 The second is that it calculated the effects of a change in MTRs from the 'prevailing level' of 3.7ppm to the LRIC level of 0.69ppm, a difference of 3.01ppm.[595] The comparison we are interested in is between the LRIC+ level and the LRIC level, a difference of 0.97ppm (in 2014/15). We asked Vodafone how we should interpret its survey and it told us that *(a)* this level of change in prices was relevant,[596] and *(b)* it wanted to 'generally look at whether reducing MTRs is a good or a bad thing'.[597] Hence the survey results seem to tell us that if a reduction in MTRs leads to price and service changes of the kind modelled by Vodafone, then a number of pre-pay customers will stop using mobile services, which is by implication a 'bad thing'.[598] But they do not tell us 'how bad' a move from LRIC+ to LRIC would be.

2.695 We could assume that since the difference between LRIC and LRIC+ is 32 per cent of the change Vodafone used, the relevant change in ownership is equivalent to 32 per cent of the recorded change. This requires strong assumptions about consumer preferences and we would not view it as entirely defensible or reliable.[599] Nonetheless, purely for illustration, it implies that moving from LRIC+ to LRIC would lead to a reduction in mobile ownership in the range of 230,000 to 275,000 people. This would be approximately 0.5 per cent of mobile users, or 0.3 per cent of subscriptions.[600]

- *Study of effects of MTR changes*

2.696 Ofcom commissioned a study from CEG into the relationship between MTRs and penetration rates for mobile subscriptions using a sample of European and OECD countries in the period from 2002 to 2007. CEG found that a 1 per cent increase in MTRs was associated with a 0.034 per cent increase in mobile *subscription* penetration (the study did not address ownership).

2.697 Ofcom used this to calculate the effect on subscriptions of moving from the prevailing level to LRIC+ and to LRIC.[601] These would represent a fall in MTRs of, respectively, 60.3 and 83.5 per cent, which translate into a percentage fall in penetration levels of 2.0 and 2.8 per cent.[602] Given the current level of penetration, the model estimates that the choice between LRIC+ and LRIC may lead to a difference in penetration of around 0.8 per cent. Vodafone argued that this amounted to an effect on 400,000 subscriptions.[603]

2.698 However, Ofcom was cautious about interpreting the results as they are based on subscriptions rather than ownership, and the fall in MTRs in its proposal was outside the data range used by CEG.[604]

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[595] We also note that Vodafone applied a price difference based on a change in charges of 3.01ppm starting from current prices, rather than the prices that would prevail if MTRs were 3.7ppm. This is likely to affect the results to some extent.
[596] We understand Vodafone's argument to be that termination costs will fall by X between 2010/11 and 2014/15; so MTRs should fall by X; and any greater fall needs to be justified. This argument ignores the fact that MTRs are only at their current level because the cost of termination in 2010/11 was overestimated in the last charge control. We are not persuaded that this is a relevant argument.
[597] Vodafone hearing transcript, pp85 & 86.
[598] But see discussion in paragraphs 2.799–2.812 below.
[599] For example, a reasonable alternative assumption would be that small changes have very little effect on ownership whereas larger changes have an effect orders of magnitude higher. In that case the estimate we provide in this paragraph would be too high.
[600] Based on numbers of users and subscriptions given in Figure 7.7 of the Ofcom Statement.
[601] Second Consultation Document, A13.100.
[602] CC calculations (based on methodology in Second Consultation Document, A13.100, updated for revised levels of LRIC+ and pure LRIC).
[603] Ofcom Statement, §7.124. Vodafone inflated this to 1.38 million subscriptions or 1.10 million users in Schedule 1 of its NoA (§3.5), by comparing its 'profit-neutral' level of MTRs with the LRIC level. However, this is not the relevant comparison.
[604] Ofcom Statement, §7.118.

- *Assessment of study of effects of MTR changes*

2.699 We agree with Ofcom that there are issues in applying the results of the study to the effects on number of users of a large reduction in MTRs, and accordingly we do not place much weight on the results.

- *Overall assessment on customer responses*

2.700 We accept that care must be taken when assessing survey results. We do not accept that a well-designed survey provides no relevant information. Since the question of consumer responses to price increases is a key issue in this determination, we would normally expect a robust survey to be important evidence that a regulator would seek to rely on. In this case, there does not appear to be any reliable survey evidence that directly addresses the magnitude of customer loss that would flow from the type of price changes we expect to observe. Vodafone and EE's surveys tell us something about the relative effects of different types of price changes, and about the relative impact on low-income customers compared with other customers, although we have been careful in how much weight to place on them.

2.701 The evidence that Ofcom has relied on, primarily about customers' attitudes to mobile phones, is of limited use. Consumers as a whole may have inelastic demand, but that does not mean that there will not be a significant reduction in number of users, especially if price increases are directed towards those with a lower willingness to pay or those who are more price sensitive.

- *Evidence on handset subsidies*

2.702 Handset subsidies for pre-pay customers are now very low or zero following recent reductions. The parties said that these reductions were partly a response to reductions in MTRs and partly to prevent 'box-breaking', which occurs when someone buys a subsidized pre-pay handset but never activates it, instead selling it for a profit in the UK or overseas. Clearly, this practice would be not profitable (or at least would not be much of a concern for MCPs) if there were no handset subsidies. Three claimed that this was the primary motivation for reducing handset subsidies, whereas other MCPs stressed that reductions in MTRs were also a major driver.

2.703 It appears that Vodafone has [✂]. Vodafone told us in its hearing: [✂].[605]

2.704 [✂]

[✂][606]

2.705 For Orange, EE has already decided to [✂] in its direct sales channel and likely around £[✂] via indirect sellers.[607] In connection to this decision, EE told us that 'PAYG handset subsidies will be [✂]'—this is a 'firm decision that [has] already been taken by the EE Commercial Board'.[608]

2.706 For T-Mobile, EE told us that it 'aims to [✂].[609] Average T-Mobile PAYG subsidies for direct sales were [✂]. We were told that T-Mobile aimed to [✂].[610] Ms Dunn for EE

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[605] Vodafone bilateral hearing transcript, §66.
[606] W/S Ness, §5.10.
[607] EE NoA, W/S Dunn I, §81. Ofcom noted that this seemed lower than EE had submitted to Ofcom (Defence A, fn 227), but EE responded that it had been reduced since Ofcom's information request (see W/S Dunn II, §28).
[608] EE NoA, W/S Dunn I, §40.
[609] EE NoA, W/S Dunn I, §89.

told us that: 'These changes are driven by a desire to [✂]. In part though not only because of the MTR cuts.'[611]

2.707 [✂]:

> Telefónica sells pre-pay handsets through direct channels (ie Telefónica shops and the O2 website), and indirect channels (third parties) also sell handsets. [✂][612]

2.708 [✂][613]

◦ *Assessment of evidence on handset subsidies*

2.709 We observe that handset subsidies for pre-pay users have been falling and are now very low. It seems likely that both a desire to avoid box-breaking and falling MTRs have contributed to this, but we are not in a position to conclude on how important each factor has been. We note that there is very little scope for MTR cuts to translate into further reductions in pre-pay handset subsidies.

- *Evidence on calling patterns*

2.710 In this section we consider evidence on calling patterns of different customer groups. We are particularly interested in which groups have net incoming calls involving MCT (and so net incoming MCT payments) and which have net outgoing calls and payments, and hence whether their net termination payments are a cost or revenue stream to their operator. Where evidence is only available on termination revenues, the operator's termination costs must be taken into account to the extent possible.

◦ *Evidence on calling patterns from Ofcom's Statement*

2.711 We reproduce below figures from the Statement showing the monthly revenue MCPs earn from different sources, including termination charges, on different cohorts of pre-pay customers. The first two figures suggest that MTRs are not an important revenue source for low users. We note that they show inbound voice revenue, not the net position on MTRs; so even for those customers where inbound MCT makes up a non-negligible amount of revenue, the MCPs will be paying outbound MTRs too, which will reduce the financial impact of cutting MTRs.

FIGURE 2.2

Revenue earned from inbound voice and other sources, by pre-pay cohort

[✂]

Source: Statement Figure A4.10.
Note: [✂]

2.712 [✂]

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[610] EE NoA, W/S Dunn I, §90.
[611] EE NoA, W/S Dunn I, §91.
[612] Telefónica SoI, W/S Wardle I, §41.
[613] [✂]—see Presentation to Telefónica Board, Exhibit LPW11, slide 23.

FIGURE 2.3

Revenue earned from inbound voice and other sources, for O2 by pre-pay cohort

Source: Statement Figure A4.11.
Note: [✂]

2.713 The data for T-Mobile, shown in the next figure, splits customers into deciles and shows both incoming and outgoing MTRs. [✂][614]

FIGURE 2.4

Interconnection revenue and cost and average spend by customer revenue decile, for T-Mobile

Source: Statement Figure A4.12.
Note: [✂]

2.714 We can also see from the following two charts that there are no cohorts of pre-pay users that generate a particularly high proportion of revenue from MTRs (again we note that these only show income from MTRs, not net MTR payments).

FIGURE 2.5

Proportion of inbound voice revenue over total revenue, by pre-pay cohort

Source: Statement Figure A4.8a.
Note: [✂]

FIGURE 2.6

Proportion of inbound voice revenue over total revenue, by pre-pay cohort

Source: Statement Figure A4.8b.
Note: [✂]

2.715 This evidence does not support a view that low-use pre-pay customers would attract larger-than-average price increases.

- *Evidence on calling patterns from Three's SoI*

2.716 Mr Ness for Three submitted evidence on the volume of calls made and received by Three's post-pay customers, split by package. He demonstrated that among Three's

[614] Ofcom reported that EE explained the spike of outbound termination costs in the lowest decile as possibly being due to special offers or deals of bundles of outbound minutes. (Ofcom Statement, Annex 4, fn 42.) We do not consider that the spike affects the conclusions we draw from the data.

post-pay customers, customers on more expensive packages on average made a higher volume of outgoing calls, and had a higher volume of net outgoing calls and a higher ratio of net outgoing calls.[615,616]

- *Evidence on calling patterns from Telefónica's SoI*

2.717 [✂]

2.718 We reproduce below two tables from Neil Marshall's expert report which, Mr Marshall said, show how many customers would become unprofitable as a result of moving from LRIC+ to LRIC, with customers segmented according to their monthly inter-connect cost and revenue.[617] We note that Mr Marshall calculated margins in three ways: first as gross margin, second allowing for 'functional costs incl. overheads' and third also allowing for depreciation and amortization.[618] [✂] as a matter of economics, the effect on the profitability of these customers is best reflected in the first measure, which we reproduce below.

TABLE 2.4

[✂]

2.719 It is useful to translate these interconnect costs and revenue into call minutes so that we can understand which consumer cohorts might be viewed as low usage. [✂]

2.720 [✂][619] [620,621]

2.721 [✂]

2.722 [✂][622] [623] This is not explained in more detail, but we take it to mean that the pre-pay table may understate the number of pre-pay subscribers who become unprofitable.

2.723 Despite the data limitations issue, the conclusions we draw from Telefónica's evidence are that:

(a) it provides no support for the theory that a large number of subscribers would become unprofitable as a result of moving from LRIC+ to LRIC;

(b) [✂] and

(c) [✂]

2.724 [✂][624]

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[615] Net outgoing calls refers to incoming and outgoing calls that involve MCT. [✂]
[616] Three SoI, W/S Ness, §3.36, and Exhibit SLN7.
[617] The submission tells us that the segmentation is based on interconnection costs and revenues incurred between March and May 2011.
[618] Telefónica SoI, Marshall expert report, §§5.32–5.34.
[619] Tariffs in Exhibits LPW5 and LPW6 (note: tariffs may have changed since but we assume these tariffs are representative of those paid by customers during the period of analysis).
[620] Ofcom Statement, §7.108, data for 2009.
[621] We also note that [✂]; and Vodafone told us that a 'typical post-pay customer' made around 160 minutes of MTM calls and 50 minutes of MTF calls per month (see Vodafone NoA, Annex 3 to Schedule 2).
[622] Telefónica SoI, Marshall expert report, §5.38.
[623] Telefónica SoI, Marshall expert report, fn 50.
[624] Telefónica SoI, Marshall expert report, §§5.34–5.36.

- *Evidence on the ongoing costs of retaining customers*

2.725 In this section we consider evidence on the cost of maintaining subscribers on a network. Some evidence suggests that once subscribers are acquired, the costs of maintaining them are very low, and so even if those subscribers attract less revenue following a reduction in MTRs, it is unlikely that they will become 'unprofitable' (ie that MCPs would prefer some subscribers to leave their network). [✂],[625] and EE argued that a number of its subscribers were already unprofitable and a further set would become unprofitable as a result of a reduction in MTRs from 4.3 to 0.5ppm.[626]

2.726 Ofcom said that the views of MCPs with fewer subscribers (such as [✂]) were that such costs were minimal, and zero for some MVNOs due to the nature of their agreement with the national MCPs.[627]

2.727 Ofcom reported cost estimates from various parties. It said that EE reported the network costs for Orange of maintaining a subscriber as being [✂].[628] [629]

2.728 Ms Dunn for EE estimated that the network costs for an Orange pre-pay subscriber based on incremental costs for relevant network equipment were £[✂] per year, and SIM costs were an additional £[✂] per year.[630] This is approximately consistent with the figures Ofcom reported for EE (above).

2.729 Mr Sheppard for Three estimated that it cost around [✂]p per year to maintain an inactive customer.[631]

2.730 We note that there is a degree of judgement and interpretation involved in these estimates as to what should be regarded as a fixed cost and what as a variable cost, and there seemed to be considerable uncertainty around Ofcom's interpretation of Telefónica's update. We have not been provided with enough information to reach a definitive judgement, but we interpret the evidence as showing that the costs of maintaining an inactive or barely active customer on the network are very low.

Overall assessment on effects on mobile ownership and subscriptions

2.731 The appellants argued that Ofcom had underestimated the effects on mobile ownership and subscriptions. Part of that claim is based on their view that Ofcom's reasoning on the pattern of price changes is incorrect. As we discussed above, we find force in that view. However, that also means that some of the arguments made a start from Ofcom's conclusions on price changes rather than the position we have taken. Therefore we apply the parties' logic and evidence as best we can.

2.732 One of Ofcom's overall conclusions on allocative efficiency is that the effects of lower MTRs on mobile ownership and subscriptions will be small. These effects depend upon the scale, targets and form of retail price changes and we discuss these under two headings below.

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[625] As discussed at the beginning of paragraph 2.717 above.
[626] W/S Dunn I, §§27–38. We have not presented the detail of EE's analysis, primarily because it reflects a much larger change in MTRs than the relevant difference between LRIC+ and LRIC, and we have no way to infer the results of that relevant comparison.
[627] Ofcom Statement, Annex 4, §A4.48.
[628] Ofcom Statement, Annex 4, Table A4.4.
[629] Ofcom noted that there was some uncertainty around a major cost component (the HLR) and that it was questionable to include customer service costs for those who made little use of their mobile. [✂]
[630] EE NoA, Exhibit Dunn 2, section 6.
[631] W/S Sheppard, §6.5.

2.733 It is difficult to form a view on the difference between the effect on subscriptions and the effect on users, since the majority of evidence relates to the former. To the extent that we place weight upon EE's survey, it suggests that users with multiple accounts are more likely to give up one of those accounts than users with only one mobile phone are to give up mobile access altogether. This suggests that a significant proportion of lost subscriptions may be second SIMs, rather than lost users.[632]

- *Scale and targets of price changes*

2.734 We first address the appellants' view that price increases for some users may be relatively large. Much of Ofcom's reasoning is based on the principle that the effect per user will be small, with Ofcom frequently citing its figure of '£2.50 per subscriber per year' (which it calculated as the net reduction in MCPs' termination revenue divided by the number of subscriptions). Ofcom used this as part of its defence on the first four of the arguments in EE's NoA, and the sixth; the fifth argument is directly about the relevance of this £2.50 number. In its response to the fifth argument, Ofcom claimed that it 'obviously did not assume that the financial impact would "be spread equally across all subscribers"'. There is a clear tension between citing the £2.50 in response to every argument and then saying that the £2.50 is just 'a useful illustration of the average effect being discussed'.[633] Ofcom did not provide good arguments or evidence that those customers who might be considered marginal (ie most likely to give up their phones in response to a price increase) would face price increases at or below this 'average' level.

2.735 Ofcom said that EE 'cannot have it both ways',[634] but Ofcom is attempting to do the same thing: it included inactive and barely active consumers in its calculation of the average price impact, but claimed that they should not be included in any quantification of the loss of users as a result of MTR increases. We are not convinced by Ofcom's argument—it seems plausible that there would be relatively little financial impact from reducing MTRs on the profitability of genuinely inactive or barely active users, but this does not necessarily mean that there is no impact on allocative efficiency (or welfare) if they give up their subscriptions, and hence we think EE's position is neither inconsistent nor unreasonable.

2.736 When considering the effect on the number of users or subscriptions, we consider it likely that certain groups will be most at risk of giving up their subscriptions, and that in general those groups will be relatively low users. Regardless of the scale of price rises, it seems plausible that high users would respond to a price increase by scaling down usage, while low users have limited ability to do so and are more likely to give up their phones (or to become inactive/barely active). This is consistent with Vodafone's survey evidence.

2.737 We do not consider the figure of £2.50 per mobile subscriber per year to be relevant to the question we are considering. Since post-pay users as a group have roughly balanced calling patterns, the effect of MTR cuts on post-pay profitability is roughly neutral. Hence the entire effect should be divided by the number of pre-pay subscrip-

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[632] Purely for illustration, we note that Figure 7.7 of the Statement showed that there were around 50 million active mobile users, and 12.5 million second handsets and datacards. If no user had more than two SIMs, this would imply that there were around 37.5 million users with a single SIM, ie around one-quarter of users has two SIMS. If a price rise led to the same proportion of single SIM users giving up their SIM as double SIM owners giving up their second SIM, around one-quarter of lost subscriptions would be second SIMs. If double SIM owners were *more* likely to give up their second SIM than single SIM owners to give up their first, a higher proportion of lost subscriptions would be second SIMs.

[633] Ofcom Defence, Annex A, §144.

[634] Ofcom Defence, Annex A, §142b, discussed in paragraph 2.671*(e)* above.

tions, giving an effect of roughly £5 per subscription per year.[635] Furthermore, it may not be possible to recover lost revenue from all users, in particular inactive or barely active users. If we divide the effect by the number of active users, the effect would be around £8 per active pre-pay user per year.[636,637]

2.738 We would expect this effect to be larger than this for some groups and smaller for others. The effect on net revenue earned from any one individual will depend on that individual's calling patterns, and we would expect some to be above and some below average. So we would be more concerned about customers giving up their mobile if there were a group with above-average lost revenue (ie who faced a relatively large price rise) and that group appeared likely to give up their phones as a result (ie if there were reason to believe that they did not place great value on being on a mobile network). In particular, we might expect a large number of consumers to give up their phones if there are a lot of light users who received many incoming calls—they might become unprofitable as a result of MTR cuts but be price sensitive.

2.739 Above, we considered evidence on calling patterns, and in particular whether there are *groups* of customers whose profitability is severely affected by a reduction in MTRs, because we expect MCPs to raise prices the most for those customers. This contributes to our assessment of the approximate size of price rises different groups of customers may face, and thus how likely those customers are to stop using a mobile phone. However, we note that knowing how many customers *in aggregate* would become unprofitable absent price changes provides very little information about the likely size and form of price changes and no information about customers' reactions.[638]

2.740 What we would be most worried about is if there is a consumer group whose profitability is heavily dependent on MTRs and who might be likely to give up their phones. If there is such a group it might face a large price increase to restore profitability.[639] For these purposes, it is most convenient to group customers according to the tariffs they pay, since if MCPs respond to falling MTRs by changing their retail prices, in practice they will have to change price plans.

2.741 We note that the effect on consumers will depend on their perception of the tariff that they pay. A 'tariff' in this context may not be as broad as an entire price plan. For example, it is now common for MCPs to set pre-pay call prices at a high level but give extra value to high-use customers (and/or customers who top up frequently), as discussed above.[640] This is a form of non-linear pricing and its effect is that high-use pre-pay customers may perceive a different tariff from low-use pre-pay customers, even if there is only one pre-pay price plan. This also means that MCPs could take one existing price plan and effectively segment customers on that plan by increasing

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[635] Pre-pay subscriptions make up roughly 55 per cent of total mobile subscriptions (Ofcom—'Consumer Experience 2010' Figure 17, submitted as Exhibit MW36).
[636] For illustration, this figure assumes that all inactive and barely active SIMs are pre-pay (see Ofcom Statement, Figure 7.7) and excludes them from the calculation.
[637] We note that the effects on competition of lower MTRs may in practice mitigate these price increases. For example, we discussed above the possibility that this may lead to an incomplete waterbed effect. In this section, we aim to abstract from competition effects as far as possible. An incomplete waterbed effect would imply smaller price rises—for example, if the waterbed effect were 80 per cent complete, the illustrative price effect would be 80 per cent of this, ie £4 or £6.40 rather than £5 or £8. Therefore the £5 and £8 figures may be viewed as conservative.
[638] For example, EE made submissions on the number of its customers that would become unprofitable. This number is itself of limited relevance. For example, it is possible that all of these customers might move from being just slightly profitable to just slightly unprofitable, and that a very small price increase would restore them to profitable status without prompting many to give up their phones.
[639] We do not need to consider individual users who fit this profile—there will inevitably be some—because MCPs cannot set prices for individual customers; they can only design tariffs and make customers self-select from those tariffs. That means that MCPs may increase prices for all customers on a tariff if the tariff becomes unprofitable (or even if it becomes less profitable and that is driven by a substantial group of unprofitable customers).
[640] See paragraph 2.644.

its complexity (eg by changing a simple linear ppm charge for calls into a non-linear price plan where high users get rewards).

2.742 Taking into account all the evidence we considered above on calling patterns, we did not find convincing evidence that there are groups of customers—and especially low-usage customers—whose net income from mobile termination charges forms a large proportion of the revenue that MCPs earn from having them as subscribers. This suggests that price increases for these customers would be modest relative to the level of charges they were already paying and, in turn, that if price increases take the form of increases in usage charges (which we consider below) then the effect on number of subscribers will be relatively small.

- *Form of price changes*

2.743 We have considered the form that price increases for pre-pay customers may take. It would be difficult to appraise the likely effects on mobile ownership and subscriptions without taking a view on the likely form, since the pricing of mobile services is complex and MCPs have scope to change their pricing in various different ways which may have different implications for consumers. Since the introduction of the current charge control, changes have taken the form of reduced handset subsidies and increased call charges.[641] The appellants have told us that future changes may continue these trends and also include measures such as:

- upfront charges for a SIM;[642]
- reducing the 'dormancy period' to terminate inactive accounts after a shorter period of time;[643]
- fixed or quasi-fixed charges such as all credit expiring after a certain period[644] or minimum monthly charges;[645] or
- introducing or increasing charges for voicemail or customer services.[646]

2.744 As we have noted, there may also be some mitigation for high-use pre-pay customers (who may not be made less profitable by MTR cuts) in the form of extras or add-ons (eg Vodafone 'Freebees').

2.745 We have considered, based on the evidence we have seen on the MCPs' reaction to MTR reductions, what form price changes are likely to take and how they would affect the parties' reasoning and conclusions as to effects on consumers. We cannot make a definitive conclusion as to the form of price changes but we found it necessary to exercise some judgement on this issue in order to assess the ultimate effects on consumers since, for example, EE's survey suggested that different types of price changes would have different effects.

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[641] And, at least for [✂] and Vodafone, an increase in the price of a text message despite reductions in the wholesale termination charge for text messaged. [✂]
[642] Ofcom Defence, Annex A, §113.
[643] EE NoA, W/S Dunn I, §40.3. [✂]
[644] Some types of credit on current plans are time limited and expire, but we understand that all MCPs currently offer plans with credit that does not expire (subject to the user not being dormant for a stipulated period of time, eg an MCP may close the account with consequent loss of credit if a customer does not make at least one call in a three-month period). The removal of such plans would be likely to affect consumer behaviour.
[645] EE NoA, W/S Dunn I, §40.3.
[646] See, for example, EE's customer survey.

2.746 Some of these changes—notably the ones already introduced—seem to take the form of a relatively small increase in prices. In particular, for low users, an increase in call prices is likely to have a small effect in absolute terms.

2.747 There seems to be limited scope to reduce handset subsidies for pre-pay handsets, since they are already small or abolished; and any attempts by MCPs to increase handset prices above cost are likely to be constrained by the availability of handsets from other sources. It is possible that MCPs could introduce or raise charges for SIM cards, but even if all MCPs introduced such prices, SIMs are generally less likely than handsets to need replacing. Hence introducing a price for SIM cards is likely to have less effect on the number of subscribers than the equivalent price increase for handsets. We also question whether it is likely that all mobile operators would introduce a substantial charge for SIM cards; if some do not, as a means of differentiating their offer, consumers would have an element of protection against this.

2.748 We consider that some form of fixed or quasi-fixed charge may have more impact on the level of subscriptions. It would likely represent a proportionately large increase in price for low users. For example, someone who carries a mobile phone for occasional use, or primarily to receive calls, may not be persuaded to give it up in response to even a large increase in call charges since the absolute effect on their bill would be small; but having to pay some kind of charge every month (or every quarter, or any other period that MCPs might consider) might have a greater financial impact and so be a greater deterrent.

2.749 We have considered whether this is a likely response by MCPs. It is more likely if MCPs want to actively remove loss-making customers from their networks. We accept that some existing customers may be genuinely loss-making. However, the level of ongoing costs involved with retaining a consumer on a network is low,[647] and we understand that every activity a pre-pay customer engages in (making or receiving a call, sending a text) should have a positive margin. We accept that a larger number of existing customers will be loss-making if they are required to make a contribution towards either overheads or their acquisition costs, but we do not consider this to provide an economic rationale for MCPs to try to remove such customers from their networks once acquired. It is more plausible that MCPs will try to avoid acquiring such customers in future by reducing acquisition costs and/or charging higher upfront prices.

2.750 Furthermore, we have no evidence that this is a likely response by MCPs. We have already seen the first and largest reduction in MTRs following the Statement, and MCPs' responses to that. They have taken the form of fairly simple price increases, primarily to usage-based charges and handset prices. We have not seen the introduction of compulsory regular fixed or quasi-fixed charges for pre-pay users and hence we must consider whether they are likely. We note that Ms Dunn, for EE, said that [✂].[648] We also note that under the heading of 'Vulnerable Customers', EE argued that pre-pay customers would face price increases primarily in the form of increased call charges.[649] Accordingly, we think that more complex pricing changes are less likely.

[647] See paragraph 2.730 above.
[648] W/S Dunn I, §§65 & 66.
[649] EE Core Submission, §155.

Effects on mobile usage

2.751 We turn now to consider the third of the subjects listed in paragraph 2.582. Above, we have considered the likely effects of lower MTRs on mobile ownership and subscriptions. The second part of Ofcom's conclusion on allocative efficiency in its Core Submission was about the effect on mobile usage.[650] We note that the effect on usage will depend on the nature and extent of price changes, and accordingly our consideration below must be viewed in the light of our conclusions about price changes as described above.

Ofcom's position

2.752 Ofcom considered that a move to LRIC may result in small increases to the overall level of mobile retail prices, which would be spread across consumers with, in general, a trend towards higher fixed fees and lower call charges. Ofcom considered that this would in turn lead to an increased demand for mobile calls, but that the increase was unlikely to be very large since the demand for calls appeared to be relatively price inelastic.[651]

Views of the appellants

2.753 EE argued that Ofcom had 'conjured up' a surprising result whereby mobile retail prices increased but usage also increased. EE claimed that Ofcom had accepted that usage prices would increase for some consumers but failed to acknowledge the implication that their usage would fall.[652]

2.754 Vodafone argued that the evidence did not support Ofcom's proposition for four reasons:[653]

(a) Usage levels on post-pay contracts were, in general, currently well below contractual limits and hence an increase in the number of minutes in the bundle was unlikely to lead to significantly more usage.

(b) Evidence did not support the proposition that historical reductions in MTRs had led to an increase in usage—for example, the CEG study referred to above found no robust relationship between MTRs and usage; and usage over the last few years suggested that off-net minutes per user had increased without any significant change in MTRs, and at a similar rate to on-net minutes. Vodafone claimed that the level of usage of on-net minutes was not driven by MTR changes, and therefore appeared to suggest that similar changes in off-net minutes should not be attributed to MTR changes. Vodafone agreed with Ofcom's view[654] that the academic literature on the price elasticity of demand for calls was of limited use.

(c) Ofcom did not attempt to evaluate quantitatively the extent of any increase in usage.

(d) Mobile usage would not increase if consumers downgraded their packages in response to increased charges.

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[650] Ofcom Core Submission, §32a, as referenced in paragraph 2.581 above.
[651] Ofcom Statement, §§7.150–7.181, summarized in Ofcom Defence, Annex A, §§173–176.
[652] EE NoA, §§46 & 73; Walker I expert report, §111.
[653] Vodafone NoA, Schedule 1, §§4.1–4.11.
[654] Ofcom Statement, §7.152.

Ofcom's Defence

2.755 In response to EE, Ofcom argued that EE had overstated Ofcom's conclusions. Ofcom said that mobile retail prices would go up, all else equal, but argued that increased competition would also put downwards pressure on call prices, and that there would be an effect on the structure of prices: for example, MCPs may increase the 'upfront' price of a post-pay bundle but offer more calls for a given bundle price, a 'more for more' proposition. Ofcom found that there were both upward and downward pressures on usage, but concluded that there was likely to be some increase in usage. Ofcom also said that, to the extent that the number of mobile users declined, that was likely to reduce the number of mobile calls made.[655]

2.756 In response to Vodafone's points, Ofcom argued that:[656]

(a) Users might select a bundle that gave them a 'margin of error' as they did not wish to make expensive out-of-bundle calls, and some such users might make extra calls if they had a larger bundle.[657]

(b) Ofcom's response to the CEG study was to suggest that there might be a reason for this lack of relationship between MTRs and call volumes (namely that the relationship was mediated by the effect on retail prices). With respect to recent evidence on call volumes, Ofcom suggested that the growth of both on-net and off-net traffic had probably been facilitated by the growth of inclusive bundles, and that it was easier to offer such bundles as MTRs fell.[658] With respect to the academic literature, Ofcom contended that it showed that there was a body of evidence and research arguing that usage would increase with lower prices; Ofcom did not attempt to argue that usage was highly elastic, merely that there was likely to be some effect. Ofcom considered this evidence to be more reliable than Vodafone's consumer survey on general principle.

(c) Ofcom argued that it explained in the Statement[659] why a fully quantified Impact Assessment was not proportionate in this case.

(d) Ofcom argued that Vodafone's survey could not be relied upon; and that in response to an increase in monthly charges for post-pay contracts (potentially offset to some extent by more included calls) some consumers would trade up ('where they can get more minutes for a fixed level of expenditure') while others would trade down ('to minimise their expenditure for a similar usage profile to what they are currently using'). We found this argument unclear.

Appellants' reply

2.757 Dr Walker criticized Ofcom's 'more for more' argument, asserting that the aggregate effect was not uncertain: since overall prices increase, the increase in the price of the bundle must outweigh the increase in value from extra minutes. Dr Walker noted that 'the evidence is that pre-pay prices have risen, not just the bundle price of post-pay

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[655] Ofcom Defence, Annex A, §§179–182.
[656] Ofcom Defence, Annex A, §§184–190, labelled 1–4 which corresponds to our *(a)–(d)*.
[657] Ofcom also contended that Vodafone's argument was inconsistent with EE's evidence that 'consumers move between different post-pay bundles with a very clear sense of the usage charges they pay so that, as usage charges decrease, usage would increase' (Ofcom Defence, Annex A, §77). We found this latter argument unclear, particularly since the parts of EE's submission that Ofcom referred to (Walker I expert report, §§72 & 73, and W/S Dunn I, §§45 & 46) said that an increase in prices led to consumers switching away from their current tariff to pre-pay or to another operator; it did not relate explicitly to usage, and made no mention of falling usage charges.
[658] Ofcom did not address the link between the increased availability of bundles and the very small changes in MTRs over this period.
[659] Ofcom Statement, §§7.10–7.13.

packages'.[660] We note that Dr Walker did not refer to evidence that post-pay package prices have risen.

2.758 Vodafone claimed that none of the points made by Ofcom in its Defence (paragraphs 183 to 191 of Annex A of the Defence) provided compelling evidence that there would be an increase in mobile usage, let alone an increase that would offset the risk of a reduction in mobile ownership and subscription rates.[661]

Assessment of effects on mobile usage

2.759 We find it difficult to be confident of the effects on mobile usage of moving from LRIC+ to LRIC, since we did not find the arguments of the parties convincing. In particular, we start from the premise that prices will change in line with our conclusions above, whereas some of the arguments start from Ofcom's position on price changes, and are thus difficult to apply. As far as possible, we apply the logic of the parties' arguments even if the detail does not exactly correspond to our starting point.

2.760 We see some merit in EE and Vodafone's arguments that Ofcom has not demonstrated that usage will increase as a result of a reduction in MTRs. However, EE and Vodafone have not demonstrated an alternative conclusion to be put in place. Dr Walker's contention (for EE) is not compelling: by his own argument we cannot predict with confidence that overall prices will rise for post-pay users (though we predict they will for pre-pay users, as we discuss below).[662]

2.761 Our first reason for treating Ofcom's conclusions with caution is that they must be affected by its reasoning as to the structure of price changes, with which we disagree. We have found in our assessment of the effect on mobile retail prices, above, that we would expect the overall level of prices paid by high-usage post-pay customers to decrease, and the overall level paid by low-usage post-pay customers will probably increase, as a result of reducing MTRs. Taking into account both Ofcom's and Vodafone's arguments, we are not convinced that this change would lead to an increase in aggregate usage among post-pay users. We note that Ofcom argued that there would be a shift in prices away from usage charges and towards fixed charges. It is not obvious what form that would take among post-pay tariffs, where a large proportion of consumers stay within their fixed bundles of minutes and do not pay anything that can be simply and clearly described as usage charges.

2.762 There are two effects arising from our conclusions on price changes. The first is that we expect some customers (predominantly pre-pay customers) to give up their mobile subscriptions as a result of reducing MTRs. This will lead to a reduction in mobile calls—both calls made by these subscribers, and MTM calls that would have been made to them.

2.763 The second concerns infra-marginal pre-pay customers (ie those who do not give up their subscriptions). We expect most pre-pay customers to see price rises, and based on the evidence of MCPs' reactions to date, some of that will come in the form of usage price increases. This follows from Dr Walker's simple logic that price increases usually lead to reduced consumption and in the absence of any argument to the contrary, we would expect aggregate usage by pre-pay customers to fall.

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[660] EE Core Submission, Walker III expert report, §§53 & 54.
[661] Vodafone Core Submission, §4.40.
[662] We note that Dr Walker may have been arguing in the alternative, ie if Ofcom's premise about price changes was correct, then Ofcom's argument on usage was flawed. Since we disagree with Ofcom's premise, Dr Walker's argument is redundant.

2.764 There may also be switching between pre-pay and post-pay, and among post-pay tariffs. We have explained that we expect overall prices for high-usage post-pay users to fall (since they have net outgoing calls) and prices for low-usage post-pay users will probably rise (since they probably have net incoming calls). This may cause some post-pay users to find better value in larger bundles and increase their usage. It is more difficult to predict what switching there will be between pre-pay and post-pay; if low-usage post-pay prices rise, that may cause some switching towards pre-pay and possibly reduced usage, but we are less confident in this prediction.

2.765 Overall, we remain circumspect about Ofcom's conclusion that there will be some (small) increase in mobile phone usage as a result of lower MTRs. However, there is no strong evidence that it will decline. Since prices may move in different directions for different groups, we would expect some groups to increase usage and others to reduce it, and it is difficult to draw a firm conclusion on the overall effects on mobile usage.

Effects on fixed prices and usage

2.766 We now turn to the fourth subject listed in paragraph 2.582 above.

Ofcom's position

2.767 Ofcom concluded that FCPs in the competitive fixed voice market would reduce their prices to consumers when MTRs fell, and hence call volumes would increase. Ofcom found it difficult to predict what form these reductions would take, as fixed services were increasingly sold in product bundles. Ofcom found that there was unlikely to be any material effect on fixed subscriptions.[663]

2.768 In the Statement, Ofcom provided some analysis of the extent to which reductions in MTRs had historically been passed through to consumers in the form of lower FTM prices. Ofcom noted that 'the data suggest that the retail price of F2M calls as a standalone service has gone up … since 2006',[664] but argued that it was more appropriate to focus on changes in the prices of a basket of fixed services because retail competition focused on bundle prices, and that the cost of the basket had fallen in real terms since 2004.[665] Ofcom concluded that it expected cost savings from lower MTRs to be passed through to fixed consumers, since the fixed retail market was competitive.[666] It could not be certain of the form of these changes, since FCPs offered a range of services, but considered that there was some evidence[667] that FTM prices would fall,[668] and that FCPs were likely to move FTM calls into bundles.[669]

Views of the appellants

2.769 EE contended that pass-through by FCPs was unlikely to be complete. Similarly, Vodafone argued that Ofcom had not provided any compelling evidence to support

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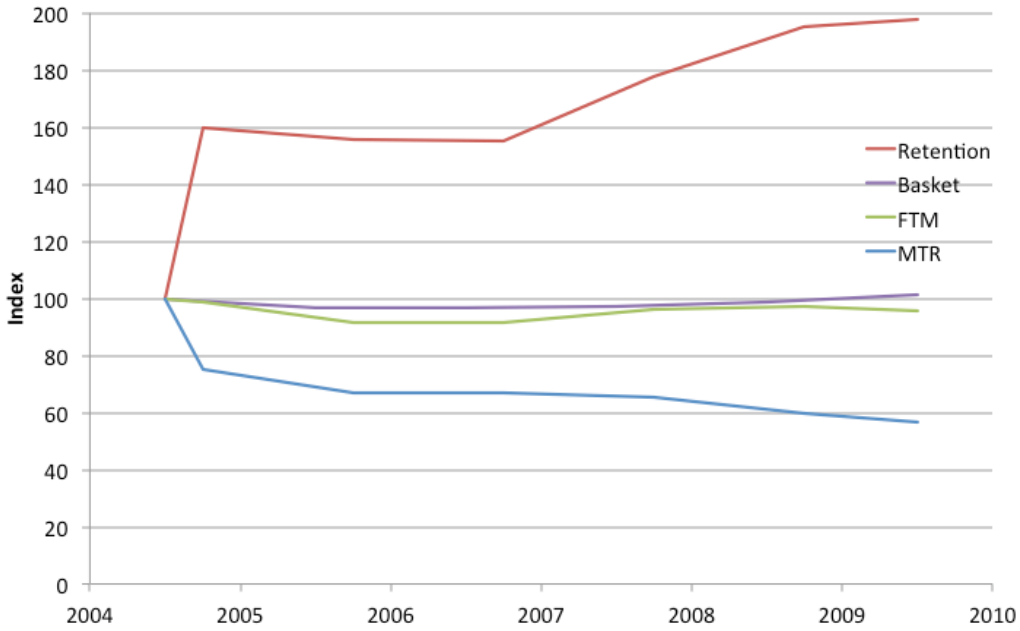
[663] Summarized in Ofcom Defence, Annex A, §192.
[664] Ofcom Statement, §7.189.
[665] Ofcom Statement, §§7.193 & 7.194.
[666] Ofcom Statement, §7.211.
[667] It is not clear what this evidence is. Ofcom found that the cost of a basket of fixed voice services had fallen in real terms since 2004—Ofcom Statement, §7.193—but noted that it was impossible to isolate the effects of falling MTRs.
[668] Ofcom Statement, §7.211.
[669] Ofcom Statement, §7.215.

its view that reducing MTRs would lead to a reduction in FTM prices or an increase in use of fixed services.[670]

2.770 EE's primary argument was based on an analysis of historical pass-through. Dr Walker for EE provided an illustration of changes in MTRs and FTM prices, reproduced below.

FIGURE 2.7

Changes in MTRs, retention and FTM call prices and the cost of an overall basket of fixed services



Source: EE NoA, Walker I, Figure 5.
Note: Data on MTRs from IRG Snapshot of Mobile Termination Rates, JP Morgan, European Equity Research Report on BT Group, 24 October 2008, p30. Data on FTM prices from Ofcom Telecoms Data Updates and retention calculated as the residual between FTM and MTRs. Data on the cost of a basket of fixed services is from the Statement, Figure 7.12, but adjusted in accordance with the table below. Data for all series has been rebased to 100 in 2004 so as to highlight the changes since 2004.

2.771 Vodafone also argued that FCPs had not passed on MTR reductions. Vodafone argued that the data Ofcom presented[671] showed that the largest reduction in fixed prices occurred between 2004 and 2006, a period in which average MTRs did not change.[672]

2.772 Dr Walker argued that Ofcom's conclusions on the cost of a basket of fixed service were flawed because they included VAT (and hence were affected by VAT rate changes) and excluded certain call types, such as non-geographic voice calls. Adjusting for this shows that the cost of the basket has increased slightly despite falling MTRs.[673] We reproduce Dr Walker's table below.

[670] Vodafone NoA, §47.7, Schedule 1 §5.2.
[671] Ofcom Statement, §§7.192 & 7.193.
[672] Vodafone Schedule 1, §5.5.
[673] EE NoA, Walker I expert report, §123.

TABLE 2.5 **Walker I Table 1: correcting Figure 7.12 in the Statement**

£ per month, 2009 prices

	2004	*2005*	*2006*	*2007*	*2008*	*2009*
Figure 7.12	23.27	22.21	21.76	21.56	21.17	21.08
Cost excluding VAT	19.80	18.90	18.52	18.35	18.02	18.33
Cost of 'Other Calls'	0.91	1.14	1.55	1.79	2.45	2.70
Cost of basket (excluding VAT and including 'Other Calls'	20.71	20.04	20.07	20.14	20.47	21.03

Source: Walker I expert report, Table 1.

2.773 EE and Dr Walker also made two other arguments: first, that analysts did not expect lower MTRs to be passed through (since they expected BT's profits to increase);[674] and second, that there was currently no constraint on FCPs including FTM calls in bundles, and indeed some did so (eg the BT Friends and Family add-on where customers can pay £1.50 per month to access cheaper calls to mobiles).[675] He said that it was not clear why reducing MTRs to LRIC would allow this while LRIC+ would not.[676] Vodafone also argued that there was limited evidence of availability of FTM calls in bundles in the UK so far despite significant reductions in MTRs.[677]

2.774 We note that Ofcom and Vodafone had differing views about the applicability of cross-country comparisons and the relevance of particular examples, but neither argument assisted our determination.

Ofcom's Defence

2.775 In response to Dr Walker's analysis of the basket cost, Ofcom argued that 'the figure was illustrative only as it did not control for the other factors affecting fixed-line prices'.[678] Ofcom said that it had concerns with the data used for 'non-geographic voice calls' and so care is needed when interpreting them.[679]

2.776 In response to EE's point on analyst reports, Ofcom considered that they were still consistent with a degree of pass-through to lower fixed prices. With regard to whether reducing MTRs to LRIC will prompt the inclusion of FTM minutes in bundles, 'Ofcom's view is that *all other things being equal* it is *more* likely' that with lower MTRs, FTM calls will be included in bundles.[680] Ofcom also contended that BT and TalkTalk claimed that an MTR of around 1ppm or below would be some kind of 'tipping point'.[681]

2.777 Ofcom did not dispute Vodafone's description of the timings of fixed price reductions, but argued that breaking down a six-year period into sub-periods to draw meaningful results could not isolate effects and would not have been proportionate in this context.[682] With respect to the current availability of bundles, Ofcom repeated its 'all other things being equal' argument (above).[683]

[674] EE NoA, Walker I expert report, §§118–120.
[675] EE NoA, Walker I expert report, §125.
[676] EE NoA, Walker I expert report, §126.
[677] Vodafone, Schedule 1, §5.6.
[678] Ofcom Defence, Annex A, §209.
[679] Ofcom Defence, Annex A, fn 378.
[680] Ofcom Defence, Annex A, §214, emphasis in original.
[681] Ofcom Defence, Annex A, §§210 & 212.
[682] Ofcom Defence, Annex A, §217.
[683] Ofcom Defence, Annex A, §218.

The appellants' reply

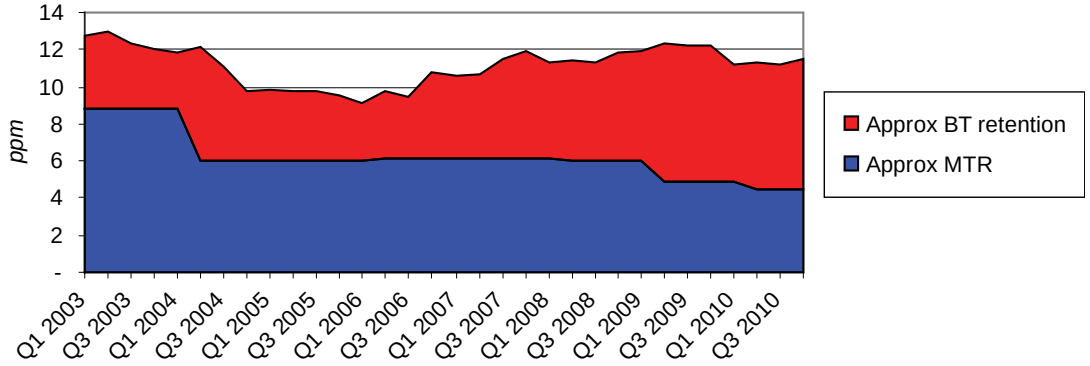
2.778 Dr Walker argued that Ofcom had accepted that its own evidence was flawed and could not be relied upon in support of Ofcom's view that MTR cuts would be passed on; and that Ofcom's 'all other things being equal' view was based on 'very weak evidence'.[684] He noted that BT and TalkTalk had strong incentives to make 'tipping point' claims and that FNOs such as BT already included 0845 calls in bundles even though they had termination rates of around 3ppm.[685]

2.779 Dr Walker also noted that both Vodafone's SoI and Telefónica's Wardle II presented evidence showing that BT's retention for residential customers had risen in absolute terms.[686] This is discussed below.

2.780 In its SoI and its Core Submission, Vodafone looked directly at quarterly data on BT's FTM retail revenues and traffic volumes to calculate ppm revenue received by BT from FTM calls, and subtracted MTRs to calculate the BT 'retention'.[687] This indicated that retention had risen over time (see Figure 2.8).

FIGURE 2.8

BT retention and MCT costs as components of total FTM ppm



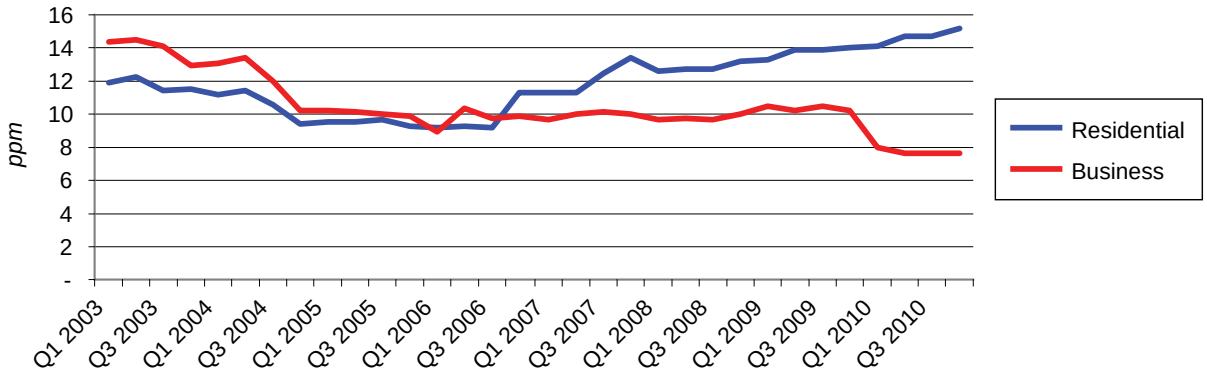
Source: Vodafone's Core Submission Figure 7.

2.781 Vodafone claimed that BT's retention from residential (as opposed to business) users had grown even more. It claimed that in the period from 2006 to 2010, when MCT charges were reduced from 6.2 to 4.4ppm, BT's average residential retail FTM rate increased from 9.2 to 15.2ppm over the same period, as illustrated in Figures 2.9 and 2.10 below.[688]

[684] EE Core Submission, Walker III expert report, §§58 & 59.
[685] EE Core Submission, Walker III expert report, §59.
[686] EE Core Submission, Walker III expert report, §61.
[687] Vodafone Core Submission, §7.12. The discussion in the Core Submission essentially reproduced that in Vodafone's SoI and so we refer only to the former.
[688] Vodafone Core Submission, §7.14.

FIGURE 2.9

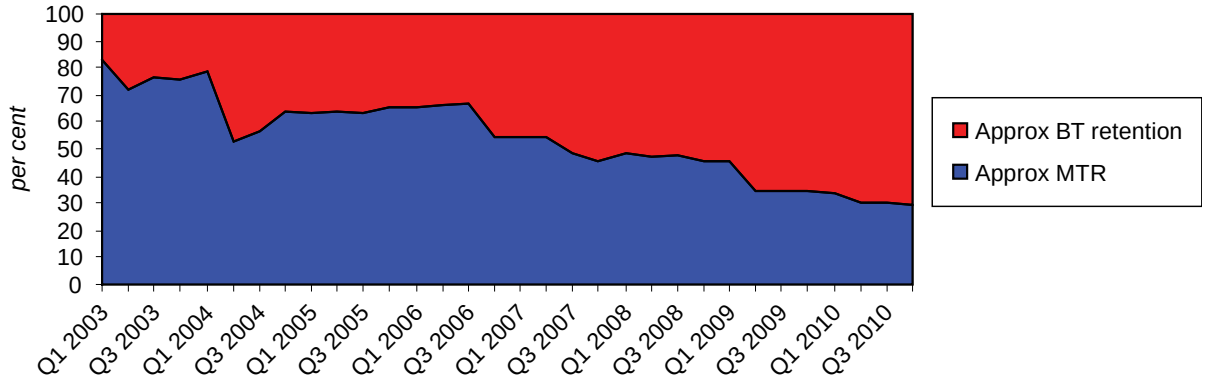
FTM retail revenue by segment



Source: Vodafone's Core Submission Figure 10.

FIGURE 2.10

Relative proportions of BT retention and MCT charge in residential FTM retail revenue



Source: Vodafone's Core Submission Figure 11.

2.782 Vodafone also argued that BT had not fully passed on the recent reduction in MCT charges, as it claimed to have done.[689] Vodafone appeared to accept that BT's headline residential FTM rates had reduced roughly in line with MTR reductions, but argued that:

(a) Each call charge was rounded up to a whole penny. Vodafone understood this to mean that, for a call of up to 1 minute duration, the customer will be charged 12ppm (peak), rather than 11.3ppm, or 6ppm (off-peak), rather than 5.3ppm.

(b) BT charged a fixed call set-up charge for FTM calls. This was increased from 11.5 to 12.5ppm with effect from 1 April 2011. For a call of up to 1 minute duration, the increase in the call set-up charge thus effectively offsets the reduction in the FTM ppm rate.

[689] Vodafone Core Submission, §§7.16–7.21.

Statements of intervention

- *Telefónica*

2.783 Telefónica argued that the price of FTM calls had increased despite reductions in MTRs. It cited an example:[690]

> … according to Ofcom data, BT's average residential calls to mobiles price increased from 11.28ppm in Q1 2007 to 15.19ppm in Q4 2010 (the most recent period for which data are available). Telefónica estimates that BT's average wholesale mobile termination cost fell from approximately 6.5ppm to 4.5ppm over the same period. This means that BT's margin for such calls would have risen from about 4.8ppm to about 10.7ppm in four years.

2.784 Telefónica suggested that BT had treated its gain from lower MTRs as a 'lump sum saving'[691] that was allocated in the most profitable manner (eg by reducing prices for its BT Vision service[692]). Telefónica argued that the FNOs might adjust prices of different products according to their relative elasticities, consistent with the principles Ofcom used to assess the impact of MTR reductions on the prices of MCPs' services.[693]

2.785 Telefónica concluded that

> a P0 adjustment [and by implication lower MTRs in general] would not, contrary to BT's submissions, be likely to achieve any relevant benefit to competition. Rather, it would simply represent a lump sum benefit to FNOs that would most likely be used to enhance their competitive position in other markets.[694]

- *BT*

2.786 BT argued that competition in fixed lines had become focused on the headline price of a bundle of services; that the high level of MTRs had made it impractical to include FTM calls in BT's basic bundles; and that BT had offered discounts on FTM calls as 'add-ons' to its call packages.[695] The most recent relevant package is 'Friends & Family Mobile', introduced in April 2009 (but no longer available to new subscribers), where a monthly fee of £1.50 (and 'free for customers on contract') gives reduction in price to 7ppm for daytime calls.[696]

2.787 BT argued that it passed on the 2011 MTR reduction in full to its residential customers as soon as practicable after the new rates were set; it subsequently held FTM prices constant while increasing most other call prices by around 5 per cent in response to inflation; and it was currently evaluating other FTM pricing options (it gave as examples [✂]).[697]

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[690] Telefónica SoI, W/S Wardle, II §20.
[691] Telefónica SoI, W/S Wardle, II §23.
[692] Telefónica SoI, W/S Wardle, II §21.
[693] As set out in paragraphs 2.624 to 2.634 above, we do not agree with those principles.
[694] Telefónica SoI, W/S Wardle, §2 25.
[695] BT SoI, W/S Richardson III, §§6–16.
[696] BT SoI, W/S Richardson III, §§6–8; and Vodafone bilateral hearing transcript, p91.
[697] BT SoI, W/S Richardson III, §§10–16.

2.788 In its Core Submission, BT made various points[698] which in general did not directly address evidence on past price changes, but commented on past regulation of BT prices and BT's view that historical evidence may be misleading because *(a)* competition did not take place through headline prices of FTM calls alone, and *(b)* BT had made commitments as a co-sponsor of the *Terminate The Rate* campaign.

Assessment of effects on fixed prices and usage

2.789 We consider that there are two issues in dispute here: what has happened in the past and whether that is a guide to the future (for example, given BT's commitments to the *Terminate The Rate* campaign). We note that the effects on fixed prices depend on the reactions of all FCPs, not just BT, although much of the argument and evidence has focused on BT.

2.790 Vodafone made a strong case that BT's headline FTM prices have not historically been reduced in line with MTR reductions. We note that BT's headline prices were reduced in line with the first MTR cut under this charge control,[699] but BT has not contested Vodafone's view that other pricing changes mitigate that reduction.

2.791 It is more difficult to draw firm conclusions on the implications of EE's argument and evidence on changes in the price of a notional basket, since FTM calls are not traditionally included within bundles. Ofcom's argument appears to be that fixed operators benefit from falling MTRs but compete away this benefit in bundles of call prices (or possibly line rental). We set out above our conclusion, based on the arguments and evidence put before us, that in the mobile market a change in costs for a particular type of call or customer is likely to result in price changes for that type of call or customer.[700] If the marginal cost of calling a mobile network falls, we would expect that to be reflected in lower prices for either FTM calls and/or bundles including FTM calls, but not in other services (such as line rental or BT Vision or, in general, bundles that do not include FTM calls). Since the inclusion of FTM calls in bundles has been limited, we would expect the primary effect to have been on the prices of FTM calls. Hence the evidence implies that historically BT, at least, has not fully passed through reductions in MTRs.

2.792 The evidence provided on the historical behaviour of other FCPs is limited (they are in aggregate included in the 'basket' but we have not seen further or more detailed evidence). We note that they collectively make up around half of the fixed market, and their incentives may not be the same as BT's.

2.793 But there are two reasons why we might not expect historical evidence to be a good guide to the future. First, if FTM calls are more widely included in bundles in the future, there is more scope for prices to be adjusted in more subtle ways. Second, BT's commitments to reducing the cost of FTM calls may influence it to pass on MTR cuts more directly and completely (at least in the short term). This does not apply directly to all FCPs, but we would expect BT's high-profile position and the level of competition in the fixed market to increase other FCPs' incentives to pass through MTR reductions.

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[698] BT Core Submission, §§53–56.
[699] In line with BT's commitments under the Terminate The Rate campaign. We note that the campaign was aimed at influencing this charge control and so BT reduced its prices when MTRs fell under the current charge control, rather than at the start of the campaign.
[700] See paragraphs 2.624 to 2.634 above.

2.794 Following Ofcom, and in the absence of pleadings to the contrary, we assume that the fixed retail market is competitive.[701] We would therefore expect cost savings to be passed through, at least to some extent, in the form of lower retail prices, just as we would expect the same to apply in the mobile retail market.

2.795 For these reasons, we would expect MTR cuts to be passed on to fixed-line consumers to some extent, although we cannot be confident that they will be fully passed on, and on balance we expect that fixed-line users will benefit (to some extent) from lower MTRs.

2.796 We also note that Ofcom's conclusion that fixed-line customers 'unambiguously benefit' from lower MTRs is not as simple as Ofcom implies. We expect fixed-line customers to benefit from lower prices, but there are two ways in which fixed-line customers could be made worse off:

(a) If MTF call prices increase (especially likely for pre-pay users), fixed-line users may receive fewer calls.

(b) If some mobile-only customers give up their handsets, some calls between those users and fixed-line customers will no longer take place. This effect might be expected to grow over time (since we expect lower MTRs to have a larger effect on the level of mobile subscriptions in the long term, once effects on upfront prices such as handset prices start to affect a larger proportion of current customers).

2.797 There is some dispute, but little or no submitted evidence, about the role of 'call externalities' and 'network externalities' in this case. We do not think it necessary to make a judgement on these matters since we are not trying to quantify the scale of loss (or of net gain) to fixed-line users.[702] We merely note that it is not clear-cut to conclude that there is a gain to allocative efficiency among fixed-line users, or that they will unambiguously benefit.

2.798 Finally, we note that around two-thirds of MCPs' net MCT income comes from FCPs in the UK, and one-third from 'other' sources (such as overseas operators). We have seen no argument or evidence as to the extent to which MTR cuts will be passed on to customers of other operators and accordingly we can make no judgement on the effects on allocative efficiency of benefits to those operators.

Implications of changes in subscribers and usage for allocative efficiency

2.799 As we noted at the start of this section,[703] Ofcom said that 'Allocative efficiency is maximized when there is an optimal distribution of goods and services taking into account costs of supply and consumers' preferences'.[704] Ofcom's assessment, and the arguments of various parties, appear implicitly to assume that *any* reduction in ownership or usage would have a negative effect on allocative efficiency.[705] We do

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[701] We note that the competitiveness of the fixed retail market was not within the scope of Ofcom's consultation process but had been examined separately. See Ofcom Statement, §7.192.

[702] We do not believe that these arguments rely on the presence of externalities. Ofcom argued that there was a benefit to allocative efficiency under LRIC since fixed-line users would pay lower prices and would make more calls. We merely point out that, at least under effect *(b)*, there is an opposing effect on the number of calls made by fixed users, and hence the outcome is logically ambiguous; and Ofcom has not provided empirical evidence to demonstrate a net gain.

[703] See paragraph 2.525 above.

[704] Ofcom Statement, §8.33.

[705] As noted in paragraph 2.581 above, Ofcom phrased its conclusion on allocative efficiency in its Core Submission (§32a) in terms of the effect on ownership and usage.

not consider this to be necessarily the case on principle. In particular, Ofcom did not appear to have taken into account costs of supply.

2.800 The problem arises because when MTRs are above costs, MCPs may have an incentive to attract subscribers that are expected to have a positive CLV even if those subscribers have a willingness to pay for a subscription which is less than the costs that would be incurred by an MCP in providing that subscription. This is compounded by a model of competition that encourages frequent (subsidized) handset upgrades. Adding an additional subscriber to a mobile network (or equivalently not losing an existing subscriber) is allocatively efficient if:

(a) the benefits to society of that subscriber being on the network outweigh the costs; and

(b) this net benefit is not outweighed by other costs incurred as a result.

2.801 We have considered three categories of cost of a subscriber being on a network: the ongoing costs of maintaining the subscriber on the network, handset subsidy[706] to acquire the subscriber, and other acquisition costs. For existing subscribers, in the short run, only the first category may apply; but in the longer run we assume that most or all consumers may need to replace their handsets and may consider changing network (which brings little or no improvement to allocative efficiency compared with the benefit from that consumer first joining a mobile network) and hence all three may apply. The parties have submitted that the ongoing costs of maintaining a mobile user are relatively small[707] and that handset subsidies for pre-pay are now either removed entirely or low. However, acquisition costs in general are likely to be substantial. Ofcom presented evidence on CARS (customer acquisition, retention and service), which showed that they were in total larger than network costs (see Table 2.6 below).[708]

TABLE 2.6 **Costs for average 2G/3G operator, 2009**

	Average cost *£m*
Total annual network costs	1,252
CARS	1,822

Source: Ofcom, final decision, Table A9.6 (extract).

2.802 These costs must be set against the benefit of a consumer having a mobile phone, which may take two forms: first, the net benefit to the consumer himself, after paying applicable fixed and variable charges, of being able to make and receive calls; and secondly, any benefit to other consumers from that consumer having a mobile phone. The latter is generally referred to as a 'network externality'.[709] It has been the subject of considerable debate in previous charge control determinations, but the parties have made little reference to it in the current determination. In the previous mobile

[706] We note that handset subsidies are in a sense just a particular structure of retail prices: consumers acquire a mobile phone for less than its cost, but MCPs aim to earn back the subsidy in the form of higher monthly or usage charges over the customer lifetime. For post-pay subscribers (apart from SIM-only customers), the handset subsidy is typically large, but the MCP knows that it will recoup it in the form of monthly charges. For pre-pay subscribers, the handset subsidy is typically small, but the MCP will not recoup it if the customer does not use the handset enough (to make or receive calls or for other services).
[707] See paragraph 2.730 above.
[708] CARS includes expenditure such as advertising and marketing, handset and SIM card costs, discounts and incentives, MCPs' networks of retail shops and commission payments made to third party retailers, customer care, billing and bad debts. The CC has previously found that the customer care and billing accounted for a small proportion of CARS spend—see Mobile phone wholesale voice termination charges, Section 8.
[709] This only includes benefits that have not been internalized: for example, a consumer may buy a mobile phone for a relative they wish to be able to contact. The benefit to that consumer from the relative being on the network has been internalized.

call termination inquiry the CC found that, in the circumstances of that case, the additional mark-up on LRIC proposed by Ofcom was not justified. The parties did not argue in their appeal documents that the charge should be reinstated.

2.803 When an MCP decides what costs it is prepared to incur, it considers the benefits to itself rather than the wider benefits. So an MCP may incur the costs of acquiring a customer because it believes that the customer will be profitable over the customers' 'lifetime', but that will not necessarily improve allocative efficiency. For example, the MCP may overestimate the profits it will earn; the customer may overestimate the benefit he will gain; and the MCP will not take into account the loss to other operators (either fixed or mobile) if the consumer either gives up or reduces usage of their products as a result. Setting MTRs above LRIC encourages MCPs to pursue customers including those whose acquisition does not contribute to allocative efficiency.

2.804 Vodafone argued that there was a demonstrable benefit to other consumers from a marginal consumer being on the network because at prices arising from a LRIC+ charge control, people do call that marginal consumer and derive value from doing so; and if the marginal consumer left the network, that value would be lost.[710] We do not dispute that—at least for some marginal consumers—there may in principle be a benefit to other consumers from their being on the network. However, we have seen no convincing evidence that this benefit is large relative to the consumer's own benefit. Vodafone emphasized that in its view this was not a network externality, though it did not elaborate whether it was because it was not an externality or because it was not related to the number of subscribers on the network.

2.805 As to the net benefit of the consumer, we can draw inferences on this for consumers who give up their mobile phone, or decide not to get one, as a result of price changes caused by MTR cuts. Economic theory tells us that a consumer will have a mobile phone if their benefit from it exceeds the costs of having it. If they give up their phone (or change their mind about acquiring one) as a result of the price increase, their net benefit from having the phone at the old prices must have been smaller than the price increase. If we believe that price increases will be relatively small, then the net benefit of these consumers must also be small.

2.806 Hence we can classify customers who would give up their phone in response to a price cut into two groups.[711] Some would only have a phone because of a subsidy (eg a handset subsidy). In the absence of network externalities, it is not allocatively efficient for those consumers to have a mobile phone, hence there is no loss of allocative efficiency when they leave. The second group is those who would have owned a mobile phone even without subsidy, but still valued being on it less than the price increase. If the price increase that causes them to give up their phone is small, then there is a loss of allocative efficiency,[712] but it must also be small (unless network externalities are substantial).

2.807 We asked Vodafone about this in its hearing. It agreed that some consumers were only on the network because they benefited from lower prices as a result of MTRs being set at LRIC+ and would leave under the prices that setting them at LRIC would cause. However, Vodafone said that it did not follow that having these customers on the network today was inefficient, and said that the loss of their participation would cause a reduction in welfare. Vodafone argued that a world with higher participation would inherently generate more surplus because more calls would be made, both per subscriber and in total. If there is a network externality, that loss would be even

[710] Vodafone bilateral hearing, transcript §§78 - 80.
[711] Excluding customers who do not pay for their own phones (eg those whose phones are paid for by another family member).
[712] Assuming that prices before the increase are not below the allocatively efficient levels.

bigger. This should be set against the fact that fixed-line users pay more under higher MTRs (assuming some pass-through by FCPs).[713]

2.808 We do not rule out the possibility that a loss of users may reduce allocative efficiency, but we do not consider that it has been established. The loss of some customers may reduce efficiency, but the loss of other customers could increase efficiency, which would partly or completely mitigate efficiency loss from the former group. The lower price increases are, the less likely it is that there would be a significant loss of efficiency. These considerations indicate to us that for any given loss of users, the negative effects on allocative efficiency are less certain, and probably smaller, than the appellants would have us believe. We are therefore cautious in interpreting the implications of a loss of users.

2.809 The link between subscriptions and allocative efficiency is even weaker. While we do not rule out the possibility that some second subscriptions contribute to allocative efficiency, it is less clear that the loss of second subscriptions would significantly reduce the number of calls that take place or the ability of a subscriber to be contacted. Since most of the evidence available—even with the caveats we have placed on it—is in terms of subscriptions rather than subscribers, we are reluctant to infer too much on the implications for efficiency of a loss of subscriptions.

2.810 On usage, we note that the marginal price customers pay for calls is generally very different from the incremental cost of calls (which we understand to be around twice the LRIC of termination). For calls outside bundles, the price typically exceeds the cost and so it would seem uncontroversial that all calls that take place are 'efficient' in the sense that the benefit from them exceeds the cost of making them. Generally we would say that prices above marginal cost lead to too little usage, and prices below marginal cost lead to too much. Hence an increase in the volume of these calls would be allocatively efficient; a reduction would be inefficient.

2.811 For calls within bundles, which typically have a marginal price of zero (below incremental cost), the situation is less clear-cut. It is possible that, for example, if consumers were given a bigger bundle of calls, they would make calls that they valued very little, perhaps less than the cost of making those calls. Unless there are call externalities, these calls could in theory be inefficient. We have not examined the issue of call externalities (in the absence of sufficient evidence from the parties on the basis of which we could have done so), we merely note that a change in call volumes does not necessarily have straightforward implications for allocative efficiency.

2.812 Even the apparent benefits of a larger number of subscribers and calls must of course be set against any loss of efficiency in the form of, for example, higher prices for FTM calls (driving a wedge between the economic costs of those calls and the costs that FCPs actually pay) and consequent reduced volume of FTM calls. We believe that the above discussion illustrates the difficulty of drawing strong and robust conclusions on allocative efficiency in a complex market.

Overall assessment on allocative efficiency

2.813 We agree with Ofcom's conclusion that high-level economic theory gives no reason to prefer LRIC+ or LRIC. We do not necessarily agree with every aspect of Ofcom's reasoning, but the appellants' arguments on economic theory did not demonstrate that LRIC+ was either more allocatively efficient than LRIC, or closer to the hypotheti-

[713] Vodafone bilateral hearing transcript, §§60–63.

cal most efficient level than LRIC. We reach this conclusion on the basis of the arguments and evidence considered in the sections above, which we summarize here.

2.814 Ofcom said that setting MTRs at LRIC would lead to a small reduction in ownership, a small increase in mobile usage, and an increase in fixed usage. In light of the cases argued by the other parties, we have considered Ofcom's reasoning and conclusions on this subject in detail.

2.815 We considered the issues which would influence mobile ownership, and mobile and fixed usage; and the implications for allocative efficiency.

2.816 It seems likely that reducing MTRs to LRIC will lead to retail price increases[714] which will be focused on pre-pay users (especially low-usage customers); and to some extent low-usage post-pay customers. This is based on both economic theory and evidence of price changes in response to falling MTRs, as set out in the appellants' submissions (although we interpret the latter cautiously). We expect these groups to be more likely to be marginal customers (ie more likely to give up their phones in response to some form of price increase).

2.817 We think that Ofcom has underestimated the average size of price increases for these relevant groups,[715] which suggests that it also underestimated the effects on mobile ownership. One important issue is the form that price increases for pre-pay users would take. Ofcom's reasoning on the recovery of common costs suggests that in theory it may be possible to increase prices with little or no impact on subscriptions or usage if price increases take the form of fixed (or quasi-fixed) prices, which may extract consumer surplus without distorting consumers' consumption decisions. If this is possible, it would imply that there may be gains from reducing MTRs which are not offset by other distortions to efficiency. Customers are heterogeneous, and so it is plausible that some pre-pay customers would accept the introduction of some form of fixed or quasi-fixed charge without adjusting their consumption, which would be efficient. However, EE's survey evidence suggests that a significant proportion of pre-pay customers would be resistant to paying this sort of charge.[716] The range of tariff structures offered to pre-pay customers is relatively limited (compared with the range of post-pay tariffs) and hence it is likely to be difficult to induce some pre-pay customers to pay fixed charges without affecting those who are resistant. If MCPs instead focused price increases on usage charges, we would expect that to cause a reduction in usage. Hence we consider that MCPs are unlikely to be able to increase pre-pay prices without reducing ownership, usage or both.

2.818 However, the available evidence suggests that price increases for low-usage customers are still likely to be modest. A reasonable assumption would be that the average price increase for pre-pay users is in the range of £5 to £8 per year (depending on whether MCPs are able to impose significant price increases on inactive/barely active subscribers and second subscriptions).[717] Since this is the average, there is a possibility that some customers would see increases well above this level. In particular, if we believed that there is a sizeable category of pre-pay users who make a low number of outgoing calls, but receive a large volume of incoming calls, and that price increases could be targeted at that category, we might expect that it would receive

[714] By 'price increases' we refer to increases in any of the prices paid by customers, which may include prices for usage, subscription/access, or joining the network (eg handset prices).
[715] We also explained that, in contrast to Ofcom, we believe that high-usage post-pay customers are unlikely to face price increases; we believe they are more likely to see price decreases.
[716] As noted, we are cautious in interpreting this evidence, but consider that the difference in reactions to price increases of different types may be informative.
[717] See paragraph 2.737 above.

above-average price increases leading to reduced ownership.[718] However, data on calling patterns (which informs the price changes customers are likely to see) does not suggest that a sizeable category of this type exists.

2.819 We have also considered evidence on the responsiveness of consumers to price increases. We would normally expect this question to be addressed using empirical evidence, but Ofcom relied on little relevant evidence in its decision and we found that the evidence of the appellants did not allow us to a make a reliable assessment on the scale of reactions to price increases. This is further complicated by the fact that most evidence refers to the number of subscriptions rather than the number of subscribers.[719] We did not think that any of the evidence demonstrated that moving from LRIC+ to LRIC would lead to significant reductions in subscriber numbers, relative to the level of subscribers in the UK today.

2.820 As noted above, the form that price increases take is likely to influence the effect on subscriber numbers. We consider that the most likely effect on pre-pay users would be call price increases (possibly mitigated for higher users by some form of reward or add-on), as we have already witnessed since the new charge control came into effect. We expect an increase in call prices to have a relatively small effect on subscriber numbers. The appellants argued that other forms of price increase were possible, and we would expect some other forms to have a larger effect on subscriber numbers. An increase in charges to join a network (such as a reduced handset subsidy) might have a relatively small immediate effect but be a deterrent in the longer term as people replace their handsets. The introduction of quasi-fixed charges (such as expiring credit[720] or a minimum monthly top-up) could constitute a large percentage price increase for low-usage customers and adversely affect those customers who value the flexibility of pre-pay, and could thus have a larger effect on subscriber numbers than an increase in call prices.

2.821 However, we are not persuaded that price changes of these types are likely. In this context we note that the MCPs' response to the first—and largest—cut in MTRs, from the previous charge control to the first year of this control, has mainly taken the form of call price increases. It is not clear to us that the smaller difference between LRIC+ and LRIC would prompt a different type of response. It does seem plausible that MCPs have reduced pre-pay handset subsidies partly in response to a fall in MTRs (and partly to prevent box-breaking), but pre-pay handset subsidies are now very small or zero so there is limited potential to reduce them further. We do not think that the commercial case for the introduction of quasi-fixed charges has been strongly made and accordingly give the possibility little weight in our analysis.

2.822 We also considered the role of MVNOs in the UK market if the MCPs do increase their prices. The parties' pleadings and evidence said very little about the MVNOs. Three argued that at least some low-price MVNOs would not increase their prices in response to a cut in MTRs,[721] and said that very cheap handsets are widely available. We were not entirely convinced that MVNOs would have no pricing reaction to MTR cuts, since we would expect their profits to be affected by changes in MTRs (and they may also have a competitive reaction if the four national MCPs increase

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[718] Specifically, our concern would be that a reduction in MTRs would have a substantial detrimental effect on the profitability of this group; and since it makes a relatively small number of calls we might expect members of this group to be more likely than average to give up their mobile phones in response to a price increase.

[719] We do not presume that if a consumer gives up a second subscription there is no consequent loss of allocative efficiency. However, we agree with Ofcom that the loss is likely to be smaller than the loss of a consumer's only subscription, and we have seen no evidence to the contrary.

[720] Or, strictly speaking, the withdrawal of tariffs where credit does not expire, as discussed in the footnote to the third bullet point of paragraph 2.743 above.

[721] Three SoI, §7.65. See also Ofcom Core Submission, §52.

their prices to low users). We would only expect no direct effect on their prices if they attracted customers who have a balanced calling pattern (ie probably those who make a lot of calls, based on what we know about calling patterns[722]), in which case their tariff structures may not be a viable alternative for low-use consumers who are priced out by the four national MCPs. But we consider it more likely that if all four national MCPs were to introduce quasi-fixed charges, there would be a gap in the market for MVNOs to offer pre-pay without quasi-fixed charges.[723] We consider that this further reduces the risk of a significant fall in subscriber numbers. As to handset prices, we have found that cheap handsets are available from MVNOs and from retailers without contract, which suggests that an increase in handset prices by the MCPs would have limited effect on subscriptions. An alternative strategy for MCPs would be to charge for a SIM card, but *(a)* SIM cards are less likely to need replacement than handsets so the effect would be less, and *(b)* it again seems likely that at least some MVNOs would continue to offer SIMs without charge as a strategy to attract certain customer segments.

2.823 Overall, in light of the available evidence we find certain aspects of the reasoning of EE, Vodafone and Telefónica convincing and prefer it to Ofcom's, particularly regarding the form of price changes that are likely to follow a reduction in MTRs. We believe that Ofcom's reasoning has led it to underestimate the negative effect on mobile ownership of adopting LRIC in preference to LRIC+. We also consider that there are no good grounds to expect LRIC to cause an increase in mobile usage (an increase or decrease are both possible); and Ofcom may have overstated the increase in fixed usage. However, the appellants have not provided convincing evidence that the scale of decline in the number of users would be significant; and the appellants have not demonstrated that this constitutes a significant negative effect on allocative efficiency. Most of the evidence available relates to the number of subscriptions, and we treat it with caution for three reasons: (1) most of the available evidence is not robust, is not aimed at the difference between LRIC and LRIC+, or both; (2) it is not clear how a decline in subscriptions translates into a loss of users; and (3) as we set out above, the loss of a subscription that was being subsidized (ie its owner valued being on the network less than the cost of being on the network) is not necessarily allocatively inefficient. To the extent that there is some loss of 'efficient' users, that has to be set against all the other effects of higher MTRs (such as higher FTM prices). Therefore we agree with Ofcom that allocative efficiency grounds alone do not provide a clear answer as to whether a LRIC or LRIC+ cost standard should be preferred. For these reasons, bearing in mind the statutory framework within which Ofcom was required to make its decision and the burden being on the appellants to prove that Ofcom erred in its conclusion that LRIC was, in particular, appropriate for the purposes set out in section 88(1)(b) of the Act, and notwithstanding those matters on which our conclusions differ from the conclusions reached by Ofcom under this part 2(a), we do not believe that Ofcom was mistaken, in respect of the appropriateness or otherwise of its choice for promoting efficiency,[724] in choosing a LRIC cost standard.

2(b) Dynamic efficiency

2.824 Ofcom defined dynamic efficiency as 'the ability and incentives of MCPs to continue to invest in the services they currently provide, and to innovate by launching new or

[722] See paragraph 2.35 above.
[723] Even if all MVNOs need to increase their retail prices in some form, we would expect that some of them may seek to differentiate themselves from the four national MCPs by increasing usage prices but avoiding quasi-fixed charges.
[724] Section 88(1)(b)(i) of the Act.

improved services'.[725] We note that although the effects on competition would be classified as dynamic, they are assessed separately and not under this heading.

Ofcom's position

2.825 Ofcom concluded that in terms of the impact on dynamic efficiency, the potential difference between LRIC and LRIC+ was small, but may marginally favour LRIC+.[726] However, Ofcom clarified that it had not found that LRIC would definitely harm dynamic efficiency.[727] LRIC would result in MCPs receiving less revenue from the fixed sector (and from other sources such as overseas operators). But Ofcom viewed the shortfall as not substantial in the context of the overall size of the mobile sector; and a strong (if incomplete) waterbed effect reduces the impact. It also noted that any negative effect should be balanced against the possibility that lower MTRs would increase smaller MCPs' incentives to invest, and that FCPs might increase their investment if they did not completely pass through lower MTRs to their customers.[728]

2.826 Ofcom also noted that whatever the level of MTRs, MCPs would continue to have incentives to invest in infrastructure to deliver call origination and access, whose assets were largely shared with termination.[729]

2.827 Ofcom observed that it had seen no evidence of materially different levels of investment and innovation in countries with low MTRs.[730]

2.828 Ofcom's view appeared to be based in part on Three's argument that lower MTRs would enhance its profit opportunities and hence have a beneficial effect on dynamic competition and investment.[731] Ofcom noted that Three had the lowest profitability of the national MCPs yet supported LRIC, and said that if concerns over dynamic efficiency were correct, Ofcom would have expected Three to be concerned about lower MTRs reducing its profits; yet Three fully supported the adoption of LRIC.[732]

Views of the appellants

Everything Everywhere

2.829 EE observed that if the waterbed effect was weaker, or the difference between LRIC and LRIC+ was larger, than calculated by Ofcom, then any harm to dynamic efficiency would be greater than Ofcom concluded.[733]

2.830 EE relied on the statement of Pippa Dunn, who said that EE already generated low returns; that reducing MTRs might lower them further; and that EE was undertaking and preparing for considerable investment. Ms Dunn concluded that '[✂]'.[734]

2.831 In EE's Core Submission, Dr Walker claimed that it was unclear why Ofcom did not agree that dynamic efficiency concerns *definitely* favoured LRIC+.[735]

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[725] Ofcom Statement, §8.45.
[726] Ofcom Statement, §A3.92.
[727] Ofcom Defence, Annex A, §227.
[728] Ofcom Core Submission, §32b.
[729] Ofcom Statement, §8.50.
[730] Ofcom Statement, §8.51.
[731] Ofcom Statement, §8.51.
[732] Ofcom Defence, Annex A, §224e.
[733] EE NoA, §81.
[734] EE NoA, W/S Dunn I, §§121–129.
[735] Walker III expert report, §62.

Vodafone

2.832 Vodafone argued that the mobile telecommunications sector was characterized by rapid technological change and innovation, and hence Ofcom should have attached more weight to the desirability of optimizing incentives for investment; and claimed that Ofcom had 'counted twice' considerations that LRIC+ acted to the detriment of smaller MCPs.[736] We take this to be a criticism of the weight Ofcom attached to these considerations in its overall decision on LRIC and LRIC+, rather than a critique of Ofcom's arguments in this area.

Ofcom's Defence

2.833 Responding to EE, Ofcom said that it was common ground that if MCPs were unable to recover lost revenues from lower MTRs, their returns would be lower; although it noted that EE did not claim that it would be unable to do so.[737] It also said that MCPs would require significant capital expenditure in the near future.[738] However, it did not place much weight on historical profitability.[739]

2.834 Responding to Vodafone, Ofcom said that it gave due weight to this consideration, and did not give extra weight to considerations that may apply under more than one heading.[740]

Statements of intervention

Three

2.835 Three supported some of Ofcom's arguments.[741]

2.836 Dr Kalmus for Three argued that lower MTRs could only have a 'marginal impact' on dynamic efficiency because the Ofcom model showed that much demand growth would come from mobile data services rather than voice.[742] He also argued that spectrum auctions may serve as a 'pressure release valve' because if industry profits decreased, all firms would bid less for spectrum (either because the value of the spectrum was reduced by lower MTRs, or because less funds were available). This was likely to reduce the price of spectrum, mitigating reductions in profitability.[743]

Assessment of effects on dynamic efficiency

2.837 We have found that the waterbed effect is likely to be strong[744] and hence the effects on MCPs' profits are likely to be relatively small.

2.838 As to the direction of any effect, we disagree with Dr Walker; Ofcom has explained the reasons it considers that the effects of lower MTRs could be ambiguous, and they have not been challenged. We agree with Ofcom that the effects are likely to favour LRIC+, if anything.

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[736] Vodafone NoA, §§48.5 & 6.
[737] Ofcom Defence, Annex A, §232d.
[738] Ofcom Statement, §10.35.
[739] Ofcom Defence, Annex A, §232a.
[740] Ofcom Defence, Annex A, §§233–238.
[741] See, for example, Three SoI, §8.21, and Three SoI, §8.22c.
[742] Three SoI, Kalmus expert report, §6.2.
[743] Three SoI, Kalmus expert report, §6.7.
[744] See paragraph 2.595 above.

2.839 As to the scale of any effect, we have not seen anything to persuade us that the level of MTRs is likely significantly to affect MCPs' incentives to invest. We agree with Ofcom that MCPs' incentives to invest are driven by many factors other than the level of MTRs, especially because many of the assets used to provide termination are also used to provide other services.

2.840 To the extent that EE has an argument, it appears to be based on the effect of lower MTRs on MCPs' cash flows and subsequent *ability* to invest, but *(a)* the effect on cash flows is very small as a proportion and *(b)* we have not seen any evidence that investment is constrained by cash flows. We discuss this in more detail in our assessment of Reference Question 4.

2.841 However, we do not agree with all the arguments made by and in support of Ofcom. We disagree with Ofcom's view that Three's support for LRIC implies that there are no valid concerns about effects on dynamic efficiency. Three's support merely indicates that Three expects the overall effect of LRIC on its profits in the long term to be positive. That does not rule out the possibility that LRIC would adversely affect Three's, or other MCPs', investment incentives; and a positive effect on Three's profits does not imply a positive effect on other MCPs' profits.

2.842 Overall, we agree with Ofcom's conclusion that there is likely to be little effect on dynamic efficiency from choosing LRIC over LRIC+.

3. Vulnerable customers

2.843 In the introduction to this reference question we set out that, in accordance with its duties under the Act, Ofcom must have regard to the position of a number of categories of consumer, in so far as Ofcom considers them relevant in the circumstances.[745] The need to have regard to those on low incomes,[746] the requirement not to discriminate unduly against particular persons, or a particular description of persons[747] and the obligation on Ofcom to ensure that a condition imposed appears to them to be appropriate for the purposes of, among other things, conferring the greatest possible benefits on end users, constitute the statutory framework within which this part of Ofcom's analysis falls.

2.844 Ofcom set out in its statement that it considered people on low incomes and/or in lower socio-economic groups to be the most vulnerable, as they could least afford an increase in prices.[748] Ofcom defined vulnerable customers as:[749]

(a) people with annual income of less than £11,500; and

(b) people who belong to the socio-economic groups D and E.

2.845 Ofcom declared itself to be most concerned about those who had only one subscription and were mobile-only, since they had no countervailing benefit on the fixed side and the loss of their mobile access would be more significant to their welfare than if they had a fixed line.[750] Most of the appellants have argued their cases based on Ofcom's description of vulnerable customers, although it has been pointed out[751] that

[745] See paragraph 1.20.
[746] Section 3(4)(i) of the Act
[747] Section 47(2)(b) of the Act
[748] Ofcom Statement, §8.119, and see paragraph 2.18.
[749] See Ofcom Wholesale Mobile Voice Call Termination Statement, §8.119 (15 March 2011).
[750] Ofcom Statement, §§A3.277 & A3.278.
[751] Three SoI, §§9.40–9.44.

this is a broad definition encompassing a large proportion of the UK population; and the income threshold will include consumers such as students who are not necessarily considered to be vulnerable, while groups D and E make up 28 per cent of the UK population, not all of whom are obviously vulnerable. Hence Three argued that Ofcom's definition should be regarded as illustrative only.

Summary of Ofcom's rationale and methodology

2.846 The potential impact on vulnerable consumers is one factor in Ofcom's decision. Ofcom stated:[752]

> Our primary duty under the Act is to further the interests of citizens and consumers.[753] In performing this duty, we are required to have regard to the needs of particular vulnerable groups such as those on low incomes, the elderly and the disabled (insofar as we consider them to be relevant in the circumstances).[754] As well as looking at the interests of consumers in aggregate ... Therefore, greater weight (and greater focus) is placed upon the likely extent of loss of access to mobile services (mobile ownership) among these groups ...

2.847 As to the role of vulnerable customers in its decision between LRIC and LRIC+, Ofcom said: '… if we considered the potential equity concerns to be material, or we thought that pure LRIC resulted in net consumer detriment then this would affect our decision between LRIC+ and pure LRIC'.[755]

2.848 Similarly, in the Defence Ofcom said:

> Ofcom considered that the equity effects on vulnerable consumers specifically should be a significant factor in the choice between pure LRIC and LRIC+ only if the adoption of one rather than the other would be likely to give rise to a significant overall detriment to such consumers.

Ofcom said that its analysis showed that this was unlikely to be the case.[756]

2.849 Ofcom analysed the likely negative impact in terms of potential reduced mobile ownership and higher mobile prices among vulnerable mobile-only customers, and the likely benefits to fixed-only customers. Ofcom concluded that vulnerable customers were likely to be more price sensitive than average and so (by Ofcom's logic explained under the heading of 'Allocative efficiency'[757]) would face relatively small price increases, if any; and hence not many vulnerable customers would drop their mobile subscriptions. Ofcom gave little weight to higher mobile prices, and found that there was likely to be some countervailing benefit to vulnerable fixed customers.[758] Hence: 'Ofcom was more concerned about the potential for a reduction in mobile ownership among such consumers than the potential for a price rise affecting them'.[759]

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[752] Ofcom Statement, §8.118.
[753] Section 3(1) of the Act.
[754] Section 3(4) of the Act.
[755] Ofcom Decision, §A3.275.
[756] Ofcom Defence, A, §349.
[757] Summarized in paragraph 2.664 above.
[758] Ofcom Core Submission, §32.e.
[759] Ofcom Defence, A, §345.

2.850 Ofcom repeated the argument that the average price effect would be small (on average £2.50 per subscriber per year) and might be smaller for price-sensitive customers, and hence would not materially affect a consumer's decision to own a mobile phone. Ofcom noted that entry-level mobile phones were very cheap and that if MCPs increased their standard tariffs, they might have decided to leave MVNOs to target the bottom end of the market.[760]

Views of the appellants

2.851 We note that many of the arguments related to vulnerable customers depend on views as to the effect lower MTRs would have on prices for different customer groups. These were discussed extensively under the heading of 'Allocative efficiency' and we do not repeat them here.

Vodafone

2.852 Vodafone considered that Ofcom had significantly understated the risk that lower MTRs would reduce overall consumer welfare, and in particular of a material reduction in mobile ownership and subscriptions.[761] It argued that its survey evidence suggested that a significant proportion of those who would give up their mobile phone in response to a price increase would be vulnerable customers.[762]

Everything Everywhere

2.853 EE addressed the potential harm to vulnerable customers by considering three questions:[763]

(a) To what extent will vulnerable customers shoulder the burden of price rises resulting from reduced MTRs?

(b) How are they likely to respond?

(c) Are the resulting outcomes harmful to vulnerable customers?

2.854 EE argued that a large part of price increases would be aimed at low-spending prepay customers (and that the factual evidence since the publication of the Statement was consistent with this), and argued that many vulnerable customers fell into this group.[764] EE argued that price increases would primarily take the form of increased call charges, and so the question was to what extent vulnerable customers would reduce their usage or pay more to maintain their existing usage.[765] EE claimed that Ofcom failed to acknowledge that, if vulnerable customers faced increased call prices, their usage would fall and this would be an adverse consequence.[766] EE concluded that some customers would reduce usage and others would pay more to maintain usage, and both types would be harmed. It noted that Ofcom sought to play down the extent to which the latter was harmful[767] but claimed that this was clearly still harm since they would be forced to reduce their consumption of other goods.

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[760] Ofcom Core Submission, §52.
[761] Vodafone Core Submission, §§4.111–4.114.
[762] Vodafone NoA, §§52.3–52.5.
[763] EE Core Submission, §146.
[764] EE Core Submission, §§148–150.
[765] EE Core Submission, §155.
[766] EE NoA, §142.
[767] Ofcom Statement, §A3.296.

Hence an increase in mobile charges for vulnerable customers was 'highly undesirable' regardless of how they responded.[768]

2.855 EE argued that the proportion of low-income adults without a mobile phone was double the figure for the population in general and ten times that for the wealthiest group, suggesting that cost factors may play a major role in mobile access and inferring that higher prices would deter ownership among vulnerable customers especially. EE argued that Ofcom did not adequately analyse the extent to which adopting LRIC would inhibit mobile take-up by new customers.[769]

2.856 EE argued that a change in pre-pay pricing structures might harm vulnerable customers' budgeting flexibility.[770]

2.857 EE argued that in comparing any harm caused by MTR cuts to mobile subscribers against any benefit to fixed subscribers, Ofcom had effectively assumed that all the benefits of lower MTRs would be fully passed through. EE also claimed that Ofcom accepted that a number of fixed customers on BT Basic would not benefit.[771]

2.858 Dr Walker argued further that since there were more mobile-only vulnerable customers (who were harmed by lower MTRs) than fixed-only vulnerable customers (who benefited from lower MTRs), MTR cuts would have undesirable distributional effects. In his third report (attached to EE's Core Submission), he claimed that Ofcom had not adequately addressed these criticisms since much of its argument relied on pre-pay charges to vulnerable customers not rising, but he noted that these prices had already risen.[772]

2.859 Dr Walker argued that any increase in prices to new customers would feed through to higher prices for existing customers, because MCPs would know that their existing customers would not have the option to switch to a cheaper tariff from another operator.[773]

Statements of intervention against Ofcom

Telefónica

2.860 [✂][774] It also argued that a significant proportion of fixed-only vulnerable customers were on the BT Basic tariff and that it was 'highly unlikely' that they would benefit from a reduction in MTRs.[775]

Ofcom Defence

2.861 Ofcom claimed that it was right to 'apply a materiality threshold' since the equity effects on vulnerable customers should be an important factor in the choice between

[768] EE Core Submission, §§161–164.
[769] EE NoA §§136 & 143.
[770] EE NoA, §151, and Walker I expert report, §241.
[771] EE NoA, §153.
[772] EE, Walker II expert report, §§170–172.
[773] EE NoA, Walker I expert report, §237. In his third expert report, adduced with EE's Core Submission, Dr Walker said that Ofcom's response to this argument—saying that MCPs could and did discriminate between existing and new customers (see Defence Annex A, §360)—did not rebut his point. Walker III expert report, §177.
[774] Telefónica SoI, §§21–27.
[775] Telefónica Core Submission, §58.

LRIC and LRIC+ only if the adoption of one rather than the other would be likely to give rise to a *significant* overall detriment, which was not the case in Ofcom's view.[776]

2.862 Ofcom argued that a low elasticity of demand implied a small reduction in usage, and interpreted EE as saying that usage elasticities for low-value users were low.[777] Ofcom responded to EE's criticism that vulnerable customers would be made worse off even if they did not give up their mobile phones by saying that the average price increase was likely to be small (£2.50 per subscriber per year, and likely to be smaller for more price-sensitive customers such as vulnerable customers).[778]

2.863 In response to a criticism from EE about the consistency of its arguments, Ofcom clarified that 'vulnerable customers are more likely [than consumers in general] to be price sensitive customers in their demand for mobile subscriptions, despite being mobile-only'.[779] Ofcom acknowledged that usage elasticity was generally low and agreed with EE that *some* customers might already have low usage and be unable to reduce it further, since customers were in general heterogeneous and Ofcom's research found that usage among low-income consumers varied considerably.[780]

2.864 In response to EE's argument that an increase in prices for new pre-pay customers would reduce the competitive pressure on prices for existing pre-pay customers, Ofcom noted that MCPs could and did distinguish between prices for new and existing customers and would continue to have an incentive to do so.[781]

2.865 In response to EE's argument that a change in pre-pay pricing structures might harm vulnerable customers' budgeting flexibility, Ofcom argued that MCPs had the ability to take consumer preferences into account when designing tariffs. If consumers preferred higher usage charges with low fixed fees, rather than the reverse, MCPs could accommodate that.[782]

2.866 Ofcom denied that all mobile-only customers would be 'unambiguous losers', as Dr Walker claimed, since the extent to which mobile users lost or gained depended on their usage profile.[783]

2.867 Ofcom accepted that if usage prices increased, usage was likely to decrease, but suggested that the reduction in usage would be small since *(a)* some evidence suggested low elasticity of demand for usage, and *(b)* mobile-only vulnerable customers might not be able to reduce their usage by substituting to an alternative.[784]

Statements of intervention in support of Ofcom

Three

2.868 Three submitted a lengthy SoI. We have focused on the point on which Three most clearly relied, as set out in its Core Submission.

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[776] Ofcom Defence, Annex A, §§348 & 349.
[777] Ofcom Defence, Annex A, §350.
[778] Ofcom Defence, Annex A, §364.
[779] Ofcom Defence, Annex A, §354.
[780] Ofcom Defence, Annex A, §356.
[781] Ofcom Defence, Annex A, §361.
[782] Ofcom Defence, Annex A, §363.
[783] Ofcom Defence, A §366.
[784] Ofcom Core Submission, §54.

2.869 Three claimed that Ofcom was right to focus on the risk of not having access to a telephone service at all, and that Ofcom's statutory duties could not properly extend to preventing all price increases.[785]

2.870 Three argued that the other MNOs' claims were overstated, and in particular that vulnerable customers would not be priced out of the market by the adoption of LRIC because, inter alia, *(a)* many new pre-pay subscribers already owned handsets and those that did not could get cheap basic or second-hand handsets; and *(b)* there were in any case cheaper pre-pay tariffs on the market from MVNOs (including one which had publically stated that it would not increase prices following Ofcom's decision, and which had launched a £10 pre-pay handset).[786] Mr Ness for Three cited MVNOs such as TalkMobile and Giff Gaff that offered pre-pay calls priced well below prevailing rates from the MCPs. He also referred to Three's own low-price tariff.[787] In this regard, Three asserted that 'No vulnerable customer is likely to be dissuaded from obtaining a mobile subscription by a material increase in price if that is the only means by which he can have a telecommunications service'.[788]

2.871 Three also claimed that the other MNOs' evidence on price changes in reaction to the decision was self-serving, adding that the reduction of handset subsidies was driven by a desire to reduce box-breaking rather than the reduced profitability of customers; and that the reduction in MTRs was being used as an excuse for price increases and tariff changes that the MCPs were planning to introduce for other reasons.[789]

2.872 Three claimed that even if the other national MCPs were to increase prices to vulnerable customers, such customers may easily secure better deals in the market. It claimed that such deals existed before the decision to adopt LRIC but were likely to become more common following it.[790]

BT

2.873 BT argued that Vodafone, EE and Telefónica's arguments overstated the extent to which price increases would fall on vulnerable customers[791] (which we have discussed under the heading of 'Allocative efficiency'); and that there was no justification for a levy on MTRs to support ownership of mobile phones by vulnerable customers, and that any such levy would distort competition between fixed and mobile operators[792] (which we have discussed under the heading of 'Competition effects').

2.874 BT argued that Vodafone, EE and Telefónica's arguments depended on the premise that competition for post-pay customers was fierce and that this prevented price increases for post-pay customers, hence price rises must fall on pre-pay customers.[793] BT argued that prices would in fact change for all customer segments

[785] Three Core Submission, §7.6.
[786] Three Core Submission, §§7.8 & 7.9.
[787] Three SoI, W/S Ness, §6.22 and §2.11(b) respectively. We note that Three's low-price tariff, Flat 12, is not marketed or available in stores or via the Internet, and we understand that it is only available to consumers who have obtained a Three SIM and call the Three service centre. See Three bilateral hearing transcript, pp47 & 48.
[788] Three SoI, §9.67.
[789] Three Core Submission, §7.10.
[790] Three SoI, §9,96.
[791] BT Core Submission, §§59–64.
[792] BT SoI, §§48–59, and BT Core Submission, §§65–68.
[793] BT SoI, §39ff.

depending on the extent of the reduction in termination revenue for each segment.[794,795]

2.875 BT argued that for a customer to give up his or her phone the following conditions must all hold. The customer must:[796]

- be one whose profitability is significantly [negatively] affected;
- be unlikely to benefit from increases in inbound calling as a result of lower MTRs;
- be on the best available package for their needs;
- have a low consumer surplus associated with their mobile ownership; and
- attach a low option value to mobile ownership.

2.876 BT argued that a priori this would not be a large group, and that the appellants had not produced significant credible evidence to the contrary.

2.877 Dr Maldoom for BT argued that customers might switch to alternative suppliers; and that lower MTRs would lead to a reoptimization of prices, meaning that vulnerable customers might be able to move to a different package and limit the extent to which they faced price rises.[797]

The appellants' reply

Vodafone's reply

2.878 In response to BT, Vodafone explained that it was not suggesting a separate levy included to support mobile ownership, and denied that it was seeking a network externality surcharge.[798]

EE's reply

2.879 In response to Ofcom's claim that vulnerable customers were relatively insensitive to price increases and so their *usage* would not be significantly affected,[799] Dr Walker contended that they would still be harmed.[800]

2.880 In reply to Ofcom as to whether increased prices for new pre-pay customers reduced pricing pressures for existing customers, Dr Walker argued that this missed the point: an increase in price to new customers reduced the attractiveness of moving between MCPs (ie this would become a weaker competitive constraint) and so prices to existing customers may rise.[801]

2.881 As to whether fixed-only users would unambiguously gain and mobile-only users may not unambiguously lose (since they may face lower retail prices, and will also receive

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[794] BT SoI, §42.
[795] Given our assessment under 'Allocative efficiency', we do not think BT's first point is correct: we examined these arguments in detail and they did not depend on this premise. BT's second point is consistent with our conclusions, although for clarity we would refer to the *net* reduction in termination revenue. Hence we do not consider these points further below.
[796] BT SoI, §44.
[797] Maldoom I expert report, §§135a,b & 183a.
[798] Vodafone Core Submission, §4.116.
[799] Ofcom Defence, Annex A, §350.
[800] EE Core Submission, Walker III expert report, §173.
[801] EE Core Submission, Walker III expert report, §177.

more FTM calls as prices rise) as Ofcom contended,[802] Dr Walker responded: he did not expect pre-pay prices to fall; he said that the detriment to mobile-only customers would be reduced if they received more FTM calls (an argument that he attributed to Ofcom, although it is not clear that Ofcom made it); but Ofcom failed to acknowledge the converse, that the benefit to fixed-only customers was reduced because they would receive fewer calls from mobile users.[803]

2.882 Dr Walker responded to Dr Maldoom's argument that lower MTRs would lead to a reoptimization of prices, meaning that vulnerable customers would be able to move to a different package and limit the extent to which they faced price rises.[804] Dr Walker described this as an 'odd argument' and criticized it on the grounds that customers would not be able to avoid price rises altogether; if they could, price rises would fail to increase MCPs' revenue and there would be no waterbed effect.[805]

Characteristics of vulnerable customers

2.883 Before assessing the arguments about the effects on vulnerable customers, it is instructive to summarize the available evidence on the characteristics of vulnerable customers. We have found that the price effects on any groups of customers is likely to depend on whether those customers are post-pay or pre-pay users, and the level of their usage. Therefore the characteristics of vulnerable customers will necessarily inform our assessment of the effects on them of lower MTRs.

2.884 Ofcom reported that 'those on low incomes/in the DE socio-economic group are more likely than the average mobile user to use pre-pay'.[806] This view is supported by Ofcom's Consumer Experience reports, which have consistently shown that a greater proportion of DE mobile phone users held pre-pay contracts than any other socio-economic group. They have also shown that incidence of pre-pay is highest among lower-income groups.[807] Ofcom had no information on the propensity for vulnerable customers to hold multiple subscriptions, but considered that it was likely to be a small minority.[808]

2.885 Ofcom concluded that *mobile-only* vulnerable consumers were more likely to be on pre-pay contracts, although it admitted that its data was insufficient to conclude that.[809] It did not conclude that their usage was necessarily less than that of average customers: 'Ofcom's research into low income customers (with income of up to £15,000 per year) found that usage varied considerably, from emergency use only to monthly expenditure of over £100 among some of those on the highest and lowest incomes in this group'.[810]

2.886 Ofcom found that more vulnerable customers were mobile-only than fixed-only: it reported that 25 per cent of DE adults lived in mobile-only homes and 12 per cent in fixed-only; and 28 per cent of adults with an income of less than £11,500 lived in mobile-only homes and 13 per cent in fixed-only.[811]

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[802] Ofcom Defence, Annex A, §366.
[803] EE Core Submission, Walker III expert report, §175.
[804] Maldoom I expert report, §§135b & 183a.
[805] EE Core Submission, Walker III expert report, §179.
[806] Ofcom Statement, Annex 3, §A.3.281, citing Figure 20 of its *Consumer Experience Report 2010*.
[807] Ofcom *Consumer Experience Report 2010*, Figures 19 and 20. Submitted as Exhibit EE NoA 10.
[808] Ofcom Statement, A3.277.
[809] See Ofcom Statement, Annex 3, §§A.3.267 & A.3.268.
[810] Ofcom Defence, Annex A, §356.
[811] Ofcom Statement, A3.278.

2.887 Dr Walker for EE said that low-income consumers were less likely to have mobile phones than higher-income consumers, noting that 20 per cent of people with incomes up to £11,500 did not have a mobile phone (compared with 9 per cent of all adults and 2 per cent of those with incomes over £30,000).[812] He also reported that 67 per cent of low-income adults had fixed-line phones, 80 per cent had mobile phones, and 31 per cent relied entirely on a mobile phone for telecommunications access.[813] 75 per cent of mobile users in this low-income group were on pre-pay (compared with 55 per cent of all mobile users, and 36 per cent of high-income users).[814]EE claimed that vulnerable consumers were predominantly low-usage pre-pay consumers. It cited statements by Ofcom, BT, Telefónica and Three in support of this; however, we note that all the citations support vulnerable customers being predominantly pre-pay, but say nothing about usage.[815]

2.888 Three argued that the link between income and usage was unclear.[816] Mr Ness for Three submitted information on customers classified using Mosaic data.[817] Mr Ness looked at the Mosaic categories of consumer to determine which were best correlated with the socio-economic groups D and E that Ofcom had used as part of their description of vulnerable customers. He then examined the monthly spend of customers in those categories.

2.889 Mr Ness presented the some of this data in his Witness Statement.[818] Table 2.7 below shows, for each of five Mosaic categories, how they index against groups D and E, the two lowest bands of household income, and three level of spending on mobile phone usage. An index of over 100 means that that category is more likely than other categories to fall into a selected group. For example, consumers in the 'Claimant Cultures' category have an index of 205 against group D, which means that these consumers are 2.05 times more likely than the average customer to be in group D. Hence we find that these are the five Mosaic categories most closely correlated with Ofcom's definition of vulnerable customers.

TABLE 2.7 **Correlation between selected Mosaic categories, socio-economic groups, household income and monthly spend on mobile phone usage**

Group	*Claimant cultures*	*Upper floor living*	*Elderly needs*	*Terraced melting pot*	*Ex-council community*
Socio-economic group D	205	133	148	148	197
Socio-economic group E	319	254	350	137	193
Gross annual household income under £10,000	199	221	190	135	84
Gross annual household income £10,000–£19,999	171	149	175	136	44
Monthly spend under £25	96	83	119	86	103
Monthly spend £25–£45	110	155	45	137	94
Monthly spend over £45	119	137	41	155	86

Source: W/S Ness, p47, Exhibits SLN 31 & SLN 32.

2.890 This evidence indicates that three of these five categories over-index on monthly mobile phone expenditure of over £25 per month, whereas 'ex council community' are quite close to the average and 'elderly needs' greatly under-index (meaning that

[812] EE NoA, §136.1.
[813] EE NoA, Walker I expert report, §221, and EE NoA, §136.
[814] EE NoA, §136.2, citing Ofcom—'Consumer Experience 2010' Figure 20 submitted as Exhibit MW36.
[815] EE Core Submission, §117.
[816] Three SoI, §9.45a.
[817] Specifically Mosaic UK's 2009 Grand Index, a consumer classification produced by Experian. Mosaic types include 141 person types which are aggregated into 15 categories. Three's submission used data at the level of 15 categories. See Exhibit SLN4.
[818] See table on p47 of W/S Ness. Mr Ness did not include the 'Ex council community' column in his table, but the information was available in Exhibits SLN 31 & SLN 32. We include them here since they also over-index in groups D and E.

they typically had low expenditure). Mr Ness also provided evidence split by post-pay and pre-pay expenditure, showing that among the Three base these categories typically had [✂] of average monthly voice usage and pre-pay top up compared with other categories of consumer.[819] Further information submitted by Mr Ness suggested that these categories had medium to high expenditure on post-pay and, especially, pre-pay usage compared with other categories.[820]

2.891 This evidence supports Ofcom's view that vulnerable customers are heterogeneous in their usage. It is not perfect data because the consumer categories do not correlate perfectly with Ofcom's definition of vulnerable customers, but in the absence of evidence to the contrary we find no reason to believe that vulnerable customers are more likely than average to have low usage of mobile phone.

2.892 Ofcom stated that its defined vulnerable customers were 'likely to be sensitive to fixed charges'[821] but said that 'this suggests that operators are likely to seek a way to avoid levying subscription fees on such consumers'.[822]

2.893 Ofcom argued that mobile-only customers' demand would be less elastic (and 'relatively inelastic'), with respect to subscriptions, than customers with fixed and mobile access.[823] This was because mobile ownership was an important service for them and they were unlikely to give up their phone but they would have to pay more to keep it.

2.894 [✂][824] [825] [826] However, since we have found no evidence to support EE's claim that vulnerable customers are typically low users, this information does not inform our view of vulnerable customers' reaction to price changes.

2.895 In conclusion, we find that vulnerable customers are more likely to be mobile-only than fixed-only, and more likely than average to use pre-pay rather than post-pay. We find no evidence that they are particularly low users, and there is little evidence about the elasticity of demand (for usage or subscription) specific to vulnerable customers.

Assessment of effects on vulnerable customers

2.896 The question we have to assess is the effect of lower MTRs on vulnerable customers, and whether that has a bearing on the choice between LRIC and LRIC+. We have found it helpful to break down our analysis into five more focused questions:

(a) Will vulnerable customers face significant price increases?

(b) Will a significant number of vulnerable customers give up their mobiles?

(c) Even if they do not, should we worry about income effects on vulnerable customers?

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[819] W/S Ness, p48.
[820] Exhibit SLN32, p2.
[821] Ofcom Statement, A3.294.
[822] Ofcom Statement, A3.294.
[823] See Ofcom Statement, §8.121.
[824] See summary at EE Core Submission, §158.
[825] EE bilateral hearing transcript, pp73 & 74.
[826] EE Core Submission, W/S Dunn II, §34, Table 1, §40 & Figure 2. We note that Ofcom challenged the admissibility of the latter two references since they contained data based on Orange's price increases in July 2011 and hence this data was not available at the time of the consultation or Statement.

(d) What are the effects on usage and are there countervailing benefits?

(e) How much weight should be given to vulnerable customers when setting MTRs?

2.897 We consider these in turn below.

Will vulnerable customers face significant price increases?

2.898 We discussed likely price effects in detail in our assessment of allocative efficiency above. We concluded that price increases for pre-pay users were likely but we were not convinced that many users would face increases significant enough to cause them to give up their subscriptions. We considered what form price increases were likely to take and we concluded that price increases for pre-pay customers were most likely to take the form of increased call prices. We did not dismiss the possibility of an increased upfront charge to join a network (in the form of reduced handset subsidies or another one-time charge) but we noted that the scope to reduce handset subsidies was very small and that the availability of very cheap handsets and competition from other MCPs and MVNOs would likely mean that customers could still join a mobile network for a low upfront charge.

2.899 The available evidence suggests that vulnerable customers are disproportionately likely to be pre-pay users. We do not claim that all pre-pay users are vulnerable, but to the extent that we have found a negative effect of lower MTRs on that group, we would expect that negative effect to be felt by a more significant proportion of vulnerable customers than of other customer groups.

2.900 We also note BT's argument that only customers whose profitability is significantly (negatively) affected would be likely to give up their mobile phone. We do not think this is correct. MCPs cannot perfectly target price increases, especially for pre-pay users where there is arguably less price discrimination. If a group of customers' profitability is reduced, the whole of that group may face price increases, even though some individuals may not become less profitable.

2.901 Given that vulnerable customers are heterogeneous and their usage is varied, it is possible that some would face significant price increases. However, we have seen no reason to believe that vulnerable customers would face larger price increases than other customers, so the scale of price increases that we have found to be a reasonable indicator (£5 to £8 per year) seems to apply here. This may be a more significant price increase to a vulnerable customer than to another consumer, but it still seems to us a relatively small amount.

Will a significant number of vulnerable customers give up their mobiles?

2.902 We were not persuaded that a significant proportion of all customers would give up their mobile phones as a result of price changes caused by lower MTRs. However, it seems plausible that a greater proportion of vulnerable customers would give up their mobile phones: partly because we believe that vulnerable customers are disproportionately likely to see price rises (since they are more likely to be pre-pay users), and partly because we believe that vulnerable customers are disproportionately likely to be income constrained.

2.903 With regard to Three's claim that 'No vulnerable customer is likely to be dissuaded from obtaining a mobile subscription by a material increase in price if that is the only

means by which he can have a telecommunications service',[827] this appears to be pure assertion and implies that no consumer would ever give up a telecommunications service no matter what the price is.

2.904 We place limited weight on Three's argument that customers may easily secure better deals from other operators in response to a price increase.[828] We believe that the existence of other operators (such as MVNOs which target particular customer groups) would mitigate the effect of price increases. We do not think it is straightforward to conclude that *(a)* these operators would not also increase prices, or *(b)* all affected consumers would be willing to switch to them. Consumers take into account a variety of factors in making their subscription decisions and they are not driven entirely by price. We note in this regard that [✂],[829] whereas Three pursues a relatively low price strategy but uses unlimited data as a feature of many of its packages.[830]

2.905 Customers will give up their mobile phones in response to a price increase[831] if either *(a)* the mobile phone no longer provides value for money, or *(b)* the customer cannot afford to continue to use the mobile phone at higher prices. We do not claim that *(a)* is disproportionately likely to apply to vulnerable customers, but *(b)* clearly is.

2.906 Whilst we accept that care must be taken when assessing the survey evidence we have seen, it suggests that low-income customers may be more likely than others to give up their mobiles in response to price increases.[832] However, we did not think that the survey evidence provided a reliable indication of the number of low-income customers that would be likely to give up their mobile phones in response to a move from LRIC+ to LRIC.[833]

2.907 Since we believe that price increases to pre-pay users (and hence to the majority of vulnerable customers) are most likely to take the form of increased usage charges, we are not persuaded that a significant number of vulnerable customers would give up their phone in response. Most customers would have the ability to reduce their usage in response, allowing them to remain within their budget constraint. As to vulnerable customers on post-pay contracts, they may be able to switch to a less expensive package, or to a pre-pay contract under which they can save by reducing their usage.[834] Hence it does not necessarily follow that they would respond to a price increase by giving up their mobile phone. Therefore, we do not think it has been demonstrated that the effect on mobile take-up among vulnerable customers would be large.

Income effects on vulnerable customers

2.908 Ofcom has focused on the effects on mobile phone subscriptions. To an extent this reflects Ofcom's duties and objectives (for example, to further the interests of citizens in relation to communications matters and to secure the availability throughout the

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[827] Three SoI, §9.67.
[828] Three SoI, §9,96.
[829] [✂]
[830] For example, Mr Ness for Three described its popular One Plan as 'a tariff that would satisfy any customer's needs for voice, text and data—effectively that would be "unlimited"'. W/S Ness, §3.40.
[831] The same considerations equally apply to potential new users considering acquiring a mobile phone. We refer only to customers considering giving up their phones for ease of exposition.
[832] See paragraphs 2.684 & 2.688 for a description of survey evidence submitted by EE and Vodafone.
[833] See paragraphs 2.691 & 2.694.
[834] We note that some customers will be within their minimum contract periods, but we understand that if MCPs significantly worsen the terms of that contract (for example, by increasing prices) then the consumer has the right to terminate the contract without penalty. We also understand that post-pay users switching to a pre-pay contract on the same network could continue to use the same handset and so would not incur an upfront cost of switching to pre-pay.

UK of communications services[835]). However, 'in performing its duties, Ofcom must also have regard to, amongst other things, the needs of [persons with disabilities, of the elderly and of] those on low incomes'.[836] If vulnerable customers keep their mobile phones and maintain usage despite income constraints, they may have to cut down on other expenditure. We would refer to this as 'income effects'.

2.909 This would be a concern if we had found that vulnerable customers would face large price rises but keep their phones. We believe that low users would face small price rises (in absolute terms), assuming that price rises predominantly take the form of increased ppm rates, and high users are likely to benefit from changes to price plans that compensate high users for increased 'headline' ppm charges.[837]

2.910 We also note that fixed-line users may gain positive income effects if the prices they pay for calls (and especially FTM) calls fall.

Effects on usage and countervailing benefits

2.911 Ofcom argued that vulnerable customers may have low usage elasticities and so their usage would not be much affected. This conclusion partly reflected Ofcom's view that vulnerable customers would largely be shielded from price increases, a view which we do not share. It also did not take into account reductions in usage due to a reduced number of mobile subscribers. Ofcom's other argument was that there would be countervailing benefits to vulnerable customers using fixed lines. Ofcom did not address fixed customers' usage elasticities or whether their usage would be much affected.

2.912 We think that the reduction in usage by mobile-only subscribers will be larger than Ofcom has allowed for, because of higher price increases and because of a reduction in subscriber numbers among this group. We agree with Ofcom that fixed-line-only vulnerable customers will benefit from lower prices, and will make more calls, although as discussed above we do not believe that fixed-line users unambiguously gain.[838] We do not expect a significant shift of users away from mobile-only towards fixed-only since the minimum monthly cost of a mobile phone is likely to remain below the minimum monthly cost of a fixed line, although there could be a small indirect shift if some vulnerable customers who have both mobile and fixed phones give up their mobiles in response to lower MTRs and consequent price changes.

2.913 EE said that Ofcom accepted that many vulnerable fixed-only customers were on the BT Basic tariff and would not benefit from a reduction in MTRs. We consider that EE mischaracterized Ofcom's position. We interpret Ofcom as saying that if the benefit to fixed-line users came in the form of mobile calls in bundles without a reduction in FTM ppm call prices, and if those bundles are not offered to BT Basic subscribers, then BT Basic customers would not benefit.[839] We understand that the BT Basic package includes line rental and a small number of calls to fixed lines, but BT Basic customers pay standard BT prices for calls to mobiles. Therefore under current arrangements they will benefit if the price of FTM calls falls. They may not benefit if the only change to BT's pricing is to include FTM calls in other bundles that are not available to or appropriate for BT Basic subscribers. Our current view is that we expect FTM prices to fall and BT Basic subscribers to benefit to some extent.

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[835] Ofcom Statement, §2.59.
[836] Section 3(4)(i) of the Act.
[837] See paragraphs 2.818–2.820 above for a summary of our findings on likely price changes.
[838] See paragraph 2.796.
[839] Ofcom Statement, A3.318.

2.914 We expect the net effect on vulnerable customers to be negative, for two reasons. First, there are around twice as many mobile-only vulnerable customers as fixed-only.[840] Secondly, the gain to fixed-line operators (which may be passed on to customers) from lower MTRs is lower than the loss to mobile operators since only around two-thirds of MCPs' net income from MCT comes from domestic fixed-line operators.

How much weight should be given to vulnerable customers when setting MTRs?

2.915 Ofcom argued that the purpose of MTR regulation is not to pursue social inclusion objectives,[841] but to correct the detriments associated with SMP in the market for MCT. Ofcom argued that it was not appropriate to address a social welfare agenda through the regulation of MCT, especially since MCT regulation had been found to be a highly inefficient measure for pursuing social objectives. As a result, Ofcom said that the equity effects on vulnerable consumers specifically should be a significant factor in the choice between LRIC and LRIC+ only if the adoption of one rather than the other would be likely to give rise to a *significant* overall detriment to such consumers.[842]

2.916 Ofcom is, however, under a duty to consider the effect of its decision on certain vulnerable groups, including those on low incomes. We have assessed the importance of that duty. Put very simply, the appellants' argument is that MTRs should not be reduced from LRIC+ to LRIC because doing so would make vulnerable customers worse off.

2.917 We agree with Ofcom that it was not appropriate to use MCT regulation as a vehicle for addressing a social welfare issue because such an approach would not be an efficient means of pursuing social objectives. Ofcom clearly did and was right to have regard to the effects of MCT regulation on vulnerable customers but the existence of negative effects does not necessarily mean that Ofcom erred in choosing LRIC. The requirement on Ofcom in relation to vulnerable consumers arises out section 3(4)(i) of the Act; specifically Ofcom must have regard to the needs of persons with disabilities, of the elderly and of those on low incomes, as relevant in the circumstances. Our conclusions on competition effects and allocative efficiency are more directly relevant to the considerations in section 88 of the Act. These conclusions establish the effect on consumers as a whole rather than a narrow assessment of one group of consumers, in respect of whom we have found only a marginal, possible negative effect.

Conclusion on vulnerable customers

2.918 We have considered effects on subscriptions, usage and income. We agree with Ofcom that its highest priority should be the effect on mobile-only subscribers giving up[843] their only means of access to telecommunications services. This reflects the fact that without a means of communication, no calls can take place between that user and other consumers. We identify some negative effects on mobile usage and income effects, but we note that both of these are partially offset by beneficial effects on fixed-line users. We find that some vulnerable customers are likely to be made worse off, but the appellants have not demonstrated that this would lead to a signifi-

[840] See paragraph 2.886.
[841] Ofcom Statement, §§A3.272–A3.273.
[842] Ofcom Defence, Annex A, §A349.
[843] We include in this potential subscribers without a fixed line who would be deterred from getting a mobile phone by the adoption of LRIC.

cation reduction in subscriptions or usage among this group. Nor have they demonstrated that the net effect across all vulnerable customers, taking into account both winners and losers, would be significant.

2.919 Accordingly, in our view the appellants have not made their case that there would be significant net detriment to vulnerable customers which would justify setting MTRs at LRIC+ once all factors are taken into account.

4. Commercial and regulatory consequences

Ofcom's position

2.920 Ofcom recognized that all regulation carried the risk of error, although it noted that the costs of estimating LRIC incorrectly were tempered by the fact that any under-recovery of costs from MCT would be moderated by the ability of MCPs to recover some of those costs from their retail activities.[844] It said that fixed and mobile call termination were separate markets and the regulatory approach in each must be appropriate to address the detriments in that market, of which the potential for competitive distortions was one consideration.[845]

Views of the appellants

Vodafone

2.921 Vodafone argued that:[846]

(a) it was unsafe to use Ofcom's LRIC estimates because its network costing model was not fit for purpose;

(b) adopting LRIC would make it more difficult to change back to LRIC+ or another charging system in the future. In its Core Submission, Vodafone clarified this to mean that adopting LRIC 'may preclude the use of two part charging in the future and that this was a relevant factor which Ofcom should have, but did not, take into account';[847] and

(c) Ofcom was wrong to want to bring MTRs more closely into line with fixed termination charges.

Ofcom's Defence

2.922 Ofcom replied that:[848]

(a) Vodafone had failed to demonstrate any fundamental deficiency with its model, and in any case the risk of material error was low given the limited changes to the LRIC estimate under different assumptions and the potential for recovery from the waterbed effect; and

(b) Vodafone's second point was purely hypothetical since there was no expectation of changing from LRIC to a different system, and it would be inconsistent to deny

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[844] Statement §§8.133 & 8.134.
[845] Statement §8.147.
[846] Vodafone NoA, §§54 & 55.
[847] Vodafone Core Submission, §4.122.
[848] Ofcom Defence, Annex A, §§367–372.

consumers the benefit of LRIC on the basis of a hypothetical situation which had already been rejected by Ofcom in the current proceedings.

2.923 We summarized Ofcom's Defence on point *(c)* in paragraph 2.919 under 'Competition effects'. [849]

Assessment of commercial and regulatory consequences

2.924 In paragraph 2.937 on the basis of the assessment conducted in Reference Question 2, we conclude that we do not find that Ofcom should have rejected the LRIC methodology on the basis that it was unable to implement it in a manner which could produce robust estimates of the LRIC cost of providing an MCT service. We therefore do not consider Vodafone to have demonstrated that Ofcom's LRIC model is not fit for purpose.

2.925 Vodafone has not explained why adopting LRIC in this charge control precludes Ofcom from switching to another system in the future. Even if it had done so, that would be a relatively minor consideration given that there is no good reason to think that any other system is more likely to be adopted in preference to LRIC. Even if Ofcom noted that a two-part system may be attractive from an allocative efficiency point of view, that does not imply that on balance and taking into account all considerations (including the Recommendation) it would be 'attractive', let alone the most attractive option.

2.926 We assessed the third point under 'Competition effects' and found the appellants had not made out their challenges to this limb of Ofcom's assessment.[850]

Overall Assessment of Reference Question 1(i)

2.927 In the paragraphs above we have set out our analysis of the arguments of the parties in relation to each limb of Ofcom's analysis of the choice between a LRIC cost standard and a LRIC+ cost standard. In doing so, we have focused on issues that are informative as to the difference between LRIC and LRIC+ as the appropriate choice. This approach reflects the approach Ofcom adopted in the Statement and the Reference Question posed to us. We have also borne firmly in mind the principles set out in paragraphs 2.44, 2.45, 2.58 and 2.59 above, specifically that any idea that there is a binary exercise in weighing the particular limbs of analysis is to be resisted and that mistakes in analysis that we do identify must have been of sufficient importance to vitiate Ofcom's judgement on the question of the appropriate cost standard.

2.928 We are also mindful of the fact that Ofcom is required to have the utmost regard to the Recommendation; it is, therefore, an important consideration in relation to the cost standard to adopt. The CC discussed the position of European Commission recommendations in the final determination in the Cable & Wireless appeal. In that case we found that Ofcom was not compelled or obliged to accept such Recommendations; however, we also found that it may not disregard a Recommendation, nor treat it lightly, and it should have good reasons as to why some other way of exercising its powers has more salience.[851]

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[849] See paragraphs 2.478 to 2.480 above.
[850] See paragraph 2.517.
[851] *Cable & Wireless v Ofcom,* CC Final Determination, 30 June 2010, paragraph 2.22.

2.929 We have considered the criticisms levelled by Vodafone, EE and Telefónica at Ofcom's adoption of the LRIC cost standard and have assessed these against each of the criteria that Ofcom used in taking its decision:

(a) We summarize our conclusions on the challenges to Ofcom's competition assessment in paragraphs 2.518 to 2.524. We do not agree with the appellants that Ofcom erred in its assessment of the relative merits of LRIC and LRIC+ from the standpoint of competition. Nor that MTRs based on LRIC+ would not lead to any appreciable distortion of competition, such as to support the choice of a LRIC cost standard, and that there were significant competition considerations that favoured the choice of a LRIC+ cost standard. We note that at its core the results of our analysis of arguments in relation to the competition assessment is that, though the scale of effect may not be large, our conclusion is that the effect favours the adoption of LRIC. We believe that Ofcom was correct to consider there to be scope for their measures to make the market more competitive and that this is consistent with the entirety of the statutory scheme including the basis for imposing remedies in the first place.

(b) We summarize our views of the challenges to Ofcom's allocative efficiency assessment in paragraph 2.823. Though we do not agree with all aspects of Ofcom's reasoning on allocative efficiency, we agree with Ofcom that allocative efficiency grounds alone do not provide a clear answer as to whether a LRIC or LRIC+ cost standard should be preferred. For these reasons, and notwithstanding those matters on which our conclusions differ from the conclusions reached by Ofcom, we do not believe that Ofcom was mistaken, in respect of the appropriateness or otherwise of its choice for promoting efficiency,[852] in choosing a LRIC cost standard. In addition we agreed with Ofcom's conclusion that the adoption of LRIC is likely to have little effect on dynamic efficiency.[853]

(c) In relation to vulnerable consumers, as set out in paragraph 2.918, we agree with Ofcom that its highest priority should be the effect on mobile-only subscribers giving up their only means of access to telecommunications services. We identified some effects on mobile usage and income effects, but we noted that both of these are partially offset by beneficial effects on fixed-line users. Though we find that some vulnerable customers are likely to be made worse off, we do not believe it has been demonstrated that the net effect across all vulnerable customers, taking into account both winners and losers, would be significant. We agreed with Ofcom that it was not appropriate to use MCT regulation as a means of pursuing social objectives. We consider this to be consistent with the statutory scheme and the nature of Ofcom's considerations under section 3(4)(i) of the Act.

(d) As set out in paragraphs 2.924 to 2.926 we did not uphold any of Vodafone's challenges to Ofcom's assessment of the commercial and regulatory consequences relative merits of LRIC+ and LRIC.

2.930 Given the nature of the exercise in which Ofcom was engaged, which involved choosing the appropriate cost standard in the context of its various statutory duties and considerations, we do not consider the choice of a cost standard to be a matter that might be interfered with merely because the alternative case can be constructed. We need to be satisfied of a material error in Ofcom's approach.

2.931 There are issues where we find some force in the appellants' arguments. However, in order to find that Ofcom erred in adopting LRIC rather than LRIC+ as a cost stan-

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[852] Section 88(1)(b)(i) of the Act.
[853] See paragraph 2.842.

dard, we would need to find errors that would materially affect Ofcom's judgement. We do not hold Ofcom to be wrong simply because we consider there to be some error in its reasoning on a particular point—the error in reasoning must have been of sufficient importance to vitiate Ofcom's decision on the point in whole or in part.[854] Having regard to our conclusions on the four limbs of assessment, set out in paragraph 2.929, and to the additional support that the Recommendation provides for Ofcoms conclusion we do not believe that it has been demonstrated that Ofcom was wrong in deciding that the LRIC cost standard was appropriate by reference to the statutory duties and considerations in sections 3, 4 and 88 of the Act. Nor do we believe that the appellants have demonstrated that these statutory duties and considerations would have been better served by the setting of the price control by reference to a LRIC+ methodology.

(ii) Suitability of Ofcom's LRIC model

2.932 This is the second part of our assessment in this section referred to in paragraph 2.1.

Vodafone's views

2.933 Vodafone argued that one of the most compelling reasons that Ofcom should have set the price control on a LRIC+ basis was that Ofcom's model could not produce a robust estimate of the LRIC cost of the MCT service. Vodafone said that since Ofcom's model could not be used for this purpose, it had sought to employ other approaches to generate an approximate measure of the LRIC cost of the MCT service from the model, and its work showed that Ofcom's measure of the LRIC of the MCT service was likely significantly to understate the true LRIC cost.[855]

2.934 Vodafone argued that the misclassifications of important categories of asset were so pervasive in Ofcom's model as to render it fundamentally unsuitable for the purpose of computing the LRIC of the MCT service without significant amendment.[856] It said that the deficiencies in Ofcom's model were tolerable where the model used a LRIC+ methodology, since any costs which were not picked up correctly as being traffic-related costs, attributable in part to the MCT service, would nonetheless be picked up, at least to some extent, by way of an implicit mark-up on the direct costs of the MCT service.[857]

2.935 Vodafone repeated the specific allegations of error made in relation to this limb of its challenge when making its challenge under Ground B, our assessment of which is contained in our findings in relation to Reference Question 2 and not repeated here.

Assessment on suitability of Ofcom's LRIC model

2.936 In Reference Question 2, we set out our view that calculating the LRIC for MCT services is effectively a theoretical exercise to establish a reasonable basis for identifying avoidable costs and that Vodafone's appeal appears to be based on a certain interpretation of how this exercise should be conducted.[858] As such, Vodafone's challenge might be characterized as an allegation of an error of discretion under section 192(6)(b). However, a substantive portion of this challenge is made up of

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[854] This is consistent with our approach in *Mobile phone wholesale voice termination charges determination*, notified to the Tribunal on 16 January 2009. See *[2009] CAT 11 (Judgment: Disposal of the Appeals)*—see paragraph 1.32.
[855] Vodafone NoA, §63.
[856] Vodafone NoA, §70.
[857] Vodafone NoA, §72.
[858] See paragraph 3.33.

specific allegations of errors of fact. In response to Reference Question 2, we concluded that we did not find there to be force in any of the specific allegations of deficiencies in Ofcom's LRIC model.[859] We therefore find Vodafone's allegation that the misclassifications of important categories of asset were so pervasive in Ofcom's model as to render it fundamentally unsuitable for the purpose of computing the LRIC of the MCT service to be without basis.

2.937 We do not therefore find that Ofcom should have rejected the LRIC methodology on the basis that it was unable to implement it in a manner which could produce robust estimates of the LRIC cost of providing an MCT service.

Conclusion on Reference Question 1

2.938 In light of the conclusions set out in paragraphs 2.931 and 2.937 above, we do not find that Ofcom's decision to use a LRIC cost standard was inappropriate by reference to the statutory considerations set out in sections 3, 4, 47 and 88 of the Act. In addition, we do not find for the appellants that better cost standard, when viewed in light of the statutory considerations, is LRIC+. In addition, we do not find that Ofcom should have rejected the LRIC methodology on the basis that it was unable to implement it in a manner which could produce robust estimates of the LRIC cost of providing an MCT service.

2.939 Accordingly we do not find that the charge control imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision has been set at a level which is inappropriate because we do not find that Ofcom erred in adopting the LRIC cost standard, rather than the LRIC+ cost standard.

[859] See paragraphs 3.252, 3.264, 3.265, 3.338, 3.366, 3.382, 3.546 & 3.978.

Section 3: Reference Question 2

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in determining the level of the charge control based on pure LRIC (for the reasons set out in paragraphs 155 to 237 of EE's Notice of Appeal (Ground 2), and paragraphs 20B and 75 to 82 of Vodafone's Notice of Appeal).

Introduction

3.1 The level of the charge control imposed by Ofcom was based on its estimates of the LRIC of providing MCT services in 2014/15 which it derived from its cost model.

3.2 In this appeal EE contended that Ofcom's cost model contained a number of flaws that undermined its ability to produce reliable estimates of LRIC of MCT services.[1] Vodafone argued that Ofcom's method for deriving a LRIC of providing MCT services was unsound. It said that Ofcom should have used a different method designed to produce a better approximation to the LRIC of MCT services. Vodafone said that as a result, Ofcom's calculation of the level of LRIC in 2014/15 of 0.69ppm (in 2008/09 prices), was incorrect and it estimated that the corrected calculation should have resulted in a figure of at least 1.25ppm.[2]

3.3 Neither Vodafone nor EE set out, by reference to section 192(6) of the Act, whether they perceived the allegations to amount to errors of law, of fact or in the exercise of a discretion by Ofcom. We infer from the paragraphs of their NoA to which we are referred by Reference Question 2 that, in this part of their respective NoAs, EE and Vodafone are appealing against both errors of fact and the exercise by Ofcom of a discretion (in making certain modelling decisions for example the parameters of the hypothetical network). Even where the allegation is an error of fact, however, we recognize that modelling exercises of this type engage a degree of judgement; we have, therefore, taken the nature of the exercise into account in our assessment of the arguments of the parties.

The 2011 Model

3.4 This section provides an overview of Ofcom's decision in so far as it relates to the points made by Vodafone and EE falling within the scope of Reference Question 2.

Ofcom modelling

3.5 Ofcom stated that it had used a bottom-up MCT cost model in setting MCT charges for the period 2011 to 2014 (2011 Model) and that this approach had been used by Ofcom (and its predecessor Oftel) for a number of years. The MCT cost models used in previous Price Controls had been twice reviewed by the CC (the 2002 CC report and the 2009 CC determination).[3] The 2011 Model was based on an updated version of the cost model from the 2007 charge control.[4]

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[1] EE NoA, §157.
[2] Vodafone NoA, §20B.
[3] Ofcom Decision, §A6.2.
[4] Ofcom Decision, §§A6.2–A6.10.

3.6 Ofcom said that the 2011 Model estimated the costs of a hypothetical average efficient operator in the UK, and was therefore based on the use of technologies and spectrum bands that had been, or were currently being, deployed in the UK.[5]

3.7 Ofcom said that the 2010 Model, on which it consulted as the basis for the 2011 Model (the subject of these challenges) used what might be called a 'total network minus' approach to calculate the LRIC of MCT services. This approach assumed that the network build parameters[6] were the same for a network with all services and a network that had all services except for MCT services.[7]

3.8 Ofcom explained that the MCT cost modelling used an abstraction of a real-world network deployment and balanced practicability and materiality in estimating the long-run incremental costs of MCT. Therefore, the model assumed, for example, that cell radii and the percentage of traffic on macrocell, microcells and picocells were parameters that neither changed dynamically with the levels of traffic nor between *(a)* a full network and *(b)* a full network minus termination traffic.[8]

3.9 Ofcom said that whilst the model had been developed as a bottom-up cost model it had also been calibrated by adjusting the unit replacement cost levels and cost causality relationships of different cost components, to ensure the model was reasonably in line with the national 2G/3G MCPs' actual costs in historical years. Ofcom described its *calibration* of the 2011 Model as follows:

(a) It was intended to ensure that the model as a whole was a good approximation to reality for the costs overall and the level of key assets.[9]

(b) Calibration was an iterative process in which first the model was built and the parameters were specified, which were then matched to metrics that were observed from the operators (eg gross book value, operating costs, or the level of key assets).[10]

(c) The calibration exercise would typically start by looking at the average of the operators, but Ofcom was at least trying to be within the upper and lower bounds from the operators, because hitting the average in every year, every time for every asset would be very challenging.[11] It said that there were no precise rules on how it performed its calibration and that it used its judgement.[12]

(d) Where in the model adjustments were made for calibration depended on where the gap was by reference to the metrics used for calibration.[13]

3.10 Ofcom said that estimated costs in the model were driven by three main factors: *(a)* the number of subscribers; *(b)* coverage requirements; and *(c)* the total traffic generated by subscribers. The number of subscribers drove a relatively small number of network assets eg Home Location Registers (HLRs), whereas coverage requirements and service demand (traffic) drove the majority of costs.[14]

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[5] Ofcom Decision, §A6.25.
[6] Network build parameters are the mathematical formulas that build the all-services and ex-MCT services network in Ofcom's 2011 cost model (Ofcom bilateral hearing transcript, p97, line 13ff).
[7] Ofcom Decision, §9.82.
[8] Ofcom Decision, §9.85.
[9] Ofcom bilateral hearing transcript, pp89, & 90.
[10] Ofcom bilateral hearing transcript, pp89, & 90.
[11] Ofcom bilateral hearing transcript, p90, line 7ff.
[12] Ofcom bilateral hearing transcript, p92, lines 15–22.
[13] Ofcom bilateral hearing transcript, p90, line 25ff.
[14] Ofcom Decision, §A6.27.

3.11 Ofcom stated that its approach to modelling LRIC was consistent with the Recommendation[15] which specified the estimation of the LRIC of termination as the avoidable costs associated with termination traffic, with MCT being the final service to be taken into account.[16] Ofcom noted that as explained at point 6 and recital 14 of the Recommendation, traffic-sensitive costs may arise jointly with other traffic services (eg call origination, SMS, MMS, etc) and were common across a number of traffic services and MCPs would continue to face those costs even if MCT volumes fell to zero.[17] Ofcom did not believe that the LRIC estimate should include a contribution to costs which were not traffic (specifically MCT traffic) driven.[18]

3.12 Ofcom said that the model calculated the network costs for the period 1990/91 to 2039/40 with a perpetuity-based terminal value thereafter, although forecasts for all inputs were constrained to be constant from 2020/21 onwards.[19]

3.13 Ofcom stated that the model recovered capital and operating costs over time using its chosen economic depreciation (ED) methodology.[20,21] This calculated a cost per unit of output in each year for every asset in the model.[22] The ED approach matched the cost of equipment to its actual and forecast usage over the long term. Consequently, there was relatively little depreciation in years when utilization was low and relatively high depreciation in years of full, or almost full, equipment utilization.[23]

The calculation of LRIC+

3.14 Ofcom said that it calculated LRIC+ as the incremental costs of traffic using a large increment approach (ie all voice and data traffic).[24]

3.15 Ofcom stated that the 2011 Model calculated service costs by allocating all network costs according to service routing factors.[25] Under LRIC+, any common costs were allocated to service increments according to routing factors.[26] For common costs where no routing factors existed (such as administration costs), the allocation was on an EPMU (equi-proportionate mark-up) basis.[27] The LRIC+ model did not identify or estimate the level of common costs. The outputs of the LRIC+ model were unit costs that included all network costs. Therefore, the model output, for a LRIC+ cost benchmark, was an incremental cost plus an implicit contribution to common costs.[28]

The calculation of LRIC

3.16 Ofcom said that when using a LRIC approach, incoming voice traffic was considered as a final increment with no common costs (such as the common costs of a coverage network) being allocated to the wholesale voice termination service.[29] The only costs allocated to voice termination were the incremental costs of providing voice

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[15] Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2009/396/EC).
[16] Ofcom Decision, §9.88.
[17] Ofcom Decision, §A9.32.
[18] Ofcom Decision, §A9.75.
[19] Ofcom Decision, §A6.31.
[20] Ofcom Decision, §A6.32.
[21] Ofcom calls this chosen approach its 'Original ED' methodology.
[22] Ofcom Decision, §A6.185.
[23] Ofcom Decision, §§A6.192 & A6.193.
[24] Ofcom Decision, §A6.13.
[25] Routing factors allocate the costs of the approximately 80 assets in Ofcom's 2011 cost model to the individual services (eg call origination and call termination). Transcript of technical modelling session, 15 September 2011, p44, line 1ff.
[26] Ofcom Decision, §A6.29.
[27] Ofcom Decision, §A6.13.
[28] Ofcom Decision, §A6.29.
[29] Ofcom Decision, §A6.14.

termination on a hypothetical network built to provide all services except voice termination.[30]

3.17 Ofcom stated that the LRIC of MCT was calculated as the cost avoided by not providing off-net termination whilst still providing all other services.[31]

3.18 Ofcom's 2011 Model calculated LRIC-based MCT charges using a total network minus[32] (or subtractional) method, which operated as follows:[33]

(a) running the model on the basis that the modelled network provided a full range of services;

(b) running the model again on the basis that the modelled network provided a full range of services excluding an MCT service;

(c) subtracting the second result from the first, so as to ascertain what additional (or incremental) assets/resources were needed to provide an MCT service, and then running the ED algorithm of the model to derive the cost of providing the MCT service;[34,35] and

(d) the output of this algorithm was the LRIC of an incoming minute of voice traffic (in ppm).

EE's and Vodafone's challenges

3.19 Vodafone and EE[36] argued that to comply with the EC Recommendation it was critical that the model used to derive a LRIC measure of the cost of the MCT service should correctly categorize costs as being traffic related, or non-traffic related, and that the quantum of traffic-related costs should be correctly attributed to different traffic services, so that when the costs of the 'all services network' and 'the ex MCT' network were computed, with a view to the application of the subtractional method, the two inputs to the subtraction were correctly derived.[37]

Vodafone's NoA

3.20 Vodafone argued that the Ofcom model was entirely unsuited to calculating the LRIC of MCT services because some costs were miscategorized as being partially or wholly unrelated to traffic when they were, in Vodafone's submission, traffic-related costs or were split incorrectly with too much of the overall cost being treated as non-traffic related. Further they submitted that deficiencies in the model meant that, when the 'subtractional' method was applied, the results were nonsensical. Vodafone said that Ofcom's failure to correct for the anomalies suggested that it had not checked its methodology. Vodafone also said that Ofcom gave no consideration to the different way in which a mobile network might be designed if it were not required to provide an

[30] Ofcom Decision, §A6.30.
[31] Ofcom Decision, §9.87.
[32] Ofcom Statement, §9.82.
[33] Ofcom Decision, §A6.15.
[34] Ofcom Decision, §§A6.15 & A6.32.
[35] Ofcom said that the same ED algorithm was used for both LRIC+ and LRIC, albeit with different asset volumes, outputs and cash flows (Ofcom Decision, §A6.15).
[36] EE NoA, §157.
[37] Vodafone NoA, §67.

MCT service. Vodafone argued that such consideration was critical for Ofcom to ascertain the true avoidable costs of the MCT service.[38]

EE's NoA

3.21 EE argued that:

(a) the output of the 2011 Model implied that common costs constituted a high proportion (around half) of total network costs;[39]

(b) Ofcom's 'total network minus' approach was based on the erroneous assumption that operators' holding of spectrum remained constant. EE argued that if operators were to cease supplying termination services, then they would be likely to reduce their spectrum holdings as well as the number of cell-sites built to provide capacity;[40]

(c) Ofcom overstated the likely cost recovery from data services and failed to take into account the magnitude of the difference between the retail prices for data services and the implied costs under its model after adjusting for operators' retail costs;[41]

(d) Ofcom's approach to ED resulted in a large proportion of cost being recovered in the years before 2009/10, therefore the cost estimates for the years subject to the charge control became much lower. Further EE said that Ofcom failed to select realistic and appropriate inputs for its calculation of Weighted Average Cost of Capital (WACC);[42]

(e) The 2011 Model produced results that were not economically sensible; when discount rates in the past were reduced, future regulated prices were increased. EE suggested this implied that Ofcom had made an assumption that, in the early years of network build, termination revenues actually generated surplus funds carried forward at the company-specific WACC;[43] and

(f) Ofcom wrongly excluded all administration costs from the calculation of LRIC.[44]

EE's SoI in support of Vodafone

3.22 EE stated that Ofcom's LRIC methodology was not fit for purpose, and said that correcting for the errors as set out by Vodafone in respect of Reference Question 3 alone would not change that.[45] EE agreed with and supported Vodafone's view that the 2011 Modelling methodology was incapable of producing a robust estimate of LRIC, and that if LRIC was ultimately adopted, the flaws in the 2011 Modelling of LRIC meant that an alternative estimation of LRIC should be used.[46]

3.23 EE also suggested (in the alternative—given, it said, the likelihood that Ofcom had underestimated LRIC) to err on the side of caution when considering specific

[38] Vodafone NoA, §69.
[39] EE NoA, §157.1.
[40] EE NoA, §157.2.
[41] EE NoA, §157.3.
[42] EE NoA, §157.4.
[43] EE NoA, §157.5.
[44] EE NoA §162.
[45] EE SoI, §18.
[46] EE SoI, §27.

modelling issues. EE suggested that judgments that produced higher cost estimates should be preferred.[47]

3.24 EE stated that it was in full agreement with Vodafone's analysis and proposed corrections to the specific LRIC errors identified by Vodafone save in two respects:[48]

(a) EE proposed that the impact of having no MCT services on spectrum costs should be modelled differently;[49] and

(b) EE suggested an altered assumption of 3G coverage based on EE's evidence.[50]

Telefónica's SoI in support of EE and Vodafone

3.25 Telefónica stated that the errors that Ofcom had made in respect of the costs of the coverage network and the other errors which Vodafone had identified rendered the model fundamentally unsuited to the task of deriving the LRIC of MCT services. Since Ofcom had no effective means of measuring the LRIC cost of MCT services, it should have adopted a LRIC+ methodology. Alternatively, if it was, despite these errors, correct to set MTRs at LRIC rates, another means of estimating those rates needed to be used, to avoid having to place reliance on a model that was fundamentally unsuited to the task.[51]

Vodafone's SoI in support of EE

3.26 Vodafone said that Ofcom's decision to exclude all administration costs as common costs, so that no administration costs were considered to be incremental to the LRIC of MCT services, was incorrect.[52]

The Recommendation in respect of the modelling of LRIC

3.27 The Recommendation recommended the use of LRIC for setting MCT charges. The Recommendation includes specific guidelines for the calculation of LRIC, including:

(a) the relevant increment being the wholesale MCT service (to third parties);[53]

(b) allow the recovery of all fixed and variable costs (as the fixed costs are assumed to become variable over the long run) which are incremental to the provision of the MCT service;[54]

(c) to include only avoidable costs (ie the costs which could be avoided in the long run if the wholesale MCT service were not provided);[55]

(d) to distinguish between non-traffic and traffic-related costs, and to attribute traffic-related costs among MCT and other services, with such traffic-related costs being

[47] EE SoI, §27.
[48] EE SoI, §35.
[49] EE SoI, §35.1.
[50] EE SoI, §35.2.
[51] Telefónica SoI, §31.
[52] Vodafone SoI, §4
[53] EU Recommendation, §6.
[54] EU Recommendation, §(14).
[55] EU Recommendation, §6.

attributed first to other services (eg call origination, SMS services) and with the MCT service being the last to be taken into account;[56]

(e) NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly;[57]

(f) 'incremental costs' are those costs that can be avoided if a specific increment is no longer provided (also known as avoidable costs);[58]

(g) 'traffic-related costs' are all those fixed and variable costs which rise with increased levels of traffic;[59]

(h) the recommended approach for asset depreciation is economic depreciation wherever feasible;[60]

(i) coverage can be best described as the capability or option to make a single call from any point in the network at a point in time, and capacity represents the additional network costs which are necessary to carry increasing levels of traffic. Coverage will cause non-traffic-related costs to be incurred which should not be attributed to the wholesale call termination increment. Investments in mature mobile markets are driven more by capacity increases and by the development of new services and this should be reflected in the cost model. The incremental cost of wholesale voice call termination services should therefore exclude coverage costs but should include additional capacity costs to the extent that they are caused by the provision of wholesale voice call termination services;[61]

(j) the costs of spectrum usage (the authorization to retain and use spectrum frequencies) are initially driven by the number of subscribers and thus are not traffic-driven and should not be calculated as part of the wholesale call termination service increment. The costs of acquiring additional spectrum to increase capacity (above the minimum necessary to provide retail services to subscribers) for the purposes of carrying additional traffic resulting from the provision of a wholesale voice call termination service should be included on the basis of forward-looking opportunity costs, where possible; and [62]

(k) the cost model should be based on efficient technologies available in the time frame considered by the model.[63]

3.28 Both EE and Vodafone confirmed that their submissions did not envisage Ofcom deviating from the LRIC modelling guidelines as set out in the EU recommendation.[64]

Context of determination

3.29 EE and Vodafone both levied a series of specific allegations of error in relation to the alleged flaws in the cost model. Vodafone argued that there were two consequences of the alleged errors in the Ofcom model:

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[56] EU Recommendation, §6.
[57] EU Recommendation, §3.
[58] EU Recommendation, §5.
[59] EU Recommendation, §5.
[60] EU Recommendation, §7.
[61] EU Recommendation, Annex.
[62] EC Recommendation, Annex.
[63] EC Recommendation, §4.
[64] Vodafone bilateral hearing transcript, p85, lines 13–18; EE Core Submission, §104.

(a) the errors demonstrated that Ofcom's chosen methodology for the computation of the LRIC of providing the MCT services was unsound in principle and Ofcom was unable, within the timetable available for the computation of new price controls, to implement a robust LRIC methodology so it should have used a LRIC+ methodology;[65] and

(b) even if it was not the case that Ofcom should have preferred a LRIC+ approach, the alleged errors demonstrate that the method Ofcom used to derive the LRIC of providing MCT services was unsound and Ofcom should have used a different method designed to produce a better approximation to the LRIC of the MCT service.[66]

3.30 The first of these consequences is a limb of Vodafone's arguments in relation to Reference Question 1 and our conclusion on that point rests upon our assessment of the specific allegations of error in this chapter. The second consequence relies upon us upholding the allegations of error, at least in sufficient part to justify a conclusion that an alternative method should be preferred.

3.31 EE also argued that if we should find that the model was unreliable this conclusion should lead us to endorse a LRIC+ methodology.[67]

3.32 Many of Vodafone's specific allegations of error were based on its argument that Ofcom should have approached the calculation of the LRIC of MCT services starting with the costs of a network that carried zero traffic (or in other words a coverage network carrying a single call). However, Ofcom has applied a very different approach to calculating the LRIC of MCT services, which involved looking at total costs and then removing the avoidable costs of MCT services.

3.33 In our view calculating the LRIC for MCT services is effectively a theoretical exercise to establish a reasonable basis for identifying avoidable costs. Vodafone's appeal appears to be based on a certain interpretation of how this exercise should be conducted. In light of the nature of the exercise we do not believe that Ofcom's approach is one that might lightly be set aside in the absence of a clearly superior alternative.

Structure of the determination

3.34 This section assesses each of the specific, pleaded allegations of error in order to establish whether Ofcom erred in determining the level of the charge control based on its calculation of the LRIC of MCT services for the purpose of answering Reference Question 2. We cross-refer to this assessment to the extent necessary in our determination of Reference Question 1, as to whether the alleged errors demonstrate that Ofcom's chosen methodology for the computation of the LRIC of providing MCT services is unsound in principle and Ofcom should have used a LRIC+ methodology instead.

3.35 In order to answer this reference question this chapter assesses it in two parts. In Part 1 we set out and assess, in turn, the arguments of the parties on each of alleged errors. In Part 2 we set out and assess the arguments in relation to whether Ofcom should have corrected the flaws or used a different method designed to produce a better approximation of the LRIC of providing MCT services.

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[65] Vodafone NoA, §20A.
[66] Vodafone NoA, §20B.
[67] EE NoA, §160.

3.36 Part 1—Vodafone and EE alleged the following key deficiencies in the 2011 Model:[68]

(a) Ofcom had wrongly specified the ex-MCT network (see paragraph 3.39ff);[69]

(b) the network design parameters were incorrect (see paragraph 3.73ff);[70]

(c) Ofcom's 2011 Model did not correctly identify traffic- and non-traffic-related costs (see paragraph 3.145ff);[71]

(d) the coverage network in the 2011 Model was too large (see paragraph 3.270ff);[72]

(e) the mark-up of LRIC+ over LRIC was implausible (see paragraph 3.344ff);[73,74]

(f) the slope of the traffic cost curve in the 2011 Model was incorrect (see paragraph 3.372ff);[75]

(g) Ofcom had modelled the zero-traffic network wrongly (see paragraph 3.388ff);[76]

(h) the modularity of assets was too large (see paragraph 3.408ff);[77]

(i) the result of the incremental asset calculation was implausible (see paragraph 3.437ff);[78]

(j) the ED calculation unduly depressed incremental costs—EE's challenge (see paragraph 3.461ff) and Vodafone's challenge (see paragraph 3.461ff);[79]

(k) Ofcom did not consider the difference in MCT cost for a 900 and 1800 MHz operator (EE and Vodafone) (see paragraph 3.553ff);[80]

(l) regulatory precedent (see paragraph 3.572ff);[81]

(m) errors in the forecast data usage (see paragraph 3.579ff);[82]

(n) administration cost were incorrectly excluded from the calculation of LRIC (see paragraph 3.580ff); and

(o) that the WACC was too low (see paragraph 3.616ff).[83]

3.37 Part 2—The claim that Ofcom should have corrected the alleged flaws in the 2011 model or used a different method designed to produce a better approximation to the LRIC (see paragraph 3.923ff). The suggested adjustments were:

(a) adjustments for errors alleged in Reference Question 3 (see paragraph 3.943ff);

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[68] Vodafone Core Submission, §§5.6 & 5.14.
[69] Vodafone NoA, §69.4.
[70] Vodafone Core Submission, §5.7.
[71] Vodafone NoA, §§69, 79 & 80.
[72] Vodafone NoA, §70.3.
[73] Vodafone NoA, W/S Roche, §4.10.
[74] EE NoA, §157.1.
[75] Vodafone Core Submission, W/S Roche II, §9.16 (last bullet).
[76] Vodafone Core Submission, §5.8.
[77] Vodafone Core Submission, §5.9.1.
[78] Vodafone NoA, §69.3.
[79] Vodafone Core Submission, §5.9.2; EE NoA, §157.5.
[80] Vodafone NoA, W/S Roche I, §4.103ff; EE NoA, §157.2.
[81] Vodafone Core Submission, §5.32.6; Vodafone NoA, §80.3.
[82] EE NoA, §157.3.
[83] EE NoA, §157.4.

(b) the year zero adjustment (see paragraph 3.945ff);

(c) the treatment of NMS, spectrum and voicemail (see paragraph 3.945ff and for spectrum also paragraph 3.985);

(d) the treatment of microcell and picocells (see paragraph 3.945ff);

(e) cell breathing (see paragraph 3.945ff);

(f) coverage assumptions (see paragraph 3.948ff);

(g) the zero coverage scenario (see paragraph 3.963ff);

(h) the stand-alone termination model (see paragraph 3.978ff);

(i) common costs are too high a proportion of total network costs (see paragraph 3.985);

(j) the ED calculation (see paragraph 3.985);

(k) forecast data usage (see paragraph 3.985);

(l) administration costs (see paragraph 3.985); and

(m) WACC (see paragraph 3.985).

Part 1

3.38 In this part we set out and assess each of EE's and Vodafone's allegations of error in relation to the 2011 Model.

(a) Specification of the ex-MCT network[84]

Ofcom's decision

3.39 Ofcom considered that its 2011 Model was suitable to calculate LRIC, particularly when considering that removing voice termination traffic was similar to a time-shift in volumes.[85]

Vodafone's challenge

3.40 Vodafone was of the view that the 2011 Model did not properly implement the requirements of the Recommendation[86] as Ofcom's subtractional method gave no consideration to the different ways in which a mobile network might be designed if it were not required to provide an MCT service, which Vodafone said was critical to the ascertainment of the true avoidable costs of the MCT service.[87]

3.41 Vodafone said that the 2011 Model did not provide the most efficient network to deliver total traffic less mobile termination and therefore LRIC was understated.[88]

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[84] Vodafone NoA, §69.4.
[85] Ofcom Decision, §A6.154.
[86] Vodafone NoA, §§66–69, W/S Roche, §§4.6 & 4.7.
[87] Vodafone NoA, §69.4 & Vodafone NoA, W/S Roche I, §4.8 (last bullet).
[88] Vodafone bilateral hearing transcript, p98, lines 12–17.

3.42 Vodafone was of the view that a rational operator would make changes to its network—in the long run—in the event that it no longer provided one of its key services, such as termination of third party traffic (eg for coverage depth, quality of coverage, network resilience, indirect costs such as office space[89]).[90]

3.43 Ofcom should have, claimed Vodafone, implemented the subtractive approach by modelling from scratch an operator which no longer provided the termination service and should have then compared the results of this network—using the subtractive approach—to the network in which all services were provided. Only by doing this would Ofcom have been able to identify the long-term response of an operator that no longer provided its full suite of services.[91,92]

3.44 Vodafone also said that the ex-MCT network should be separately configured for each year.[93]

3.45 Vodafone said that the theoretical world permanently without termination was 'not just a simple time shift, but a paradigm shift'. It was impossible to believe that an efficient network operator, when faced with a network with traffic levels permanently significantly less would make identical network design assumptions and decisions as in the all-services network.[94]

3.46 Vodafone said that the ex-MCT network fundamentals would be the same, but the actual detailed implementation would be different, and as a consequence, the cost differential between the world with and the world without termination would be greater.[95]

3.47 Vodafone admitted that the network ex-MCT would be a network that was not built in reality[96] and that a completely redesigned ex-MCT network could not be calibrated to an external benchmark.[97]

3.48 Vodafone said that the Recommendation looked for the long-run incremental cost attached to the termination services and the only way to model these was to consider what planning decisions would be made in the hypothetical world with a permanent absence of termination and how these planning assumptions would differ from the real world.[98] This would involve, for example, building fewer microsites, because the hotspots they were designed to cover would be lower in intensity.[99]

3.49 Vodafone was of the view that the fact that there had been a LRIC+ calibration at current traffic levels did not provide any information about whether the model was correctly identifying the incremental costs of providing MCT services at all traffic levels. The identification of the level of costs at a different and theoretical level of traffic was always going to be an estimate derived from the best possible evidence.[100]

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[89] Vodafone Core Submission, W/S Roche II, §5.16.
[90] Vodafone Core Submission, W/S Roche II, §5.15.
[91] Vodafone Core Submission, W/S Roche II, §5.2.
[92] Vodafone bilateral hearing transcript, p99, lines 6-18.
[93] Vodafone bilateral hearing transcript, p10, lines 12–14.
[94] Vodafone Core Submission, W/S Roche II, §10.26.
[95] Vodafone bilateral hearing transcript, p95, lines 9–11.
[96] Vodafone staff hearing transcript, p11, line 5ff.
[97] Vodafone NoA, W/S Roche, §4.126.
[98] Vodafone staff hearing transcript, p4, line 17ff.
[99] Vodafone staff hearing transcript, p5, line 1ff.
[100] Vodafone Core Submission, W/S Roche II, §10.29.

EE's SoI in support of Vodafone

3.50 EE agreed that it would be possible to redesign the ex-MCT network. For example, because cell radii could be increased, there would be no need for sectorization at some sites, sites and equipment would be cheaper, and there would be fewer Mobile Switching Centres (MSCs).[101]

3.51 EE stated that there were an infinite number of ways the EE network could be hypothetically reoptimized.[102]

Ofcom's Defence

3.52 Ofcom stated that, in principle, it was possible that sufficiently large changes in the volume of traffic would result in a change of network design given the fundamental features of mobile network technologies—eg 3G cell breathing.[103]

3.53 Ofcom said that modelling the LRIC of MCT as the final increment of traffic did not require the adoption of different input assumptions for the network without MCT from those used in the network with all traffic as there was not a sufficient basis for doing so. In particular, for the network with all services other than MCT, Ofcom would expect the network to already reflect the efficient dimensioning of assets for traffic handling capacity.[104]

3.54 Ofcom was of the view that it was not appropriate to treat costs as being wholly or partly the avoidable costs of the final increment unless there was a sufficient evidential or analytical basis on which Ofcom could conclude that those costs would not be incurred by the hypothetical efficient operator in the absence of providing MCT services.[105] It said that no such evidence was provided to it during the market review process, nor did Ofcom consider there to be a sufficient analytical basis for such a conclusion.[106]

3.55 Ofcom said that it was unlikely that a network planner would fundamentally redesign the network, given the size of the MCT increment.[107] Ofcom also noted that Vodafone said that in the real world, network designers planned for both capacity and coverage.[108]

3.56 Ofcom said that capturing time-varying effects was complex and the robustness of any alternative network assumptions (eg cell radii without MCT traffic) could never be verified through calibration to real world network deployments. By contrast, Ofcom's approach went through a careful calibration exercise to ensure that it adequately represented the network size and cost of an average efficient network.[109]

3.57 Ofcom explained that for the purposes of calculating LRIC, the MCT traffic increment was treated as the final increment. The final increment approach meant that the removal of MCT traffic was akin to changing traffic over time. When traffic increased over time, additional network assets were added to the existing network to meet busy hour traffic demand. Similarly, when the MCT traffic increment was added (or

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[101] EE SoI, W/S James, §55.
[102] EE SoI, W/S James, §56.
[103] Ofcom Core Submission, §81.
[104] Ofcom Defence, Annex B, §51(iv).
[105] Ofcom Defence, Annex B, §99.
[106] Ofcom Defence, Annex B, §99.
[107] Ofcom bilateral hearing transcript, p122, lines 5–13; and Ofcom Core Submission, §82.
[108] Ofcom bilateral hearing transcript, p120, line 20ff.
[109] Ofcom Core Submission, p111, line 7ff.

removed) it was supplemental to the busy hour traffic from all the other existing services.[110] Ofcom said that the ex-MCT network was not calibrated, but was built according to the dimensioning parameters in the 2011 Model.[111,112] Ofcom considered that the ex-MCT network was nevertheless sufficiently accurate because the 2011 Model predicted total costs and asset counts over time. Ofcom considered that, at least in principle, the concept of taking out a traffic service had parallels with a time shift in the all-services cost model.[113] Consequently, if the model was calibrating well at the total service level, then taking out services should not be different to moving at different points in time between the total service model.[114] Ofcom noted that despite the calibration, the cost drivers in the 2011 Model were fixed for periods of time.[115]

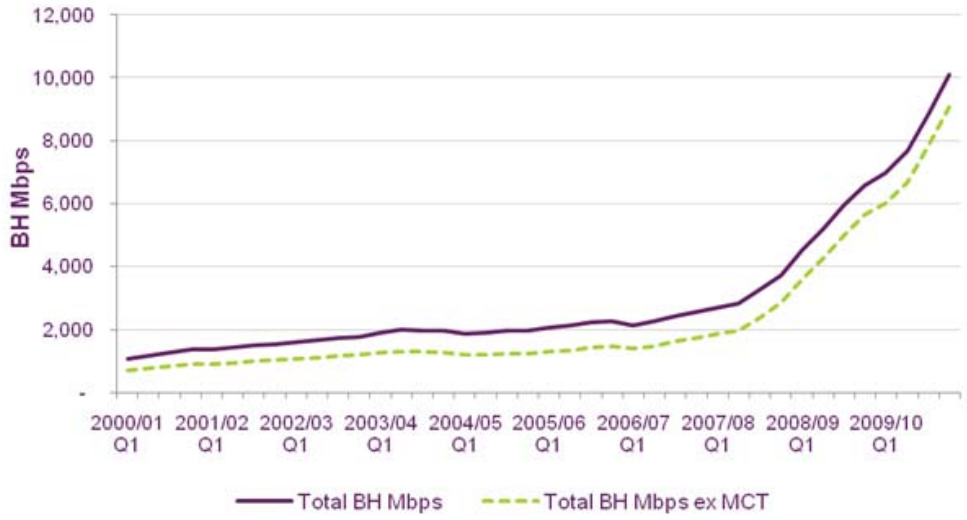
3.58 Ofcom explained that the 2011 Model had cost drivers that were designed to increase network capacity, which in turn would increase network costs, as the busy hour network traffic increased. Ofcom claimed that the 2011 Model remained well calibrated (for both key network asset counts and in terms of total costs) for the period over which it was explicitly calibrated (2006 to 2009 inclusive) and also having regard to longer periods. Ofcom stated that Vodafone agreed that the calibration of the 2011 Model was satisfactory and reasonable. Ofcom considered that because the model was adequately calibrated, the relationship between network traffic and costs was correct. Ofcom was of the view that the 2011 Model was able to accurately track the evolution in network costs as a result of changes in the traffic over time.[116]

3.59 Ofcom said that the size of the MCT traffic increment was small when compared with the growth of overall traffic over time. Ofcom stated that MCT traffic during the calibration period was a decreasing proportion of the busy hour network traffic. Over the past ten years (from Q1 2000/01 to Q4 2009/10), MCT traffic accounted for an average of 30 per cent of busy hour traffic. However, traffic grew considerably more than 30 per cent during the period in which calibration data was available. For example, between Q4 2008/09 and Q4 2009/10, the total busy hour traffic (in Mbps) grew by more than the absolute amount of MCT traffic (in Mbps) in any year over the ten-year period. Over the ten-year period in question, busy hour traffic increased by around 850 per cent. Ofcom submitted that if the 2011 Model was able accurately to capture the change in costs caused by such a large change in busy hour traffic, it was also able to capture the change in costs caused by the removal of the (significantly smaller) MCT traffic increment.[117] Ofcom provided Figure 3.1 below.

[110] Ofcom Core Submission, §79d.
[111] Dimensioning parameters are the mathematical formulas that define which and how many assets are needed to build the all-services and ex-MCT services network in Ofcom's 2011 cost model.
[112] Ofcom bilateral hearing transcript, p98, lines 4–9.
[113] Ofcom bilateral hearing transcript, p97, lines 13–15.
[114] Ofcom Core Submission, §§79b & 88b.
[115] Ofcom bilateral hearing transcript, p98, lines 10–13.
[116] Ofcom Core Submission, §79c.
[117] Ofcom Core Submission, §79d.

FIGURE 3.1

Comparison of total busy hour traffic and total busy hour traffic excluding MCT[118]



Source: Ofcom.

BT SoI in support of Ofcom

3.60 BT said that while Ofcom's calculations of LRIC were based on the costs of a hypothetical network, it was a network that represented the mobile networks as they actually were and its costs had been calibrated against actual costs. Moreover, it said that Ofcom's subtraction approach correctly treated terminating traffic as the last increment.[119]

Three SoI in support of Ofcom

3.61 Three explained that in order to calculate LRIC+, the model already relied on network dimensioning assumptions to estimate the impact of large changes in traffic levels.[120] The additional functionality required from the model in order to calculate LRIC was that it should estimate the changes in traffic levels associated with a loss of MCT. These latter changes were generally similar or smaller in scale than the changes already considered for LRIC+.[121,122]

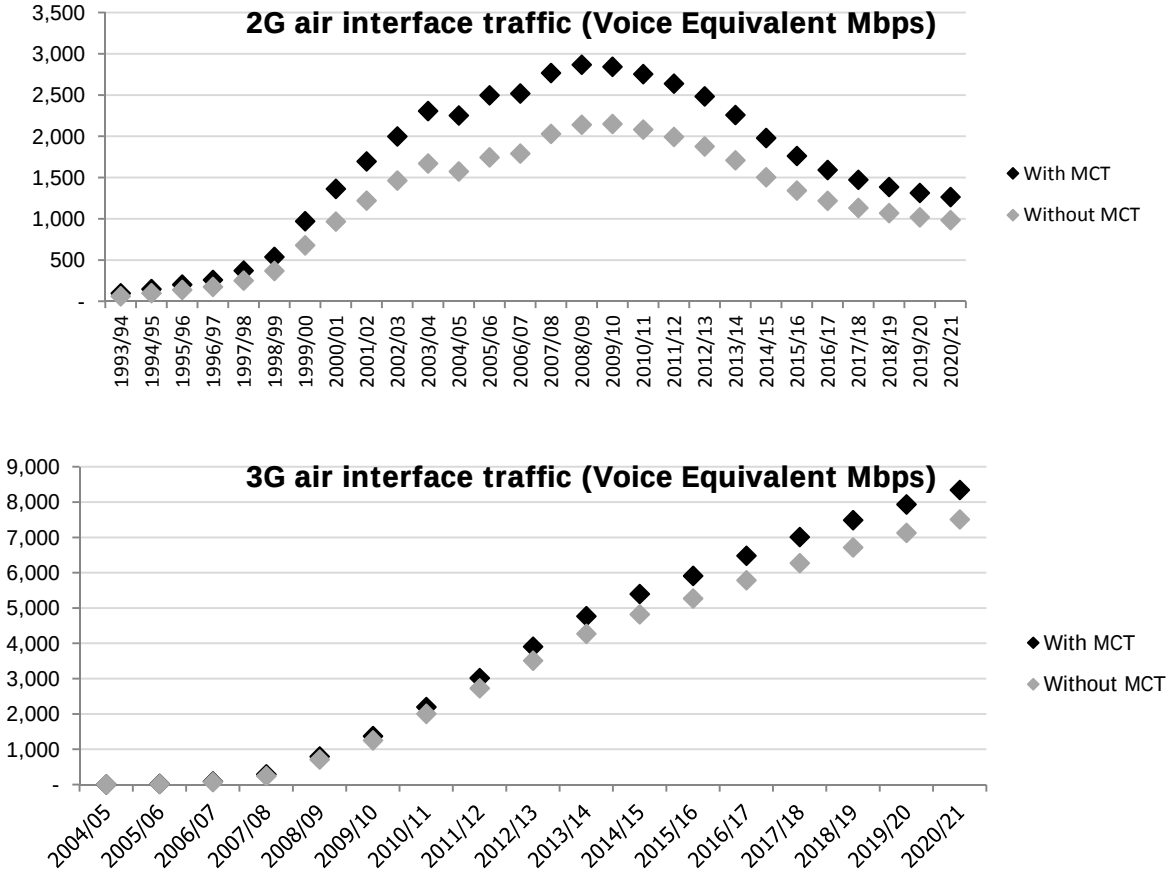
3.62 Three said, that for example 2G traffic without MCT was between 20 and 30 per cent lower than 2G traffic with MCT, but 2G traffic with MCT was forecast to fall by 56 per cent between 2009/10 and 2020/21. It said that 3G traffic without MCT was around 10 per cent lower than 3G traffic with MCT, but 3G traffic with MCT was forecast to rise by 508 per cent between 2009/10 and 2020/21.[123] Three also provided another example, where 3G traffic with MCT in 2014/15 was forecast to increase by 13 per cent compared with the prior year (when calculating LRIC+) and MCT services in the

[118] Ofcom Core Submission, §79, Figure 2.
[119] BT SoI, W/S Richardson 2, §15a, BT SoI, §63e.
[120] Three stated that the need to do this in the calculation of LRIC+ was because the ED methodology required the 2011 Model to calculate the average level of asset utilization over every year of the modelled period (1993/94–2020/21) (see Three SoI, W/S Mantzos 2, §§2.6–2.13).
[121] Three SoI, W/S Mantzos 2, §2.18.
[122] Three SoI, W/S Mantzos 2, §2.14.
[123] Three SoI, W/S Mantzos 2, §2.16.

same year represented around 10 per cent of 3G traffic.[124] Three provided the following two figures to illustrate this.[125]

FIGURE 3.2

Impact of removing 2G and 3G MCT traffic from the 2011 Model on overall traffic levels



Source: Three.

3.63 Three concluded that the addition of LRIC functionality to the model did not require a fundamentally revised approach to estimating the impact of changing traffic levels,[126] because it was reasonable to suppose that if the network dimensioning assumptions in the model were capable of estimating the networks required for LRIC+ over time, they were also capable of estimating the networks required for LRIC.[127]

3.64 Three said that the traffic levels in earlier years of the all-services network were very similar to traffic levels in the ex-MCT network, which was an appropriate comparator for the ex-MCT network and would inform the decision of how the ex-MCT network was dimensioned.[128]

[124] Three SoI, W/S Mantzos 2, §2.19.
[125] Three SoI, W/S Mantzos 2, §2.15.
[126] Three SoI, W/S Mantzos 2, §2.23.
[127] Three SoI, W/S Mantzos 2, §2.86.
[128] Three comments on staff hearing transcripts, 8 November 2011, p4.

3.65 Three pointed out that Ofcom's decision (in Annex 7) suggested a reasonable degree of success in asset count calibration over the period 2004/05 to 2009/10.[129]

Assessment: specification of the ex-MCT network

3.66 Ofcom considered that the ex-MCT services network was a network that was similar to the all-services network, but smaller, because it carried less traffic. Ofcom said that the ex-MCT network should be considered as a network that was effectively built a little bit later in time.

3.67 Vodafone's view in respect of the network design of the network without MCT services was that this would be a completely redesigned network, optimizing network costs for providing all services excluding MCT services.

3.68 We were persuaded by Ofcom's reasoning that, in principle, a network that has design parameters that provide the cost of the all-services network satisfactorily over time does also provide a sufficient approximation of the costs of the ex-MCT network at a specific point in time.

3.69 We are also persuaded by Ofcom's reasoning that the all-services network build parameters in its 2011 Model were informed by its calibration over time. Vodafone's approach would require a large number of hypothetical assumptions that could not be calibrated to what operators do in practice, whereas Ofcom's approach, at least in principle, would be informed by how operators have responded to traffic growth in the past, providing a verifiable reference point.

3.70 We note, in this context that EE stated that there would be an infinite number of ways that the ex-MCT network could be hypothetically reoptimized and we were persuaded by Ofcom that there would likely be considerable practical difficulties in identifying an appropriate reoptimized ex-MCT network. Neither Vodafone nor EE have provided evidence that showed that any of these hypothetical networks could be calibrated against an external benchmark or would be built in practice.

3.71 We also agree with Ofcom that it is not appropriate to treat costs as being wholly or partly the avoidable costs of the final increment unless there was an evidential or analytical basis on which Ofcom could conclude that those costs would not be incurred by the hypothetical efficient operator in the absence of providing MCT services.

3.72 We do not therefore consider that Vodafone has demonstrated that Ofcom erred in its specification of the ex-MCT network.

(b) The network design parameters

Ofcom's decision

Percentage of microcell and picocell deployment

3.73 Ofcom observed that microcell deployment data gathered from the national MCPs did not suggest a clear link between the percentage of microcells and the levels of termination traffic. While the number of cells would ultimately vary with traffic, the precise split between macrocells, microcells and picocells as a function of termination traffic levels was not clear. Therefore, the removal of termination traffic could delay

[129] Three SoI, W/S Mantzos 2, §2.26.

the deployment of additional macrocell sites and/or microcell sites and this was captured in the model through the traffic demand used for network dimensioning. Provided the MCT cost model accurately captured the long-run average relationship between traffic and different cell site deployments Ofcom considered this to be satisfactory. Through the calibration exercise Ofcom was sufficiently confident that the model dimensioning rules reasonably captured the relationship between network assets such as cell sites and network traffic.[130]

Cell breathing and cell radii

3.74 Ofcom said it recognized that some parameters, such as cell radii, could vary with the level of traffic in a practical deployment. However, the MCT cost model was an abstraction of a real-world network deployment and balanced practicability and materiality in estimating the long-run incremental costs of MCT. Therefore, the model assumed, for example, that cell radii were parameters that neither changed dynamically with the levels of traffic nor between *(a)* a full network and *(b)* a full network minus termination traffic.[131]

3.75 Ofcom undertook a simple assessment of the impact of changing the cell radii in response to the removal of termination traffic (ie the cell breathing effect) to assess the materiality of this effect. The changes in cell radii for the 'full network minus termination traffic model' resulted in a 4 per cent increase in the LRIC unit cost of termination. This was based on traffic levels in a single year and Ofcom stated that a fuller analysis based on a more dynamic and complex model could give different results.[132]

Vodafone's challenge

3.76 Vodafone said that the network design rules in the 2011 Model were not really rules but the outcome of the calibration process.[133] The LRIC+ model was differently configured in each year of the modelled period to optimize the network configuration for the total level of traffic to be carried in that year, but the ex-MCT network was not reconfigured, which, it claimed, meant that it was an inefficiently configured network and the subtractional method therefore deducted too much cost from the all-services network, leaving an LRIC estimate that was too small.[134]

3.77 Vodafone said that while the network design underlying the model might be an efficient network at the current level of traffic, this provided no assurance that it would be the most efficient design (among the infinite range of designs) at any other level of traffic. Vodafone also said that as some network demand parameters could effectively vary continuously, the network design that was efficient at one point would almost certainly be inefficient for any other level of traffic.[135] This would underestimate the LRIC cost of mobile termination.[136] Vodafone said that the Ofcom model did change network dimensioning parameters over time, but did not change any dimensioning parameters in the ex-MCT network.[137]

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[130] Ofcom Decision, §9.86.
[131] Ofcom Decision, §9.85.
[132] Ofcom Decision, fn 720.
[133] Vodafone NoA, W/S Roche I, §2.35.
[134] Vodafone bilateral hearing transcript, p10, line 12ff.
[135] Vodafone Core Submission, W/S Roche II, §3.16.
[136] Vodafone Core Submission, W/S Roche II, §3.17.
[137] Vodafone Core Submission, §5.7, Vodafone Core Submission, W/S Roche II, §§3.1–3.3.

3.78 Vodafone said that the fundamental modelling principles that had been used by Ofcom to maximize the degree of model calibration and reconciliation over time for a LRIC+ output had been entirely absent from the 2011 Modelling of the LRIC of termination.[138]

3.79 Vodafone said that the use of different dimensioning parameters from one year to another (except for asset cost inflation/deflation), ensured a reasonable degree of calibration to 'real world' asset volumes for each year of the total modelled period. It claimed that this meant that different parameters should also be used in the 'without MCT' version of the model. If they were not Ofcom's LRIC calculation, said Vodafone, was really a collection of short-term responses to the removal of a material traffic service, rather than the long-run response of a rational operator that was able to optimize its network at all levels of demand[139]).[140]

3.80 Vodafone provided the following specific examples where it considered that the network dimensioning parameters should have changed in the ex-MCT network:

(a) cell site rental costs;

(b) the proportion of microcells and picocells; and

(c) cell breathing and cell radii.

Cell site rental

3.81 Vodafone said that it would have expected that site rental costs would change in response to the related reduction in traffic in the ex-MCT network.

3.82 Vodafone explained that site rental costs had increased significantly in recent years—especially in traffic-constrained urban areas. This was because the supply of sites was relatively fixed and the demand for sites had increased in response to the growth in traffic. Vodafone said that the 2011 Model clearly recognized the relationship over time between the number of sites demanded and rental cost per site, but the LRIC calculation did not show the extent to which an operator was able to reduce costs in the long-run (in the ex-MCT version of the model).[141]

Proportion of microcells and picocells

3.83 Vodafone said that the 2011 Model made significant use of microcells and picocells in the urban and suburban areas.[142] The principal purpose of these short-range microcell and picocell sites (which were overlaid inside the wider area coverage provided by the larger and higher capacity macrosites) was to address local hot-spots of traffic peaks: however, these sites were considerably less cost-effective than a macrosite.[143] They were a response to the need to carry additional traffic. If traffic levels were lower, fewer of them would be deployed.[144]

3.84 Vodafone stated that in the 2011 Model, these sites were dimensioned in a fixed proportion of total traffic within each geotype[145] but, in the absence of inbound voice

[138] Vodafone Core Submission, W/S Roche II, §3.18.
[139] Vodafone Core Submission, W/S Roche II, §3.3.
[140] Vodafone Core Submission, §5.7; & Vodafone Core Submission, W/S Roche II §§3.1–3.3.
[141] Vodafone Core Submission, W/S Roche II, §3.4.
[142] Vodafone NoA, W/S Roche, §5.32.
[143] Vodafone NoA, W/S Roche, §5.32.
[144] Vodafone Core Submission, §5.41.1.
[145] Vodafone NoA, W/S Roche, §5.34.

traffic, there would be considerably lower hot-spot volumes (roughly one-third of 2G voice traffic was inbound). A rational network planner would therefore have needed to build significantly fewer of them, and would have expected them to handle a lower proportion of the traffic in the relevant geotypes.[146] Vodafone said that the 2011 Model showed that as traffic had increased over time the proportion of traffic on macrocells decreased.[147]

3.85 Vodafone said that as the network ex-MCT services did not exist[148] (and as therefore no empirical evidence was available), the question became one of logic.[149] Vodafone said that it would appear unfair criticism to assert that Vodafone was unable to provide evidence of network dimensioning in the world without termination when clearly such a world did not exist and had never existed.[150]

Cell breathing and cell radii

3.86 Vodafone said that when making an adjustment for cell breathing it assumed that different network design rules should apply to the ex-MCT network.[151]

3.87 Vodafone said that the fundamental part of its claim with respect to cell breathing was that the cell radii that Ofcom used in the model were a mixture of the need to provide coverage and the need to provide capacity. Vodafone noted that in the 2011 Model the cell radii changed over time, even though the coverage had not changed. Vodafone said that the cell radii had been forced to change in order to achieve the calibration against past equipment quantities.[152]

3.88 Vodafone said that cell breathing was a fundamental aspect of 3G networks, and primarily resulted from the fact that, unlike 2G, where adjacent cells could not share the same frequency 3G was designed to use the same carrier and frequency in adjacent cells. As the level of traffic carried by a 3G cell and its neighbours rose the effective range of a cell site shrank. Thus lower traffic volumes enabled the deployment of larger cells.[153] It followed that, under the lower traffic volumes assumed in the world without MCT, the area that could be covered by each site would rise, giving a larger cell radius and fewer sites in any given geotype.[154]

3.89 Vodafone said that when operators designed their networks, coverage was planned assuming a certain traffic load and the cell breathing effects were taken into account as a part of the design. Heavily loaded networks were designed with smaller cells compared with lightly loaded networks.[155]

3.90 Vodafone said that the cell breathing adjustments it applied, using the OPTA[156] approach were not objectively derived and were presented as a proxy for the wider failure of the 2011 Model to capture the full incremental costs of termination.[157]

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[146] Vodafone NoA, W/S Roche, §5.35.
[147] Vodafone Core Submission, W/S Roche, §3.3.
[148] Vodafone Core Submission, W/S Roche II, §§9.54 & 9.55.
[149] Vodafone Core Submission, W/S Roche II, §9.46.
[150] Vodafone Core Submission, W/S Roche II, §5.94.
[151] Vodafone staff hearing transcript, p10, line 25ff.
[152] Vodafone staff hearing transcript, p11, line 8ff.
[153] Vodafone NoA, W/S Roche, §5.50.
[154] Vodafone NoA, W/S Roche, §5.54.
[155] Vodafone NoA, W/S Roche, §5.53.
[156] OPTA is the Dutch Telecoms regulator.
[157] Vodafone Core Submission, W/S Roche II, §10.21.

3.91 Vodafone stated that adopting the same small 3 per cent increase in cell radius as used by OPTA[158] in the 'without' scenario increased LRIC by 0.0841ppm (which is around 12 per cent of Ofcom's LRIC estimate of 0.69ppm in 2014/15).[159]

EE

3.92 EE stated that Ofcom's cost model had not been properly updated for market and technological developments, and did not properly reflect the sensitivity of network design and costs to changes in traffic.[160]

3.93 EE stated that critical to the estimation of LRIC was accuracy in modelling the structure of the network and how costs changed with particular traffic volumes. This required a robust analysis of the extent to which specific costs were variable or fixed (this was a secondary issue for LRIC+ where charges contributed to both variable and fixed costs). Further, LRIC required consideration of what network would be built in a world without termination. This was quite different to the normal approach to modelling LRIC+ which was guided by how the actual UK networks had developed and were expected to develop into the future.[161]

Cell radii assumptions

3.94 EE stated that it considered that Ofcom's cost model could not be readily adapted to produce a reliable LRIC estimate because Ofcom had not focused its analysis to date on the key question of how termination traffic drove particular costs.[162] EE stated, for example, that one way that Ofcom had achieved calibration between overall traffic and costs over 2006 to 2009 was by assuming a significant increase in coverage sites. This was the result of the entirely artificial assumption that the maximum potential radius of a coverage cell decreased each year (as if technology was regressing or the laws of physics were changing).[163]

Microcells and picocells

3.95 EE said that fewer microcells and picocells would be needed if traffic reduced significantly.[164]

Cell breathing

3.96 EE said that it was reasonable to make an adjustment for cell breathing.[165] EE explained that for a 2G network coverage could be provided independently from capacity, but this was not the case for 3G.[166] With 3G the MNO had to make a decision on capacity on day one.[167] EE said that if no MCT services were provided, it would have built its network using larger cell radii for 3G.[168]

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[158] Vodafone pointed out that OPTA (the Dutch telecom regulator) made an adjustment for cell breathing in its model.
[159] Vodafone NoA, W/S Roche, §§5.55 & 5.56.
[160] EE Core Submission, §§10g & 199.
[161] EE Core Submission, W/S Hird 4, §8.
[162] EE Core Submission, W/S Hird, §10.
[163] EE Core Submission, W/S Hird, §11.
[164] EE SoI, W/S James, §59; & W/S Hird 2, §67.
[165] EE NoA, W/S Hird 2, §69.
[166] EE staff hearing transcript, p33, line 25ff.
[167] EE staff hearing transcript, p33, line 3ff.
[168] EE staff hearing transcript, p33, line 8ff.

Ofcom's Defence

3.97 Ofcom said that the 2011 Model built a 2G and 3G/HSPA network, which was built using over 80 individual assets. The dimensioning of these assets was influenced by a number of factors including network coverage, network traffic in the busy hour of the network, number of subscribers, floor space, equipment capacity, etc. The 2011 Model aimed to mimic real-world network deployments as far as possible while balancing complexity and materiality. The 2011 Model dimensioned a particular type of network asset based on the predominant factor that drove additional investment of that type of asset; for example, dimensioning of base stations was driven by network coverage and network traffic in the busy hour whereas dimensioning of voicemail servers was driven by the number of subscribers.[169]

3.98 Ofcom said that LRIC was calculated using the same network parameter assumptions in the ex-MCT network as the all-services network.[170]

3.99 Ofcom said that its calculation of LRIC could not be shown to be wrong by identifying certain costs—such as the costs of equipment in base stations, or the size of cell radii affecting the number of base stations that are needed—that were said to be affected, to some extent, by the hypothetical operator's projected traffic volumes. Even if there was some such effect (for example, because a hypothetical operator that projected that it would carry only a very small amount of call traffic would have bought cheaper equipment), it did not follow that the removal of MCT traffic volumes would have such an effect on the amount of avoidable costs (treating MCT as the final increment).[171]

Cell site costs

3.100 In respect of Vodafone's statements in relation to cell site costs, Ofcom responded that for a network providing all services other than MCT, Ofcom would expect the network to already reflect efficient dimensioning of assets for traffic handling capacity. Ofcom did not consider there to be a sufficient basis for concluding that the hypothetical network without MCT should be dimensioned on a different basis through adjustment of network design parameters.[172]

Microcells and picocells

3.101 Ofcom said that the 2011 Model included microcells and picocells to reflect real-world network deployments. These smaller cells were used to meet localized coverage needs (ie to provide in-fill to localized coverage gaps) and capacity needs (also known as traffic 'hot-spots'). Network design parameters determined the percentages of traffic in each geotype that were handled by microcells and picocells.[173]

3.102 Ofcom submitted that there was no material error in the modelling of traffic carried by microcells and picocells and therefore it was not necessary to make any adjustment for this.[174] In particular, for the network with all services other than MCT, Ofcom

[169] Ofcom Defence, Annex B, §124; Ofcom Core Submission, §78.
[170] Ofcom Core Submission, §78.
[171] Ofcom Defence, Annex B, §98.
[172] Ofcom Defence, Annex B, §154.
[173] Ofcom Defence, Annex B, §166.
[174] Ofcom Defence, Annex B, §165(iii).

expected the network to already reflect efficient dimensioning of assets for traffic handling capacity.[175]

3.103 Ofcom also referred to its decision where it stated that microcell deployment data, gathered from the national MCPs did not suggest a clear link between the percentage of microcells and the levels of termination traffic. While the number of cells ultimately varied with traffic, the precise split between macrocells, microcells and picocells as a function of termination traffic levels was not clear. Therefore, the removal of termination traffic could delay the deployment of additional macrocell sites and/or microcell sites and this was captured in the model through the traffic demand used for network dimensioning.[176]

Cell breathing and cell radii

3.104 Ofcom referred to its decision where it stated that some parameters, such as cell radii, could vary with the level of traffic in a practical deployment (for example, cell radii changing as result of cell breathing). However, the 2011 Model was an abstraction of a real-world network deployment and balanced practicability and materiality in estimating the long-run incremental costs of MCT.[177]

3.105 Ofcom agreed that cell breathing may have some effect on the LRIC of MCT, but the extent of that effect was uncertain and likely to be minor. Ofcom indicated an impact of around 4 per cent on LRIC[178] but that it may reduce over time as more spectrum became available.[179] Ofcom also said that the estimate of 4 per cent was likely to be too high when taking into account that there may be factors that would reduce this estimate (for example, in some geotypes, like rural geotypes, it was highly unlikely that most of the sites would be capacity constrained[180] and in early years the traffic per cell site or per sector would be very low, so the impact on cell breathing would be very limited[181]).[182]

3.106 Ofcom stated that given the complexity of modelling cell breathing and its uncertain and apparently limited effect on the unit costs of MCT, Ofcom did not consider it proportionate to investigate this effect further. To robustly model cell breathing would require modelling time-varying cell radii, which were a function of network traffic, and this would be complex to implement. Vodafone's suggested adjustment of increasing the cell radii of all cells by 3 per cent for all years could overestimate the cost of MCT because cell breathing was unlikely in cells that were not capacity constrained and, in addition, the increase in cell radii in some capacity-constrained sites could be less than 3 per cent.[183]

3.107 Ofcom also considered that if it made a cell radii adjustment in the ex-MCT network, it would not be able to verify the robustness of this adjustment through a calibration exercise, because no ex-MCT network existed in practice.[184] Ofcom considered that trying to model cell breathing in the ex-MCT network would require significant consultation with MNOs, which would be on a highly speculative basis.[185] Ofcom also considered that making an adjustment for cell breathing may require other adjustments

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[175] Ofcom Defence, Annex B, §169.
[176] Ofcom Defence, Annex B, §168.
[177] Ofcom Defence, Annex B, §171.
[178] Ofcom Defence, Annex B, fn 220.
[179] Ofcom Defence, Annex B, §171 and fn 222.
[180] Ofcom staff hearing transcript, p51, line 11ff.
[181] Ofcom staff hearing transcript, p52, lines 1–14ff.
[182] Ofcom staff hearing transcript, p50, lines 1–17ff.
[183] Ofcom Defence, Annex B, §172.
[184] Ofcom staff hearing transcript, p50, lines 17–22ff.
[185] Ofcom staff hearing transcript, p50, line 23, to p51, line 6.

elsewhere in the model (eg for the profiling of 3G traffic on to 2G).[186] Ofcom said it made the conscious decision that it was not necessary to model cell breathing on the grounds of proportionality.[187]

BT SoI in support of Ofcom

Cell breathing and cell radii

3.108 BT was of the view that cell breathing costs were driven by customer numbers rather than by traffic.[188] BT noted that Vodafone stated that cell breathing was necessary to cope with a situation where the number of people accessing the network in a cell increased and the cells therefore had to 'breathe (in)' and reduce the radius served. BT noted Vodafone's explanations were entirely in terms of the number of users not traffic volumes: 'This dynamic effect based on the number of users in the cell is known as cell breathing.' BT concluded that allowing for cell breathing ought properly to be considered as being part of providing an adequate access network[189] that could enable every customer who wanted to do so to make or receive a call.[190]

3.109 BT stated that it was common ground that, as the number of people using a mobile phone in a 3G cell increased, the cell needed to breathe and that MNOs needed to increase their investment in their access networks to cater for this. The MNOs characterized this as a 'traffic-related' cost but BT said that in reality, catering for cell breathing was rather just part of providing adequate network access using 3G technology—if MNOs did not allow for cell breathing then the probability that customers would be able to make or receive calls at busy times would fall below the levels that customers would find acceptable (and any MNO who did not allow for cell breathing would lose customers to those who did).[191]

3.110 BT stated that there was no equivalent of cell breathing in the fixed access network but that was because the underlying technologies (and hence what was involved in providing adequate access) were different. It stated that such differences in technology did not justify treating fixed and mobile networks differently when it came to the recovery of access network costs through termination rates.[192]

3.111 BT added that Vodafone overestimated the impact of cell breathing because not all cells would be affected by the cell breathing effect (for example, cells in rural and suburban areas).[193]

Three's SoI in support of Ofcom

Microcells and picocells

3.112 Three stated that the number of microcells and picocells had reduced over time as traffic levels had risen and more macrocells had been installed instead.[194]

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[186] Ofcom staff hearing transcript, p53, lines 14–21.
[187] Ofcom Defence, Annex B, §172.
[188] BT SoI, §63d, BT SoI, W/S Richardson, §15d.
[189] BT said that all communications networks comprised two elements: first, an access network that enabled customers to send and receive calls (or other forms of communication); and second, a core network that switched calls and transmitted them to the access networks of the called parties—see BT SoI, W/S Richardson 2, §12.
[190] BT SoI, W/S Richardson 2, §57c.
[191] BT Core Submission, §71b.
[192] BT Core Submission, §71c.
[193] BT staff hearing transcript, p9, line 16ff.
[194] Three SoI, §10.31.

3.113 Three provided the example of 2009/10 where the 2011 Model indicated that traffic would fall by 24 per cent (if MCT services were excluded). This would take traffic to just below the level observed in 2004/05, when it was 21 per cent below the 2009/10 level. However, evidence presented by Ofcom on operator asset counts suggested that between 2004/05 and 2009/10, the number of 2G microcell and picocell sites fell, and the number of 2G macrocell sites rose, and that as a result the prevalence of microcell sites and picocell sites fell from 22 to 17 per cent of all 2G sites.[195]

3.114 Three stated that this did not prove that there was no positive correlation between traffic levels and the prevalence of microcell and picocell sites, but it did suggest that it would be inappropriate to assume one for modelling purposes in the absence of further evidence.[196]

Cell breathing and cell radii

3.115 Three explained that cell breathing was a fundamental aspect of 3G networks and resulted from the fact that 3G was designed to use the same frequencies in adjacent cells. Cell breathing improved the overall radio network spectral efficiency but introduced some challenges for the radio network design.[197]

3.116 Three explained that as the level of traffic carried by a cell and its neighbours rose, so inter-cell and intra-cell interference rose, and the effective range of a cell site shrank.[198]

3.117 Three stated that cell breathing was a very complicated phenomenon with many dependencies. Three noted, in particular, that cell breathing was impacted by how the surroundings affected the passage of radio waves. For example, cell breathing was more pronounced in urban environments where there were more solid objects to absorb the radio waves.[199] Three provided an example that showed that a reduction in capacity of 25 per cent would increase the cell radius by 3.3 per cent in an urban environment and 2.9 per cent in a suburban environment.[200]

3.118 Three was of the view, given the complexities of cell breathing, that network operators did not model cell breathing in every circumstance, but would try to plan ahead to manage the effects of cell breathing by deploying cell sites a reasonable distance apart with effective ranges that overlapped at very low levels of traffic. Operators would then add capacity to the cell sites, for example by deploying an additional carrier, once traffic passed a certain threshold, in order to prevent effective ranges shrinking too far (and creating coverage gaps between cell sites).[201] The further apart that cell sites were initially deployed, the lower the traffic threshold at which additional capacity was required to prevent coverage gaps. In other words, there was a trade-off to be made between the planning radius of a cell site and its traffic capacity. A larger radius resulted in a lower capacity; and a smaller radius resulted in a higher capacity (and a reduction in capacity increased the need to deploy additional sites to service traffic at a later stage[202]).[203] It was this trade-off that was the basic operational characteristic of cell breathing.[204]

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[195] Three SoI, W/S Mantzos 2, §3.31.
[196] Three SoI, W/S Mantzos 2, §3.31.
[197] Three SoI, W/S Binucci 2, §2.1.
[198] Three SoI, W/S Binucci 2, §2.1.
[199] Three SoI, W/S Binucci 2, §2.2.
[200] Three SoI, W/S Binucci 2, §2.4.
[201] Three SoI, W/S Binucci 2, §2.5.
[202] Three SoI, W/S Binucci 2, §2.9.
[203] Three SoI, W/S Binucci 2, §2.6.
[204] Three SoI, W/S Binucci 2, §2.6.

3.119 Three considered that as the 2011 Model assumed fixed radii for cell sites and then added capacity to cell sites as traffic increased, and as the parameters for both had been compared with historical operator data, the 2011 Model implicitly captured the basic operational impact of cell breathing.[205]

3.120 Three accepted that it would theoretically be possible to deploy 3G cells with larger cell radii if each cell did not have to carry as much traffic (due to the absence of MCT traffic). However, the larger cell radii would lead to a reduced capacity of each cell. It would be extremely difficult to work out exactly how the reduction in cell radii would affect capacity.[206]

3.121 Three considered that it was unnecessary to perform such an analysis since the 2011 Model implicitly captured the basic operational impact of cell breathing, and considered that if Vodafone's approach to cell breathing was taken, it would result in double counting (this was because the cell breathing effect determined the maximum capacity of the cell[207] and the capacity constraining effect of cell breathing was captured in the network dimensioning that Ofcom had done in the 2011 Model[208]).[209] Three also said that if cell breathing was modelled as an increase in cell radius, then an offsetting adjustment would need to be made about the capacity that could be carried in these larger radii.[210]

3.122 Three considered that Vodafone's adjustments to the 2011 Model to reflect cell breathing ignored the reduction in capacity resulting from larger radii, and that Vodafone's adjustment was therefore inconsistent with 'cell breathing'.[211] Three considered that Vodafone, because it did not also reduce cell traffic capacities in its adjustment for cell breathing, modelled an unwarranted increase in the overall level of network efficiency, and an understatement of costs, in the ex-MCT scenario.[212]

Assessment: the network design parameters

3.123 Vodafone said that Ofcom should have used different network design parameters for the ex-MCT network compared with the all-services network.

3.124 We consider that, in principle, there may be a case for Ofcom using different design parameters in the ex-MCT network in certain circumstances, for example for assets where Ofcom uses different design parameters over time and where such differences are traffic related (as Ofcom considered the ex-MCT network to be similar to a time shift (ie an earlier build) of the current network). However, we consider that the appropriateness of any such design parameter adjustment cannot, when modelling the MCT charge control, be answered at a general level, in the abstract. Rather any potential adjustments must be considered individually, parameter by parameter, based on specific arguments raised and evidence presented.

3.125 We accept that the 2011 Model is an abstraction of reality and will necessarily need to include approximations.

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[205] Three SoI, W/S Binucci 2, §2.7.
[206] Three SoI, §10.50; Three SoI, W/S Binucci 2, §§2.7 & 2.9.
[207] Three staff hearing transcript, p12, line 16ff.
[208] Three staff hearing transcript, p13, lines 3ff & 16ff.
[209] Three SoI, §10.50.
[210] Three staff hearing transcript, p14, lines 9–19.
[211] Three SoI, W/S Binucci 2, §2.10.
[212] Three SoI, W/S Mantzos 2, §3.65.

Cell site costs

3.126 Vodafone said that site rental costs in the ex-MCT network should be lower than in the all-services network. This was because less demand for cell sites would drive rental costs down and because the 2011 Model had shown increases over time for cell site costs.

3.127 Vodafone has not provided supporting evidence that site rental costs would, on average, be lower for those sites that remained if MCT services were not provided. For example, it is not clear that the increase for cell site costs in the 2011 Model is predominantly caused by an increase in traffic volumes.

3.128 We therefore consider that it has not been demonstrated that Ofcom erred in not adjusting cell site costs in the ex-MCT network.

Proportion of microcells and picocells

3.129 Vodafone said that Ofcom should have used a different proportion of microcells and picocells in the ex-MCT network compared with the all-services network. It reasoned that because these sites were more expensive than macrocell sites, disproportionately more of these sites would be removed in the ex-MCT network given the lower traffic levels of the ex-MCT network. Vodafone said that the 2011 Model itself showed an increased proportion of microcells and picocells over time. Ofcom said that microcell and picocell sites were used to meet a mixture of local coverage and capacity needs and that it considered that the proportion of microcells and picocells in its model reflected an efficient deployment of microcells and picocells. Ofcom also stated that it had no evidence of a clear link between the proportion of microcells and picocells and termination traffic. Three also provided evidence suggesting that there was no clear link between traffic levels and the proportion of microcells and picocells.

3.130 We note that Vodafone indicated that the evidence of a link between the proportion of microcells and picocells and the ex-MCT network was one of logic when the ex-MCT network did not exist. However, we were persuaded by Ofcom's reasoning that, in principle, a network that has design parameters that provide the cost of the all-services network satisfactorily over time does also provide a sufficient approximation of the costs of the ex-MCT network at a specific point in time (see paragraph 3.68). We therefore consider that evidence relating to the proportion of microcells and picocells over time could inform the appropriateness of such an adjustment.

3.131 We agree with Vodafone that the proportion of microcell and picocell sites increased in certain periods in the 2011 Model. However, we agree with Ofcom and Three that there is insufficient evidence to suggest that the proportion of microcells and picocells is related to termination traffic. In particular, we were persuaded by Ofcom's explanation that a proportion of microcells and picocells are built for coverage purposes.

3.132 We therefore do not consider that Vodafone has demonstrated that Ofcom has erred in its modelling of microcells and picocells.

Cell breathing and cell radii assumptions

- *Cell radii assumptions*

3.133 Vodafone stated that cell radii had changed in the 2011 Model over time in order to achieve calibration of the 2011 Model. EE said that Ofcom's cell radii assumptions changed over time, but that this did not reflect the physical properties of cell radii, which did not change.

3.134 We consider it plausible that if cell radii in the 2011 Model change over time, similar changes should be expected in the ex-MCT network if such changes are traffic related. However, Vodafone and EE have not provided us with any evidence of changes to 3G cell radii over time in the 2011 Model.

3.135 Vodafone and EE pointed out only very minor changes to 2G cell radii (a 1 per cent reduction of cell radii per year for a period of four consecutive years). However, EE and Vodafone provided no evidence that the changes in the 2G cell radii in the 2011 model were traffic related.

3.136 We also note Ofcom's view that changes in the size of cell radii, even if they were traffic related, would not necessarily be related to the removal of MCT traffic volumes (when treating MCT as the final increment).

3.137 We also consider, given that the only change in the 2G cell radii was a 1 per cent reduction per year for a period of four consecutive years, and given that we noted in paragraph 4.242 in Section 3 that removing this adjustment to the 2G cell radii only had a small impact on LRIC of less than 1 per cent, it would likely be disproportionate to make a similar adjustment in the modelling of the ex MCT network.

3.138 We therefore do not consider that it has been demonstrated that Ofcom erred by not changing cell radii in the ex-MCT network.

- *Cell breathing*

3.139 Vodafone said that for 3G cells, the coverage radii increased as the traffic carried in the site shrank and an adjustment should therefore be made to the ex-MCT network to reflect this increased cell radii as the ex-MCT network carried less traffic.

3.140 From the evidence provided, it was unclear to us if an adjustment for cell breathing was, in principle, appropriate.

3.141 Ofcom acknowledged that cell breathing may have an effect on LRIC, but considered that this effect was less than 4 per cent of LRIC and that modelling this effect would have been complex and, therefore, disproportionate.

3.142 We found Three's case that the 2011 Model implicitly captured the basic operational impact of cell breathing persuasive for sites that are capacity constrained (because an adjustment would need to be made to account for the reduced cell capacity in the ex-MCT network if cell radii are decreased) and found Ofcom's case persuasive that cell breathing would be unlikely to have a significant effect in coverage sites. Further, we were not persuaded that Ofcom was wrong to say that modelling cell radii would likely have been disproportionate. While Vodafone's proposed adjustment for cell breathing would have had a larger impact on LRIC than suggested by Ofcom (12 per cent compared with 4 per cent or less), we gave less weight to this estimate as Vodafone had stated that its own adjustment was not objectively derived.

3.143 We are therefore not persuaded that Ofcom erred by not modelling cell breathing.

Conclusion on network design parameters

3.144 Based on our assessment of the reasoning and evidence as set out above, we do not consider that it has been demonstrated that Ofcom erred in its modelling of the network design parameters in the 2011 Model.

(c) Traffic- and non-traffic-related costs

Ofcom's decision

Spectrum

3.145 Ofcom stated that, in principle, LRIC could include some contribution to spectrum costs.[213] However, the implementation of LRIC in the MCT cost model meant that Ofcom did not have to include an explicit estimate of spectrum costs (and that it would not be conceptually appropriate to do so[214]). This was because there was a trade-off between spectrum carriers and network equipment, and Ofcom considered that a rational MCP would not be prepared to pay more for a spectrum carrier to meet a given increment of traffic than the network costs associated with the traffic increment.[215] The LRIC version of the MCT cost model already estimated those network equipment costs, so adding any traffic-driven spectrum costs would effectively involve double counting. Ofcom considered that, viewed in this way, changes in spectrum value should have no impact on the LRIC of MCT.[216]

3.146 Ofcom said that LRIC should be unaffected by the value assigned to spectrum as third-party incoming voice traffic did not require the hypothetical efficient operator to deploy extra spectrum carriers (or if it did would be willing to pay no more than the avoided network costs thereof).[217]

HLR update costs

3.147 Ofcom said that it did not include the home location register (HLR)[218] update costs in the LRIC calculation because HLR updates would need to occur even if there were no off-net originated incoming calls.[219] Ofcom explained that the 2011 Model assumed that HLR update costs were driven by subscriber numbers. It was true, it said, that if there were no incoming calls there would be no need for HLR updates, so in that sense HLR update costs could be seen as traffic driven. However, HLR updates would in any case be needed to support on-net inbound traffic. The off-net termination increment would not cause additional HLR updates and so would not produce incremental costs.[220] Ofcom noted that for 2014/15 the HLR update costs contributed 0.01ppm (in 2008/09 prices) to the LRIC+ of MCT.[221]

Vodafone's challenge

3.148 Vodafone said that the 2011 Model did not correctly distinguish between traffic- and non-traffic-related costs[222] and that it did not properly implement the requirements of the EC Recommendation as:[223]

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[213] Ofcom explained that the reason LRIC could include some contribution to spectrum was that if termination volumes were zero, then this might entail an MCP avoiding having to purchase (or reducing) its current spectrum holdings. For a given amount of spectrum, more capacity could be provided by increasing the size of the network (ie increasing the number of base stations and/or traffic-handling capacity at base stations). Alternatively, for a given size of network (ie a fixed number of base stations), more capacity could be provided if more spectrum was deployed. (Ofcom Decision, §A9.8.)
[214] Ofcom Decision, §§9.93 & A9.7.
[215] Ofcom Decision, §§A9.34 & 9.97.
[216] Ofcom Decision, §A9.9.
[217] Ofcom Decision, §9.101.1.
[218] Ofcom explained that the HLR updates identify the location of subscribers on the network in order to efficiently route mobile services, including incoming voice calls, to them.
[219] Ofcom Decision, §A9.82.
[220] Ofcom Decision, §A9.97.
[221] Ofcom Decision, §A9.83.
[222] Vodafone Core Submission, §5.19.2.
[223] Vodafone NoA, §§66–69; Vodafone NoA, W/S Roche, §§4.6 & 4.7.

(a) Some costs were treated as being unrelated to traffic (ie classified as fixed coverage costs, or as varying with some factor other than traffic—eg customer numbers, or cell sites) when they were, in fact, traffic-related costs in whole or in part.[224]

(b) Some costs that were partly traffic related and partly non-traffic related were split incorrectly, with too much of the overall cost being treated as non-traffic related.[225]

3.149 Vodafone said that when the 2011 Model was used to calculate incremental costs for all services, the sum of traffic-related costs for all services was less than 50 per cent of total costs. It described this as implausible.[226]

3.150 Vodafone further stated that when all traffic-related demand from the 2011 Model was removed, the 2011 Model still produced (non-traffic-related) costs of more than 50 per cent of total costs (£10.8 billion costs out of total network costs of £20.7 billion[227]).[228]

3.151 Vodafone said that Ofcom needed to attempt to measure which costs were incremental to termination, rather than just rely on the outputs of a model built for another purpose.[229] Vodafone was of the view that the best first step was to identify which costs were traffic related and which were not, at all levels of traffic, so that the correct total of incremental cost relating to termination could be obtained from all years of the model.[230]

3.152 Vodafone said that the 2011 Model was derived from previous models which never had to identify separately traffic-related and non-traffic-related costs.[231] It was wrong for Ofcom to assume that the 2007 Model that did not need to separate traffic from non-traffic-related costs would automatically produce a correct split of traffic- and non-traffic-related assets.[232]

3.153 Vodafone said that the 2011 Model did not measure the right quantity of assets incremental to MCT services. It said that the 2011 Model should, in every single year, measure the assets that were incremental to termination in order to get the MCT right for that particular year.[233]

3.154 Vodafone provided the following examples of assets that were incorrectly treated in the 2011 Model as being non-traffic related:

(a) the network management system (NMS) (see paragraph 3.156);

(b) spectrum (see paragraph 3.164);

(c) voicemail (see paragraph 3.180); and

(d) HLR update (see paragraph 3.182).

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[224] Vodafone NoA, §69.1.
[225] Vodafone NoA, §69.2.
[226] Vodafone NoA, W/S Roche, §4.12.
[227] Costs in this context are the cumulative cash outflows from the start of the model in 1991/92 to 2014/15. See Vodafone NoA, W/S Roche, Table 4.2.
[228] Vodafone NoA, W/S Roche, §§4.13 & 4.24.
[229] Vodafone Core Submission, W/S Roche II, §5.12.
[230] Vodafone Core Submission, W/S Roche II, §5.11.
[231] Vodafone NoA, W/S Roche, §2.35.
[232] Vodafone bilateral hearing transcript, p91, lines 2ff.
[233] Vodafone staff hearing transcript, p37, line 1ff.

3.155 Vodafone's reasoning in relation to each of these assets is set out below in turn.

NMS

3.156 The cost of NMSs was not fixed and it was wrong to assume that all its individual components, hardware, software, people, equipment, space etc were totally invariant to traffic levels.[234] Vodafone stated that at least 90 per cent of network management costs were traffic related.[235]

3.157 Vodafone said that it was a matter of interpretation as to what the NMS really was. Vodafone's view of the NMS was a collection of people and systems that managed the network and any such system must, it said, increase in complexity with traffic.[236]

3.158 Vodafone considered that in the real world network management was something rather more than a single piece of software—it was the rising complexity of the network in terms of traffic volumes, network nodes, services, devices and so on that increased the difficulty and cost of network management.[237]

3.159 Vodafone estimated that the LRIC would change by 0.0065ppm (this is around 1 per cent of Ofcom's LRIC of 0.69 in 2014/15) if 20 per cent of NMS cost were deemed to be incremental to MCT services.[238]

3.160 Vodafone said that Ofcom's reference to its information request to MCPs (which allegedly showed no deployment of additional NMS assets over time), on which information Ofcom based its NMS costs in the model, was misleading because the relevant question to MCPs focused on network management centres, which might not be co-extensive with the NMS, and because the question focused on the number of network management centres, not their scale/cost.[239]

3.161 Vodafone said that the evidence it provided to Ofcom during its consultation process made clear that it did not consider that incremental NMS costs would be small.[240]

3.162 Vodafone said that Ofcom did not ask enough or sufficiently clear questions to get enough information to make the decision it did on the NMS.[241]

3.163 Vodafone accepted that the use of traffic as the single driver of network management cost was a simplification, but a more likely expression of the real world than Ofcom's implicit assumption that the costs were fixed.[242]

Spectrum

3.164 Vodafone stated that 90 per cent of spectrum costs (but not spectrum volume) should be considered to be traffic related.[243] Vodafone also said that in the absence of traffic, spectrum would be worthless to a mobile operator and spectrum must thus be a traffic-related cost, consumed in relation to its resource usage.[244]

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[234] Vodafone NoA, W/S Roche, §4.33.
[235] Vodafone NoA, W/S Roche, §4.35.
[236] Vodafone staff hearing transcript, p12, line 4ff.
[237] Vodafone Core Submission, W/S Roche II, §9.31.
[238] Vodafone NoA, W/S Roche, §5.19.
[239] Vodafone Core Submission, §5.29.2.
[240] Vodafone Core Submission, §5.29.3.
[241] Vodafone staff hearing transcript, p13, line 4ff.
[242] Vodafone Core Submission, W/S Roche II, §3.33.
[243] Vodafone NoA, W/S Roche, §§4.44 & 4.45.
[244] Vodafone NoA, W/S Roche, §5.21.

3.165 Vodafone said that where the total cost of a network asset could be logically argued to be different in the world without termination from the world with termination, then it was appropriate that this cost should be recovered from termination.[245] It said that the EC Recommendation clearly contemplated that spectrum would be treated as being, in part, incremental to the MCT service.[246]

3.166 Vodafone said that Ofcom appeared to acknowledge that an absence of the MCT service would affect the value of spectrum.[247] The value of spectrum was therefore related to traffic and should be less in a network that carried less traffic.[248]

3.167 Vodafone clarified that its appeal was not about the volume of spectrum an average efficient operator would possess, but more about the value of this spectrum.[249]

3.168 Vodafone pointed out that in the Netherlands, the NRA (OPTA) took account of these considerations by reducing 2G spectrum volume and cost in assessing the costs of providing a network without an MCT service.[250]

3.169 Vodafone estimated that if spectrum cost (ie its value, rather than volume) was reduced by 20 per cent (because Vodafone estimated that 20 per cent of all resources were used by MCT services[251]), the value of LRIC increased by 0.1787ppm (this is around 25 per cent of Ofcom's LRIC of 0.69 in 2014/15).[252]

3.170 Vodafone was of the view that spectrum cost in Ofcom's Model should be determined by the value in use[253] and by the opportunity cost measured by the equipment cost saved from using spectrum.[254]

- *Value in use*

3.171 With respect to the LRIC of MCT, Vodafone stated that the relevant consideration was the value of spectrum to an MNO that provided all services except MCT vis-à-vis the value of the same spectrum to an MNO that provided all services.[255] Vodafone said that it valued spectrum by reference to the value in use and if Vodafone predicted less traffic it would assign less value to the spectrum.[256,257]

3.172 Vodafone said it considered that value in use of spectrum was the revenue-generating capabilities of spectrum, taking into account equipment costs and opportunity costs associated with providing these services.[258] Vodafone said that in competitive markets operators would value spectrum at the level that generated normal profitability taking into account the demand function and the cost of providing the services. The removal of MCT resulted in a material reduction in the operator's value

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[245] Vodafone Core Submission, W/S Roche, §9.49.
[246] Vodafone Core Submission, §5.32.4.
[247] Vodafone Core Submission, §5.32.5.
[248] Vodafone staff hearing transcript, p19, line 1ff.
[249] Vodafone NoA, W/S Roche, §5.22.
[250] Vodafone Core Submission, §5.32.6.
[251] Vodafone NoA, W/S Roche, §5.22.
[252] Vodafone NoA, W/S Roche, §5.29.
[253] Vodafone staff hearing transcript, p18, line 20ff.
[254] Vodafone staff hearing transcript, p19, line 1ff.
[255] Vodafone Core Submission, W/S Roche II, §9.37.
[256] Vodafone Core Submission, W/S Roche II, §§9.47 & 9.48, and Vodafone staff hearing transcript, p17, line 13ff.
[257] Vodafone said that whilst some spectrum valuations were a function of potential cost savings or avoidance of cost inefficiencies, this was generally only the case for spectrum renewals. With respect to the LRIC of termination, the relevant consideration was the value of spectrum to an MNO that provided all services except termination compared with the value of the same spectrum to an MNO that provided all services.
[258] Vodafone bilateral hearing transcript, p117, line 19ff.

in use calculation and the amount that operator would be prepared to pay for the spectrum would decline.[259]

3.173 The long-run market outcome (in this hypothetical world) would depend on whether an alternative use of spectrum was more valuable, in which case the operator would be incentivized to give up some spectrum. This would result in the operator incurring more network costs causing an additional reduction in spectrum value until normal profitability ensued.[260]

3.174 Vodafone stated that spectrum was the single most scarce resource for an MNO and that all MNOs would seek to obtain as much spectrum as possible.[261] This scarcity explained why spectrum auctions had raised billions of pounds for European governments in the last ten years—a trend that showed no sign of abating.[262] In the event that an MNO no longer provided termination services, it would still be in the MNO's interest to maintain its full spectrum holding.[263]

3.175 [✂][264] Vodafone also noted that Three was claiming that it was going to run out of 3G spectrum by the end of 2012.[265]

- *Opportunity cost of spectrum*

3.176 Vodafone explained that changes in traffic also changed the opportunity cost of spectrum.[266]

3.177 Vodafone said that as the amount of traffic on the network went down, opportunity cost would also go down, so the value of the spectrum would reduce at the margin.[267] It said that the cost of the equipment did not change with varying traffic levels, but the opportunity costs of the spectrum did change because, with less traffic, the difference in the amount of equipment that could be saved would go down (for example, because there would be fewer microcells and picocells,[268] and because if traffic was close to zero then spectrum could be given up without any requirement to increase the asset count[269]).[270]

3.178 Vodafone explained that at current traffic levels the equipment costs saved were much higher than at a near-zero-traffic level (where removing spectrum would not create any cost savings). There was therefore a continuum between the near-zero-traffic scenario, where the value of the spectrum was zero, and the current price of the spectrum. Therefore in the ex-MCT network spectrum values must be somewhere between a zero value of spectrum and the current value of spectrum.[271]

3.179 However, Vodafone also said that the shape of the cost/traffic curve was not known precisely, but that spectrum was valued in relation to traffic.[272]

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[259] Vodafone Core Submission, W/S Roche II, §9.37.
[260] Vodafone Core Submission, W/S Roche II, §3.7.
[261] Vodafone Core Submission, W/S Roche II, §9.37.
[262] Vodafone Core Submission, W/S Roche II, §9.36.
[263] Vodafone Core Submission, W/S Roche II, §3.7.
[264] Vodafone bilateral hearing transcript, p120, line 21.
[265] Vodafone bilateral hearing transcript, p121, lines 17–21.
[266] Vodafone NoA, W/S Roche, §4.40.
[267] Vodafone staff hearing transcript, p19, line 1.
[268] Vodafone bilateral hearing transcript, p114, line 22ff.
[269] Vodafone bilateral hearing transcript, pp115 & 116.
[270] Vodafone bilateral hearing transcript, pp115 & 116.
[271] Vodafone staff hearing transcript, p19, line 12ff.
[272] Vodafone bilateral hearing transcript, p116, lines 6–8.

Voicemail

3.180 Vodafone said that Ofcom had modelled voicemail boxes as being dimensioned by customer numbers, with the result that none of the costs of such voicemail boxes were regarded as incremental to the MCT service. Vodafone alleged that this was incorrect as such boxes were ultimately dimensioned by their messaging capacity, although it said that they were provided in proportion to subscriber numbers.[273] However, the capacity and cost of such platforms were directly influenced by the size of each box and this was a direct result of traffic.[274]

3.181 Vodafone explained that in the volumes of on-net traffic and off-net originated inbound traffic were roughly equal.[275] Therefore 50 per cent of the voicemail messages deposited might be inferred to originate from off-net sources. It followed that, in the absence of an MCT service, a voicemail platform would need only 50 per cent of the capacity.[276] Vodafone estimated that making such an adjustment would increase the LRIC by 0.0090ppm (this is around 1 per cent of Ofcom's LRIC of 0.69 in 2014/15).[277]

HLR

3.182 Vodafone said that the purpose of the HLR (which maintained a current knowledge of a customer's status and location) was to eliminate excessive signalling in the network in order to enable the rapid connection of an inbound call, and was therefore traffic related as in the absence of traffic on the network there would be no need for the HLR.[278] Vodafone stated that HLR accounted for £474 million out of the £10.8 billion non-traffic-related cost in the 2011 Model, but did not provide an estimate for the impact on LRIC from this error.

EE's challenge and SoI in support of Vodafone

3.183 EE stated that the Ofcom model treated as fixed some of the costs that should have been treated as variable costs in the long run. For example, without termination services MCPs would vary both their spectrum holdings and their network equipment, yet the 2011 Model was based on keeping spectrum holdings fixed. Similarly, EE said that Ofcom ignored that absent MCT services, MCPs could and would adjust the number of their microcells and picocells and reduce overall coverage.[279]

NMS (EE's SoI in support of Vodafone)

3.184 EE said that the NMS was the hardware and software that helped monitor and manage the usage and performance of the network as well as managing faults and security.[280] The administration of routing tables and especially the frequency of change of those tables was dependent on the amount of traffic as with more traffic and more routes to choose from, it became more important to optimize costs through lowest-cost routing for the right quality interconnections with other networks. These network management systems costs would therefore be likely to be reduced in the event that a termination service was no longer provided (approximately 20 per cent

[273] Vodafone NoA, W/S Roche, §4.48.
[274] Vodafone Core Submission, W/S Roche II, §7.125.
[275] Vodafone Core Submission, W/S Roche II, §7.125.
[276] Vodafone NoA, W/S Roche, §4.48.
[277] Vodafone NoA, W/S Roche, §5.40.
[278] Vodafone NoA, W/S Roche, §4.51.
[279] EE NoA, §34.
[280] EE SoI, W/S James, §54.

lower if no MCT services were provided).[281] EE said that whilst some NMS equipment may not vary with traffic, when looking at the totality of NMSs they were associated with quite a lot of incremental equipment purchases.[282]

Spectrum (EE's challenge and SoI in support of Vodafone)

3.185 EE argued that Ofcom had made an error in assuming that operators' holding of spectrum remained constant, when working out the total cost of supplying all services except termination.[283]

3.186 Whilst EE agreed with Vodafone that additional savings from spectrum costs could be achieved if no MCT services were provided (which were not captured in the 2011 Model), the magnitude of such savings was difficult to identify.[284] EE was of the view that only 5 per cent of spectrum costs could be saved (vs Vodafone's assumption of 20 per cent).[285] These additional savings were from the ability to trade off spectrum cost savings vs equipment costs savings and the savings due to the overall lower demand for spectrum if no MCT was provided.[286] EE suggested that Ofcom may be able to provide an estimate of the cost savings.[287]

- *Reducing both spectrum and network equipment*

3.187 EE argued that ceasing to supply all termination services could not be said to be a marginal change.

3.188 EE said that if operators ceased to supply MCT then cost savings were likely to be achieved by operators by reducing both their spectrum holdings as well as the number of cell sites built to provide capacity. It said that this would lead to greater cost savings than those Ofcom calculated by assuming that spectrum holdings were held fixed, and accordingly Ofcom had underestimated the LRIC of termination.[288]

3.189 EE also said that if there was a functioning market for spectrum, operators could have acquired spectrum at a later date (which would delay the expenditure for spectrum).[289]

3.190 EE said that 2G spectrum became tradable recently, but the number of trades were very small.[290] It added that spectrum holdings for all the mobile operators for 2G had not changed for a long time and therefore it was not really possible to use more or less spectrum in practice.[291] EE explained that because spectrum was valuable, operators would not reduce the amount of spectrum they would hold, but the spectrum that they would hold would be of lower value.[292]

3.191 EE later stated that it did not believe that savings were available from optimizing the trade-off between spectrum and equipment cost savings as, in the UK, in practice operators were unlikely to reduce the amount of spectrum that they would hold

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[281] EE SOi, W/S James, §54; and EE SoI, W/S Hird 2, §§61 & 62.
[282] EE staff hearing transcript, p31, line 13ff.
[283] EE NoA, §157.2.
[284] EE SoI, W/S Hird 2, §65.
[285] EE SoI, W/S Hird 2, §66.
[286] EE SoI, W/S Hird 2, §§65 & 66.
[287] EE SoI, W/S Hird 2, §66.
[288] EE NoA, W/S Hird I, §44, EE NoA, §157.2; and EE Core Submission, W/S Hird 4, §62.
[289] EE letter of 8 November 2011, p3.
[290] EE staff hearing transcript, p39, line 21ff.
[291] EE bilateral hearing transcript, p110, lines 23–25.
[292] EE staff hearing transcript, p23, line 25.

(because prices of spectrum would fall to create demand for any excess spectrum, leaving spectrum holdings constant[293]).[294]

- *Value in use*

3.192 EE considered that total termination revenues should efficiently cover the total incremental cost of supplying termination. As the supply of termination across the industry would result in higher demand for, and a higher price for, spectrum, then this cost (ie the volume and price changes resulting from spectrum) should be recovered in termination revenues. If not, MCPs would have to cross-subsidize termination from other services to avoid suffering a loss.[295]

3.193 EE stated that the 2011 Model assumed that there would be no change in the price of spectrum even if all MCPs were to stop supplying incoming calls.[296] EE said that if all operators ceased supplying mobile termination services, then it was likely that the value of spectrum would fall.[297]

3.194 EE disagreed with Ofcom's view that the price paid for a resource would stay the same as long as its purpose stayed the same. As an example, EE noted that the highest-value use for some land might always be for residential housing; however, that did not mean that the price of land would not change as overall demand for residential housing in an area changed.[298]

3.195 EE said that whilst Ofcom rejected the argument that the price of spectrum would change in the absence of voice traffic, previously Ofcom had submitted to the CC that the price of spectrum could vary with demand.[299]

- *Opportunity cost of spectrum*

3.196 EE said that it was reasonable to assume that the price of spectrum was equivalent to the opportunity cost of the network cost equipment saved. The ex-MCT network would see a significant reduction in the volume of services that needed to be supplied, and the equilibrium for equipment cost savings was therefore different at that point compared with the equilibrium at the all-services network.[300]

3.197 EE considered that the opportunity costs of equipment were lower at lower traffic volumes, because there were diminishing margins of returns. (EE explained that when an output was reliant on a number of inputs and if one input was held constant, output could be increased by growing the other inputs, but fewer and fewer returns were generated from doing so.)[301]

3.198 EE said that as volumes of traffic carried on the network increased, the unit prices of equipment came down, but the logistics of deploying that equipment would be more difficult (for example, there were only a limited number of buildings that could be

[293] EE staff hearing transcript, p23, line 25ff.
[294] EE staff hearing transcript, p23, line 4ff.
[295] EE Core Submission, W/S Hird 4, §68.
[296] EE Core Submission, §§10g & 199a.
[297] EE NoA, W/S Hird I, §47.
[298] EE Core Submission, W/S Hird 4, §§69–71.
[299] EE Core Submission, W/S Hird 4, §§63 & 64.
[300] EE staff hearing transcript, p26, line 1ff.
[301] EE staff hearing transcript, p26, line 25ff.

used and these buildings were in non-optimal locations).[302] EE also noted that the unit cost of the site itself did not change much with traffic volumes.[303]

Voicemail (EE's SoI in support of Vodafone)

3.199 EE said that if it no longer provided a voicemail deposit and retrieval service for inbound off-net traffic, there would be voicemail-related costs that would be avoided (around [✂] per cent of voicemail costs would be avoided). This was because operators could adjust the number of voicemail platforms downward from their current levels.[304,305]

3.200 EE stated that subscriber numbers were only used as a rule of thumb to dimension voicemail capacity and that traffic was a relevant consideration when assessing the impact of not providing a service increment such as a wholesale mobile call termination service.[306]

3.201 This rule of thumb was used in anticipation of the voicemail traffic that the subscribers would generate—both to each other, and to the network from subscribers of other networks. If termination traffic ceased to exist, then less voicemail capacity would be required per subscriber.[307]

3.202 EE considered that the significance of licence fees (as set out by Three in paragraphs 3.343 and 3.344) might reflect Three's relatively small traffic volumes, and in any case might not reflect the underlying costs of providing voicemail capacity.[308]

HLR (EE's SoI in support of Vodafone)

3.203 While it was true that HLRs had been and were still primarily dimensioned and costed due to the number of subscriptions (registrations on the platform), some cost could be attributed to the signalling traffic.[309]

Cheaper equipment (EE's SoI in support of Vodafone)

3.204 EE also considered that in the absence of MCT services, cheaper MCT equipment may be deployed.[310]

Ofcom's Defence

3.205 Ofcom stated that Vodafone sought to emphasize the importance of distinguishing traffic-related from non-traffic-related costs, but claimed that it overstated the relevance and importance of this exercise. What mattered was instead the avoidable cost of MCT, taken as the final increment. The relevant costs were those which were

[302] EE staff hearing transcript, p28, line 13ff.
[303] EE staff hearing transcript, p28, lines 13ff & 21ff.
[304] EE SoI, W/S James, §58.
[305] EE SoI, W/S Hird 2, §68.
[306] EE Core Submission, W/S James 2, §14.
[307] EE Core Submission, W/S James 2, §14.
[308] EE Core Submission, W/S Hird 4, §76.
[309] EE SoI, W/S James, §57.
[310] EE staff hearing transcript, p32, line 21.

not only traffic-related, but which were related to MCT traffic when this was taken as the final increment.[311]

3.206 Ofcom said that it was not sufficient for Vodafone to argue that Ofcom had incorrectly assessed some costs as non-traffic related (rather than traffic related), but that Vodafone would need to identify costs that were both traffic related and also part of the avoidable costs of MCT as the final increment.[312] This was because the EC Recommendation only required the NRA to take account of the traffic-related costs in the calculation of LRIC if they were avoidable costs of MCT, when MCT was treated as the final increment.[313]

3.207 Ofcom also said that it was not necessary to expressly categorize assets as traffic related and non-traffic related. This was because the EC Recommendation required a calculation of LRIC with reference to the avoidable costs of no longer providing MCT (ie the identification of costs which were over and above the costs of providing an all-services mobile network without MCT) and the 2011 Model did this. Not explicitly labelling assets as traffic related or non-traffic related did not affect the results of the calculation of the LRIC of MCT in the 2011 Model.[314,315]

3.208 Ofcom also said that dividing assets in traffic related and non-traffic related might be difficult since some assets were not unambiguously traffic related or non-traffic related (because that depended on the level of traffic and possibly also geography). For some assets the minimum installation (to provide coverage) gave a significant amount of capacity, for example 3G base stations.[316]

NMS

3.209 Ofcom considered the NMS to be a common cost because this asset and the cost incurred could not be avoided in the event that one service (in this case MCT) was no longer provided.[317]

3.210 Ofcom said that information obtained from national MCPs showed that there was no incremental deployment of the NMS asset over time.[318] In particular, the information on equipment inventory submitted by the MCPs showed that there had been no incremental deployment of NMS over time when there had been a significant increase in traffic carried over their networks. Therefore, it was unlikely that the absence of MCT would have resulted in the deployment of an NMS that was smaller and cheaper.[319] Ofcom said that its information request on NMS followed a stake-holder workshop where Ofcom explained that it was modelling LRIC and LRIC+ of MCT services.[320]

3.211 Ofcom also said that it had only made adjustment to the capacity and cost of assets where there was a clear evidential basis for doing so. Given that MCT made up such a limited proportion of total network traffic, Ofcom would not expect any reduction in the size of the NMS when MCT was removed as the final increment.[321]

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[311] Ofcom Core submission, §77.
[312] Ofcom Defence, Annex B, §96.
[313] Ofcom Defence, Annex B, §95.
[314] Ofcom Defence, W/S Allen, §31.
[315] Ofcom Defence, W/S Allen, §27.
[316] Ofcom Defence, W/S Allen, §30.
[317] Ofcom Defence, Annex B, §129(ii).
[318] Ofcom Defence, Annex B, §129(i).
[319] Ofcom Defence, Annex B, §129(iii).
[320] Ofcom letter of 8 November 2001, p3.
[321] Ofcom Defence, Annex B, §129(iii).

3.212 Ofcom claimed that Vodafone had not provided any persuasive evidence that an MCP that was not providing MCT would have purchased a smaller and cheaper NMS.[322]

3.213 Ofcom noted that NMSs were treated in the same way in the 2007 Model.[323] Ofcom also noted that our 2002 report concluded that NMS costs were common costs.[324]

Spectrum

3.214 Ofcom considered it appropriate to capture the relevant incremental cost of spectrum through the avoided network costs associated with reduced MCT traffic.[325]

3.215 Ofcom agreed that it did not include an explicit contribution to the cost of spectrum in the LRIC calculation and that, in principle, spectrum could make a contribution.[326] However, the purpose of the 2011 Model was not to determine the optimal substitution between spectrum and network equipment inputs in a general sense, but was designed to calculate the incremental costs in the provision of MCT when that service was treated as the final increment. Ofcom therefore considered that for the range of output in question, and when looking at a final increment of traffic for MCT, an MCP was likely to face a trade-off in which its willingness to pay for spectrum would not be expected to exceed the network costs otherwise incurred.[327]

3.216 Ofcom did not agree that removing the MCT increment would cause a reduction in the market price for spectrum. This was because:

(a) A single MCP's MCT service would amount to a limited proportion of its own traffic (6 per cent of traffic in the busy hour in 2014/15[328]) and less still of total industry traffic. In addition, spectrum was used not only for traffic but also to provide coverage. As a result, MCT provided by a single MCP would only use a fraction of total spectrum suitable for mobile services. Therefore, it seemed most unlikely that as a result of a single MCP no longer carrying MCT, the market price for spectrum would change.[329]

(b) Ofcom considered that envisaging the impact of a reduction in spectrum holdings by all MCPs no longer providing MCT was incompatible with the continued existence of off-net mobile-to-mobile (M2M) traffic among other networks (as removing off-net M2M MCT would result in modelled mobile traffic being even further reduced, because if all MCPs ceased to provide MCT, then by definition there could be no off-net M2M calls). This would be such a significant modelling change that Ofcom considered that it would or should have been covered by the EC Recommendation and the supporting documentation.[330]

(c) Even if, contrary to Ofcom's view, the impact of a reduction in demand for spectrum by all MCPs were the relevant scenario to model, the value of spectrum was likely to be unchanged. This was because a potential purchaser (ie entrant MCP) faced the same spectrum and equipment cost trade-off as the incum-

[322] Ofcom Defence, Annex B, §129(iii).
[323] Ofcom Defence, Annex B, §129(i).
[324] Ofcom Defence, Annex B, §129(ii).
[325] Ofcom Defence, Annex B, §136.
[326] Ofcom Defence, Annex B, §133.
[327] Ofcom Defence, Annex B, §134.
[328] Ofcom Defence, Annex B, §99.
[329] Ofcom Defence, Annex B, §135(i).
[330] Ofcom Defence, Annex B, §135(ii).

bent(s). Only if mobile services were not the highest-value alternative use would the opportunity cost of spectrum be different.[331]

3.217 In response to a point made by Vodafone,[332] Ofcom noted that, unlike the German regulator, it had not received an invitation by the EC to change its treatment of spectrum cost.[333]

3.218 Ofcom considered that spectrum was a scarce resource and that there was strong demand for it. It regarded it as an important asset which no one wanted to sell and which was rarely traded.[334] If the hypothetical operator did not need it for MCT services, Ofcom considered it likely that a buyer would be found and it was therefore unlikely that no alternative buyer would be found for spectrum if the hypothetical operator did not need it for MCT services.[335]

3.219 Ofcom also noted that given that spectrum was not traded in practice, it would not be possible to verify any variation of spectrum holdings associated with variation in mobile traffic.[336]

Voicemail servers

3.220 Ofcom considered that it was appropriate to dimension voicemail servers on the basis of subscriber numbers because the information gathered from the MCPs on voicemail platforms indicated that subscriber numbers was the predominant factor in determining the number of voicemail servers required in a network.[337] Ofcom noted that two out of three submissions answering Ofcom's information request on this issue pointed to traffic not being a relevant cost driver.[338]

3.221 Ofcom considered that it might have been possible to work out a design rule that took into account the number of subscribers, the traffic and various other factors, but that this would have been disproportionate, given that the model was a simplification of reality to a very vast extent (and that it would be preferable not to have too many cost drivers per asset,[339] and that the MCT model was already Ofcom's most complicated model[340])[341] and that the voicemail asset did not significantly contribute to LRIC.[342] Ofcom also stated that making such an additional adjustment for voicemail would have required it to make similar second-level adjustments for other assets as well and that would have been disproportionate.[343] Ofcom also said that it spent more time on those issues that it considered had a larger impact on the charge control.

HLR updates

3.222 Ofcom submitted that it was appropriate not to include HLR updates in the LRIC calculation because they were not an avoidable cost of providing MCT services.[344]

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[331] Ofcom Defence, Annex B, §135(iii).
[332] Vodafone NoA, W/S Roche I, §4.41.
[333] Ofcom Defence, Annex B, §136.
[334] Ofcom staff hearing transcript, p33, line 3ff.
[335] Ofcom staff hearing transcript, p35, line 7ff.
[336] Ofcom reply to staff hearing questions, p2.
[337] Ofcom Defence, §140.
[338] Ofcom Defence, §141.
[339] Ofcom staff hearing transcript, p18, line 5ff.
[340] Ofcom staff hearing transcript, p18, line 20ff.
[341] Ofcom staff hearing transcript, p17, line 13ff.
[342] Ofcom staff hearing transcript, p18, line 10ff.
[343] Ofcom staff hearing transcript, p19, line 20ff.
[344] Ofcom Defence, Annex B, §144.

3.223 Ofcom stated that HLR updates would occur even in the absence of off-net originated incoming calls (ie they would not be avoided by the absence of MCT), since location updates were also required to support efficient on-net call routing.[345]

BT's SoI in support of Ofcom

NMS

3.224 BT said that there was a significant fixed element to NMS costs.[346] NMS costs would increase not just with the volume of traffic but also with the number of customers and with the range of different services carried over the network, in BT's experience, it was more complex to manage voice and data services over a network than voice alone.[347]

Spectrum costs

3.225 BT noted that the charges that the MNOs paid for the use of 2G spectrum were calculated by reference to the additional costs that the operators would incur if they had less spectrum.[348]

3.226 BT considered that no business other than a mobile business would want to own mobile wireless spectrum.[349]

3.227 It said that spectrum was valuable because it created a barrier to entry for other operators, because it allowed the launch of new services (eg 3G) and because it lowered the equipment cost in the network roll-out.[350]

Voicemail boxes

3.228 BT said that voicemail box costs were substantially incurred when the boxes were provided and not when they were used. Voicemail boxes were provided when customers were added to the network, one box per customer.[351]

HLR

3.229 BT explained that HLRs existed to keep track of customers and the costs could be considered to rise in line with the number of customers.[352]

Three's SoI in support of Ofcom

NMS

3.230 Three explained that the costs of the NMS consisted of software licences and hardware. Software licences (including maintenance and support) were normally priced per subscriber and accounted for [✂] per cent of the cost of the NMS. Some of the hardware-related costs might be avoided if no MCT services were provided.

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[345] Ofcom Defence, Annex B, §142.
[346] BT SoI, W/S Richardson 2, §39a.
[347] BT SoI. W/S Richardson 2, §39b.
[348] BT SoI, W/S Richardson 2, fn 41.
[349] BT SoI, W/S Richardson 2, fn 57.
[350] BT bilateral hearing transcript, p32, lines 3–13.
[351] BT SoI, W/S Richardson 2, §44.
[352] BT SoI, W/S Richardson 2, §45a.

However, hardware-related costs accounted only for [✂] per cent of NMS costs.[353] Three stated that as a result very little of NMS costs were traffic driven. Three estimated the impact of NMS on LRIC to be 0.001ppm or around 0.1 per cent of LRIC in 2014/15.[354]

3.231 Three (in relation to EE's point on the routing provided by NMS) stated that lowest-cost routing was only relevant to outgoing traffic and that routing was not part of the NMS.[355]

3.232 Three noted that a refinement of Ofcom's network dimensioning assumptions for NMS could have merit and might be worth implementing.[356]

Spectrum

3.233 Three accepted that it was theoretically possible that some spectrum cost might be avoided by the cessation of MCT.[357]

3.234 Three was also of the view that an operator's ability to vary its holding of spectrum would either not change the LRIC calculated by reference to network expenditure alone, or reduce it.[358] It noted that the EC Recommendation recommended that spectrum costs should not be included unless that spectrum cost could be avoided by the cessation of MCT (or, equivalently, that it had only been acquired for the purpose of providing MCT).[359]

Voicemail servers

3.235 Three stated that the cost drivers for voicemail servers were complex. Whilst it was true that voicemail server costs would be affected to some extent by traffic volumes, there was no simple relationship and there were other cost drivers.[360]

3.236 Three said that the cost of the voicemail platform was affected by both the number of subscribers and anticipated traffic.[361] [✂][362]

3.237 [✂][363]

3.238 Three said that, based on a high level review of its voicemail platform, approximately [✂] per cent of costs were driven by subscriber numbers ([✂]) and approximately [✂] per cent by the volume of voice traffic terminated. Three said that this was based on using the latest voice access technology.[364]

3.239 Three considered that, on the basis of the evidence available to Ofcom when taking the decision, it was reasonable for Ofcom to assume that no part of the cost of voice-mail servers was incremental to MCT.[365]

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[353] Three SoI, W/S Sheppard, §2.5.
[354] Three SoI, Mantzos 2, §3.26.
[355] Three SoI, W/S Sheppard, §2.8.
[356] Three SoI, W/S .
[357] Three SoI, §10.47.
[358] Three SoI, W/S Mantzos 2, §3.17.
[359] Three SoI, W/S Mantzos 2, §3.20.
[360] Three SoI, §10.27.
[361] Three SoI, W/S Sheppard, §4.3.
[362] Three SoI, W/S Sheppard, §4.4.
[363] Three SoI, W/S Sheppard, §4.5.
[364] Three SoI, W/S Sheppard, §4.6.
[365] Three SoI, §10.28.

3.240 Three estimated that the impact on LRIC for an adjustment for voicemail servers was approximately [✂] ppm or [✂] per cent in 2014/15.[366]

3.241 It noted that a refinement of Ofcom's network dimensioning assumptions for voice-mail could have merit and might be worth implementing.[367]

Assessment: traffic- and non-traffic-related costs

3.242 Vodafone identified various assets that appear in the 2011 Model to be invariant to traffic when going from full traffic (ie providing all services) to zero traffic (ie when eliminating all services including MCT services from the 2011 Model, except for minimal traffic).[368] What the 2011 Model (and the EC Recommendation) tries to measure, however, is which assets are invariant to traffic when going from full traffic to full traffic less incoming third party calls (ie full traffic less MCT services). As MCT services are a much smaller increment than all services, it is plausible that some assets may well be invariant to traffic when the increment is MCT services even if these assets would vary with traffic if the increment is all services. We agree with Ofcom that where MCT services are the last increment it is highly likely that common costs form a larger proportion of total costs than where the increment is all services. This is because costs for jointly-used assets would have already been allocated to the first increment and all other increments before any remaining costs are allocated to the final increment.

3.243 Vodafone said that too few assets were modelled as traffic variant in the 2011 Model. We accept that the 2011 Model is an abstraction of reality and will necessarily need to make approximations.

3.244 We set out below our assessment of Vodafone's specific, pleaded examples of assets that were incorrectly treated in the 2011 Model as being non-traffic related.

NMS

3.245 It appears that there is no single definition of the NMS.

3.246 Vodafone and EE both stated that traffic was a driver for network management costs, but accepted that traffic was not the only driver of network management costs. Vodafone, EE and Three indicated that with further investigation additional information would have been available to indicate that some NMS costs varied with traffic.

3.247 Three's evidence indicated that the majority of NMS costs were not traffic related.

3.248 Ofcom stated that it had reviewed evidence from MCPs that indicated that operators had not deployed more NMS equipment when traffic increased and that it had no persuasive evidence that NMS costs would reduce if MCT services were no longer provided.

[366] Three SoI, §10.28; Three SoI, W/S Mantzos 2, §3.37.
[367] Three SoI, W/S Mantzos 2, §3.86.
[368] Vodafone's reasoning was based on creating a zero-traffic scenario from the 2011 Model (ie calculating the costs in the 2011 Model assuming that the operator does carry only near zero-traffic volumes). Vodafone then examined this zero-traffic scenario and showed that various costs that were included in the zero-traffic scenario that should not have been included (ie that those costs should really vary with traffic and be (at least partially) part of MCT costs). Vodafone then said that this showed that there were too many non-traffic-related costs in the model.

3.249 Neither Vodafone nor EE have provided sufficient supporting evidence for us to accept their assertion that a significant proportion of NMS costs would be avoided if MCT services were no longer provided.

3.250 We note that the NMS accounts for a relatively small amount of total LRIC costs.

3.251 We do not consider that it has been demonstrated that Ofcom erred when modelling NMS as non-traffic related for the purpose of calculating the incremental costs of MCT services. This is because we consider that Ofcom had come to a reasonable decision given the level of NMS costs and the information before it at the time of the decision and because the evidence we received from Three indicated that the majority of NMS costs are not traffic related.

Spectrum

3.252 Vodafone and EE said that in the ex-MCT network spectrum costs would be lower (ie the spectrum price should be lower), because:

(a) there would be less demand for spectrum from mobile network operators, which would lower the price;

(b) spectrum would be worth less to the operator because less revenue could be earned from it; and

(c) spectrum costs would be lower because the opportunity cost of equipment costs saved would be lower.

3.253 We do not consider that less demand, as set out in (*a)*, is a point that can be distinguished from the points in (*b)* and (*c)*, as the reasons given by the parties for less demand are related to less revenue-earning capacity or because less equipment costs could be saved. Both points are addressed below.

- *Value in use*

3.254 We consider that calculating the LRIC for MCT services is effectively a hypothetical exercise. The modelling of spectrum appears to be based on a certain interpretation of how this exercise should be conducted. We do not consider that Vodafone has demonstrated that its approach is manifestly superior to that of Ofcom.

3.255 Vodafone's appeal appears to be based on the assumption that Ofcom, in its modelling, should have taken price changes of assets (in particular, spectrum) into account (ie Ofcom should have considered pecuniary effects) when calculating the LRIC of MCT services. We do not find that Vodafone has provided sufficient reasoning why Ofcom should have adopted such an approach. We do not consider that Vodafone's examples, which are based on the presumption that pecuniary effects should be taken into account, can assist in demonstrating that Ofcom erred because Vodafone has not put forward any principled arguments in support of its case. For example, Vodafone suggested that the relevant increment to measure pecuniary effects was that all operators ceased to supply MCT services, whereas Ofcom's was that only one operator ceased to supply MCT services. We think that other interpretations would also have been available.

3.256 We do not agree with EE that there would be cross-subsidization of MCT services from other services if spectrum costs are not adjusted in the 2011 Model (see paragraph 3.192). We consider that it is more likely that the opposite is true. This is because we consider that, in principle, the calculation of LRIC for MCT services is to

allocate an appropriate share of costs that are incurred in the all-services network to MCT services. We do not consider that changing input price assumptions in the ex-MCT network would be compatible with the objective to allocate costs to specific services. This is because doing so effectively allocates a disproportionately large amount of spectrum costs to the MCT services. The reason for this is that the MCT services will already carry the spectrum costs at current prices and changing spectrum prices for the remaining services would effectively allocate a proportion of the spectrum costs that are incurred by the remaining services to the MCT services instead. We do not consider this effect to be appropriate.

- *Opportunity costs*

3.257 We do not consider that it has been demonstrated that the traffic cost function is substantially different in the ex-MCT network compared with the full service network. We note that Vodafone stated that the change in the traffic cost function was not known precisely and EE's evidence was in part pointing towards increasing costs as traffic decreased (eg EE indicated that unit prices of equipment increased as traffic reduced).

3.258 We also agree with Ofcom that the opportunity cost of spectrum is reflected in its calculation of the avoided network costs associated with reduced MCT traffic. We therefore do not consider that further adjustments to spectrum costs are necessary to capture this effect.

3.259 We are therefore not persuaded that Ofcom erred by not changing spectrum costs in the ex-MCT network.

Voicemail servers

3.260 From the evidence provided it seems plausible that voicemail boxes are to some extent built in response to traffic, in particular MCT traffic.

3.261 We note that the evidence provided by Three indicated that the majority of voicemail costs are subscriber-driven (rather than traffic-driven) costs. This view is supported by the evidence that Ofcom had when it made its decision, which indicated that most operators use a rule of thumb relating to subscriber numbers when determining the number of voicemail servers in the network.

3.262 The evidence provided to us indicated that voicemail servers account for only a small proportion of LRIC costs. It appears that making an adjustment to the treatment of voicemail servers, when considering that the majority of voicemail costs are subscriber driven, would likely entail a change in LRIC of less than 1 per cent.

3.263 We therefore also accept Ofcom's position that it would have been disproportionate for Ofcom to further investigate the exact level of the traffic-related voicemail costs.

3.264 Given all of these factors, we do not consider that Ofcom erred by not modelling voicemail costs as traffic related in the 2011 Model.

HLR updates

3.265 Vodafone stated that HLR updates would not be needed if no traffic was carried on the network and that the HLR updates should therefore be treated as traffic related in the 2011 Model. However, we note that Vodafone's statement related to the

variability of HLR costs in respect of an all-services increment, rather than if the increment were the MCT services.

3.266 Ofcom stated that HLR costs could not be avoided in the absence of MCT services as HLR would still be needed for off-net originated incoming calls.

3.267 EE stated that the majority of HLR costs were driven by the number of subscribers and only some costs were traffic related.

3.268 We are not persuaded by the arguments of Vodafone and so we do not consider that Ofcom erred in treating HLR updates as non-traffic related in the 2011 Model.

Conclusion on number of traffic-related assets

3.269 Based on our assessment of the reasoning and evidence as set out above, we do not consider that it has been demonstrated that Ofcom erred by modelling an insufficient number of assets as traffic related.

(d) Size of the coverage network

Ofcom's decision

3.270 Ofcom said that in order to derive a realistic assessment of cost structures for the hypothetically efficient national MCP, the 2011 Model used a bottom-up approach that calculated the quantities of each type of network asset required. The approach for dimensioning 2G and 3G/HSPA networks was the same as in the 2007 Model. Under this approach, the radio network was dimensioned for whichever was the greater of coverage and capacity requirements within each geotype.[369]

3.271 Ofcom said that network coverage in rural areas was determined by a number of competitive and commercial factors and Ofcom did not believe that it would be appropriate or practicable to calculate optimal network coverage for a network without off-net termination.[370]

Vodafone's challenge

3.272 Vodafone considered that it was implausible that a large proportion of the UK landmass (98 per cent) and a large proportion of the UK population (72 per cent) is served by the coverage network in the 2011 model. However, we do not consider that it is self evident that these percentages by themselves show that the coverage network is too large. We therefore considered, in detail, Vodafone's more specific, detailed reasons as to why it claimed the coverage network in the 2011 model is too large.

3.273 Vodafone said that the assets (and costs) treated in the 2011 Model as being 'coverage' assets should have represented a much lower proportion of total network assets.[371] Vodafone said that the 2011 Model built far too many assets at too high a cost for coverage purposes and the result of this was that the model was under-recording the real volume and cost of incremental assets.[372] Vodafone said that it

[369] Ofcom Decision, §A6.132.
[370] Ofcom Decision, §9.87.
[371] Vodafone NoA, W/S Roche, §4.122.
[372] Vodafone NoA, W/S Roche, §4.140.

was implausible that for many assets in the 2011 Model, no incremental assets were built for MCT services.[373]

3.274 Vodafone said that the 2011 Model assumed that the coverage outcome was greater than the 'capacity' outcome for all geotypes except urban and suburban 1.[374]

3.275 Vodafone stated that the 2011 Model assumed that only 27 per cent of the UK population was considered to live in areas (geotypes) that were capacity constrained (ie that when running the 2011 Model only in these areas did the model show incremental asset build when traffic volumes changed) and that this was clearly incorrect.[375] Vodafone considered that 73 per cent of the population having no capacity assets associated with them was implausible, given that very few assets were required in the absence of traffic.[376] This, it said, appeared to be largely attributable to deficiencies in the geotypes employed in the model, which were not sufficiently refined to reflect the real world to an acceptable degree of accuracy to support the implementation of a LRIC methodology.[377]

3.276 Vodafone said that Ofcom had probably overestimated the amount of the country that was adequately served by a coverage network.[378] Vodafone said that by 2014/15 only 2 per cent of Britain's landmass had sites installed for capacity.[379] Vodafone said that in the rural 1 geotype, the number of sites built for coverage was not necessarily the right number and in reality there were fewer of them.[380]

3.277 Vodafone said that it was critical to have a realistic assessment of how much of the country was adequately served by a coverage network when measuring LRIC. Ofcom's assumption that large parts of the country had no radio equipment incremental to termination was the result of an extremely rough and ready disposition of geotypes without any regard to whether that really mapped on to reality in the UK.[381]

3.278 Vodafone said that the overstatement of the assets required to provide coverage was most evident in the radio access network assets, where large parts of the UK were deemed in the model to provide only coverage assets, without any traffic-driven assets. This was incorrect.[382]

3.279 Vodafone said that the use of minimum assets counts in calibrating the model caused an understatement of LRIC.[383] Vodafone explained that the majority of the 80 assets in the 2011 Model had 'minimum' quantities associated with them. Vodafone explained that, generally, the Ofcom model assumed for these assets that a minimum asset quantity was required to maintain any service (ie to enable one call to be made somewhere in the network). Beyond that, the model assumed that additional units of the same asset were required to carry additional traffic, and such assets were treated as traffic related, with some part of the costs of such additional assets being incremental to the MCT service.[384]

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[373] Vodafone bilateral hearing transcript, p102, to p103.
[374] Vodafone Core Submission, W/S Roche II, §4.24.
[375] Vodafone NoA, W/S Roche, §§4.14 & 4.15.
[376] Vodafone bilateral hearing transcript, p102, lines 4–9.
[377] Vodafone Core Submission, §5.44.
[378] Vodafone staff hearing transcript, p46, line 13ff.
[379] Vodafone NoA, W/S Roche, paragraph 4.14.
[380] Vodafone staff hearing transcript, p45, line 15ff.
[381] Vodafone staff hearing transcript, p47, line 19ff.
[382] Vodafone Core Submission, §5.8.2.
[383] Vodafone bilateral hearing transcript, p104, lines 3–11.
[384] Vodafone NoA, W/S Roche, §4.56.

The coverage network

3.280 Vodafone stated that an operator (in the real world, rather than in the 2011 Model) was considered to have provided a (minimum) coverage network if the network:[385]

(a) had the ability to carry a single call;[386]

(b) assumed that cells were lightly loaded (and therefore little interference from other callers[387]);[388] and

(c) had a 90 per cent probability of service to 90 per cent of the UK population.[389]

3.281 Vodafone said that no operator had ever rolled out a coverage network. Operators only rolled out a network in the expectation that the network would be filled with traffic. A coverage network was a construct purely for modelling purposes.[390]

3.282 Vodafone stated that the explanatory note accompanying the EU Recommendation made clear that a coverage network should be defined as a network that carried zero traffic. This was reflected in the terms of UK spectrum licences.[391] Vodafone pointed out that the 2011 Model did not adopt this approach and took no account of what would be appropriate design/build solutions for such a network, nor of the likely costs of particular classes of asset (eg cell sites).[392]

3.283 Vodafone provided some key adjustments showing how the costs associated with such a minimum coverage network compared with the cost in the near zero-traffic scenario in the 2011 Model.[393]

3.284 These adjustments included cell site radii (for both 2G and 3G), sectorization of sites, site and equipment costs, backhaul costs and MSC-related costs.[394]

3.285 Vodafone also provided further detailed submissions on how a coverage network would be designed.[395]

Cell radii

3.286 Vodafone said that 2G networks were designed to prevent interference which reduced the effective range of a cell site, so that more cells could be packed into the same area, thereby increasing the traffic capacity, without creating interference.[396]

3.287 Vodafone said that Ofcom modelled different cell radii in the different geotypes. Whilst some of the difference in radius related to the difficulties arising from urban clutter, much of it was derived from empirical evidence as to how urban sites were in practice configured to allow for significant traffic capacity.[397]

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[385] Vodafone NoA, W/S Roche, §4.60.
[386] Vodafone NoA, W/S Roche, §4.64.
[387] Vodafone NoA, W/S Roche, §4.65.
[388] Vodafone NoA, W/S Roche, §4.64.
[389] Vodafone NoA, W/S Roche, §§4.63 & 4.66.
[390] Vodafone bilateral hearing transcript, p108, lines 17–22.
[391] Vodafone Core Submission, §5.38.1.
[392] Vodafone Core Submission, §5.38.2.
[393] Paragraph 4.71.
[394] Vodafone NoA, W/S Roche, §§4.71–4.96 & Table 4.4.
[395] Vodafone Core Submission W/S White, paragraphs 13–16.
[396] Vodafone NoA, W/S Roche, §4.71.
[397] Vodafone NoA, W/S Roche, §4.72.

3.288 Vodafone explained that many of the dimensioning assumptions for the RAN (eg cell site radii and sectorization) had been derived as a product of Ofcom's calibration process, rather than by reference to real dimensioning rules.[398] However, it was the geotype level dimensioning rules in the model which drove the calculation of the incremental costs of the RAN.[399]

3.289 Vodafone explained that geotypes were a modelling fiction and the cell site radii were values arrived at in the calibration process that appeared to replicate approximately the real-world volumes, but only at the level of the sum of all geotypes (ie the model was only calibrated at the highest level of the total number of sites and not by geotype[400]). Such calibration had not been aimed at identifying the minimum configuration that was required in the absence of traffic, or the volumes of assets that were required for an incremental service, at current and much lower traffic volumes.[401]

3.290 Vodafone said that for the coverage network as defined in paragraph 3.280, much lower numbers of cell sites would be necessary.[402] Adjusting the 2011 Model by assuming higher 2G cell radii reduced the minimum cumulative cash flow by 2014/15 by around £2.5 billion (from £8.5 billion).[403]

3.291 For 3G cell sites, Vodafone said that a reduction of the number of cell sites could be made in rural areas to account for the allowed 10 per cent coverage gaps, which would reduce the number of cell sites by up to a further 10 per cent.[404]

3.292 Vodafone explained that network capacity was the ability to enable multiple customers to make and receive calls and use data services simultaneously in the same geographic areas. Once a network operator was aware that it must be able to carry calls to and from a number of customers, the approach to the design of the network must change from that of a coverage network (that carried only a single call[405]).[406]

3.293 Vodafone said that in practical terms, the need to plan for capacity meant that a mobile network operator would typically require many more sites at a wide variety of locations (ranging from rooftops to shopping centres to streetworks) to ensure that large volumes of traffic could be carried across the network.[407]

3.294 Vodafone explained that in the real world, a mobile network operator would simply not design a coverage network as this was inefficient (given that a mobile operator would in reality expect to provide for capacity from the outset). The types of mobile sites that would be only used in a coverage network (eg sites at high locations) would create difficulties for a network planner and as such were avoided by the mobile network operator.[408]

Sectorization of sites

3.295 Vodafone said that the 2011 Model assumed that 2G sites had three sectors in order to provide coverage (in all urban, suburban and rural 1 geotypes). In a minimal coverage scenario this was not necessary. Moving the model to omni sector sites for all

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[398] Vodafone Core Submission, W/S Roche II, §§4.16 & 4.17.
[399] Vodafone Core Submission, W/S Roche II, §4.19.
[400] Vodafone Core Submission, W/S Roche II, §4.18.
[401] Vodafone Core Submission, W/S Roche II, §4.33.
[402] Vodafone NoA, W/S Roche, §4.73.
[403] Vodafone NoA, W/S Roche, §4.74.
[404] Vodafone NoA, W/S Roche, §§4.75 & 4.96.
[405] Vodafone Core Submission, W/S White, §13.
[406] Vodafone Core Submission, W/S White, §17.
[407] Vodafone Core Submission, W/S White, §22.
[408] Vodafone Core Submission, W/S White, §19.

2G sites reduced cumulative cash flows to 2014/15 by £190 million[409] and making a similar adjustment for 3G sites reduced cash flow by a further £99 million.[410]

3.296 Vodafone pointed out that in the suburban 2 geotype, there were never any new sites built above the initial deployment in the model of 1,037 sites. The reason for this was that all sites in this geotype were assumed to be initially built as three sector sites. When assuming single sector sites, the model would build 1,037 sites for coverage but also 2,359 sites for capacity.[411]

3.297 Vodafone also pointed out that the 2011 Model built three sectored 2G sites in the rural 1 geotype, but on switching in the model to single sectored sites, exactly the same number of cell sites were built, which indicated that there was no need for sectorization of sites as a response to rising traffic in this geotype.[412]

3.298 Vodafone said that the requirement to provide for capacity also influenced the way in which sites were designed and operated. A site was typically designed in a way that it would serve three cells (ie sectorization with three sectors), which increased the capacity of a given site. This approach to site design and operation was accordingly one that would be adopted in the real world where a network planner must expect that the network would be required to handle traffic. In the hypothetical scenario of a coverage-only network, there was no need to extract the maximum possible capacity from a site.[413]

Resulting changes in cost of sites and equipment and backhaul costs

3.299 Vodafone said that making the adjustments to cell radii and sectorization would result in fewer and smaller sites, which would reduce cell site opex and capex as smaller cell sites used less power, and as smaller sites with no need for future expansion could be built at a lower cost and would incur lower rental costs. When using 10 per cent less capex and 20 per cent less opex, the cash flows to 2014/15 reduced by a further £240 million.[414]

3.300 Vodafone said that the cost of cell site equipment would also be considerably lower as current equipment had features that would only be used in a scenario where use was expected to grow and, absent an assumption of growth, cheaper equipment could be used. Vodafone suggested that equipment cost would be 50 per cent lower for opex and capex.[415] It claimed that this would reduce costs by around £1 billion.[416]

3.301 In addition, it said that lower-capacity backhaul products would also be used (reducing costs by a further £100 million[417]).[418] Vodafone said that backhaul was dimensioned by the number of cell sites, which was driven by the amount of termination. Backhaul assumptions included the size of each individual link and the number of links that were required. Both of those would vary with traffic, and some with termination traffic.[419]

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[409] Vodafone NoA, W/S Roche, §§4.78–4.83.
[410] Vodafone NoA, W/S Roche, §4.83.
[411] Vodafone Core Submission, W/S Roche II, §4.35.
[412] Vodafone Core Submission, W/S Roche II, §4.36.
[413] Vodafone Core Submission, W/S White, §23.
[414] Vodafone NoA, W/S Roche, §§4.84–4.87.
[415] Vodafone NoA, W/S Roche, §§4.88 & 4.89.
[416] Vodafone NoA, W/S Roche, §4.96.
[417] Vodafone NoA, W/S Roche, §4.96.
[418] Vodafone NoA, W/S Roche, §§4.88–4.91.
[419] Vodafone staff hearing transcript (original), p6, line 14ff.

MSCs and transit networks

3.302 Vodafone argued that the 2011 Model (in the near zero-traffic scenario) built too many 2G and 3G MSCs and that the minimum for 2G and 3G MSCs should be two.[420] This would reduce costs by £123 million.[421]

3.303 Vodafone also said that the near-zero-traffic network would not need a transit network (as the need for a transit network was based on having to manage a large number of MSCs).[422] This would reduce costs by a further £30 million.[423]

3.304 However, Vodafone also said that the transit network was likely to be required in the ex-MCT network, but the number of transit switches would vary with the traffic in the network (and the transit network may be built later[424]).[425]

Ofcom's Defence

3.305 Ofcom said that the 2011 Model assumed a minimum quantity of assets in the dimensioning of most network assets, for example 2G and 3G cell site equipment. Additional assets were then dimensioned to meet the capacity required as a result of additional projected traffic. A large number of asset types were modelled on this basis.[426]

3.306 Ofcom said that the reason that its model did not record any incremental sites in rural areas was that there was excess capacity that was being built as part of the minimum level of equipment that was deployed in different geotypes. So the removal of MCT traffic did not really lead to a material reduction in the number of sites in those areas.[427] Ofcom said that this could be either because the assets deployed for capacity served the incremental MCT traffic or because the model installed the assets in relatively large increments (ie with a large modularity).[428] Ofcom considered that its model was an abstraction of reality, but was sufficiently accurate in the bounds of what was reasonable and possible within a market review.[429] Ofcom considered that the deployments of network equipment that the model specified were reasonable and compatible with what operators did in terms of the size of equipment that was available and the way that equipment was deployed.[430]

The coverage network

3.307 Ofcom said that the 2011 Model did not explicitly identify coverage costs but directly calculated the additional capacity costs caused by the provision of MCT. However, this did not affect the results of the calculation of the LRIC of MCT.[431]

3.308 Ofcom stated that Vodafone's arguments in respect of assets with a minimum quantity were fundamentally misconceived. This was because:

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[420] Vodafone NoA, W/S Roche, §4.92
[421] Vodafone NoA, W/S Roche, §4.92
[422] Vodafone NoA, W/S Roche, §§4.93.
[423] Vodafone NoA, W/S Roche, §§4.93.
[424] Vodafone staff hearing transcript, p7, line 11ff.
[425] Vodafone staff hearing transcript, p7, line 1ff.
[426] Ofcom Defence, Annex B, §145.
[427] Ofcom bilateral hearing transcript, p105, lines 12–13.
[428] Ofcom bilateral hearing transcript, p107, lines 3–11.
[429] Ofcom bilateral hearing transcript, p106, lines 11–13.
[430] Ofcom bilateral hearing transcript, p106, lines 8–17.
[431] Ofcom Defence, W/S Allen, §33.

(a) Vodafone's statement was couched in terms of the potential traffic-sensitive nature of asset deployments over and above a minimum coverage deployment.

(b) Vodafone's arguments on the traffic sensitivity of various assets were inappropriately couched in terms of either a total traffic increment, or on the basis of a consideration of what the result would be if MCT were considered as the first increment.

(c) Vodafone assumed that traffic sensitivity of costs was constant over the entire range of traffic (ie over all traffic increments).[432]

3.309 Ofcom stated that Vodafone could not show that Ofcom's calculation of LRIC was wrong simply by identifying that certain costs were traffic related (eg costs of equipment in base stations or the size of cell radii). Even if they were (eg if the hypothetical operator would have bought cheaper equipment if it carried very little traffic), it did not follow that the removal of MCT traffic volumes would have such an effect on the amount of avoidable costs when MCT services were the final increment.[433]

3.310 In respect of Vodafone's suggested coverage adjustments (in particular for cell radii, sectorization, MSCs, transit switches, cell site, cell equipment and backhaul costs), Ofcom stated that a comparison with a network providing very little cell capacity was of no real assistance for the purpose of estimating the avoidable costs of MCT services as the final increment of traffic. In particular, for a network providing all services other than MCT, Ofcom would expect the network already to reflect efficient dimensioning of assets for traffic-handling capacity. Ofcom did not consider there to be a sufficient basis for concluding that the hypothetical network without MCT should be dimensioned on a different basis through adjustment of network design parameters.[434]

Cell radii and sectorization

3.311 Ofcom said that its approach in the 2011 Model of not adjusting the assumptions in respect of cell radii and the number of sectors per cell site was reasonable.[435] This was because:

(a) these parameter values were designed to be reflective of real-world network deployments and were similar to the 2007 model;[436] and

(b) Vodafone (and other MCPs) did not provide any evidence during the consultation process to justify a change to these parameter values.[437]

3.312 Ofcom also said that a rational network planner who looked at both future coverage and capacity requirements would pick a three-sector site for urban and suburban geotypes rather than a one-sector site. This was because a one-sector site might need to be upgraded later, which was less cost-efficient than putting in a three-sector site at the outset. Ofcom said that this was what it had seen in real-world deployments.[438]

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[432] Ofcom Defence, Annex B, §148.
[433] Ofcom Defence, Annex B, §98.
[434] Ofcom Defence, Annex B, §§151(iv), 154 & 156.
[435] Ofcom Defence, Annex B, §151.
[436] Ofcom Defence, Annex B, §§151(i) & 151(ii).
[437] Ofcom Defence, Annex B, §151(iii).
[438] Ofcom staff hearing transcript, p29, line 11ff.

BT's SoI in support of Ofcom

The coverage network

3.313 BT stated that a zero-coverage network as suggested by Vodafone for the basis of calculating LRIC charges was a theoretical network, quite unlike the networks that the MNOs actually designed and built.[439]

Three's SoI in support of Ofcom

The coverage network

3.314 Three was of the view that a network designed for zero coverage as set out by Vodafone would experience considerable inefficiencies in upgrading the network when traffic grew, increasing the total network cost when significant levels of traffic were carried in the network.[440] Three said that, for example, new cell sites required to service additional traffic would probably be positioned suboptimally and equipment deployed that was suitable only for low traffic levels would probably need to be replaced well before the expiry of its useful life.[441] In addition, more frequent site visits to upgrade sites might be necessary and an increased level of network faults as sites reached the limits of their low capacities might also occur.[442]

3.315 Three considered that the zero-coverage approach suggested by Vodafone was inconsistent with both the 2009 EC Recommendation and the reality of the network cost function. It resulted in costs which were not incremental to MCT being included in LRIC and would predict asset counts that would never exist in the real world, either with or without MCT.[443]

Assessment: size of the coverage network

The coverage network

3.316 Vodafone said that the coverage network in the 2011 Model was too large, which was caused by the 2011 Model stipulating minimum asset quantities that were too high and the LRIC of MCT services was therefore understated. Vodafone said that an appropriately defined coverage network had the ability to carry a single call.

3.317 We agree with Ofcom that a coverage network that has the ability to carry a single call is unlikely to be of assistance in the calculation of the LRIC of MCT services, because it is unlikely to reflect the costs that are incremental to providing MCT services when all other services are still provided. Such a network, able to carry only a single call, is likely to be more reflective of an all-services increment than the MCT services increment. Using such a coverage network as the basis for setting the LRIC charges for MCT services may therefore inappropriately allocate to MCT services common costs that are shared between several services. We agree with Ofcom that costs should only be included in the calculation of LRIC if they are part of the final increment when providing MCT services (ie if they are avoidable costs of supplying MCT services).

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[439] BT SoI, W/S Richardson 2, §54e.
[440] Three SoI, W/S Sheppard, §§3.2 & 3.6.
[441] Three SoI, W/S Sheppard, §§3.2a & 3.2b.
[442] Three SoI, W/S Sheppard, §3.3.
[443] Three SoI, §10.45.

3.318 We also agree with Ofcom that a coverage network that has the ability to carry a single call would be unlikely to reflect the efficient dimensioning of assets in the ex-MCT network. We note that Vodafone itself stated that it would not build such a coverage network in practice and in particular that every network would always be built with traffic growth in mind.

3.319 We note that whilst Vodafone's definition of a coverage network is in line with the definition of a coverage network in the EC Recommendation, the EC Recommendation does not appear to recommend that LRIC is calculated by reference to all costs less costs of the coverage network, but rather it refers to the coverage network costs as costs that should not be included in the calculation of LRIC. For example, there may well be costs that are not coverage costs (such as subscriber-driven costs), which are nevertheless unavoidable if MCT services are the final increment and which therefore also need to be excluded from the calculation of the LRIC of MCT services.

3.320 For these reasons, we are not persuaded that Ofcom erred in its modelling of the coverage network as alleged.

3.321 We therefore do not need to assess Vodafone's examples of assets that were incorrectly modelled for coverage purposes, (nor its evidence as to how a coverage network would be constructed). However, for completeness we consider below if Ofcom specified incorrect minimum asset quantities in its 2011 Model, for the assets set out in paragraph 3.284ff.

Cell radii and sectorization

3.322 Vodafone said that for the coverage network that carried a single call, much lower numbers of cell sites would be necessary (increasing the cell radii) and only omni sector sites would be needed.

3.323 We agree with Ofcom that a comparison with a network providing very little cell capacity is of no real assistance for the purpose of estimating the avoidable costs of MCT services as the final increment of traffic.

3.324 We also note that Vodafone itself indicated that where networks were built with future traffic growth in mind (as would be the case for the ex-MCT network) very different dimensioning parameters would be used compared with a coverage network for both the number of sites (and therefore cell radii) and for the number of sectors per site.

3.325 We therefore consider that Vodafone has not demonstrated that Ofcom erred in not adjusting cell site radii and sectorization in the ex-MCT network (ie by not specifying higher cell radii and only omni-sectors in the ex-MCT network).

3.326 We set out in paragraph 3.572ff that it would not be appropriate to change the coverage levels in the ex-MCT network. We therefore do not consider that Vodafone has demonstrated that Ofcom erred, by not assuming lower coverage levels in the ex-MCT network.

Cell site costs

3.327 We agree with Ofcom that the relevant increment to consider is MCT services. Vodafone has used an all-services increment in its reasoning.

3.328 Vodafone has provided no evidence that cell site costs would reduce if MCT services were the relevant increment.

3.329 We also refer to our assessment of cell site costs in paragraph 3.126ff.

3.330 We therefore consider that Vodafone has not demonstrated that Ofcom erred in not changing cell site costs in the ex-MCT network.

Cheaper equipment

3.331 We agree with Ofcom that the relevant increment to consider is MCT services. Vodafone used an all-services increment in its reasoning.

3.332 Vodafone provided no evidence that in the absence of MCT services the remaining network traffic could be carried on cheaper equipment.[444] In particular, we do not agree with Vodafone that in the ex-MCT network assets would not require an ability to grow. We note that Vodafone stated that all networks would be built with the ability to cater for growth in capacity over time.

3.333 We therefore consider that Vodafone has not demonstrated that Ofcom erred in relation to the use of cheaper equipment.

Lower backhaul costs

3.334 We agree with Ofcom that the relevant increment to consider is MCT services. Vodafone has used an all-services increment in its reasoning.

3.335 Vodafone provided no evidence that in the absence of MCT services the remaining network traffic could be carried on lower-cost backhaul products.[445]

3.336 We therefore consider that Vodafone has not demonstrated that Ofcom erred in relation to the modelling of backhaul capacity.

Minimum number of 2G/3G MSCs

3.337 Vodafone stated that the minimum requirement for 2G and 3G MSCs should be two (for each) in Ofcom's 2011 Model, but that Ofcom had modelled a higher number. However, Vodafone did not provide any supporting evidence for this statement.

3.338 We do not consider that the minimum number of MSCs required by the hypothetical operator is self-evident. For example, the minimum number of 2G and 3G MSCs is not a number that can be identified without an understanding of how mobile networks are built and operated.

3.339 Given the lack of supporting evidence, we do not consider that Vodafone has demonstrated that Ofcom erred in the modelling of the minimum number of 2G and 3G MSCs.

The transit network

3.340 We agree with Ofcom that the relevant increment to consider is MCT services, but that Vodafone had used an all-services increment in its reasoning.

[444] Vodafone NoA, W/S Roche, §§4.88–4.91.
[445] Vodafone NoA, W/S Roche, §§4.88–4.91.

3.341 Vodafone in its reasoning only pointed out that if a network provided very little capacity then there was no need for a transit network. However, Vodafone also stated that the transit network would be needed if MCT services were the relevant increment.

3.342 We therefore consider that Vodafone has not demonstrated that Ofcom erred in its treatment of the transit network in the 2011 Model.

Conclusion

3.343 Based on our assessment of Vodafone's reasoning above, we do not consider that Vodafone has demonstrated that Ofcom has erred in the modelling of the coverage network.

(e) Markup of LRIC+ over LRIC[446]

Vodafone's challenge

3.344 Vodafone stated that the implied level of mark-up of LRIC+ over LRIC of 110 per cent[447] was implausible[448] because too much cost in the 2011 Model was erroneously treated as invariant to traffic.[449] As a result, Vodafone considered that the 2011 Model was unusable and a different calculation method was needed.[450]

3.345 Table 3.1 shows a summary of Vodafone's proposed adjustments to the traffic-related costs in Ofcom's 2011 model.[451]

TABLE 3.1 **Cumulative cash outflows by asset type to 2014/15**

£ million

	Cash outflow to 2014/15				
	Total in the 2011 Model	*Total in Ofcom model assuming 'zero traffic'*	*Incremental costs in the 2011 Model*	*Total in Ofcom zero traffic after Vodafone adjustments*	*Incremental costs in the 2011 Model after Vodafone adjustments*
Row	(1)	(2)	(1)–(2)	(3)	(1)–(3)
Single volume assets	1,630	1,630	0	160	1,470
Assets with other drivers than volume	527	527	0	0	527
Assets with minimum quantities	18,296	8,524	9,772	2,522	15,774
Other assets	222	115	107	115	107
Total	20,675	10,796	9,879	2,797	17,878
As a % of total cash flows*	100	52	48	14	86

Source: Vodafone, except for the last row marked with *, which are our own calculations.

3.346 Vodafone inferred from this analysis that in a minimum coverage network only around 13 per cent of the cash outflows were not incremental to traffic. Vodafone stated that this implied a mark-up to traffic-related costs of around 15 per cent (in

[446] Vodafone reply to post staff-level hearing questions, p2.
[447] Vodafone NoA, W/S Roche, §1.4.
[448] Vodafone NoA, W/S Roche, §4.10.
[449] Vodafone NoA, §§79 & 80.
[450] Vodafone NoA, §§77 & 78.
[451] Vodafone NoA, W/S Roche, Table 4.5.

other words, Vodafone stated that its analysis showed that LRIC+ should only be around 15 per cent above LRIC).[452]

3.347 Vodafone stated that in 2002 Oftel estimated the costs of a stand-alone coverage network in 2000/01 to be approximately 21 per cent of the overall costs of the network.[453]

3.348 Vodafone was of the view that the definition of a coverage network as set out by BT (see paragraph 3.359—ie to enable any customer to make a call if he/she wishes to do so) was incorrect and that its own definition was well-established and was conceptually directed at distinguishing the minimum assets required to enable the network to function (ie to carry a single call) from the additional assets required to carry additional traffic.[454]

3.349 Vodafone further stated that BT's view that the costs of access should be excluded from the calculation of MCT charges (see paragraph 3.362) was incorrect. The coverage network was not dimensioned to provide sufficient access to carry traffic, and (unlike a fixed network) access assets deployed in a mobile network varied with traffic volumes.[455]

Telefónica's SoI in support of Vodafone

3.350 Telefónica stated that it agreed that Ofcom's Model overestimated the costs of providing a coverage-only network and consequently understated the LRIC cost of call termination.[456]

3.351 Telefónica estimated that if it operated a 'coverage-only' network (ie a network which provided coverage but had no capacity to carry traffic) it would incur no more than [✂].[457] [✂] Telefónica's costs of maintaining, improving and operating its network was to provide capacity to carry traffic.[458] Telefónica therefore agreed with Vodafone that the 2011 Model, which produced results that over 50 per cent of costs were non-traffic related, was unsuited to deriving a measure of the LRIC of the MCT service.[459]

EE's challenge and support for Vodafone

3.352 EE said that the level of common costs assumed within the 2011 cost model was too high.[460]

3.353 EE noted that previously Ofcom and the CC (in the 2002 decision[461]) had assumed that common costs comprised only around 3 to 5 per cent of total network costs.[462] EE stated that Ofcom's assumption of a very high level of common costs in total network costs (around half of total network costs were common costs in the 2011 Model[463]) was the result of an incorrect identification of the extent to which particular

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[452] Vodafone NoA, W/S Roche, §4.102.
[453] Vodafone NoA, W/S Roche, §4.25.
[454] Vodafone Core Submission, §§5.95 & 5.96.
[455] Vodafone Core Submission, §5.97.
[456] Telefónica SoI, §30.
[457] Telefónica SoI, W/S Wardle, §70.
[458] Telefónica SoI, W/S Wardle, §5g.
[459] Telefónica SoI, W/S Wardle, §70.
[460] EE NoA, §157.1.
[461] EE NoA, §157.1.
[462] EE NoA §157.1; EE SoI, §31; and EE SoI, W/S Hird I, §§10 & 36.
[463] EE NoA, §157.1; and EE NoA, W/S Hird I, §10, 36.

asset costs varied with traffic volumes.[464] This illustrated that the model itself and/or the way in which it had been used by Ofcom must be flawed.[465]

3.354 EE said that the higher common costs implied that there were substantial scale economies in the UK networks for which Ofcom lacked a solid evidential basis.[466] In 2001, a report prepared for Oftel said that the relationship between cost and the number of subscribers was broadly linear with little evidence of economies of scale (and scale economies would be even lower now given the growth of mobile networks since then[467]).[468]

Ofcom's Defence

3.355 Ofcom said that as the increment for LRIC was MCT services and the increment for LRIC+ was all services, common costs would likely be higher for the LRIC calculation.[469]

3.356 Ofcom also said that in previous charge controls the model was based on a total traffic increment in which the costs common between traffic services would have been allocated to all services and where increases in costs would directly impact on the incremental cost calculations for all services. In contrast, the 2011 cost model was identifying the costs avoided by not providing MCT services.[470]

3.357 Ofcom said that a significant departure from the 2002 reference was the introduction of 3G, which it explained was much lumpier in terms of the investments made (for example, the 3G minimum spectrum requirements were much larger than for 2G). Ofcom also said that the capacity of equipment in 3G was much higher than under 2G.[471]

BT's SoI in support of Ofcom

3.358 BT stated that the implausible difference that Vodafone identified between LRIC and LRIC+ was because Vodafone interpreted the mark-up as a mark-up of overhead costs (such as sales, administration and general costs) on direct production costs, but in fact the difference in LRIC and LRIC+ was comparing the costs the mobile operators largely incurred in providing access to their networks with the costs they incurred in routing calls over their networks. A priori, there was no reason why access costs should be expected to be less than 50 per cent of total network costs (or indeed any other particular proportion of network costs).[472] BT noted that Vodafone included subscriber-driven access costs in its calculations as Vodafone's definition of access only included the costs of building a minimum coverage network.[473]

3.359 BT said that coverage should be defined as 'effective coverage': the ability to make or receive a call, given the number of subscribers that the operator of minimum efficient scale was assumed to have (ie providing sufficient network resources that there was a high probability that any customer wanting to make a call could in fact do

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[464] EE SoI, W/S Hird 2, §60.
[465] EE SoI, §31.
[466] EE NoA, §157.1.
[467] EE NoA, W/S Hird I, §40.
[468] EE NoA, W/S Hird I, §§37 & 39.
[469] Ofcom bilateral hearing transcript, p124, lines 10–19.
[470] Ofcom hearing transcript, p125, line 20, to p126, line 5.
[471] Ofcom hearing transcript, p125, lines 1–6.
[472] BT SoI, W/S Richardson 2, §35.
[473] BT SoI, W/S Richardson 2, fn 8.

so) and not as coverage as defined by Vodafone, ie a network that allowed one person to be able to make a call at any time.[474]

3.360 BT considered that this was supported by the EC Recommendation which set out that the minimum efficient scale for the purposes of cost modelling should be a market share of 20 per cent.[475]

3.361 BT was of the view that coverage costs therefore included all the non-traffic-sensitive costs of a hypothetical efficient operator, including costs which were fixed with respect to subscriber numbers and the variable subscriber-driven network costs of dimensioning the access network for the number of customers under the assumed minimum efficient scale. Both these fixed and variable subscriber-driven coverage costs were to be excluded from the MTR calculation as neither would be avoided if the MNOs were not to provide call termination.[476]

3.362 BT said that the access network was customer number driven and access network costs should therefore be excluded from the calculation of LRIC.[477] BT estimated that around 75 per cent of the difference between LRIC+ and LRIC was related to the cost of the access network (ie the assets connecting the customer to the nearest mobile phone cell (consisting of spectrum, cell site and other access-related costs).[478]

Assessment: mark-up of LRIC+ over LRIC

3.363 It was alleged that the mark-up of LRIC+ over LRIC was implausibly high (at 110 per cent) and should be no more than 20 per cent.

3.364 Vodafone said that the main reason for this implausibly high mark-up was that too many assets in the 2011 Model were non-traffic related and that prior regulatory decisions had been set implying lower levels of mark-up.

3.365 EE said that this was because the common costs in the CC's 2002 decision were only 3 to 5 per cent and, while Oftel said at that time that economies of scale were limited then, EE claimed that economies of scale were even more limited now.

3.366 We are of the view that a reference to traffic-related costs in general does not provide that insufficient traffic-related costs have been allocated to MCT services. We note in this context that the EC Recommendation recommends LRIC to be calculated treating MCT services as the last increment, after all costs have been allocated to other services first. This also supports Ofcom's view that the amount of common costs would be larger in the LRIC calculation than in the LRIC+ calculation. We agree with Ofcom that where MCT services are the last increment, it is highly likely that common costs form a larger proportion of total costs than where the increment is all services. This is because costs for jointly-used assets would have already been allocated to the first increment and all other increments before any remaining costs are allocated to the final increment.

3.367 We agree with BT that there is not necessarily an intuitive benchmark for the correct level of mark-up of LRIC+ over LRIC. We also agree with BT that Vodafone's example, supporting its view that only 20 per cent of total costs are common costs, is

[474] BT SoI, §§63b & 63c; and BT SoI, W/S Richardson 2, §§9 & 48–50.
[475] BT SoI, §63iii.
[476] BT SoI, W/S Richardson 2, §10.
[477] BT SoI, W/S Richardson 2, §§13c & 13d.
[478] BT SoI, W/S Richardson 2, §§12 & 13d.

based on building a minimum coverage network that carried only one call, which would not be built in reality and would understate the common cost of the ex-MCT network, because it would, for example, exclude subscriber-driven costs from it.

3.368 We do not consider that EE has supplied sufficient supporting evidence or sufficiently explained as to why, even if there were no scale economies in UK networks, this would indicate that the LRIC of MCT services is too low.

3.369 We also note that we did not find that Vodafone had demonstrated that Ofcom modelled too many non-traffic-related assets in its 2011 Model (see paragraph 3.243ff).

3.370 We agree with Ofcom that the prior decisions cited by Vodafone and EE were made in respect of the calculation of LRIC+ and that the mobile networks have changed substantially since then. Vodafone and EE have not provided any further reasoning why these decisions are nevertheless relevant to the current charge control (see also paragraph 3.434) and, consequently, we conclude that they are not relevant to our deliberations.

Conclusion

3.371 We therefore do not consider that it has been demonstrated that Ofcom's 2011 Model is incorrect because the mark-up of LRIC+ over LRIC is implausible.

(f) The slope of the traffic cost curve

Vodafone's challenge

3.372 Vodafone said that the slope of the traffic cost curve in the 2011 Model was incorrect.[479] Vodafone said that a reason for this was because the zero-traffic point in the 2011 Model was overstated and because Ofcom had not adjusted sufficient network design parameters.[480]

3.373 Vodafone said that the 2011 Model was designed to build a network which minimized the cost of carrying the total traffic load at a given traffic volume. The model disclosed the efficient cost of providing all relevant traffic services at a given traffic level, but it provided no information about the shape of the total cost curve.[481]

3.374 Vodafone was of the view that Ofcom's assertion that there were continuous economies of scale was mere speculation.[482] This was because Ofcom's argument took no account of the fact that the LRIC of the MCT service was the sum of the incremental costs of the MCT service for each year of the total modelled service, including many years when economies of scale would, even on Ofcom's supposition, be minimal.[483] Furthermore it said that Ofcom's argument took no account of the fact that the modelled network must meet different levels of demand in different geographic areas, so that overall growth in traffic would not lead to economies of scale such as Ofcom supposed unless such traffic was distributed across the network and

[479] Vodafone NoA, W/S Roche, §9.16 (third bullet).
[480] Vodafone bilateral hearing transcript, p102, to p104.
[481] Vodafone Core Submission, §5.24.1.
[482] Vodafone Core Submission, §5.24.2.
[483] Vodafone Core Submission, §5.24.3.

the growth in traffic in each area was sufficient to give rise to significant scale economies.[484]

3.375 Vodafone said that some of the reasons which Ofcom gave for expecting economies of scale were unrelated to scale, but relied on an expectation that new, more efficient technologies would be introduced over time: if anything, this suggested that costs fell over time, not with scale.[485]

3.376 Vodafone said that Ofcom's argument as to the impact of the modularity (ie lumpiness) of assets (that, as traffic volumes increased, more classes of asset became modular) on the slope of the cost curve was incorrect as:

(a) it took no account of the fact that, under the 2011 Model, many classes of asset were not dimensioned by reference to traffic (eg the network management system);[486]

(b) for some classes of asset, the size of the relevant module was so small, relative to the volume of traffic as a whole, as to render the modularity largely irrelevant at many traffic levels;[487] and

(c) mobile networks were critically dependent on the use of scarce resources, in particular spectrum and base station sites. These physical limitations meant that it would not be possible to increase traffic indefinitely at declining marginal costs.[488]

Ofcom's Defence

3.377 Ofcom said that it had made the assumption that the (true, but unobservable) network long-run total cost (LRTC) curve (for MCT services) experienced continuous economies of scale across the range of outputs shown (ie falling long-run average cost (LRAC) as output expanded) and continuous diminishing marginal costs (ie the slope of the LRTC curve reduced as output expanded).[489] It said that the reason why LRTC was likely to have this shape was because:

(a) as the volume of traffic increased, new technological network developments would become viable which decreased the average cost of traffic;[490,491] and

(b) of the modularity (ie lumpiness or capacity) of assets.[492] From a final increment avoidable cost perspective, those assets with high or medium modularity would already have been purchased before the final increment was introduced. As such, the avoidable assets of the final increment of traffic would be those assets with low capacity. As the size of the traffic increment increased, or as more

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[484] Vodafone Core Submission, §5.24.4.
[485] Vodafone Core Submission, §5.24.5.
[486] Vodafone Core Submission, §5.24.6.
[487] Vodafone Core Submission, §5.24.7.
[488] Vodafone Core Submission, §5.24.8.
[489] Ofcom Defence, Annex B, §103.
[490] Ofcom provided the example of the move from 2G to 3G technology. At low levels of traffic, it was likely to be cheaper to use a 2G network to achieve coverage and deliver the required low quantity of voice traffic. As traffic increased, the roll-out of the more efficient 3G technology became viable, which for higher levels of traffic led to lower average costs. There were two reasons for this. First, 2G equipment prices were typically lower than 3G equipment prices. Second, 3G technology was more modular (ie higher capacity) than 2G technology.
[491] Ofcom Defence, Annex B, §111(i).
[492] Some assets (eg NMS) were able to handle a full network carrying all traffic and so had a very high modularity. Some assets, such as 2G TRXs, were each only able to carry a small increment of traffic and so had low modularity.

increments were removed, some of the assets with larger capacity would be avoided and so the average cost of the increment would increase.[493]

3.378 Ofcom said that LRIC was an approximation to the slope (ie rate of change) of total costs. However, the slope of the LRTC curve depended not only on the size of the increment (eg the volume of MCT), but also where that increment was measured on the LRTC curve. The EC Recommendation stated that the relevant increment should be measured by attributing traffic-related costs first to services other than wholesale voice termination, with finally only the residual traffic-related costs being allocated to the wholesale voice call termination service.[494] Ofcom said that it therefore measured LRIC as the final increment on the LRTC curve.[495]

3.379 Ofcom considered that the 2011 Model did not necessarily mimic the shape of the true LRTC curve over the entire range of output (ie all traffic), but considered that as long as the modelled and actual cost curves had a similar slope for the range of output around the termination increment, the LRIC estimate would be robust.[496] It also considered that the 2011 Model was a good fit to the total network costs (ie LRTC) of an efficient 2G/3G MCP and from this, concluded that the derivation of the costs of the final increment (ie LRIC) using the 2011 model should be considered sufficiently accurate for charge control purposes.[497]

3.380 Ofcom said that at higher levels of network usage, operators would employ high fixed cost/low marginal cost technology, which supported its view that the slope of the traffic cost curve at the MCT increment level was shallower than the straight cost line between the zero and all-traffic network.[498]

BT's SoI in support of Ofcom

3.381 BT explained that mobile access network costs did not vary linearly with the number of customers and per customer costs would fall as customer numbers increased.[499]

Three's SoI in support of Ofcom

3.382 Three stated that some costs were likely to be incremental to aggregate traffic, but not incremental to individual services such as MCT.[500] The extent to which this was the case depended on the size of the increment and the extent to which the cost traffic relationship was linear.[501]

3.383 Three said that the cost-volume function was likely to be non-linear.[502]

Assessment: the slope of the traffic cost curve

3.384 Vodafone and Ofcom disagreed on the likely slope of the traffic cost curve for MCT services. Vodafone considered that this curve was steeper than implied in the 2011 Model.

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[493] Ofcom Defence, Annex B, §111(ii).
[494] Ofcom Defence, Annex B, §104.
[495] Ofcom Defence, Annex B, §105.
[496] Ofcom Defence, Annex B, §107.
[497] Ofcom Defence, Annex B, §110.
[498] Ofcom bilateral hearing transcript, p108, lines 5–23.
[499] BT SoI, W/S Richardson 2, §13c.
[500] Three SoI, W/S Mantzos 2, §2.90.
[501] Three SoI, W/S Mantzos 2, §2.91.
[502] Three SoI, W/S Mantzos 2, §2.65a.

3.385 Vodafone said that this was because the zero-traffic point in the 2011 Model was overstated and because Ofcom had not adjusted sufficient network design parameters.

3.386 We did not find that Vodafone has demonstrated that Ofcom has erred in the modelling of the network design parameters (see paragraph 3.123) or the amount of traffic-related assets (see paragraph 3.243) or the size of the coverage network (see paragraph 3.316) or the design of the zero-traffic point (see paragraph 3.404ff).

Conclusion

3.387 We therefore do not consider that Vodafone has demonstrated that the slope of the traffic cost curve in Ofcom's 2011 Model is incorrect.

(g) The zero-traffic network

Vodafone's challenge

3.388 Vodafone said that the volume of assets that would be required in the situation without termination was not known.[503] It said that the identification of the level of costs at a different and theoretical level of traffic was always going to be an estimate derived from the best possible evidence, which could best be obtained from using two points, the costs with all traffic and the costs with zero traffic.[504] Vodafone said that it was possible to measure costs if there was zero traffic. From the increment of these two points the incremental costs (of MCT services) could be extrapolated.[505] Vodafone said that the advantage of the zero-traffic network was that all costs beyond this network were incremental to traffic.[506]

3.389 Vodafone said that the 2011 Model would inevitably underestimate the LRIC of a given service if it systematically over-dimensioned the network at all levels of traffic other than total traffic. Given that the model only had two explicit traffic levels[507]—total traffic and zero traffic—if the zero-traffic point was wrong, the LRIC estimate would be wrong.[508]

3.390 Vodafone said that in the early years of the model, the volume of traffic without termination was not at all substantial (eg the network ex-MCT was only required to carry 492 million minutes of voice traffic in the first year, which was to all intents and purposes indistinguishable from a zero-traffic network). The consideration of a zero-traffic network was therefore very much a relevant exercise in LRIC modelling.[509]

3.391 Vodafone said that whilst the full-traffic network had been calibrated against the real world, the zero-traffic network could not be calibrated, but was much lower than Ofcom had in its model. The 2011 Model, on an asset-by-asset basis, drew a straight line between Ofcom's zero-traffic network and the full-traffic network. As the zero-traffic point in the 2011 Model was wrong, some of the assets would respond insufficiently to a reduction in traffic.[510]

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[503] Vodafone staff hearing transcript, p37, line 1ff.
[504] Vodafone Core Submission, W/S Roche II, §10.29.
[505] Vodafone staff hearing transcript, p37, line 11ff.
[506] Vodafone staff hearing transcript, p39, line 1.
[507] Vodafone stated that the model did not explicitly model total traffic less termination but assumed that the network size was correct when termination was removed from the model.
[508] Vodafone Core Submission, W/S Roche II, §§4.3, 4.4 & 5.52.
[509] Vodafone Core Submission, W/S Roche II, §5.47.
[510] Vodafone staff hearing transcript, p39, line 2ff.

3.392 Vodafone said that correctly distinguishing traffic- and non-traffic-related costs (by identifying the correct underlying costs of a zero-coverage network and relevant traffic-related cost drivers) was a logically necessary step if the 2011 Model was to be able to compute the incremental assets required to provide the MCT service in each and every year of the total modelled period.[511]

3.393 Vodafone suggested that had a LRIC model been designed from scratch, it would have included multiple traffic levels to allow network optimization at those different levels.[512] Vodafone stated that the size of the MCT increment was different at different points in time and, therefore, the model needed to be able to identify the incremental termination costs at vastly different traffic levels (eg a high proportion of termination traffic as a percentage of total traffic in earlier years and a lower proportion in later years).[513]

3.394 Vodafone said that there must be a continuum between the current level of traffic and the zero-traffic network as everything changed a little bit from the current level of traffic down to the zero-traffic level.[514] The network would respond in different parts of the network as traffic went all the way down from full-traffic to the zero-traffic point.[515]

3.395 Vodafone stated that if the slope between the zero-traffic level and the full-traffic level was a straight line, then interpolating between them must be a more robust approach than Ofcom's, because the zero-traffic level was one accurate point with which to calibrate the model.[516]

3.396 Vodafone said that another reason why it was necessary to model the zero-coverage network accurately was because, according to the ED method used to convert the incremental assets into MCT charges for any given charge control period, the incremental assets used in providing the MCT service in any single year contributed to the computation of the MCT charges in every charge control period. Thus, the zero-traffic year was one input into the MCT charges for each charge control year.[517]

3.397 Vodafone said that when MCT costs were calculated by reference to smaller historic networks, then this would include expectation of enormous traffic growth. No one had ever built a zero-traffic network at a point in time with the expectation that it would remain at zero traffic.[518]

3.398 Vodafone also suggested that a zero-traffic network would be built with no growth in mind and therefore all costs over and above the zero-traffic network would be incremental to traffic.[519]

Telefónica's SoI in support of Vodafone

3.399 Telefónica said that the 2011 Model had a linear relationship between traffic and costs, and that in the non-traffic network, it showed a greater cost than was actually the case if a network was build from scratch.[520]

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[511] Vodafone Core Submission, §5.19.1.
[512] Vodafone Core Submission, W/S Roche II, §4.4.
[513] Vodafone Core Submission, W/S Roche II, §5.43.
[514] Vodafone staff hearing transcript, p8, line 13ff.
[515] Vodafone staff hearing transcript, p8, line 21ff.
[516] Vodafone Core Submission, W/S Roche II, §4.53.
[517] Vodafone Core Submission, §5.8.1.
[518] Vodafone staff hearing transcript, p37, line 12ff.
[519] Vodafone staff hearing transcript, p38, line 24ff.
[520] Telefónica bilateral hearing transcript, p52, lines 15–19.

Ofcom's Defence

3.400 Ofcom said that Vodafone's points by reference to a 'zero-traffic' network (ie a 'coverage-only' network which did not carry any calls) were not relevant. Ofcom said that the EC Recommendation did not require any assessment to be made of what would be the costs of such a 'zero-traffic' network, but instead recommended the LRIC to be calculated by comparing *(a)* the costs of a network providing all services except MCT to third-party networks with *(b)* a network providing all services including MCT. All services included traffic-carrying services, including call origination and the conveyance of on-net calls as well as messaging and data services and the hypothetical network without incoming termination was one which carried a very substantial amount of traffic (ie the full amount of traffic that the network would carry excluding only that amount accounted for by third-party MCT).[521]

BT's SoI in support of Ofcom

3.401 BT considered that the zero coverage network was a theoretical network quite unlike the networks that the MNOs actually designed and built.[522]

Three's SoI in support of Ofcom

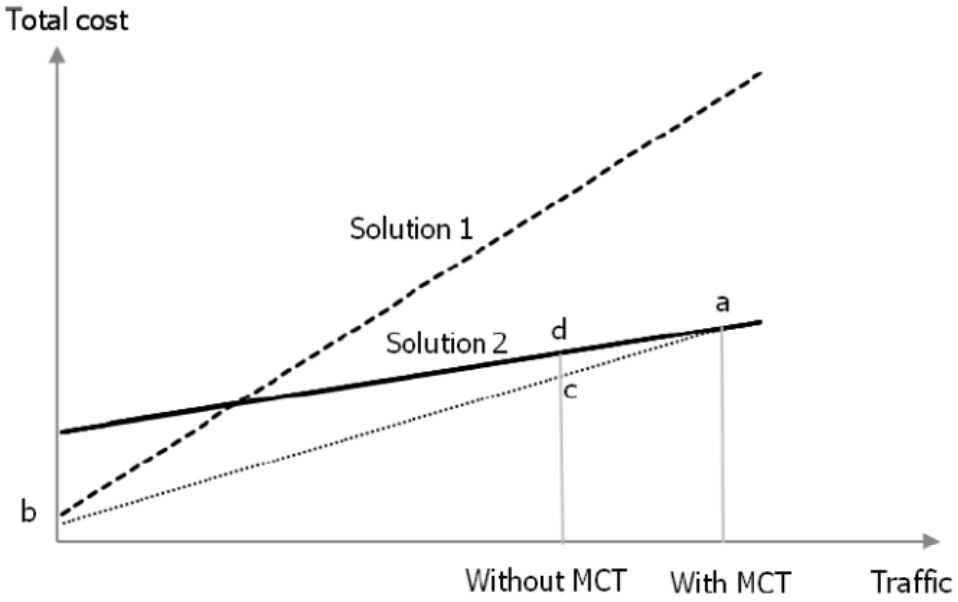
3.402 Three said that the 2011 Model did not need to predict the costs of a zero-traffic network to calculate LRIC (and a zero-traffic network would not offer relevant insights into the design of a network without MCT[523]). A zero-traffic network was not relevant where a network without off-net voice termination still had very substantial volumes of traffic (and the level of traffic-related costs and common costs for a service-specific increment were likely to be quite different from those for an all-service increment[524]).[525]

3.403 Three considered that the zero-traffic network would only assist in the calculation of LRIC if the traffic cost relationship was linear and if the network configuration optimal for zero traffic was similar to that optimal at current levels of traffic.[526] However, it said that this was unlikely to be the case because at very low levels of traffic, operations would likely be configured so that fixed costs were minimized, but would likely come at the expense of a relatively high marginal cost. Conversely, at higher levels of traffic, it might be more efficient to invest more in fixed costs in order to benefit from lower marginal costs. This indicated that the traffic cost curve for MCT services was not linear.[527] Three provided the following graph to illustrate this.[528]

[521] Ofcom Defence, Annex B, §97.
[522] BT SoI, W/S Richardson 2, §54e.
[523] Three SoI, §10.30.
[524] Three SoI, W/S Mantzos 2, §2.65c.
[525] Three SoI, §10.1c.
[526] Three SoI, W/S Mantzos 2, §§2.69–2.72 & 2.79.
[527] Three SoI, W/S Mantzos 2, §§2.74–2.78.
[528] Three SoI, W/S Mantzos 2, §2.76.

FIGURE 3.3

Illustration of non-linear cost curve



Source: Three.

Assessment: the zero-traffic network

3.404 Vodafone said that the 2011 Model calculated an inappropriately large zero-traffic network.

3.405 We agree with Ofcom that a zero-traffic network as defined by Vodafone is not relevant to the calculation of the LRIC of MCT services. This is because both the all-services network and the ex-MCT network would be built with future growth in mind. In contrast, the zero-traffic network as defined by Vodafone appears to be built with no traffic growth in mind. We therefore consider that Vodafone's proposed zero-traffic network would be incompatible with the ex-MCT network required for the calculation of the LRIC of MCT services.

3.406 We note that Vodafone itself said that no one would build a zero-traffic network, as all networks were built with the expectation that traffic would grow.

Conclusion

3.407 We therefore do not find that Ofcom erred by not modelling a zero-traffic network as alleged.

(h) The modularity of assets

Ofcom's decision

3.408 Ofcom stated that a 'modularity' effect occurred in its model because when a new asset was purchased it might not be fully utilized immediately. If assets were under-utilized, the spare capacity would be used before any additional costs were incurred.

Likewise, if assets were fully utilized, then adding incremental traffic would incur costs immediately.[529]

Vodafone's challenge

3.409 Vodafone said that calculating LRIC involved the calculation of a long-run incremental cost, not a simple short-run incremental cost, when only the current traffic volumes might be relevant.[530]

3.410 Vodafone said that the 2011 Model instead was calculating the short-run avoidable costs of the MCT service and was unable reliably to identify or isolate the long-run incremental costs of terminating third-party voice traffic, which is what it should be doing.[531]

3.411 Vodafone said that Ofcom wrongly assumed that its model could implement the 'subtractive approach' to determine the LRIC of the MCT service without any significant adjustment. It claimed that this was incorrect because the subtractive method resulted in short-run common costs arising from the modularity of assets being deemed to be long-run common costs. In essence, the use of the subtractive approach meant that the first asset in an asset class was not incremental to any service because of the nature of the calculation, rather than a proper examination of whether the asset was incremental to traffic or not.[532]

3.412 The modularity of assets caused material intra-service common costs and, as a result, the model could not distinguish between long-run incremental cost and long-run joint and common cost.[533] In particular, said Vodafone, Ofcom had created in its model assets that were more lumpy than in reality and had therefore overstated the modularity of assets in its model.[534]

3.413 Vodafone explained that any site was deployed with the expectation of it carrying traffic. There was no long-run provision of coverage for the sake of coverage. The coverage network mapped to the expectation of how much traffic was going to occur. As soon as a site started to fill up with traffic it became a traffic-driven site, not a coverage-driven site at all. So all the equipment at the site would (at least as soon as traffic started to go on to the site) become incremental to traffic, not incremental to coverage.[535] Vodafone said that modelling this would have the effect of reclassifying an asset from non-traffic-related to traffic-related as soon as it started bearing traffic.[536]

3.414 Vodafone provided the example of multi-sector sites, which had a lot of voice capacity, which was above and beyond the equipment needed for coverage purposes.[537]

3.415 Vodafone considered that when running the subtraction in the 2011 Model, assumptions as to the modularity of equipment could result in a contrived view of costs, which Oftel had previously indicated should be avoided in cost models. This was because, in the subtractive method, there was deemed to be no incremental cost incurred in meeting any demand up to the effective capacity of the already existing

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[529] Ofcom Decision, Annex 10, fn 312.
[530] Vodafone Core Submission, W/S Roche II, §5.41.
[531] Vodafone bilateral hearing transcript, p10, lines 15–19.
[532] Vodafone Core Submission, §5.9.
[533] Vodafone NoA, §2.37.
[534] Vodafone bilateral hearing transcript, p10, line 20, to p11, line 2.
[535] Vodafone staff hearing transcript, p16, line 10ff.
[536] Vodafone staff hearing transcript, p16, line 24ff.
[537] Vodafone staff hearing transcript, p17, line 6ff.

modules of equipment on the network. For assets which were added in relatively sizeable modules (ie each module has a relatively high capacity, such as switches and high-capacity backbone links), the subtractive method could result in material intra-service common costs even though the asset was only deployed for traffic purposes.[538]

3.416 Vodafone said that all costs in relation to radio equipment installed at coverage sites should be treated as traffic related.[539]

3.417 This was because with radio equipment, once it was fully utilized and an additional unit was installed, all units were then dedicated to carrying traffic and any distinction would be meaningless.[540] These costs were there due to lumpiness of investment which were only lumpy in the short run and not in the long run.[541] Vodafone said that this view was supported by the CC's 2002 inquiry into MCT, which stated that in the long run any equipment cost should be treated as variable.[542,543]

3.418 Vodafone said (in relation to Ofcom's attempt to distinguish the present case from the previous decision of the CC) that the CC was considering whether the first module of each relevant asset should be treated as incremental to traffic, and its assessment was just as relevant to the present case as to the one under consideration then.[544]

3.419 Vodafone stated that incremental modules of radio network assets should be assumed to be of minimal size, so that the total traffic costs were, in effect, apportioned among traffic services, according to the relative volume and proportionate consumption of assets of different types by different traffic services.[545]

EE's SoI in support of Vodafone

3.420 EE laid out the existing guidance to modelling MCT costs:[546]

(a) The EC Recommendation (ie the increment is all MCT services to third parties),[547] that MCT cost should be measured in the long run and therefore all fixed costs should become variable costs,[548] traffic- and non-traffic-related costs should be distinguished.[549]

(b) The CC had stated (in its 2002 decision) that operators had substantial flexibility to redesign their networks in the long run, which carried the implication that most network costs should be expected to be variable with traffic changes.[550] The CC said: 'Taking the economist's definition of long run as being the period in which all costs can be varied, if a service is not provided, then in the long run it may be possible to design the network to avoid many shared costs that are fixed or common in the short term.'[551]

(c) The CC had taken the view (in its 2002 decision) that:

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[538] Vodafone NoA, W/S Roche, §2.37.
[539] Vodafone NoA, W/S Roche, §§4.114 & 4.121.
[540] Vodafone NoA, W/S Roche, §4.114.
[541] Vodafone NoA, W/S Roche, §4.116.
[542] Vodafone NoA, W/S Roche, §4.118.
[543] Vodafone NoA, W/S Roche, §§4.115 & 4.67.
[544] Vodafone Core Submission, §5.24.9.
[545] Vodafone NoA, §§79.1–79.2.
[546] EE SoI, §28.
[547] EE SoI, §55.
[548] EE SoI, §29.1; and EE SoI, W/S Hird 2, §55.
[549] EE SoI, §29.1; and EE SoI, W/S Hird 2, §55.
[550] EE SoI, §29.2.
[551] EE SoI, W/S Hird 2, §58.

> the fact that equipment is shared between services now does not necessarily mean that the cost of the equipment is common among services in the long run because, if one service ceased, the amount of equipment needed could—and would—be scaled down to the level needed to run the other activity.[552]

(d) Ofcom had stated that if termination services were removed 'most of the network costs incurred on call termination could be saved'.[553]

(e) Ofcom had stated that 'service demand (traffic) drives the majority of costs'.[554]

3.421 EE agreed with Vodafone that once an initial unit of equipment of any particular class was fully utilized in any particular area, so that another unit had to be installed to carry additional traffic, it became the case that all the units of equipment in that area were dedicated to carrying traffic. EE said that Ofcom's 'total network minus' approach excluded this initial capacity from the LRIC of termination, underestimating the LRIC of termination. This was because if an operator found itself with significant spare capacity freed up because it no longer offered MCT services, then that operator would adjust its pricing so that it supplied more of other services. From an economic perspective, the value of the additional services that would otherwise be supplied should form part of the LRIC of termination.[555]

Ofcom's Defence

3.422 Ofcom said that its 2011 Model was a total lifetime cost model and was therefore a long-run cost model. Furthermore, Ofcom considered that the MCT cost calculation should focus on avoidable costs of providing MCT services. Ofcom said that a long-run avoidable cost calculation was most consistent with the EC Recommendation.[556]

3.423 Ofcom said it did not contest that the modularity (ie lumpiness) of equipment could in theory cause low incremental costs (or high incremental costs) depending on whether the increment of traffic could be largely accommodated by the capacity of assets already installed, or whether new lumpy assets were required.[557]

3.424 Ofcom considered that the appropriate way to calculate the LRIC of MCT services involved the detrimental approach it had adopted, in which the actual modularity of network equipment was captured (rather than some hypothetical alternative where assets with a smaller capacity/modularity could be envisaged). It was not clear to Ofcom that such a low-capacity asset would be purchased in a world without MCT. Network assets were produced with capacities as designed by the equipment manufacturers and supplied globally. Given that all other MCPs would still be receiving MCT, they would still be purchasing assets designed to meet the full traffic requirements of a network that supported all services including MCT. Ofcom expected that to purchase a bespoke (low-capacity) asset might actually cost an operator more than to purchase an off-the-shelf larger-capacity asset.[558]

3.425 Ofcom said that it had endeavoured to model the network assets that an MCP providing all services would require and had based the LRIC calculation on the cost that would be avoided when the MCT traffic increment was removed. Ofcom believed that

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[552] EE SoI, §29.2; and EE SoI, W/S Hird 2, §57.
[553] EE SoI, §29.3; and EE SoI, W/S Hird 2, §59.
[554] EE SoI, §29.3; and EE SoI, W/S Hird 2, §59.
[555] EE SoI, W/S Hird 2, §72.
[556] Ofcom bilateral hearing transcript, p125, lines 15–23.
[557] Ofcom Defence, Annex B, §117.
[558] Ofcom Defence, Annex B, §114.

using the assets that actually existed in the real world was most consistent with an avoidable cost approach as put forward in the EC Recommendation.[559]

3.426 Ofcom said that in respect of modelling the cost of the MCT increment:

(a) From a first-best perspective, prices should be aligned to the marginal resource costs actually incurred on a forward-looking basis. If no new capacity were required for the additional traffic, economic principles would point to a zero charge being efficient.[560]

(b) Ofcom said that while it was recognized that pricing on the basis of short-run marginal cost (SRMC) could lead to price volatility which was not desirable in the context of charge control regulation, the 2011 Model was a lifetime network cost model which used ED. This feature of the model would largely smooth lumpy or potential spikes in costs due to the modularity of equipment and so the SRMC effects would be smoothed out.[561]

(c) The 2011 Model contained a large number of modular assets. When these assets were aggregated at the network level, the path of unit costs would be less likely to exhibit spikes as new modular assets were added.[562]

(d) It was consistent with the EC Recommendation not to include assets in the LRIC calculation, where modularity meant that these assets were not avoided when MCT traffic was removed.[563]

3.427 Ofcom said that for the purposes of modelling MCT as the final increment, it was not necessary to treat all radio equipment installed at coverage sites as being traffic related. This was because the amount of radio equipment modelled to provide coverage was not large and because the 2011 Model factored in the incremental radio equipment deployed in response to traffic, when considering that the final increment were MCT services.[564]

3.428 Ofcom said that the Oftel submission to the 2002 CC inquiry was not relevant as that inquiry used a different incremental cost concept (it did not calculate LRIC) and a different increment (an all-traffic increment).[565]

3.429 Ofcom said that the shape of the network had changed significantly since its 2002 decision (for example, the introduction of 3G with its lumpier investments).[566]

Assessment: the modularity of assets

3.430 Vodafone said that assets in the 2011 Model were more modular (lumpy) than in reality and that assets that were coverage driven initially should be treated as traffic driven as soon as their capacity was reached.

3.431 We preferred, however, Ofcom's reasoning that it was appropriate to calculate the LRIC of MCT services using the actual modularity of assets as this was most consistent with calculating the avoidable costs of providing MCT services and because of

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[559] Ofcom Defence, Annex B, §115.
[560] Ofcom Defence, Annex B, §117(i).
[561] Ofcom Defence, Annex B, §117(ii).
[562] Ofcom Defence, Annex B, §117(iii).
[563] Ofcom Defence, Annex B, §117(iv).
[564] Ofcom staff hearing transcript, p28, line 15ff.
[565] Ofcom Defence, Annex B, §118.
[566] Ofcom bilateral hearing transcript, p123, line 24, to p124, line 3.

the practical difficulties involved with using a hypothetical modularity. We also considered that this reflected how costs were incurred by operators in reality.

3.432 We agree with Ofcom that the modularity of assets may either cause high or low incremental costs, but that its economic depreciation method and the long time period covered by its model would smooth out the impact of modularity.

3.433 We were unpersuaded by Vodfaone's case about equipment becoming traffic related. We prefer Ofcom's explanation that it is not necessary to treat all radio equipment installed as coverage sites as traffic related, because the 2011 Model factored in the incremental radio equipment deployed in response to traffic when considering that the final increment is MCT services.

3.434 We agree with Ofcom that the prior decisions cited by Vodafone were made in respect of the calculation of LRIC+ and that the mobile networks have changed substantially since then. Vodafone and EE have not provided any further reasoning why these decisions are nevertheless relevant to the current charge control. (See also paragraph 3.370.) We conclude that those earlier decisions do not assist us. We note that LRIC is derived using a subtractional method which is different from the method used by Ofcom to derive LRIC+ in this and previous charge controls.

3.435 EE stated that the value of additional services that would otherwise be supplied in the absence of MCT services should inform the calculation of LRIC. We do not find that EE has provided sufficient reasoning why Ofcom should have adopted such an approach, because EE has not put forward any principled arguments in support of its case. We also note that such an approach would imply that other services are not provided in their current form (ie the increment would not be only MCT services[567]) and that this would likely depart from the Recommendation.[568]

Conclusion

3.436 For all the above reasons, we consider that it has not been demonstrated that Ofcom erred in its treatment of the modularity of assets.

(i) The incremental asset calculation

Ofcom's decision

3.437 Ofcom stated that its model could indicate negative assets (and hence costs) for some asset types when termination traffic was removed from the model. For example, node B-facing RNC ports increased during some years when termination was removed. This was caused by the swapping of asset types on the basis of traffic volumes, for example the swapping of TDM links with Ethernet backhaul. When termination traffic was removed, the number of sites and the number of backhaul links decreased, but not in the same proportion. This resulted in a different TDM links per site ratio impacting the timing of the Ethernet backhaul deployment in a geotype. Asset types, such as node-B facing RNC ports, that were linked to the swapped

[567] This would have implications for the allocation of costs to MCT services. For example, costs would then need to be allocated to these additional services.

[568] Recommendation (recital 14) states that the cost allocated to the wholesale call termination service should thus be equal only to the additional cost incurred to provide the service. Recommendation (paragraph 6) states that within the LRIC model, the relevant increment should be defined as the wholesale voice call termination service provided to third parties. This implies that in evaluating the incremental costs NRAs should establish the difference between the total long-run cost of an operator providing its full range of services and the total long-run costs of this operator in the absence of the wholesale call termination service being provided to third parties.

assets could also show negative quantities. Ofcom was satisfied that the 2011 Model was behaving correctly.[569]

Vodafone's challenge

3.438 Vodafone set out a number of alleged calculation errors in Ofcom's subtractional method (ie in the incremental version of the model—after subtracting the full service less MCT model from the full service model), which it said needed to be corrected if Ofcom's method was used[570] and which supported Vodafone's view that the 2011 Model was unable to provide an appropriate estimate of LRIC.[571] Vodafone provided the following examples.

Incremental asset counts from year to year

3.439 Vodafone said that in the incremental version of the model some assets were built in one year and then decommissioned in the next.[572] This was because traffic-related assets (for example, 2G traffic-related assets) were built before demand existed, but coverage assets were built in the year that coverage increased (ie the model assumed that capacity requirements should be installed in advance of the traffic occurring, but when the traffic actually occurred, the assumed coverage network was deemed to be sufficient to accommodate it, so the requirement reversed out;[573] and this resulted in the incremental model building assets before services commenced[574]).[575]

3.440 Vodafone said that correcting for this error increased LRIC+ by 0.0 per cent (or 0.0004ppm) and decreased LRIC by 0.3 per cent (or –0.0023ppm) in 2014/15.

Implausible asset movements

3.441 Vodafone said that some movements in incremental assets (ie assets incremental to MCT services) were implausible in the 2011 Model, for example:

(a) The increment for asset number 55 (the RNC node B-facing port) fluctuated from positive to negative volumes (however, this asset was not having an impact on costs in the model).[576]

(b) Microwave backhaul assets (numbers 37 to 41 and 68) exhibited incoherent behaviour. Asset 68 was always installed with asset 37 but the model showed negative incremental volumes of asset 37 in early years, and a lack of matching with the volumes of asset 68.[577]

(c) The model made incorrect assumptions on the relationship between incremental volumes of terminating voice minutes and the number of incremental macrosites

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[569] Ofcom Decision, A6.156.
[570] Vodafone NoA, W/S Roche, §4.131.
[571] Vodafone NoA, W/S Roche, §4.144.
[572] Vodafone NoA, W/S Roche, §4.134.
[573] Vodafone NoA, W/S Roche, §4.137.
[574] Vodafone NoA, W/S Roche, §4.133.
[575] Vodafone NoA, W/S Roche, §4.132.
[576] Vodafone NoA, W/S Roche, §4.141.
[577] Vodafone NoA, W/S Roche, §4.141.

these volumes required.[578] For example, in 2014/15 there was a sudden drop in the number of incremental macrosites by approximately 40 per cent.[579]

3.442 Vodafone was of the view that the examples in paragraph 3.441 indicated that the subtractional approach in the 2011 Model (overlaid on an erroneously high coverage assumption) did not work correctly and was not fit for purpose.[580]

3.443 Vodafone concluded that the Ofcom model was unable to assess how a network would react to material changes in traffic of a particular service at different points in time.[581] Vodafone was not able to quantify the impact on LRIC from correcting these alleged errors.[582]

EE's SoI in support of Vodafone

Incremental asset counts from year to year

3.444 EE stated that the error that Vodafone identified where investments in the initial year were being reversed out the following year was a problem and was indicative of the general issues with the mismatch in the timing of asset build and cost recovery. EE said that this specific example, however, had only a very small impact on the resulting cost estimates.[583]

Ofcom's Defence

Incremental asset counts from year to year

3.445 Ofcom submitted that Vodafone was mischaracterizing the 2011 Model when it identified negative capex and erratic volumes of some network elements as being a problem. When taking the difference between the two networks (ie with and without MCT), Ofcom would expect to see large swings in the asset counts. Much of the difference between the two networks was not the absolute quantity of network equipment, but rather the timing of the purchase of that equipment.[584]

3.446 Ofcom said that it would expect to see periods of time when the network including MCT had more equipment than the network without MCT and periods when they had the same or a very similar quantity of certain equipment. This was particularly the case given the modularity of some network equipment. The cost associated with purchasing equipment at an earlier point in time (in the scenario when MCT traffic was included) was then captured as a cost in the LRIC calculation.[585]

3.447 Ofcom acknowledged that in the 2011 Model, the use of look-ahead planning of network capacity resulted in building assets for capacity before they were needed. However, this did not mean that these assets were then removed in the following year when the assets required for coverage were greater than those required for capacity in following years. In 1992/93, there was more traffic in the network with MCT than without MCT. When the coverage network was built in the following year (1993/94) both networks became the same size. The network with MCT purchased the sites at an earlier point because of the additional MCT traffic on that network. For

[578] Vodafone NoA, W/S Roche, §4.142.
[579] Vodafone NoA, W/S Roche, §4.143.
[580] Vodafone NoA, W/S Roche, §4.138.
[581] Vodafone NoA, W/S Roche, §4.144.
[582] Vodafone response to post staff hearing questions, p20, 18 October 2011.
[583] EE SoI, W/S Hird 2, fn 18.
[584] Ofcom Defence, Annex B, §183.
[585] Ofcom Defence, Annex B, §184.

a single year the network with MCT was larger than the network without MCT. When the difference between these two networks was calculated, this showed up as incremental assets in 1993/94. This cost manifested itself in the LRIC calculation through less discounting (ie the cost of the asset is discounted for one year less), more opex (ie a single additional year's opex) and in some cases higher asset purchase costs (ie where MEA prices were falling, assets purchased in earlier years would be more expensive).[586]

3.448 Ofcom explained that the model with termination, because it had more traffic, would roll out certain assets at an earlier point, driven by when it hit modularity boundaries and rollout boundaries for different assets (and the network ex-MCT would hit these boundaries later).[587]

Implausible asset movements

3.449 Ofcom said that in the case of the macrosites, the apparent fall-off of incremental assets was because the network ex-MCT was now also rolling out these assets (this could be, for example, due to the ex-MCT network triggering capacity-related asset builds[588]).[589]

3.450 Ofcom said that Vodafone's evidence truncated the period for which it analysed the incremental macrosites and it would be more constructive to look at a longer period.[590]

Three's SoI in support of Ofcom

Incremental asset counts from year to year

3.451 Three stated that the patterns could be understood if one considered the fact that LRIC by its nature incorporated only the differences between a with-MCT scenario and a without-MCT scenario. Where the increment of MCT caused an asset to be deployed one year early, that asset would appear in incremental costs only for the year in which it was additional.[591]

Assessment: the incremental asset calculation

Incremental asset counts from year to year

3.452 We were unpersuaded by Vodafone's case and prefer Ofcom's explanation that the apparent anomaly in the incremental asset counts from year to year was due to the timing of the purchase of equipment and the modularity of assets. For example, Ofcom explained that such an effect could appear where the all-services network was bigger in one year than the ex-MCT network, but both networks were then of the same size in the following year, and that this was because the model with termination, because it had more traffic, would roll out certain assets at an earlier point.

3.453 We therefore do not consider that it has been demonstrated that the 2011 Model contains implausible incremental asset counts from year to year.

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[586] Ofcom Defence, Annex B, §185.
[587] Ofcom staff hearing transcript, p56, line 20ff.
[588] Ofcom staff hearing transcript, p58, line 7ff.
[589] Ofcom staff hearing transcript, p57, line 10ff.
[590] Ofcom staff hearing transcript, p58, line 7ff.
[591] Three SoI, §10.35, & Three SoI, W/S Mantzos, §§2.46–2.54.

Implausible asset movements

3.454 Ofcom satisfied itself in its decision (see paragraph 3.437) that the fluctuations in asset number 55 (the RNC node B-facing port) and for backhaul were not due to an error in the model and provided a number of reasons why such fluctuations might occur in the model in its decision.

3.455 Vodafone also stated that asset number 55 did not have any impact on LRIC.

3.456 It is not clear if the error in respect of microwave backhaul assets set out by Vodafone is the same anomaly as identified in Ofcom's decision. However, we do not consider that Vodafone has provided sufficient reasoning for us to distinguish this error from the more general statement in Ofcom's decision.

3.457 We therefore do not consider that Vodafone demonstrated that Ofcom erred in its modelling of asset number 55 and microwave backhaul assets.

3.458 We agree with Vodafone that the reduction in incremental macrosites does appear surprising. However, we do not consider that it is sufficient for Vodafone just to present an apparently surprising model result without any further explanation or evidence why this surprising model result is incorrect, especially as Ofcom indicated that there may be plausible explanations for this effect.

3.459 We are therefore not persuaded that Ofcom erred in the modelling of incremental macrosites.

Conclusion

3.460 For these reasons, we do not consider that the incremental asset calculation in the 2011 Model is implausible.

(j) The ED calculation

3.461 Both EE and Vodafone challenged Ofcom's use of ED in its model for calculating MTRs based on LRIC but they each did so in different ways. EE's challenge focused on the results of the interaction between Ofcom's ED methodology and Ofcom's calculation of the WACC. Vodafone's challenge focused on what it described as the mismatch of timing between expenditure and recovery under Ofcom's ED methodology; it did not challenge the ED methodology per se.

Ofcom's decision

3.462 Ofcom set out its approach to ED in Annex 6 of its Statement.[592] ED is the mechanism in the 2011 Model for recovering network costs over the lifetime of the network. In using its ED approach, Ofcom sought to set the optimal path of cost recovery over time by mimicking the outcomes of a benchmark hypothetical competitive market. In this hypothetical competitive market Ofcom assumed that unit prices in a given year did not depend on the level of utilization at that time, but on the level of utilization achieved over the lifetime of the network. It is also assumed that a new entrant would have the same utilization profile over time as incumbents rather than achieving long-run utilization more rapidly. If there were no changes in input costs (including the cost

[592] Ofcom Statement, §§A6.185–A6.235.

of capital), this would result in a constant level of unit cost recovery over the lifetime of the network.[593]

3.463 Ofcom said that it had two primary objectives when determining the optimal path of cost recovery.[594] First, the profile of cost recovery should not deny operators the opportunity to recover their efficiently incurred costs including a reasonable return on their investment. Second, the profile of cost recovery should aim to give efficient pricing signals for consumption and investment.

3.464 Ofcom's ED calculation is performed in three stages:

(a) The theoretical constant unit cost recovery level is calculated as if the final year utilization and input costs applied over the entire lifetime of the network.

(b) A second component is added to recover the additional costs caused by earlier underutilization of the network compared with the final level. This step is also applied as a constant unit price for all time.

(c) A third component is added to recover the remaining unrecovered (or over-recovered) costs due to input costs being above (or below) the final level. The shape of this component is determined by the arithmetic difference between in-year and final-year input costs and is therefore zero in the final year (or any year that shares the same level of input cost as the final year). More costs are recovered in years when asset prices and the WACC are higher than the final year.[595]

3.465 This approach to depreciation matches the cost of equipment to its actual and forecast usage over the long term. Consequently, there is relatively little depreciation in years when utilization is low and relatively high depreciation in years of full, or almost full, equipment utilization.[596]

The U-shaped relationship

3.466 Ofcom said that, although counter-intuitive, it was possible for a decrease in WACC to increase unit costs when there were differences in relative timings of investment and cost recovery.[597]

3.467 Ofcom explained two effects that were acting in different directions to create the U-shaped relationship between unit costs for future years and the assumed WACC. These were the so-called 'cash-flow' effect and the 'Modern Equivalent Asset' (MEA) effect. At WACC levels down to 7.3 per cent the MEA effect dominated the cash-flow effect.[598]

3.468 Ofcom explained that the ED algorithm tilted the cost recovery path so that in periods when input costs were higher, unit charges would be higher. In the Model, the WACC was updated on a forward-looking basis. A reduction in the WACC, all else equal, would result in unit costs in the future being lower and a profile of cost recovery that recovered more costs in the earlier years.[599]

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[593] Ofcom Statement, §A6.190.
[594] Ofcom Statement, §A6.188.
[595] Ofcom Statement, §A6.192.
[596] Ofcom Statement, §A6.193.
[597] Ofcom Statement, §A6.216.
[598] Ofcom Statement, §A6.219.
[599] Ofcom Statement, §A6.219.

3.469 Ofcom explained that a decline in the WACC had a proportionally greater impact on those costs and volumes incurred further into the future. If a greater proportion of volumes were in early periods and costs were in later periods, a decrease in the WACC could cause an increase in future unit costs.[600]

3.470 Ofcom said that in the subtractional model there was spare capacity from the coverage network in the early years. This meant that in the early stages of network development there were incoming termination volumes but very few incremental costs. Costs were only incurred as the network became capacity constrained. This meant that for some network elements early cash outlays would be low but traffic significant, thereby yielding the pattern of cash flows which could result in an inverse relationship between the WACC and unit costs for some values of the WACC.[601]

Steep decline in costs

3.471 Ofcom said that the combination of asset prices and the reduction in the value of the WACC caused a steep decline in costs (ie this effect was not just due to the WACC). It said that it could have smoothed this (as suggested by EE during the consultation phase) but did not think it should. It argued that the WACC was exogenously determined and that it was likely that it had been too high in the past. It said that there was no reason to allow a high WACC to continue.[602]

Negative costs

3.472 Ofcom accepted that some assets in its 2011 Model did produce negative unit cost values in earlier years (this was where MEA prices increased after 2008/09). It explained that if an asset had an increasing MEA price trend, then 2009/10 would represent the low point for combined input costs (increasing MEA and a reduced WACC). However, Ofcom considered the ED algorithm to be mathematically correct. It said that the ED algorithm would always set unit costs so that the present value of efficiently-incurred costs was recovered over the life of the network. It said that if in the future the hypothetical firm could charge more (because investment costs faced by entrants (and incumbents) were higher), it would optimally recover less cost in the present period. In principle, this could occur to such an extent that the cost recovered in the present period would be negative.[603]

3.473 Ofcom said that, although negative costs were conceptually consistent with the way the ED algorithm operated, it accepted that this was counter-intuitive. As such, Ofcom introduced a 'fix' to prevent unit costs for network elements turning negative. The fix introduced an iterative element to the final stage of the ED algorithm that shifted the cost recovery profile weighting factor upwards until no unit costs for the output of that element were negative.[604]

3.474 Ofcom said that the consequence of this iterative fix was to increase the LRIC in 2014/15 from 0.68 to 0.69ppm.[605]

[600] Ofcom Statement, §A6.126.
[601] Ofcom Statement, §A6.217.
[602] Ofcom Statement, §§A6.223–A6.225.
[603] Ofcom Statement, §A6.277.
[604] Ofcom Statement, §A6.228.
[605] Ofcom Statement, §A6.229.

Historic cost recovery

3.475 Ofcom said that whilst changing the WACC could lead to a cost recovery profile that did not match the charges operators were allowed to set under the previous caps, this was not the case when comparing the 2011 charge control with the 2007 charge control (see Figure 3.4).[606]

FIGURE 3.4

Comparison of historic MTR estimates: path of unit costs from the 2011 and 2007 Models

Source: Ofcom Statement, Figure A6.19.

3.476 Ofcom said that even if there was evidence that historic charges were below the new cost recovery profile, this did not mean that it would necessarily change its approach. It considered updating the path of unit cost to be desirable as the objective of ED was to mimic the path of unit cost recovery arising from (hypothetical) competitive entry into MCT. Ofcom said that its approach of updating unit cost estimates and applying a glide path up or down to the revised cost estimate was designed to give MCPs at least a 'fair bet'.[607] It saw step changes in the unit cost as a natural consequence of updating the parameter values in a single year.[608]

EE's and Vodafone's challenges to Ofcom's use of ED

3.477 Both EE and Vodafone made arguments in respect of ED:

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[606] Ofcom Statement, §A6.230.
[607] Ofcom Statement, §A6.232.
[608] Ofcom Statement, §A6.234.

(a) EE's arguments were concerned with the relationship between the ED function and the WACC; and

(b) Vodafone focused on what it described as the mismatch of timing of expenditure and recovery under Ofcom's ED methodology.

3.478 Three commented on the Vodafone ED arguments in its SoI in support of Ofcom.

The ED calculation—EE's challenge

The outcome of the ED calculation is implausible

3.479 EE argued that the step change in the WACC assumed by Ofcom had revealed a flaw in the model.[609] It described the effect of reducing the WACC as follows: 'a large proportion of cost recovery in the model has been pushed into the years before 2009/10, with the consequence that the cost estimates for the later years, ie the years subject to the charge control, become much lower'.[610]

3.480 EE argued that the main reason underlying this flaw was that Ofcom had failed to recognize the need to select realistic and appropriate inputs for its WACC. It claimed that Ofcom's ED function was capable of producing implausible results if Ofcom did not use appropriate inputs to its cost model and/or if it sharply changed the value of these inputs through time. It said that this was partly because changes to model inputs in any given period would tend to affect the outputs in all periods. Given that the modelling period began in the past (effectively in 1993/94), the ED function could push cost allocation many years into the past in response to input changes, even when the input changes purported to be forward-looking.[611] Dr Hird said that any cost model that, in response to a future WACC reduction, raised costs/prices prior to that WACC reduction was flawed.[612]

3.481 Dr Hird said that Ofcom accepted this extreme property in its Defence (in Annex B, §192—see paragraph 3.490), but said that Ofcom's example assumed a timing of cash flows that was the complete opposite of that within the model (ie that proportionally more costs than volumes occurred in later periods). He said that in any event the example was irrelevant as it used a single WACC that was being changed over the entire life of the project and a single price was being charged over the entire life of the project. He said that given the example, Ofcom was right to conclude that if expenditures were more backloaded than revenue, then a lower WACC would raise prices. However, Dr Hird argued that this had nothing to do with the alleged error in the 2011 Model which related to a change in the WACC midway through the project. He said that it was possible to construct an example (using highly unlikely expenditure/volume profiles) where a lower WACC raised the average price charged over the period. However, there was no defensible scenario where a lower WACC at point 't' raised prices prior to that period.[613]

3.482 Dr Hird also used a hypothetical example to explain why he considered the results of the ED function to be implausible.[614] He said that when discount rates in the past

[609] EE NoA, §§157.4 & 157.5.
[610] EE NoA, §157.4.
[611] EE NoA, W/S Hird I, §54.
[612] EE CS, W/S Hird IV, §79.
[613] EE CS, W/S Hird IV, §80–83.
[614] Dr Hird confirmed that this was a hypothetical example in the EE hearing (EE hearing transcript: p99, lines 9–13).

were reduced, future regulated prices were increased—which was not an economically sensible outcome.[615]

3.483 At the hearing, Dr Hird confirmed that his argument was not concerned with changing assumptions over time. Even if Ofcom had assumed that the WACC would reduce over time in its first ever charge control, he would see this as an issue because the effect of a declining WACC was that too much cost was allocated to earlier periods and not enough to later periods (ie the argument was not specifically about the potential for over-/under-recovery compared with MTRs under previous charge controls).[616]

3.484 Dr Hird also confirmed that what he found objectionable was Ofcom's approach to looking at cost recovery based on WACC times MEA.[617] He confirmed that whilst his concerns were expressed in terms of the WACC, the cause of the effects he described was the net effect of the WACC and MEA.[618]

Surplus funds

3.485 EE also said that the model assumed that surplus funds could be carried forward at the company-specific WACC, which it said was an error.[619] It considered that the model assumed that surplus funds were generated by termination rates in the early years of network build (ie that termination was effectively free riding on investments put in place to provide coverage and calling capacity).[620] EE said that if these surplus funds were to be carried forward, this should be at the risk-free rate (RFR) (the rate at which the company could, at zero risk, invest the excess profits in order to fund future costs).

Negative unit costs

3.486 EE argued that for some assets the step change in the WACC in 2009/10 was so disruptive to the ED function that it produced negative unit costs in some years. It said that Ofcom had mitigated this problem by using a 'fix' that prevented negative cost recovery. EE considered that this 'fix' addressed only the most egregious results.[621] It said that this problem called into question the reasonableness of the overall path of cost recovery and that Ofcom's proposed solution did not address the underlying cause of the negative outputs of the ED function.

Ofcom's WACC assumptions in the 2011 Model

3.487 Dr Hird said that he found it unrealistic and internally inconsistent to model the path of cost recovery on the basis that on 31 March 2009 investors had a WACC of 11.5 per cent, but on the next day, 1 April 2009, investors' WACC fell to 6.2 per cent. He said that it was not plausible that both of these assumptions were true. If the 6.2 per cent estimate was accurate, then the 11.5 per cent estimate must be an overstatement of investors' past requirements. Dr Hird observed that changing nothing

[615] EE NoA, §157.5, & EE NoA, W/S Hird I, §55.
[616] EE hearing transcript, p100, lines 12–16, & p101, lines 1–16.
[617] EE hearing transcript, p104, lines 21–23.
[618] EE hearing transcript, p97, line 1.
[619] EE NoA, §157.5.
[620] EE NoA, W/S Hird I, fn 22.
[621] EE NoA, W/S Hird I, §55.

else in the model but setting a 6.2 per cent WACC in all past and future periods would increase both LRIC and LRIC+ (LRIC would increase by 4.3 per cent).[622]

3.488 EE said that once a higher level of WACC was adopted in line with the empirical evidence set out in Dr Hird's first witness statement, then the problems of the cost model, arising from an assumed sharp fall in the WACC, would be much less significant.[623]

Ofcom's Defence to EE's challenge

The outcome of the ED calculation is implausible

3.489 Ofcom acknowledged that EE correctly stated that the ED algorithm would push cost allocation into the past in response to a decrease in the WACC at a given point in time (when historic values of the WACC were left unchanged at higher values).[624]

3.490 With regard to Dr Hird's suggestion that it was inappropriate for a reduction in historic values for the WACC to cause an increase in current or future prices, Ofcom said that, as discussed in its Statement, it was perfectly possible for a decrease in the historic WACC to cause an increase in current or future unit costs. In a simple example, where the unit costs were calculated as the ratio of the present value of costs to the present value of volumes, decreasing the WACC would increase the present value of both the costs and volumes. However, the decrease in the WACC would have a proportionally greater impact on the cost and volumes that were incurred in future periods (since they were affected more by discounting). If a greater proportion of costs fell in later periods and volumes in early periods, a reduction in the WACC could cause unit costs to increase.[625]

Surplus funds

3.491 Ofcom said that Dr Hird appeared to be arguing that part of the MCT volumes and cash flows should be discounted at a different rate from the remaining part. Ofcom considered that this was inconsistent with the way ED had been applied in previous MCT models and was at odds with the assumed competitive constraint operating under ED.[626]

3.492 Ofcom did not consider it appropriate to characterize the 2011 Model as 'carrying forward' revenues—for example, in the sense of a company carrying a provision for future liabilities and/or charges. It said that through the ED algorithm, the 2011 Model ensured the recovery of the present value of lifetime network cash flows given lifetime network traffic. In so far as cash inflows and outflows did not match, the 2011 Model behaved in the first instance much like any NPV calculation. Where the 2011 Model differed was that the profile of cost recovery was shaped by both the MEA price trend for inputs and the WACC (another input cost, specifically the opportunity cost of capital). But this shaping of the profile of cost recovery was designed to mimic the outcome of a competitive market—as considered extensively in the 2009 CC Determination on MCT. At its simplest level, if the WACC was falling over time, the path of unit costs would also be shaped to fall over time since it was assumed that

[622] EE NoA, W/S Hird I, §56.
[623] EE NoA, W/S Hird I, §57.
[624] Ofcom Defence, Annex B, §188.
[625] Ofcom Defence, Annex B, §192.
[626] Ofcom Defence, Annex B, §193.

entrants in later periods could otherwise undercut incumbents based on lower financing costs.[627]

Ofcom's WACC assumptions in the 2011 Model

3.493 With regard to the argument that Ofcom should have introduced a more gradual decline in the WACC, Ofcom said that it had always implemented a change in its estimate of the WACC as a step change from the financial year when better information was available. It said that the WACC was a forward-looking parameter and, in so far as it was estimated at a particular point in time (ie the year leading up to the end of the previous charge control), the appropriate time to revise that parameter in the 2011 Model was from the point when the new information was available.

3.494 Ofcom also explained that, in the context of a charge control set using a four-year glide path, the impact of the step change would be felt over the course of that period. Therefore, it considered that any such large reduction would be attenuated by the glide-path mechanism.[628]

Assessment: the ED calculation—EE's challenge

3.495 EE's arguments can be considered in three parts:

(a) ED methodology;

(b) specific effects; and

(c) ED and the WACC.

ED methodology

3.496 EE's argument (in paragraph 3.480) is that a model in which a future WACC reduction causes increased recovery in the period prior to that reduction is flawed. As an example, EE also described the effect of reducing WACC in the past on future cost recovery.

3.497 Ofcom's approach to ED allows higher recovery of costs in years when input prices (including the WACC) are higher. Given the profile in the 2011 Model of reducing input costs both in terms of MEA prices and the assumed fall in the WACC over time, the model recovers proportionally more costs in earlier years than later years. Ofcom said that this was a feature of its chosen ED methodology (paragraph 3.469).

3.498 EE challenged (in paragraph 3.481) Ofcom's explanation that frontloaded recovery was a natural consequence of the ED approach, stating that Ofcom's example using costs that were more backloaded than volumes was highly unlikely. However, the model under the subtractional approach assumed backloaded costs and front-loaded volumes. This is because MCT is considered to be the final increment. We therefore consider that Ofcom's Defence appropriately explained the model outcomes and functionality of the ED approach.

3.499 In our view, EE's arguments only explain the effect of the changing input price assumptions on the cost recovery profile; they do not robustly challenge this effect. The effect described is a natural consequence of the MEA effect on cost recovery

[627] Ofcom Defence, Annex B, §190.
[628] Ofcom Defence, Annex B, §194.

profiling, ie that more costs are recovered when input prices are higher. What EE does not do is explain clearly which features of the ED methodology it objects to, why the effects it describes are inappropriate or inconsistent with Ofcom's objectives (for example, those in paragraph 3.462), or why Ofcom's objectives are inappropriate.

3.500 In our view, EE has not demonstrated that Ofcom's chosen ED methodology was wrong.

3.501 We consider further the specific effects EE highlights below.

Specific effects

- *Negative unit costs*

3.502 EE argued that the ED function in some cases produced negative unit costs and that Ofcom had not addressed the underlying cause of this (paragraph 3.486). Ofcom accepted that decreasing the WACC had in some cases resulted in negative prices for certain assets. Ofcom acknowledged this in its Statement and, following the April 2010 consultation, adjusted the modelling to address this issue (paragraph 3.473). In its Defence, Ofcom made no comment on EE's view that the 'fix' tackled only the largest errors. Ofcom's view was that the negative cost recovery was economically sound—see paragraphs 3.472 and 3.473. It argued that, if the cost in the future was expected to rise, then future charges would increase and less would be recovered in the current period.

3.503 We accept Ofcom's argument and therefore do not consider that the 'fix' in the model was necessary. The ED module is set to recover costs over the lifetime of the network; our understanding is that negative charges are generated for only some assets and not at an MCT level overall. The effect when charges are summed across all assets is that the path of cost recovery will reflect net changes (ie both increases and decreases) in input costs over time. We therefore agree with Ofcom that no further adjustments are required. We note that Ofcom's fix resulted in a 0.01ppm increase to MTRs (see paragraph 3.474): EE has not demonstrated that had Ofcom sought to address the underlying cause, it would result in a significant change to MTR rates. We do not consider that EE has made a case for the underlying cause of the negative ED outputs to be addressed.

- *Surplus funds*

3.504 EE argued that surplus funds in the model were incorrectly being carried forward at the company-specific WACC (paragraph 3.485). As discussed above, the model generated negative unit costs for certain assets. It therefore generates these 'funds' only on certain asset classes but not for the total. We agree with Ofcom that the surplus cash flows are not like a provision for future liabilities and charges.

3.505 EE's view was that different discount rates should be applied to different cash flows within the model (ie that the RFR should be applied to cash inflows at the MCT level). However, we consider that this type of approach is not readily applicable at the subservice/product level since it is at the firm level that the business acquires funding, and we have no reason to believe that a 'surplus funds' situation had been created. EE has not explained why it would be appropriate to apply such an approach at the subservice/product level. Introducing multiple discount rates would lead to considerable additional complexity and change the nature of the model; we therefore do not consider it appropriate. Even if it were shown to be theoretically

appropriate to build a more complex model, the practicality and proportionality of such an approach would need to be established.

ED and the WACC

3.506 EE highlights the step change in the model as the WACC is changed from 11.5 to 6.2 per cent in the 2011 Model. This argument appears to have two limbs:

(a) that such a step change resulting from updating assumptions is inappropriate (this has been argued by EE); and

(b) that any sharp changes in assumptions, even if assumed from day one, result in too much cost being recovered in early periods (this argument can be pieced together from EE's comments at the hearing and its SoI in the Vodafone case).

3.507 With regard to the first point, we note that Ofcom models WACC periodically for each charge control and does not make retrospective changes to the assumed WACC: as such, its modelling will be liable to potentially step changes in assumptions. Whilst EE is correct that it is unlikely that investors' expectation of the WACC changes value overnight as a step change (paragraph 3.487), we see this as a feature in Ofcom's cost modelling. Sometimes a company will benefit from this and sometimes it will not. We do not consider that Ofcom erred in adopting this approach. The 2011 Model seeks to be forward-looking and uses the best available data to update its model. EE has not explained why Ofcom's forward-looking approach is not appropriate. As Dr Hird pointed out, the use of a step change could result in investors' past requirements being over- or understated, but this is a feature of mobile telecommunications regulation and Dr Hird did not explain why it was inappropriate in this context.

3.508 With regard to the second point, EE clarified at the hearing that it considered that the ED methodology recovered too much cost in early periods irrespective of changes to assumptions after day 1 (t>0). Sharp declines in input costs will cause more cost to be recovered in early periods than under a gradual decline (assuming that each decline begins at the same time). However, the decline in the WACC in this case is as a result of changes in assumptions after t=0 and so the arguments in paragraph 3.507 are valid. We also refer to our conclusions in paragraph 3.499 where we found that EE had not credibly challenged Ofcom's ED methodology.

3.509 EE's suggestion that 6.2 per WACC should be applied in each year appears to be a hypothetical example, used to illustrate the effect of reducing WACC in the past rather than a serious suggestion that this was investors' expectations of WACC at time zero (paragraph 3.487). Ofcom has made a forward-looking change to the cost of capital; this does not mean that the rate in the past was necessarily set too high, only that future expectations have changed; we therefore do not consider this point further.

3.510 We agree with Ofcom that the WACC is an exogenous input. EE's proposal (paragraph 3.488) to increase the WACC to address the problems it has described would not address the underlying issue (even if we agreed there was a problem). We consider whether the WACC has been assessed appropriately in paragraphs 3.616 to 3.920.

Conclusion on EE's challenge to Ofcom's use of ED

3.511 We find that EE has not demonstrated that Ofcom erred in determining the level of the charge control based on LRIC on the basis of the arguments set out in paragraphs 157.4 and 157.5 of its NoA.

The ED calculation—Vodafone's challenge

3.512 Vodafone said that its point on ED was not that the method of ED was wrong per se but rather that the ED issues were a symptom of the inability of Ofcom's 2011 Model to produce a reasonable LRIC output.[629] Vodafone said that when applying the ED methodology in the LRIC version of the model, there were some effects which should have been taken into account and adjusted for where possible.[630] It argued that there were deficiencies in the model which meant that, when the 'subtractional' method was applied to derive a measure of LRIC of the MCT service, the result embodied anomalies which were nonsensical.[631]

Timing mismatch of cost recovery

3.513 Vodafone said that the cash outflows the model generated were not being recovered in a reasonable manner.[632,633]

3.514 It said that for LRIC+, the model quite reasonably recovered costs some time after they were incurred. However, when applying the same ED method to the incremental outflows of the model (under the LRIC approach), the coverage dimensioning dictated the timing of the first deployment of assets which were incremental to the MCT service.

3.515 Mr Roche said that, although the MCT service started on the network launch date, it might be some years before an additional asset that was incremental to termination was actually required. However, under the ED method, charges for the MCT service for traffic carried in the early years served to recover a significant proportion of the future incremental expenditure before it was actually either incurred or put to use in the network.[634] Vodafone said that this had the effect of reducing LRIC.[635]

3.516 Vodafone recognized that this was a feature of ED in general, but said that the effects were more extreme in the case of LRIC.[636] Vodafone explained that:

(a) Assets that were incremental to MCT services and were built but not yet used were treated as a common cost (rather than allocated to MCT services) in the 2011 cost model.[637] Vodafone explained that this could happen if an asset was built with a view that it would be needed for traffic in the long run, but under the subtractive model and ED approach the investment would effectively be delayed for a few years until it could be considered incremental to MCT.

(b) Modularity meant that the first asset of a kind was almost treated as free as the asset did not become incremental until its capacity was used up (this was described as a more marginal effect).[638] Assets were also modelled in a more modular way than they actually were acquired, leading to a delay in them being recognized in the incremental cost calculation.[639]

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[629] Vodafone response to post staff hearing questions, p20, 18 October 2011.
[630] Vodafone hearing transcript, pp132–134.
[631] Vodafone NoA, §69. The NoA itself did not mention a mismatch of timing for expenditure and recovery, but it is under this heading that Mr Roche made his comments in relation to ED in W/S Roche I, §4.
[632] Vodafone NoA, W/S Roche I, §4.145.
[633] Vodafone NoA, W/S Roche I, §§4.145, 4.149 & 4.153.
[634] Vodafone NoA, W/S Roche I, §§4.149–4.153.
[635] Vodafone hearing transcript, p134, line 26, to p135, line 4.
[636] Vodafone hearing transcript, p132, line 17, to p133, line 4.
[637] Vodafone hearing transcript, p132, line 17, to p133, line 4.
[638] Vodafone hearing transcript, p133, lines 5–9.
[639] Vodafone hearing transcript, p132, lines 8–13.

3.517 Mr Roche said that the proportion of future incremental expenditure recovered before it was either incurred or put to use was magnified by the higher unit costs and higher WACC used in the early years of the model, which pulled costs forward in the 2011 Model. The effect was that the MCT service was being given, from an incremental point of view, a 'free ride' on these coverage assets.[640] Vodafone also said that the ED approach magnified reductions in LRIC compared with LRIC+ as the incremental costs occurred later than the total network expenditure (through the discounting effect).[641]

3.518 Vodafone said that paragraph 18 of the Recommendation stated that 'a depreciation method that reflected the economic value of an asset was the preferred approach'. Vodafone suggested that a depreciation method that attempted to recover the cost of an asset before it was purchased did not satisfy this requirement.[642,643]

3.519 Vodafone also said that some costs of incremental assets for MCT were recovered in periods before and after assets incremental to MCT were in use (and were therefore not recovered in the appropriate time frame).[644]

3.520 Vodafone provided the following examples in support of its view.

- *Costs recovered in periods before the asset was in use*

3.521 Mr Roche provided two examples (macrocells and 3G cell equipment)[645] which he said showed that the model was recovering the incremental costs of providing MCT services in periods before any incremental costs were incurred for providing MCT services. Vodafone's calculations indicated that the total value of the costs recovered before the first of the two assets was used (incrementally for MCT services) was in the region of £4 million for each of the two assets.[646]

3.522 Vodafone also said that this was particularly pronounced for MCSs in the 2011 Model.[647]

- *Costs recovered in periods before and after the asset was in use*

3.523 Vodafone provided another example (Asset 5) stating that this asset (in the incremental model) was required only for a limited period but that the costs associated with this asset were recovered over the whole modelling period.[648] This did not seem to be a reasonable cost recovery method.[649] Vodafone indicated that the total value of incorrectly recovered costs was in the region of £4 million.[650]

3.524 Vodafone stated that, if this error (the Asset 5 error) was corrected by changing the sectorization of the highway geotype cell sites from two to one, then the LRIC would change from 0.6921ppm to 0.7118ppm (in 2014/15).[651] It said that this was a conservative estimate mainly because the calculation it provided did not include all its

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[640] Vodafone NoA, W/S Roche I, §4.151.
[641] Vodafone hearing transcript, p109, line 25, to p110, line 10.
[642] Vodafone NoA, W/S Roche I, §4.153.
[643] Vodafone hearing transcript, p137, lines 6–10.
[644] Vodafone NoA, W/S Roche I, §§4.154–4.162.
[645] Vodafone NoA, W/S Roche I, §§4.150–4.152, §4.153.
[646] Vodafone NoA, W/S Roche I, Tables 4.12 & 4.13—calculated as the sum of cost recoveries in the years before the first incremental asset is in service.
[647] Vodafone hearing transcript, p132, line 17, to p133, line 4.
[648] Vodafone NoA, W/S Roche I, §§4.154–4.162.
[649] Vodafone NoA, W/S Roche I, §4.162.
[650] Vodafone NoA, W/S Roche I, §4.158.
[651] Vodafone NoA, W/S Roche I, §4.165.

suggested adjustments to reflect the minimum coverage network.[652] Vodafone stated that the same situation applied to other assets—particularly at a geotype level.[653]

3.525 Vodafone considered that the Asset 5 error was related to the winding down of 2G traffic and was unlikely to be offset by similar errors elsewhere in the model.[654]

- *Zero-coverage network*

3.526 Vodafone said that the cost recovery mismatch was exacerbated by the overstatement of the assets employed in the zero-traffic network. This led to an even longer time gap when the asset was deemed to be purchased in the subtractive calculation.[655] Vodafone said that LRIC charges were lower if incremental assets were required later (ie the present value of the investment was reduced by delaying the investment). It said that this could happen if the zero-traffic network was modelled incorrectly.[656]

3.527 Vodafone considered that the problems with the ED framework would be less material and significantly smaller[657] if the incremental cost calculation was corrected (ie by removing the high minimum coverage or equipment numbers in the incremental version of the 2011 Model).[658] Vodafone said that the minimum coverage issues were resolved by Vodafone's zero coverage approach and the modularity issues were resolved by Vodafone's zero coverage termination only model.[659]

EE's SoI in support of Vodafone

3.528 EE concurred with Vodafone's conclusion that the cost allocation methodology for Asset 5 was not a reasonable cost allocation methodology.[660] EE said that this error was compounded by the fact that the 2011 Model effectively assumed that the mobile operator took the revenues generated between 1993/94 and 2004/05 and invested these at the extremely high returns associated with the assumed level of mobile operators' WACC in the early years of the network and used the proceeds to fund the investment in 2004/05 and beyond. For example, the 2011 Model assumed that £1 of compensation associated with Asset 5 earned in 1993/94 was invested by the mobile operator so as to be worth £8.9 in real terms in 2004/05 when the asset had to be purchased. As a result, the mobile operator could use £1 earned in 1993/94 to pay for £8.9 of the asset when it was actually required.[661]

3.529 EE noted that the mismatching (of the timing of asset build and expenditure with cost recovery) incorporated into Ofcom's Model was 'counterintuitive and economically indefensible'.[662]

3.530 Dr Hird used a stylized example (see Figure 3.5) to show that Ofcom's methodology allowed greater recovery in early years than it would under a perfectly contestable model and below perfect contestability recovery levels in all other years (except the

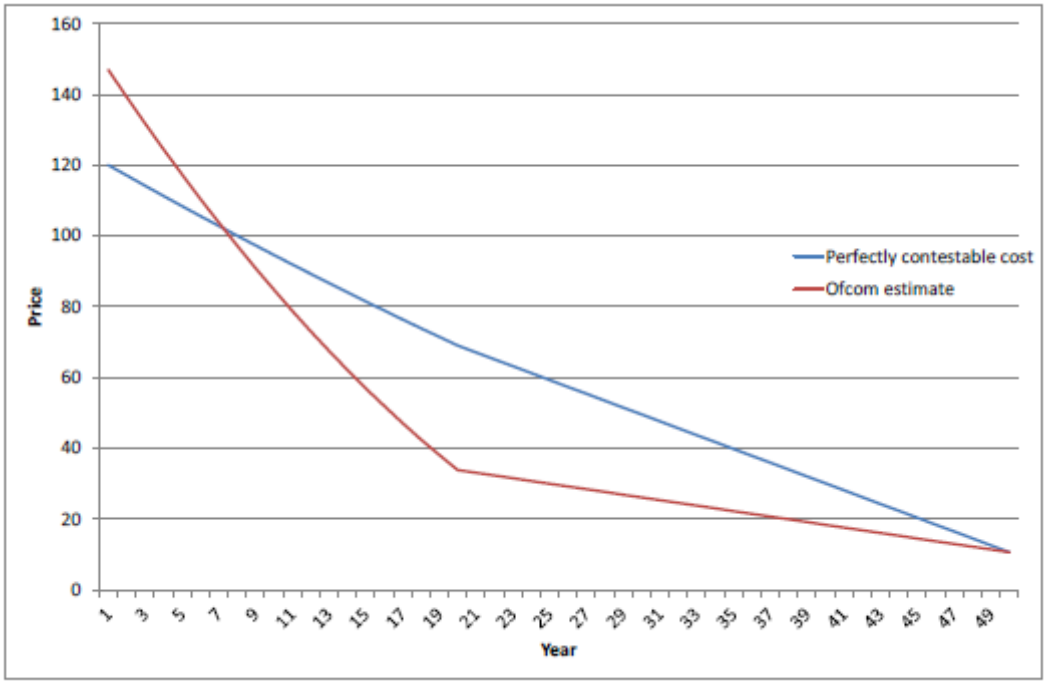
[652] Vodafone NoA, W/S Roche I, §4.166.
[653] Vodafone NoA, W/S Roche I, §4.168.
[654] Vodafone staff hearing transcript, p28, line 20ff.
[655] Vodafone Core Submission, §5.9.2.
[656] Vodafone hearing transcript, p132, lines 8–13.
[657] Vodafone hearing transcript, p135, lines 21–24.
[658] Vodafone hearing transcript, p135, lines 5–10.
[659] Vodafone hearing transcript, p135, lines 11–18.
[660] EE SoI in support of Vodafone, W/S Hird 2, §76.
[661] EE SoI in support of Vodafone, W/S Hird 2, fn 19.
[662] EE SoI in support of Vodafone, W/S Hird 2, §75.

final year). He argued that the use of the ED algorithm was not a good way to allocate costs.

3.531 At the hearing, Dr Hird explained that what he meant by 'perfectly contestable' was a model of economic competition with zero sunk costs. The path of mobile prices would reflect the cost on that day, or that year, of building the network. There would be no smoothing of costs, because someone who was entering in ten years' time would be able to undercut those prices.[663]

FIGURE 3.5

EE's stylized example comparing Ofcom's results with perfect contestability



Source: W/S Hird II (EE SoI in support of Vodafone), Figure 3.

3.532 At the hearing, Dr Hird accepted that if utilization was low in the beginning and higher at the end of the time frame considered, the result described in the above graph would be less extreme.[664]

3.533 Dr Hird argued that it was not generally appropriate to determine cost in a given year solely by reference to the discount rate in that year. He said that if the discount rate was expected to fall over the life of the asset, then an investor may rationally assess its costs with respect to the average discount rate over the life of the asset. The investor may rationally accept a return that was lower than the discount rate prevailing in the early years of the asset's life but higher in later years.

3.534 He also argued that the economic cost in any given year was not determined solely by reference to capital costs but also by reference to operating costs. He said that Ofcom's allocation of under-recovered costs over time ignored variations in operating costs. This had the effect that where operating costs were rising over time but MEA multiplied by WACC was falling, the 2011 Model allocated recovery of under-

[663] EE hearing transcript, p104, line 18, to p105, line 1.
[664] EE hearing transcript, p104, lines 2–4.

recovered operating costs to the early years—even though operating costs were low in those years. In response to Ofcom's Defence, Dr Hird accepted that he had misunderstood how operating costs were being treated over time. However, he maintained that there was no obvious reason that falling WACC at time 't' should lead to more operating costs being recovered in years prior to time 't'.[665]

3.535 Dr Hird argued that very high prices in the network's life when usage was low, falling dramatically to much lower levels, was unlikely to promote efficient use of the network over time. He said that, consistent with Ramsey pricing, it was likely that a flatter profile of prices (cost recovery) would be more efficient.

3.536 Overall, he said that the 2011 Model was capable of allocating the recovery of costs in a more frontloaded approach than even a model based on perfect contestability which Ofcom had previously rejected on the grounds that such models front-loaded cost recovery.

Ofcom's Defence

3.537 Ofcom said that the 2011 Model used ED to recover costs over time pursuant to the Recommendation.[666] Ofcom explained that the ED algorithm sought to recover the cost of assets over time with more of the asset cost being recovered at times when input prices were high.[667]

3.538 Ofcom confirmed that the 2011 Model recovered costs both before and after incremental costs were incurred but this was a feature that existed in the LRIC+ calculation as well as the LRIC calculation, and that this was a fundamental feature of ED which was largely unchanged from the 2007 Model.[668]

3.539 Ofcom also pointed out that Vodafone accepted that to modify the ED calculation so that it only recovered costs on traffic carried over incremental assets was not a logical approach.[669]

3.540 Ofcom said that the effects of the ED methodology were more pronounced in the LRIC calculation, because under the ED methodology—in some of the early periods—costs were recovered (through revenues) without there being any incremental assets in place. However, Ofcom considered this to be an expected effect of the ED methodology and that not allowing cost recovery in those early periods would mean that MCT services would be provided free in such periods.[670]

3.541 In response to EE's submission that Ofcom's ED approach produced a less stable path than perfect contestability, Ofcom submitted that Dr Hird's analysis was incorrect, in particular as it assumed full asset utilization at all times and that traffic was constant, which was not the case.[671]

Three's SoI in support of Ofcom

3.542 Three was of the view that it was an inherent feature of any charge based on long-run costs, as LRIC explicitly was, that customers in every year paid charges which

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[665] EE CS, W/S Hird IV, §84.
[666] Ofcom Defence, Annex B, §178.
[667] Ofcom Defence, Annex B, §178.
[668] Ofcom Defence, Annex B, §186.
[669] Ofcom Defence, Annex B, §187.
[670] Ofcom hearing transcript, p127, lines 5–17.
[671] Ofcom Defence, Annex B, §199.

were based on the present value of the long-run incidence of costs—which could mean that customers in some years paid before costs were incurred.[672] Customers paying before costs were incurred might be justified where the aim of the charge control setting was to set long-run signals for consumption and investment.[673]

Assessment: the ED calculation—Vodafone's challenge

3.543 Vodafone's challenge to Ofcom's approach does not question the ED approach per se, rather its concern is with the application of this approach in the case of LRIC. It was concerned that under LRIC, incremental costs were recovered before they were incurred; which it did not recognize as a feature of ED under LRIC+. However, Ofcom explained that under both LRIC and LRIC+, costs for particular assets could be recovered before they were incurred.

3.544 Vodafone argued that under LRIC the effect of the ED approach was to produce extreme results which did not satisfy the requirements of the Recommendation. Vodafone's argument is incomplete in that it highlights an outcome of the ED approach when applied in the subtractional model but does not explain why an ED approach that Vodafone considers to be reasonable in the context of calculating a LRIC+ based cost is not appropriate for LRIC. It appears that Vodafone considers the results under LRIC to be counter-intuitive; however, given that the model is a simplification, we do not consider this to be self-evident. In particular, Vodafone does not relate the objections it has to the underlying principles or objectives of the ED methodology developed by Ofcom or explain why these are not appropriate in the calculation of a LRIC.

3.545 It appears to us that Vodafone's primary concern is about the coverage network and the calculation of the MCT increment. For example, the arguments about the delay to investment in incremental assets are not specific to ED (paragraph 3.516). Vodafone's concern in terms of the ED function seems to be illustration of the consequences of this profile of incremental costs—in particular, that the model recovers significant proportions of the costs of incremental assets in years when no incremental asset is required (paragraph 3.514).

3.546 The Recommendation recommends that an approach reflecting the economic value of an asset is used.[674] Ofcom's position is that if no costs were recovered in early years from MCT traffic, then operators would effectively be providing MCT services free (paragraph 3.540). For the reasons explained by Three (paragraph 3.542), an ED methodology that spreads costs in this way is consistent with setting charges by reference to a measure of the average incremental cost, per minute terminated, of providing termination over the entire period that this service is provided. We agree that such an approach is consistent with Ofcom's objective in setting charges that will send efficient pricing signals for consumption and investment.

3.547 Vodafone also appears to be arguing against its position that the effect of Ofcom's subtractive approach is to give users of MCT services a free ride on the coverage network. In particular, the implication of its arguments in relation to the application Ofcom's ED methodology is that users of MCT services should not even make a contribution to the incremental costs associated with termination services in periods where no assets incremental to the coverage network are required to provide termination services.

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[672] Three SoI in support of Ofcom, W/S Mantzos II, §2.59.
[673] Three SoI in support of Ofcom, W/S Mantzos II, §2.60.
[674] See Recommendation §7.

3.548 We are therefore not persuaded that Vodafone has shown that Ofcom has erred in its application of the ED methodology to the subtractional model.

3.549 With respect to EE's SoI in the Vodafone case, we consider that it made the following points:

(a) the model assumed that revenues generated in early years were invested at the WACC and used in later periods which it considered unreasonable;

(b) Ofcom's approach resulted in cost recovery being more front-loaded than a perfect contestability model;

(c) an operator may rationally accept a return that was lower than the discount rate prevailing in the early years and a higher return in later years;

(d) there was no reason for a fall in WACC at time 't' resulting in more operating costs being recovered prior to time 't'; and

(e) consistent with Ramsay pricing, a flatter profile of cost recovery should be used.

3.550 We have considered these arguments and find that in respect of:

(a) We have addressed this in our assessment of the 'surplus funds' argument under EE's own NoA—see paragraph 3.504.

(b) Ofcom explained that EE's description ignored the effect of underutilization in early years (paragraph 3.541) and EE in its hearing (paragraph 3.532) accepted that this would reduce the overall effect it had described. We therefore consider that EE has itself accepted that, given the profile of utilization, the result described in Figure 3.5 is not borne out.

(c) Dr Hird's view (paragraph 3.533) that an operator may rationally accept a return that was lower than the discount rate prevailing in the early years and a higher return in later years appears to neglect the possibility of entry in the market. Dr Hird does not explain how his view was consistent with Ofcom's objectives of setting the optimal path of price recovery by mimicking the outcomes of a bench-mark competitive market or why Ofcom's objective is inappropriate. If a new entrant were to be able to accept the lower discount rate in later years, then an incumbent would not be able to charge a higher rate.

(d) The arguments around failure to consider variations in operating costs (para-graph 3.534) have been addressed in Ofcom's Defence[675] and appear to be a misunderstanding of the methodology by EE. EE accepted this but maintained that falling input costs at time t should not increase cost recovery in periods prior to time t—this is the same argument as for capex. We have not found that EE has made a credible challenge to Ofcom's approach which does result in capex and opex costs being recovered more in early years if there is a decline in the WACC for the reasons set out under EE's own NoA in paragraphs 3.496 to 3.500.

(e) With regard to Dr Hird's view that a flatter profile of cost recovery would (consistent with Ramsey pricing) be more efficient (paragraph 3.535), we note that he is suggesting that the approach to determining the optimal profile for unit prices should take account of demand-side factors (ie elasticities of demand over

[675] Ofcom Defence, Annex B, §200.

time). Currently this is not the case. This is therefore a fundamental challenge to Ofcom's approach to the annualization (spreading) of costs. For us to accept such an argument EE would need to provide sufficient justification for such an approach and an adequate description as to how such an approach would be implemented.

3.551 In summary, Ofcom's approach tilts cost recovery towards the years in which MEA and the discount rate (the WACC) are higher in order to mimic the path of cost recovery arising from a competitive entry. EE has not explained why this approach is not appropriate. EE has not shown the approach to be more front-loaded than a perfect contestability model and the recovery profiling effects it described are not unexpected.

Conclusion on Vodafone's challenge to Ofcom's use of ED

3.552 We therefore do not find that it has been shown that there is an error in Ofcom's approach to cost recovery for the reasons alleged.

(k) The 900/1800MHz operator

Vodafone's challenge

3.553 Vodafone stated that Ofcom had not properly assessed whether it should have modelled a combined 900/1800MHz operator or a 1800MHz only operator for its 2G network (the 900/1800MHz issue). Vodafone said that whilst this was not necessary for LRIC+ calculations, it was needed for LRIC calculations.[676]

3.554 Vodafone said that the reason it raised the 900/1800MHz issue was because Ofcom did not seem to have thought about the 900/1800MHz issue when setting up the LRIC calculation (and that it was not considered during the course of the market review whether this was the more appropriate way to model LRIC[677]). Vodafone considered that this was an example which showed that Ofcom did not approach the LRIC calculation properly.[678] Vodafone also said that this was a sign that coverage costs were likely lower than currently modelled in the 2011 Model.[679]

3.555 Vodafone said that Ofcom should have considered the 900MHz issue because the coverage costs and traffic-related costs were different between a 900 and 1800MHz operator.[680] Vodafone noted that two out of the three 2G/3G operators were 900/1800MHz operators and one was an 1800MHz-only operator.[681]

3.556 Vodafone stated that a 900/1800MHz operator would need fewer coverage sites and that Ofcom's 2007 model had assumed 24 per cent fewer coverage sites for a 900/1800MHz operator than for an 1800MHz operator.[682] This showed that a 900/1800MHz operator had lower zero/minimum coverage costs than an 1800MHz operator although total network costs were similar, because more traffic-related investments were required for 900/1800MHz operators compared with an 1800MHz

[676] Vodafone NoA, W/S Roche, §4.104.
[677] Vodafone staff hearing transcript, p15, line 24ff.
[678] Vodafone staff hearing transcript, p15, line 2ff.
[679] Vodafone staff hearing transcript, p15, line 18ff.
[680] Vodafone staff hearing transcript, p14, line 10ff.
[681] Vodafone staff hearing transcript, p14, line 21ff.
[682] Vodafone NoA, W/S Roche, §§4.105 & 4.106.

operator. This was because less spectrum was available to the 900/1800MHz operator.[683]

3.557 Vodafone said that higher incremental costs for MCT services were likely for a 900/1800MHz operator than for an 1800MHz operator.[684] Vodafone suggested that Ofcom should therefore have examined this difference in its LRIC modelling.[685]

3.558 However, Vodafone explained that it did not suggest a change to Ofcom's use of an 1800MHz operator in its model, but that the differences should be taken into account when deciding on the size of the traffic-related costs for the average 2G/3G operator in that any estimate of traffic-related costs from using an 1800MHz operator should be considered as a conservative estimate.[686]

3.559 Vodafone expected that the 900MHz operator would have higher incremental costs when MCT services were the increment, as the 900MHz operator had less spectrum and therefore could put less kit at any particular cell site and therefore needed more cell sites to carry additional traffic.[687,688] Vodafone said that this was not necessarily inefficient as efficiency needed to be assessed by reference to overall costs (rather than costs incremental to MCT services).[689]

EE's SoI

3.560 EE agreed with Vodafone on the 1800MHz issue. EE noted that the CC said in its 2002 decision that it was easier for the 900/1800MHz operators to provide additional capacity without the need to develop new cell sites.[690]

3.561 EE said that from a theoretical capacity viewpoint, there was no difference between 900 and 1800MHz, but 900MHz had better coverage (for example, it travelled better through buildings). However, it was difficult to say if there was a difference between these two technologies when MCT was the final increment. When EE built its network it made assumptions on capacity irrespective of the spectrum used and capacity was not something that was added to the network after a coverage network was built.[691]

3.562 EE said that in order for there to be a difference between 1800 and 900MHz in calculating the final increment of MCT services, it was necessary to assume that the ex-MCT network was a different network from the all-services network.[692]

Ofcom's Defence

3.563 Ofcom did not agree that the output of the 2011 Model was too low or should be viewed as conservative as a result of the 900/1800MHz issue.[693]

3.564 Ofcom stated that whilst it accepted that a combined 900/1800MHz operator would have a different coverage profile from an 1800MHz-only operator, any network cost

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[683] Vodafone NoA, W/S Roche, §4.107.
[684] Vodafone NoA, W/S Roche, §4.108.
[685] Vodafone NoA, W/S Roche, §4.109.
[686] Vodafone NoA, W/S Roche, §§4.110–4.111.
[687] Vodafone staff hearing transcript, p35, line 9ff.
[688] Vodafone staff hearing transcript, p14, line 5ff.
[689] Vodafone staff hearing transcript, p35, line 16ff.
[690] EE SoI, W/S Hird 2, §71.
[691] EE staff hearing transcript, p35, line 8ff.
[692] EE staff hearing transcript, p35, line 21ff.
[693] Ofcom Defence, Annex B, §160.

difference between 1800MHz and 900MHz spectrum would be expected to be eroded by market-based mechanisms for spectrum assignments.[694]

3.565 Ofcom also said that any cost disadvantage for a 900MHz operator on providing termination services would be offset by the lower coverage costs of a 900MHz operator (and so a 900MHz operator would have a cost advantage in providing coverage[695]).[696]

3.566 Ofcom explained that 900MHz was more suitable for the provision of coverage. Ofcom also considered that, given that spectrum was liberalized by 2014/15, it was more likely that high-frequency spectrum would be used for the provision of capacity (rather than low-frequency spectrum).[697]

3.567 Ofcom also thought that choosing an 1800/2100MHz operator in its cost modelling was more representative of the different MNOs than using a 900/1800/2100MHz operator as not all operators had 900MHz spectrum.[698]

Assessment: the 900/1800MHz operator

3.568 Vodafone's statements on the 900/1800MHz issue were largely focused on the lower coverage costs of a 900MHz operator compared with an 1800MHz operator. However, coverage costs are excluded from the calculation of the LRIC of MCT services as these are common to both the all-services and the ex-MCT network.

3.569 Whilst Vodafone said that it expected the incremental MCT costs to be higher for a 900MHz operator, EE stated that it would be difficult to say if there was a difference between these two technologies when MCT was the final increment. Vodafone did not provide any supporting evidence that showed that traffic-related costs for a 900/1800MHz operator were different from traffic-related costs of an 1800MHz operator when the increment is the MCT services rather than all services.

3.570 Whilst Ofcom did indicate there may be a cost difference between a 900MHz and 1800MHz operator, it also indicated that there may be some offsetting factors. For example, it explained that an operator would be incentivized to use 900MHz spectrum for coverage rather than to provide capacity. We consider that this would be particularly the case if Vodafone were correct that incremental capacity was provided more cheaply using 1800MHz spectrum. We also noted that one of the 2G/3G operators did not have 900MHz spectrum.

Conclusion

3.571 We therefore conclude that Vodafone has not demonstrated that Ofcom erred in not modelling a 900/1800MHz operator in calculating the LRIC of MCT services.

[694] Ofcom Defence, Annex B, §158.
[695] Ofcom staff hearing transcript, p54, line 1ff.
[696] Ofcom Defence, Annex B, §59.
[697] Ofcom staff hearing transcript, p54, line 1ff.
[698] Ofcom staff hearing transcript, p55, line 14ff.

(l) Regulatory precedent[699]

Vodafone's challenge

3.572 Vodafone said that in at least one other member state (OPTA in the Netherlands) the NRA had refined its model to allow for the design/build of the 'without MCT' network to be significantly different from the design/build of the 'with MCT' network, and this had had a material effect on the measure of the LRIC of the MCT service. Vodafone said that Ofcom (in W/S Allen) recognized that the Dutch NRA made such adjustments, and that the models used by the Norwegian and Belgian NRAs also did so.[700]

3.573 Vodafone said that it did not have sight of the detail of the reasoning of each of these regulators.[701]

Ofcom's Defence

3.574 Ofcom stated that NRAs from other member states had created LRIC models using similar approaches to Ofcom. Ofcom noted that the balance between LRIC and LRIC+ generated by the 2011 Model was in line with the ratio of LRIC to LRIC+ generated by the models released by other EU NRAs.[702] Ofcom provided data showing that the LRIC as a percentage of LRIC+ was in a range of around 40 to 70 per cent in this group of comparators (France, Sweden, Netherlands).[703,704]

Three's SoI in support of Ofcom

3.575 Three considered that the 2011 Model was suitable for producing LRIC figures and was very similar to models used by other regulators in the EU.[705]

Assessment: regulatory precedent

3.576 We do not consider that methods applied by other regulators are a determining factor for Ofcom's decision. Ofcom is not bound by how other regulators have implemented their own charge controls. Nor do we consider that it would be appropriate to look at individual parts of the regulatory model of another regulator without a full understanding of the broader context in which the charge control was set, and without looking at other related assumptions that are made in the charge control modelling of that regulator.

3.577 In addition, Ofcom's evidence showed that the mark-up of LRIC+ over LRIC in its model is within the range of charge control decisions of other telecommunications regulators, which satisfied us, from a high-level perspective, that Ofcom's charge control decision was not substantially out of line with other regulatory decisions.

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[699] Vodafone reply to post staff-level hearing questions, p2.
[700] Vodafone Core Submission, §5.27.1.
[701] Vodafone Core Submission, W/S Roche II, §10.14.
[702] Ofcom Defence, §119.
[703] Ofcom Defence, W/S Allen, Figure 2.
[704] This compares to a LRIC/LRIC+ ratio of 42 per cent in 2014/15 in Ofcom's decision (see Tables 2 and 3 in Ofcom's Defence).
[705] Three SoI, §§1.2(h) & 10.1.

Conclusion

3.578 We therefore do not find that Vodafone has demonstrated that Ofcom has erred in setting the MCT charge control in a different way from other telecommunications regulators.

(m) Forecast data usage[706]

3.579 As set out in paragraph 4.397, we do not consider that EE demonstrated that Ofcom erred in its modelling of forecast data usage. For the same reasons given there, we do not consider that an error has been demonstrated in respect of this Reference Question 2.

(n) Administration costs[707]

EE's challenge

3.580 EE argued that Ofcom had erred in excluding any contribution to administration costs from its LRIC model. It said that this was significant, as Ofcom estimated that UK MCPs incurred £460 million of administration costs in 2009.[708] EE argued that a significant proportion of these costs were not truly common costs as they increased as output increased.[709]

3.581 EE argued that a range of administration costs were related to MCT; for example, the wholesale billing system, a significant part of the legal and regulatory teams who deal with interconnection agreements, disputes and regulation as well as accounting reporting requirements. It said that a significant proportion of head office costs that were shared between MCT and other services would be lower if MCT services were not supplied.[710,711]

3.582 EE said that the fact that administration costs had significantly increased over time as traffic had increased and that Three incurred less administration costs than larger operators was consistent with a significant share of administration costs being incremental to traffic and was inconsistent with Ofcom's view that all administration costs were fixed common costs.[712,713]

3.583 It argued that a share of administration costs were related to MCT and were part of the LRIC of MCT services. EE said that the treatment of administration costs as common costs had been undertaken more for reasons of practicality than because these costs were entirely common costs.[714]

3.584 EE said that some costs were separately identifiable although correctly estimating the appropriate proportion of staff time and related resource costs would be a substantial undertaking.[715]

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[706] EE NoA, §157.3.
[707] EE NoA, §162.
[708] EE NoA, §228.
[709] EE NoA, §234.
[710] EE NoA, §232, & EE NoA, W/S Hird I, §213.
[711] See also EE, W/S Dunn I, §132.
[712] EE NoA, §234.
[713] See also EE, W/S Dunn, §134.
[714] EE NoA, §235.
[715] EE NoA, §233.

3.585 EE proposed that in order to determine the share of administration costs related to MCT, the best practical allocation method would be to apply the rough accounting-based approach that Ofcom had applied in the past.[716] Dr Hird suggested that the mark-up for administration costs applied to LRIC+ should also be applied to the LRIC estimate, and said that this would suggest an increase of 0.16ppm.[717]

Vodafone's SoI in support of EE

3.586 Vodafone said that Ofcom had asked itself the wrong question, as it had not asked whether the quantum of administration costs varied with traffic volumes and the volume of MCT services.[718] It said it appeared that Ofcom had not asked this question because its cost model treated administration costs as a unitary item of cost, which did not vary with volumes of any particular service. It considered this manifestly incorrect for the reasons given by EE.[719]

3.587 It said that the method used by Ofcom to provide recovery of administration costs under LRIC+ essentially acknowledged that some part of the MNO's total administration costs was driven by traffic and varied with the volume of MCT services provided.[720]

3.588 It explained that this was because Ofcom's methodology calculated the average total administration costs of a single MNO in the reference year, split this figure between retail and network operations pro rata to operator average total direct retail and network costs and assumed that the same level of network administration costs would be incurred in each relevant future year. Ofcom then allowed for these costs to be recovered across all traffic services on an equi-proportionate mark-up basis.[721]

3.589 Vodafone said that its conclusion that administration costs varied, to some extent, with traffic volumes and, by implication, with volumes of MCT traffic accorded with common sense as:

(a) A minimal coverage network would entail a low level of network costs, and would require only a low level of senior management supervision, and low levels of human resources, accounting, legal and other support. As the network expanded to carry more traffic it would it would need more administrative support, entailing additional costs.

(b) It was to be expected that a large proportion of the costs expended in connection with administration of the network would be dependent on intermediate cost drivers such as the number of employees, which themselves varied with network size and ultimately demand for services. It said that Ofcom's characterization of these costs as 'common' was therefore an over-simplification leading to the mistaken assumption that they did not vary with demand for traffic services.[722]

3.590 Vodafone explained that Ofcom had not sought to obtain data from the mobile operators to enable it to measure and analyse network administration costs. However, even within the confines of the Ofcom model, there was a distinction between costs that were traffic and non-traffic related. There was accordingly no reason in principle why network administration costs could not be divided along these lines. Vodafone

[716] EE NoA, §236.
[717] EE NoA, W/S Hird I, §219.
[718] Vodafone SoI, §§5 & 6.
[719] Vodafone SoI, §7.
[720] Vodafone SoI, §8.
[721] Vodafone SoI in EE's Appeal, §8.
[722] Vodafone SoI in EE's Appeal, §12.

considered that the most appropriate and practical approach in the circumstances would be as follows:

(a) The Ofcom model treats approximately 50 per cent of total network costs as being traffic related. It followed that Ofcom should have concluded that approximately the same proportion of network administration costs were also traffic related. This would amount to £85 million.

(b) Under the LRIC+ methodology, the Ofcom model generated a mark-up on the cost of the MCT service of 0.16ppm, on the assumption that 100 per cent of network administration costs should be recovered from traffic services. It followed that, if 50 per cent of such costs were to be regarded as incremental to traffic services (and, hence, to MCT and other traffic services), then the LRIC cost recovery for network administration costs referable to the MCT service should have been approximately 0.08ppm. However, for the reasons advanced by Vodafone (in its own Appeal), substantially more than 50 per cent of network costs varied with volumes of traffic and therefore the LRIC for MCT services should include a network administration cost component of 0.16ppm.[723]

Ofcom's Defence

3.591 Ofcom said that there was little evidence that administration costs varied with the volume of traffic. It noted that whilst traffic volumes had been constantly increasing over time, the administration costs had seen declines as well as increases. It also pointed to the CC's 2009 determination, where it said the CC recognized that administration costs had been falling over time and found no error in Ofcom treating administration costs as common due to difficulties in identifying cost drivers.[724]

3.592 It said that administration costs varying with size of a company did not mean that it was appropriate to attribute them to MCT and the final increment. It noted that there were some administration costs in setting up interconnection with other networks but that these arrangements would often enable traffic to be sent in both directions (originated and received).[725]

3.593 It said that even if administration costs did vary with MCT traffic as a final increment, it did not consider that administration information gathered as part of the market review would provide a robust basis on which to cost them for the purpose of estimating the efficient LRIC of MCT services.

3.594 Ofcom said that BT was allowed to charge in order to recover administration costs of interconnection across each call that crossed over BT's network and, if MCT was allocated a similar level of charge, it would increase the 2014/15 LRIC by just over 1 per cent. Setting the administration costs for MCT at the BT DLRIC level would yield an increase of less than 3 per cent of the 2014/15 LRIC for MCT.[726]

3.595 At the hearing, Ofcom explained that the BT example was given as an illustration to highlight that EE's view of a required mark-up equal to that under LRIC+ of 0.16ppm[727] for administration costs was biased upwards.[728]

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[723] Vodafone SoI in EE's Appeal, §14.
[724] Ofcom Defence, Annex B, §205.
[725] Ofcom Defence, Annex B, §206.
[726] Ofcom Defence, Annex B, §208.
[727] At the hearing, Ofcom said 1.61ppm, but this is the 2014/15 LRIC+ charge, not the markup for administration costs, which EE estimated at 0.16ppm (EE NoA, W/S Hird I, §219). We assume that Ofcom meant the 0.16ppm figure.
[728] Ofcom hearing transcript, p117, lines 8–14.

Three's SoI in support of Ofcom

3.596 Three said that Ofcom was justified in concluding that it would be disproportionate to try to calculate an amount of administration costs to include in the LRIC of MTR services, as on any sensible basis the figure would be very small.[729]

3.597 Three noted that the CC had ruled in 2009 that Ofcom had not made an error in treating administration costs as common costs due to the difficulty in identifying cost drivers.[730]

3.598 It said that it agreed with Ofcom that a claim that administration costs varied with the 'overall size of the business and the value of the business' was not the same as saying that it was appropriate to attribute any increase to MCT services as the final increment. In any event, Three claimed that its evidence showed that administration costs were not strongly correlated (if at all) to traffic growth and reduced as a proportion of total costs as a mobile business grew.[731]

3.599 Mr Woodward presented evidence of Three's administration costs versus terminating traffic volumes over time.[732] This showed increasing traffic volumes and declining administration costs; he said that administration costs were not directly proportional to traffic, not least because of economies of scale. Mr Woodward said that such economies of scale appeared to be the rationale behind the EE merger.[733]

3.600 Three added that it could not be right that originating operators (including FCPs) should, through the MTRs, bear the costs of MCPs' appeals seeking to increase the MTRs. There would be a clear moral hazard in allowing that the more MCPs spent on MTR appeals and disputes, the more they could recover in MTRs. Excluding disputes and appeals, Three's estimate was that no more than [✂]ppm of administration costs could be considered incremental to MCT.[734]

EE response to Ofcom Defence

3.601 EE refuted Ofcom's portrayal of the CC's 2009 decision and said that the CC supported the approach that termination charges should include a small mark-up to make a contribution to administration costs.[735]

3.602 Dr Hird said that the decrease in administration costs cited by Ofcom was not part of the causal relationship and was more likely to be due to greater managerial efficiency or changes in input prices (ie there was no reason why the decrease would be driven by increased traffic).[736]

3.603 Dr Hird disagreed with Ofcom's example of interconnection working both ways as he said that the interconnection agreement was driven by the termination service that each party supplied to the other. He also disagreed with the comparison with BT and did not see that BT's costs should be comparable to an MCP's.[737]

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[729] Three SoI in support of Ofcom, §10.4.
[730] Three SoI in support of Ofcom, §10.38; & Three Core Submission, §8.4.
[731] Three SoI in support of Ofcom, §10.39.
[732] 2005–10 for volumes, 2002–10 for administration costs.
[733] Three SoI, W/S Woodward I, §§2.21–2.23.
[734] Three SoI in support of Ofcom, §10.42.
[735] EE Core Submission, W/S Hird IV, §87.
[736] EE Core Submission, W/S Hird IV, §86.
[737] EE Core Submission, W/S Hird IV, §88 & 89.

3.604 With regard to Mr Woodward's estimate of the direct administration costs associated with the supply of termination, Dr Hird noted that the variable costs of termination would likely go beyond direct costs, for example CEOs of larger companies tended to be paid more than CEOs of smaller companies.[738]

Vodafone response to Ofcom's Defence

3.605 Vodafone said that it had provided a reasonable estimate of the proportion of network administration costs which were likely to vary with traffic, and, hence, the proportion which would have been likely to be incremental to the MCT service. It said that it was not properly open to Ofcom simply to argue that Vodafone's estimate was imprecise: the burden was on Ofcom to show that it had examined and addressed this matter with sufficient rigour to enable it to generate a reliably accurate measure of the LRIC of the MCT service.[739]

3.606 Mr Roche said that Ofcom's Defence that administration costs information gathered as part of the market review would not provide a robust basis on which to set the efficient LRIC of MCT was 'very unhelpful' to Ofcom.[740] He said that Ofcom in 2007 (and prior) had allowed operators to receive a contribution for network administration costs. Given this, if Ofcom had failed as part of the market review process to attempt to gather sufficient evidence to demonstrate that network administration costs would not change in the permanent absence of the termination service, then in the absence of such evidence there was no reason to exclude such costs from the termination increment. Ofcom's existing method of calculating network administration costs provided a simple way of determining an appropriate recovery as part of LRIC.[741]

3.607 Mr Roche noted Ofcom's suggestion that BT's charge might provide some sort of indicative benchmark for inclusion in the LRIC of MCT services, but said that the CC in 2009 stated that BT's charges bore no relation to the mobile operator's network administration charges.[742] He therefore believed that Ofcom had not made the case that network administration costs should be excluded from the LRIC of termination and that Vodafone's suggestion of 0.16ppm should be added to the modelled LRIC output to reflect this.[743]

Assessment: administration costs

3.608 EE said that Ofcom should have included some administration costs in the calculation of LRIC and provided examples of administration costs that would not be needed in the absence of MCT services. However, EE did not provide an estimate of the amount of administration costs for these examples. EE also stated that estimating the appropriate proportion of administration costs might be a substantial undertaking. It proposed using the same level of administration costs (0.16ppm) in the LRIC estimate as under LRIC+.

3.609 We consider that EE's position in which it assumes that the allocation of administration costs in the LRIC calculation should be the same as under the LRIC+ calculation may overstate the amount of incremental administration costs in the LRIC calculation, as the cost allocation used in the LRIC+ model is based on an all-services increment, whereas the cost allocation used in the LRIC calculation is based on

[738] EE Core Submission, W/S Hird IV, §90.
[739] Vodafone Core Submission, §§6.6.3 & 6.6.4.
[740] Vodafone Core Submission, W/S Roche II, §12.19.
[741] Vodafone Core Submission, W/S Roche II, §12.20.
[742] Vodafone Core Submission, W/S Roche II, §12.21.
[743] Vodafone Core Submission, W/S Roche II, §12.22.

treating MCT services as the last increment. We noted earlier that where MCT services are the last increment, it is highly likely that common costs form a larger proportion of total costs than where the increment is all services. This is because costs for jointly-used assets would have already been allocated to the first increment and all other increments before any remaining costs are allocated to the final increment (see paragraph 3.366).

3.610 We do not consider that Vodafone's reasoning that some administration costs are traffic related can demonstrate that insufficient administration costs are allocated to MCT services. This is because the Recommendation recommends that traffic-related costs are allocated to all other services first, treating MCT services as the final increment. This means that it is not self-evident that traffic-related costs are necessarily also the avoidable costs of providing MCT services.

3.611 EE argued for a 0.16ppm increase (as did Vodafone, although calculated on a different basis). This compares to Three's position of incremental administration costs being [✂]ppm (excluding external adviser/appeal fees). However, we consider that EE's and Vodafone's calculations do not appear to be performed on the basis that MCT services are the last increment. We therefore accept Ofcom's view that the incremental administration costs would likely be much lower than those proposed by EE and Vodafone.

3.612 EE has provided us with insufficient evidence to prove that a significant amount of administration costs are driven by MCT traffic (when treating MCT services as the final increment). We consider that the identification of stable consistent drivers of administration costs is likely to be difficult. Some of the indirect measures may be particularly difficult to identify; for example, the extent to which larger companies may have higher CEO costs. We consider that there is considerable complexity involved in assessing the true relationship between voice termination as the final increment and administration costs.

3.613 Considering that EE itself stated that estimating the appropriate proportion of administration costs might be a substantial undertaking, we consider that Ofcom's judgement that it was not proportionate to calculate the incremental administration costs has not been shown to be an error.

3.614 We note that EE considered that our decision in 2009 supported the inclusion of administration costs in the calculation of LRIC. We do not consider that EE sufficiently explained what the reasons were in our 2009 decision that supported the inclusion of administration costs in the calculation of LRIC. We noted previously that our prior decisions were made in respect of the calculation of LRIC+ (see also paragraphs 3.370 and 3.434).

Conclusion on administration costs

3.615 We therefore do not consider that it has been demonstrated that Ofcom erred by not including administration costs in the calculation of LRIC for the reasons set out in EE's NoA.

(o) WACC

3.616 EE argued[744] that Ofcom's LRIC model was unable properly to determine a reliable estimate of LRIC because of an 'implausible step change in the WACC', from 11.5 per cent in 2008/09 to 6.2 per cent in 2009/10.

3.617 It claimed that Ofcom's underestimation of the WACC had a major impact on the estimated costs resulting from Ofcom's cost model and was therefore highly material.

3.618 Three intervened in support of Ofcom in relation to its assessment of the cost of capital. Three's evidence, supplied by Dr Hern (its expert witness), responded to the criticisms of Ofcom's approach made by Dr Hird, the expert witness for EE. Dr Hern said that Dr Hird's criticisms 'lack substance' for a number of specific reasons, each of which it set out and which we cover below.[745] Three went on to submit, in its Core Submission, that Dr Hird's report for EE revealed no material error.[746]

EE's challenge

3.619 EE argued that the cost of capital had been set too low. EE challenged two parts of Ofcom's decision in respect of the WACC: the beta and the RFR.

3.620 EE proposed that the asset beta should be set at 1.2 (Ofcom: 0.56) and the RFR at 2.0 per cent (Ofcom: 1.5 per cent). It said that these changes would result in a WACC of 11.0 per cent compared with Ofcom's 6.2 per cent.[747]

3.621 In its NoA, EE structured its challenge to Ofcom's decision on WACC under the headings 'cost of equity' and 'cost of debt'. The former was separated into:

(a) preliminary points;

(b) long-term beta analysis;

(c) short-term beta analysis (and the Global Financial Crisis (GFC));

(d) beta estimates for mobile operators other than Vodafone; and

(e) other relevant cross-checks.[748]

3.622 Under the heading 'cost of debt', EE's arguments related to the assessment of the RFR. EE did not specifically link its arguments regarding the RFR to the cost of debt—its arguments related more to the cost of equity through its comments on the equity risk premium (ERP). We have considered the arguments as relating to the risk free rate (RFR) more generally and have used this heading (rather than cost of debt) in our assessment.

3.623 Within the 'long-term beta analysis' and 'short-term beta analysis (and the GFC)' sections, EE argued that consistency required that asset betas should be combined with an ERP estimate that reflected the same level of market volatility and market

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[744] EE NoA, §§157.4 & 157.5.
[745] Three SoI, §11.2.
[746] Three Core Submission, §9.1.
[747] Additionally, Ofcom used a debt beta of 0.15 whereas EE used 0.1 (W/S Caldwell, §11).
[748] Dr Hird's first expert report was not structured according to the headings in the NoA and it summarized the arguments differently (inappropriate high weight to a small number of beta estimates from a single operator; failure correctly to interpret estimates; insufficient weight to: beta estimates from other operators, a longer time series of data, the need for internal consistency in the estimation period of beta and ERP and other relevant cross-check such as regulatory decisions).

risk. It discussed this in terms of the GFC[749] and market gearing[750] depressing the measured Vodafone beta and described this as a 'pick- and-mix' type error, ie an error of inconsistency. EE also considered that the measured Vodafone betas were depressed due to *(a)* an increasing proportion of overseas business and *(b)* the effect of mining and banking stocks on the FTSE. EE argued for a longer period of estimation.

3.624 It is relevant to note here that Ofcom's Defence was structured around the headings in the EE NoA. In particular, under 'long-term beta analysis', Ofcom made the fundamental point that it considered that higher market gearing and market risk, to the extent they existed, would be reflected in the ERP and not beta, as argued by EE and Dr Hird. Ofcom noted that it had increased its ERP estimate from 4.5 to 5 per cent but that it did not accept the need for an ERP above this.

3.625 EE, in its Core Submission, stated that Ofcom's Defence mischaracterized Dr Hird's views as being that Ofcom set an unreasonably low ERP. In its Core Submission (and Dr Hird's third witness statement presented in support of this), EE's argument was repositioned to focus on the alleged inconsistency of setting an ERP based on an assumption of a return to more normal market conditions and a beta that was estimated from atypical market conditions. In Dr Hird's first witness statement, this was a sub-argument under 'Betas affected by GFC' while in the Core Submission it becomes the central argument. In its Core Submission, it focused on mining and banking stocks (in addition to gearing and the GFC) being part of this pick-and-mix issue.

Structure of assessment of EE's challenge to Ofcom's calculation of WACC

3.626 We note that EE's Core Submission departed from EE's original delineation, in its NoA, of long-term and short-term analysis and instead focused on the so-called 'pick-and-mix' error. We have therefore not used EE's original delineation but have instead focused our consideration of the arguments under the following headings, which better match EE's presentation in its Core Submission. In doing so, we have considered all the arguments raised by EE in its NoA, Core Submission and supporting witness statements.

3.627 We have considered the arguments as follows.

Beta

- *Forward-looking expectations and the relationship between beta and ERP*

3.628 In this section (paragraphs 3.668 to 3.800), we first look at the arguments made in relation to the relationship between beta and the ERP and then make some general observations on this relationship (paragraphs 3.668 to 3.698). Second, we consider whether, for the reasons given by EE, the beta assessed by Ofcom was depressed. These were: higher market gearing (paragraphs 3.700 to 3.721), influence of mining and banking stocks (paragraphs 3.722 to 3.745) and the GFC (paragraphs 3.746 to 3.790. We then conclude as to whether Ofcom's estimation of beta and the ERP were inconsistent and whether Ofcom should have used a longer period to estimate beta (paragraphs 3.791 to 3.799). We also cover EE's argument that Ofcom failed properly to take account of investors' forward-looking expectations.

[749] EE NoA, §206.
[750] EE NoA, §188.

- *Ofcom's reasons for believing MNO risk was declining were flawed*

3.629 In this section (paragraphs 3.801 to 3.837), we look at whether Vodafone was a poor proxy for UK MNOs as the proportion of Vodafone's business in the UK was declining (paragraphs 3.801 to 3.820) and whether Ofcom's assessment that the systematic risk of MNOs had fallen was incorrect, ie that there were other reasons for the fall in beta (paragraphs 3.821 to 3.837).

3.630 We note that EE raised arguments regarding Vodafone's overseas business in two places in its NoA, first in its long-term beta section—where it argued that the recent measurements were lower as a result of increased overseas business[751]—and second, in arguing that Ofcom failed to adequately take into account beta estimates for operators other than Vodafone.[752] We consider these arguments together in our assessment.

- *Other issues with beta*

3.631 In this section (paragraphs 3.838 to 3.900), we first consider EE's arguments that Ofcom should have used O2's beta (paragraphs 3.839 to 3.844); next, we consider whether Ofcom's cross-checks were flawed (including Ofcom's use of overseas comparators and failure to compare to other regulatory decisions) (paragraphs 3.845 to 3.896), and we then consider whether Ofcom should have used five-year daily data in estimating its five-year beta (paragraphs 3.897 to 3.900).

3.632 We conclude on EE's challenge to Ofcom's assessment of beta in paragraph 3.901.

RFR

3.633 For the reasons stated above (paragraph 3.622), we consider the arguments presented as relating to the cost of debt under the heading RFR (see paragraphs 3.902 to 3.919).

3.634 We start by setting out the core aspects of Ofcom's Statement in relation to the challenged elements of the WACC. We have then structured our assessment of the arguments and evidence in two parts, beta (broken down as above) and RFR.

3.635 In each part, we first set out EE's challenge as set out in its NoA, followed by Ofcom's Defence, then the intervention of Three, next EE's response to Ofcom's Defence in its Core Submission and any comments from Ofcom responding to EE's Core Submission. This is followed by our assessment of the arguments presented.

Ofcom's calculation of WACC

3.636 Annex 8 to the Statement sets out in detail Ofcom's approach to calculating the cost of capital.

3.637 Ofcom explained that: 'The model we have consistently used for estimating the cost of capital is the Capital Asset Pricing Model (CAPM), the preferred model of the Competition Commission and other UK regulators' and described that pricing model used, in its simplest form, as:[753]

[751] EE NoA, §189.
[752] EE NoA, §§211–217.
[753] Ofcom Statement, Annex A §8.12; & EE NoA.

WACC = Cost of equity x (1-Gearing)+(Cost of debt x Gearing)

where the cost of equity was given by:

Cost of equity = RFR + (equity beta x ERP)

and the relationship between asset and equity beta was given by:

Asset beta = equity beta x (1- Gearing) + (debt beta x Gearing)[754]

3.638 The Statement sets out Ofcom's pre-tax WACC estimate of 6.2 per cent. It noted that in the estimation of certain parameters Ofcom had erred on the side of caution. It said that the ERP was a good example of this, as the range identified was 4.5 to 5 per cent, but the point estimate selected was at the top of the range.[755]

3.639 Ofcom said that its ERP estimate was informed by the work of Professors Dimson, Marsh and Staunton (DMS) from the London Business School. In addition, Ofcom believed that the volatility it observed in equity markets at the time of its consultation suggested that investors required a higher level of return in exchange for holding risky equity assets, and an increase of 0.5 percentage points in its ERP estimate (from the ERP in the 2007 Statement) did not seem unreasonable in this context.[756]

3.640 Table A8.3 of Annex 8 to the Statement sets out the estimated values of the different elements which go towards Ofcom's calculation of the cost of capital. This is reproduced below as Table 3.2.

TABLE 3.2 **Ofcom's cost of capital estimates in its April 2010 Consultation and March 2011 Statement**

Component	*April 2010 (Consultation)*	*March 2011 (Statement)*
ERP (%)	5	5
Asset beta (midpoint)	0.62	0.56
Equity beta at 30% gearing	*0.7–1.0*	*0.76*
RFR (%)	2	1.5
Inflation (%)	2.5	2.5
Debt premium (%)	1–2	1.5
Tax rate (%)	28	24
Pre-tax WACC (%)	6.5–8.8	6.2

Source: Ofcom Statement, Table A8.3.

Ofcom's assessment of beta—cost of equity

3.641 Ofcom stated its preference for using Vodafone's equity beta and gearing levels when considering an efficient national MCP. It said that this was due to Vodafone's business being predominantly based on mobile telephony as opposed to the more diversified bases of other MCP parent companies.[757]

3.642 In making its estimates of these levels, Ofcom also stated that it tended to adopt measurement periods that mapped quite closely to the duration of the charge control (ie four years)[758] because, over the long run, this gave it the chance to capture most of the movements in systematic risk over the period in question and gave it some

[754] See paragraph 3.850.
[755] Ofcom Statement, §A8.164.
[756] Ofcom Statement, §§A8.72 & A8.73.
[757] Ofcom Statement, §A8.94.
[758] Ofcom Statement, §A8.99.

comfort that, in the long run, any potential short-term errors would be 'smoothed out'.[759]

3.643 As to the estimation period chosen, Ofcom said:[760]

> ... we place emphasis on the 2 year daily equity beta analysis, alongside average gearing during the same 2 year period, in order to derive an asset beta based on 2 years of data points. Our belief is that 2 year daily data affords the best compromise between sufficient datapoints to provide a statistically robust estimate, and the most up to date information.
>
> In this charge control, we are also considering other datasets, including 1 year daily data, and 5 year weekly data. From this information we then derive a plausible range for the asset beta of an efficient national MCP.
>
> We consider that the use of a range that includes both the 1 year data (which cannot be said to be from 'the midst of the crisis'), and the 5 year data (which is a relatively long-run view of the asset beta), should mitigate the risk of an error such as that suggested by CEG.[761,762]

3.644 Ofcom checked the 'direction of travel of the asset beta' against the asset betas of other UK national MCP parent companies and those of US pure-play wireless operators.[763] It noted that in October 2010, the asset betas for the other MCPs' parent companies were around 0.4 and were around 0.6 for US wireless companies. Ofcom said that the additional asset beta data supported its view that mobile operators were viewed by investors as exhibiting relatively lower levels of systematic risk now than in the past.[764]

3.645 Ofcom observed that during the credit crisis, as market capitalizations of companies fell, gearing levels rose. It said that this meant observed asset betas were depressed even if equity betas were observed to be stable.[765]

3.646 Ofcom said that it used asset beta data which took account of the GFC, alongside a normal ERP assumption (which would also necessarily include data that related to both crisis and non-crisis periods). Its stated intention was to use an ERP estimate that was not adjusted for such short-term crisis effects and to adopt a similarly defined beta.[766]

3.647 While noting that the scale of the recent reduction in the two-year betas was large, Ofcom considered that any concerns that this might be caused by the inclusion of credit crisis data had been mitigated by the updating of the analysis to reflect the two-year period from mid-February 2009 up to mid-February 2011.[767]

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[759] Ofcom Statement, Annex A, §A8.99.
[760] Ofcom Statement, Annex A, §§8.105–107.
[761] CEG argued in the Consultation that Ofcom's error has been to set the value of the market risk premium based on an assumption of long-run 'normality' but an MNO beta based on a low estimate from the midst of the crisis (Ofcom Statement §A8.102).
[762] CEG—Competition Economic Group advisers to EE.
[763] Ofcom Statement, §A8.108.
[764] Ofcom Statement, §A8.109.
[765] Ofcom Statement, §A8.112.
[766] Ofcom Statement, §A8.113.
[767] Ofcom Statement, §A8.116.

3.648 It said that the downward trend in two-year beta had continued since April 2010.[768] Ofcom recognized that its analysis factored in lower equity and asset betas for Vodafone than in its previous charge control and said that this raised a concern that it was potentially observing the low point of the asset beta curve for Vodafone and that this could be a temporary, short-term phenomenon. However, Ofcom stated that, in common with previous reviews, the parameter would be reassessed in four years' time.[769]

3.649 Ofcom added that it now considered, in light of the latest evidence, that the downward movement in observed betas may be more of a long-term trend than a short-term market fluctuation. It said that with the benefit of hindsight, its previous estimate of beta (ie that used in 2007 Statement) may have given too much weight to past long-run volatility and not enough weight to recent data: which may have resulted in an estimate that was too high.[770]

3.650 The asset beta data Ofcom considered is set out in Table 3.3.

TABLE 3.3 **Ofcom's assessment of equity and asset betas for Vodafone vs FTSE All Share**

Data period	*5 years to 14.2.2011*	*2 years to 14.2.2011*	*18 months to 14.2.2011*	*1 year to 14.2.2011*
Equity beta	0.78	0.67	0.67	0.76
Average gearing (%)	25	30	30	29
Asset beta	0.61	0.50	0.50	0.57

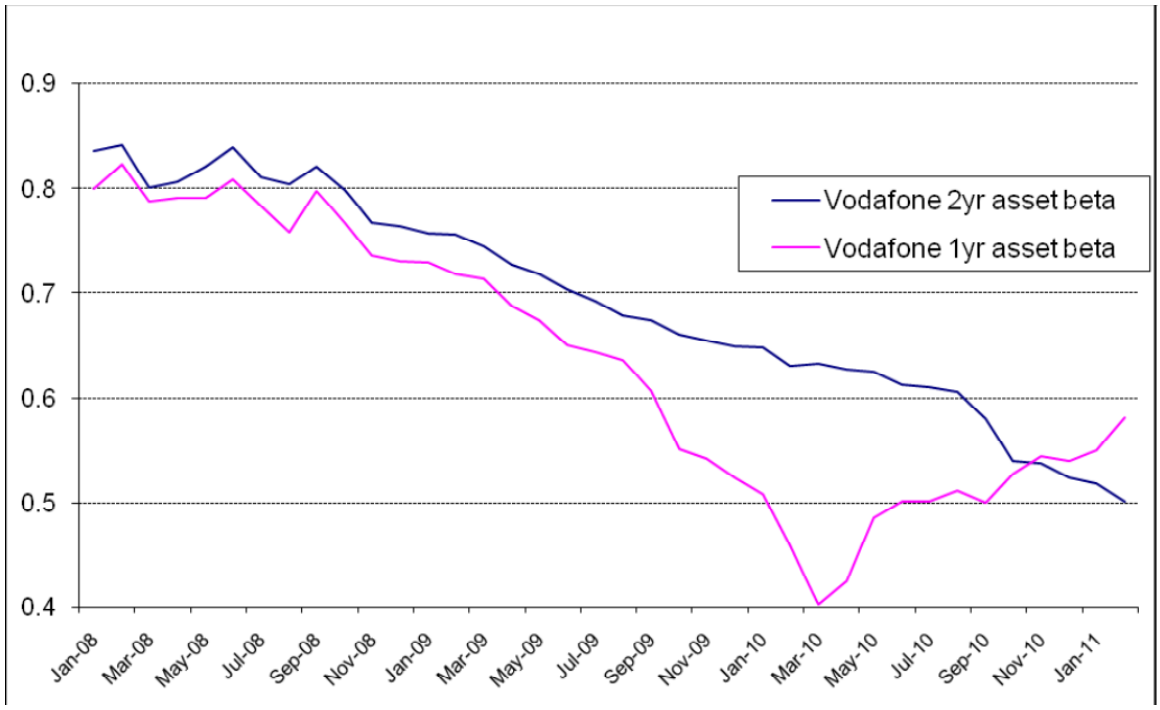
Source: Ofcom Statement Table A8.8.

3.651 Ofcom concluded that a range of asset betas of 0.5 to 0.61 would be appropriate. This incorporated all of the most recent asset beta observations for periods between one year and five years (0.61 was given as the five-year asset beta to 14 February 2011).[771] It had looked at the trend of the two-year asset beta (see Figure 3.6) over the last three years and said that it appeared to be stabilizing 'at or around 0.5'. It said that the one-year asset beta had dipped as low as 0.4 in the last year.[772] Ofcom's point estimate was the midpoint of this range, ie 0.56.[773]

[768] Ofcom Statement, Tables A8.7 & A8.8.
[769] Ofcom Statement, §§A8.123 & A8.124.
[770] Ofcom Statement, §§A8.125 & A8.126.
[771] Ofcom Statement, §A8.129 & Table A8.8.
[772] Ofcom Statement, §A8.128.
[773] Ofcom Statement, §A8.129.

FIGURE 3.6

Two-year and one-year asset beta for Vodafone over last three years



Source: Ofcom Decision Figure A8.2.

3.652 Ofcom said that it was acutely aware of the inherent difficulties in making equity and asset beta estimates, particularly when it observed large changes over time. It believed that by including asset betas from periods between one year and five years in its range it was giving reasonable weight to both long-term data and recent data.[774]

3.653 Ofcom said that it was required to use its judgement to arrive at a reasonable estimate that took account of all available data. It believed that its range of 0.5 to 0.61, with a midpoint estimate of 0.56, was a reasonable assessment of the asset beta. It said that this estimate should be viewed in conjunction with its ERP estimate of 5 per cent.[775]

3.654 In response to Vodafone's suggestion in the consultation that Ofcom should exclude data from the credit crisis and only look at pre-2008 data, Ofcom said that had the equity and asset beta evidence been stable over the last five years then it might have found such an approach reasonable. However, it was Ofcom's belief that the systematic risk of telecommunications operators in general—and mobile operators in particular—had fallen in recent years.[776]

3.655 Nevertheless, Ofcom did consider it important to understand the potential effects of the credit crisis. To do this, it divided the last five years into three periods:[777]

- pre-crisis, being 1 March 2006 to 31 May 2008 (2.25 years);
- mid-crisis,[778] being 1 June 2008 to 31 May 2009 (1 year); and

[774] Ofcom Statement, §§A8.130–A8.131.
[775] Ofcom Statement, §A8.132–A8.133.
[776] Ofcom Statement, §A8.134–A8.136.
[777] Ofcom Statement, §A8.139.

- post-crisis, being 1 June 2009 to 28 February 2011 (1.75 years).

3.656 Ofcom found that the asset betas for Vodafone declined across each of these periods (pre-crisis ~0.8, mid-crisis ~0.65, post-crisis ~0.5). On this basis, it concluded that any concerns that the inclusion of the major period of the credit crisis might have biased the two-year beta analysis downwards appeared to be unfounded.[779]

Ofcom's assessment of the RFR

3.657 Ofcom stated that: 'The risk-free rate is perhaps the most important parameter when estimating the WACC since it influences both the cost of equity and the cost of debt.'[780] It estimated the RFR to be 1.5 per cent.[781]

3.658 Ofcom was conscious that the observed RFR was at a historically low level. It said that it needed to be cautious in selecting values to ensure that they were appropriate and not unduly influenced/distorted by very particular short-term events.[782] Consequently, it gave greater weight than usual to longer-term averages.[783] Ofcom stated that its approach was to estimate a rate that was based on historic and current data, but one that should be relevant for the four-year period covered by the control.[784]

3.659 Ofcom said that in the past, in relation to the RFR, it had given significant weight to an observed tendency for mean reversion.[785] It said that it was mindful that departing from this well-understood methodology in an unexpected way could create regulatory uncertainty.[786]

3.660 Ofcom observed that:[787]

(a) The RFR (as measured by yields on UK five-year gilts) had been falling since November 2008 when it peaked at over 4 per cent. It said that in the previous year (ie to February 2011) the rate had been between –0.5 per cent and 0.5 per cent: Ofcom did not believe this to be a sustainable long-term level (certainly not at the lower end of that range).

(b) The level of demand for UK gilts had been affected by the UK Government's programme of quantitative easing as well as from strong investor demand for UK government debt.

(c) The high levels of demand for UK gilts at February 2011 looked unusual when viewed against long-term data and Ofcom was cautious about attaching too much weight to (then) current very low rates.

3.661 Ofcom said that whilst it continued to favour the use of five-year gilt yields when estimating the RFR, it also considered ten-year gilt yields. It noted the CC's comments in Bristol Water where the CC said that at the time of the report shorter-

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[778] Ofcom said that its mid-crisis period encompassed the most volatile period of equity movements.
[779] Ofcom Statement, §A8.142.
[780] Ofcom Statement, Annex 8, §8.31.
[781] Ofcom Statement, Annex 8, §8.51.
[782] Ofcom Statement, Annex 8, §8.18.
[783] Ofcom Statement, Annex 8, §8.45.
[784] Ofcom Statement, Annex 8, § 8.33.
[785] Ofcom explained that: mean reversion describes a general tendency by certain parameters (such as the RFR) to fluctuate around observed average levels. If the parameter value is above or below the average for a period of time, mean reversion suggests that it will trend back towards the average in time. (Ofcom Statement, Annex 8, fn 162.)
[786] Ofcom Statement, §A 8.19.
[787] Ofcom Statement, Annex 8, §§8.37–8.39.

dated index-linked yields were affected by action to address the credit crunch and recession and were less relevant to estimating the RFR.[788]

3.662 Ofcom looked at historic averages of index-linked five- and ten-year gilt yields as at 14 February 2011 using averaging periods of: 1 day, 1 month, 3 months, 6 months, 1 years, 2 years, 5 years and 10 years.

3.663 Given the likelihood of increasing yields in later years, it gave more weight to the one-, two- and five-year averages than recent very low rates. It calculated that the five-year average yield for five-year government index-linked gilts was 1.3 per cent and the ten-year average for five-year government index-linked gilts was 1.7 per cent.[789] It said that the average yield on the ten-year government index-linked gilt over the last five years was also 1.3 per cent—the same as that on the five-year government index-linked gilt.[790]

3.664 Ofcom said that in its Bristol Water decision, the CC used a range of 1 to 2 per cent for the RFR from which a point estimate of 2 per cent could be inferred. Ofcom said that this was based on evidence gathered up to and including July 2010. It viewed the CC's estimated RFR as a useful reference point but was also aware that it had six months' more data.[791]

3.665 Whilst Ofcom was aware that an estimate of 1.5 per cent was some way above (the then) current RFR, it considered this reasonable because of:

(a) the CC's range of 1 to 2 per cent in the Bristol Water determination; and

(b) the five-year and ten-year average yields on five-year government index-linked gilts were around 1.5 per cent (1.3 per cent and 1.7 per cent respectively).

3.666 Ofcom said that it was mindful, when estimating regulatory cost of capital rates, of the potential negative effects of making sudden large changes, which could create regulatory uncertainty. It said that it was particularly mindful that current low rates reflected very specific conditions (including the Bank of England's quantitative easing programme) and it had taken this into account.[792]

Beta

3.667 As set out in paragraphs 3.628 to 3.632, we have considered the arguments relating to beta under the following headings:

(a) forward-looking estimates and the relationship between beta and ERP (including gearing, mining and banking stocks, GFC);

(b) Ofcom's reasons for believing that MNO risk was declining were flawed (including use of Vodafone as a proxy and other reasons for the decline in beta);

(c) other issues with beta (including O2 beta, cross-checks and calculation of five-year beta); and

(d) overall conclusion on beta.

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[788] Ofcom Statement, §A 8.43.
[789] Ofcom Statement, §A8.46.
[790] Ofcom Statement, §A8.48.
[791] Ofcom Statement, §A8.50.
[792] Ofcom Statement, §A8.53.

Forward-looking estimates and the relationship between beta and ERP

EE's NoA

3.668 EE argued that it was not clear that in its WACC analysis Ofcom adequately took into account that observed betas did not necessarily reflect the relevant forward-looking investor perceptions of absolute risk.[793]

3.669 It said that 'the purpose of WACC calculations is to calculate the likely cost of borrowing [sic] for UK MCP*s over the period of the charge control*. As a result, what matters are likely investor perceptions (as to the riskiness of UK MCPs) over that future period'.[794] EE said that, to the extent that asset betas and ERP over the charge control period were likely to vary from past periods, it was crucial that Ofcom should take this into account in its calculations.[795]

3.670 EE also said that what mattered was likely investor perceptions as to the absolute level of risk of investing in UK MCPs. It explained that the asset betas of individual companies did not measure this and were an estimate of the level of risk associated with the company relative to equities in general during the estimation period. EE said that Ofcom did not properly take this into account throughout its analysis.[796] EE said that the following Ofcom statement reflected this misunderstanding or failure: 'The additional asset beta data supports our view that mobile operators are viewed by investors as exhibiting relatively lower levels of systemic risk now than in the past.'[797]

3.671 EE alleged that[798] '... Ofcom failed to recognise that asset betas and equity risk premium should be measured over the same period (or at least, should not be measured over periods when market conditions are, on average, very different from each other)' whereas[799] '... if asset betas are estimated from data covering a period in which they are likely to be depressed as a result of market volatility, consistency requires that they should be combined with an equity risk premium that is higher to reflect the same level of volatility.

3.672 EE pointed out that 'The CC has recently identified that it is erroneous for Ofcom to adopt a "pick-'n'-mix" approach to WACC calculations under which different inputs are estimated at different points in time or over different time intervals.'

3.673 Dr Hird said that investors would only believe that lower measured Vodafone betas over this period reflected lower levels of forward-looking beta if they believed that the market conditions under which they were estimated were expected to be typical of future market conditions.[800] He considered that the market conditions over this period were likely to have affected the FTSE in a specific and atypical manner which, if they were likely to be repeated, implied that a higher ERP should be attached to betas estimated relative to the FTSE. EE argued that once these effects had played out, Vodafone's asset beta was likely to rise considerably from that estimated over the GFC period. It considered that if an asset beta derived from a period of market volatility were used—where the asset beta was likely to be depressed—the estimate

[793] EE NoA, §174.
[794] EE NoA, §175.
[795] EE NoA, §175.
[796] EE NoA, §176.
[797] EE NoA, §176, citing Ofcom Statement, §A8.109.
[798] EE NoA, §180; & EE W/S Hird I, 85.
[799] EE NoA, §206.
[800] EE NoA, W/S Hird I, §81.

must be combined with an ERP that was higher to reflect the same level of volatility.[801]

3.674 Dr Hird pointed to the Brattle report which also suggested that if ongoing volatility reduced telecommunications betas it would not justify a decrease in the cost of capital as sustained volatility would imply an increase in ERP demanded by investors and the effect of higher ERP and lower beta would likely cancel each other out.[802]

3.675 Dr Hird used an ERP of 5 per cent and argued that the beta estimate should be based on data prior to mid-2008 to ensure that the beta was not affected by the GFC.[803]

Ofcom's Defence

3.676 Ofcom's Defence presented a number of points regarding its general approach.[804] It noted that none of the respondents to the Second Consultation suggested that its use of the CAPM for assessing the WACC was inappropriate.[805]

3.677 The cost of equity within the WACC combined the beta (a relative assessment) with the expected ERP and the RFR (market measures) to get the expected cost of equity for a particular firm. It said that this combination properly took account of the absolute risk of investing in a UK MCP.[806]

3.678 Ofcom considered that, unless there was compelling evidence to suggest otherwise, the best estimate of the beta in the future was the equity beta which had been observed over the recent past. It recognized that there were inherent difficulties associated with estimating forward-looking betas and accepted that observed historical betas did not necessarily represent the forward-looking beta.[807]

3.679 Ofcom explained that it assessed observed betas for a range of historic periods, noted the decline in observed betas and took account of the pace of change within the mobile industry relative, for example, to utilities. For this reason, Ofcom placed more weight on recent data.[808]

3.680 Ofcom had specifically considered in the Statement whether its WACC estimate based on current and historic data would remain relevant and valid for the entire Price Control period and concluded that it would.[809] Ofcom did not consider that there was sufficient evidence to suggest that either the ERP or the asset beta was likely to change in any predictable way over that period. It said that for ERP it had increased its estimate from 4.5 to 5 per cent since the 2007 Price Control to reflect the additional return which investors were likely to demand as a result of a perceived increase in the risk of the market since the 2007 Statement.[810]

3.681 Ofcom said that in making estimates of the key parameters used in the WACC, it used the best available data based on a combination of historic and current market data. In this case, for the ERP, it had used both historical and current evidence.[811]

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[801] EE NoA, §206.
[802] EE NoA, W/S Hird I, §83.
[803] EE NoA, W/S Hird I, §186.
[804] Ofcom Defence, Annex D, §§14–27.
[805] Ofcom Defence, Annex D, §25.
[806] Ofcom Defence, Annex D, §§25 & 26.
[807] Ofcom Defence, Annex D, §§15 & 16.
[808] Ofcom Defence, Annex D, §19.
[809] Ofcom Defence, Annex D, §§20 & 21.
[810] Ofcom Defence, Annex D, §23.
[811] Ofcom Defence, Annex D, §§51 & 52.

For the asset beta it used recent historic beta estimates whilst also taking into account both longer- and short-term beta estimates.

3.682 Ofcom considered that recent historical observed betas provided the most robust estimate of forward-looking betas for the Price Control period. However, given recent market conditions, Ofcom also considered longer-term data in the Statement.[812]

3.683 Ofcom noted that EE had not appealed Ofcom's decision to set the ERP at 5 per cent and said that increasing the beta (as EE suggested) to account for any perceived increase in general market risk was not an appropriate way to address increases in the risk of the market index.[813] This was because the changes described by EE would relate to the market as a whole and the ERP measured the extra return required by investors for investing in the equity market as a whole rather than risk-free assets. It said that if market risk increased, then it was likely that investors would demand higher returns for holding equities and a higher ERP estimate would be required to reflect this.[814] Therefore, if EE was correct in submitting that these changes had occurred, the changes would properly be directed at the ERP estimate and not the asset beta.[815]

3.684 Ofcom pointed out that it had increased the ERP estimate from 4.5 per cent (used in 2007) to 5 per cent to reflect an increase in market volatility over the relevant period compared with the relatively benign period considered in the 2007 Decision. Ofcom did not accept that higher market gearing and increased volatility would result in an ERP above 5 per cent or that there had been changes such that market risk had increased beyond that accounted for in its 0.5 per cent increase to the ERP estimate.[816,817]

3.685 Professor Franks (witness for Ofcom) noted that the very high levels of risk of the market index discussed by Dr Hird had largely mean reverted and were close to longer-run averages; that the Bank of England's estimate of the ERP increased during the crisis but had since declined to levels closer to those prevailing prior to the GFC; and the evidence that UK economic regulators had been prepared to change their estimate of the ERP to reflect changing market risk including the period of the GFC referred to by Dr Hird.[818]

3.686 Ofcom went on to explain that the effects described by EE were temporary in nature and said that there had not been a fundamental increase in the volatility of the FTSE as a result of the GFC and changing composition of the index.[819]

3.687 With regard to EE's reference to the CC's finding in the *Carphone Warehouse*[820] case, Ofcom said that the CC's finding was made in relation to the assessment of the cost of debt and not in relation to the asset beta and ERP (ie it was made in a different context).[821]

3.688 It further said that, when considering the asset beta for Bristol Water,[822] the CC had used the two-year daily beta for the period 21 March 2008 to 22 March 2010 which

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[812] Ofcom Defence, Annex D, §28.
[813] Ofcom Defence, W/S Franks I, §17.
[814] Ofcom Defence, Annex D, §§31 & 32.
[815] Ofcom Defence, Annex C, §32.
[816] Ofcom Defence, Annex D, §33.
[817] Ofcom Defence, Annex D, §35.
[818] Ofcom Defence, W/S Franks I, §26.
[819] Ofcom Defence, Annex D, §39.
[820] *The Carphone Warehouse Group plc v Office of Communications*, 31 August 2010.
[821] Ofcom Defence, Annex D, §§48–50.
[822] *Bristol Water plc: a reference under section 12(3)(a) of the Water Industry Act 1991*, 4 August 2010.

included the period of the GFC. The CC had then combined this with an assessment of the ERP that combined historical and forward-looking data.

3.689 Ofcom stated that its approach to '… the ERP and the asset beta in the Statement is therefore consistent with the approach taken by the CC in Bristol Water; and the time periods and data selected by Ofcom were reasonable'.[823]

EE's Core Submission

3.690 In its Core Submission, EE presented a further witness statement from Dr Hird. This said that Ofcom had only two options in implementing the CAPM consistently:

(a) It could assume that atypical market conditions, consistent with those under which the beta was estimated by Ofcom, would prevail into the future. In this case, Ofcom could consistently use the beta it had estimated but would need to apply that beta to an ERP that was also consistent with those atypical market conditions.

(b) Or it could assume that future markets would (or had already) returned to more normal conditions. In this case, Ofcom could adopt an ERP that reflected a return to normal conditions but could not use a beta estimated over the atypical market conditions described above.[824]

3.691 EE did not argue for a change in the ERP estimate, only an increase in the beta estimate—in effect arguing that given its ERP estimate, Ofcom should have chosen option *(b)*.

3.692 EE also argued that Ofcom's mischaracterization of the alleged error meant that Ofcom's Defence did not address EE's view that Vodafone's beta was depressed, only Ofcom's view that ERP was not appealed.[825]

3.693 Dr Hird said that Ofcom and Professor Franks repeatedly referred to the temporary nature of these atypical market conditions and thereby attempted to infer some protection from the error. He said that the view that the atypical market conditions were temporary was no protection from the alleged error as, if Ofcom was right about a return to more normal market conditions, then it must be wrong to use the beta it had estimated.[826]

General comments on the relationship between beta and ERP

3.694 We first make an observation on terminology. In calculating beta and ERP, regulators are concerned with the additional return above the RFR required to compensate investors for the risk that they assume in holding the equity of the firm in question. An important assumption is that investors hold diversified portfolios and therefore require compensation for exposure to systematic or market risk rather than company-specific risk. The ERP captures the required return above the RFR for investing in the equity market in general and the beta captures the company's exposure to this market risk. It is this exposure to market or systematic risk that EE and Ofcom (in response) have described as 'absolute' risk.

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[823] Ofcom Defence, Annex D, §53.
[824] EE Core Submission, W/S Hird III, §7.
[825] EE Core Submission, §202.
[826] EE Core Submission, W/S Hird III, §16.

3.695 We note that Ofcom's beta estimate is based on data from a shorter time frame than its ERP estimate. Ofcom considered that recent beta data was the best forward-looking estimate although, given the economic conditions, it placed more weight than usual on the five-year data. ERP, on the other hand, is difficult to estimate reliably from returns data over a short period. Since realized returns fluctuate dramatically from year to year, it is necessary to consider a long time series of historical returns to obtain a representative picture of forward-looking expectations. There is an element of judgement in this and regulators may consider the implications of short-term market conditions when setting the forward-looking ERP.

3.696 We understand EE's claim to be that Ofcom had used parameters that were mutually inconsistent. We can see that in theory if beta were assessed solely from a period of high market volatility, it might not provide a reliable estimate of the forward-looking beta. However, to the extent that changes in market volatility or risk are considered to be non-transitory or to inform perceptions of prospective future risk, we would expect them to be reflected in the ERP. We note that Ofcom increased its estimate of the ERP from 4.5 per cent (in the 2007 Price Control) to 5.0 per cent in the 2011 Statement. This was because Ofcom believed that the high level of volatility in equity markets suggested that the ERP might have increased in recent years.[827,828]

3.697 When assessing beta by statistical means one may retrospectively identify an anomalous period in which market conditions are unusual for some reason and the relationship between the share price and the market is atypical. If such conditions are thought to be transitory and not expected to be present in the future, there may be a case for omitting the anomalous period from the data set. However, this needs to be done cautiously. It is very difficult to judge what is and is not normal, or how investors assess the possibility of atypical events being repeated. In practice, it may be difficult to form a robust view on whether market conditions are indeed atypical and to specify the boundaries of any such atypical period in an objective manner.

3.698 Finally, by way of general remarks, we agree with Ofcom that the CC's comments in the *Carphone Warehouse* case, concerning a 'pick-and-mix' approach to selecting time periods for different inputs, were made in the context of the cost of debt and are not directly comparable. We do not consider that they have a bearing on this case.

3.699 We now turn to EE's arguments in support of its view that Vodafone's beta assessed by Ofcom was artificially depressed and inconsistent with a 5 per cent ERP estimate. We consider these arguments under three subheadings: increased market gearing; impact of mining and banking stocks; and the impact of the GFC. We then consider whether EE overall has demonstrated that Ofcom has used inconsistent beta and ERP estimates (see paragraphs 3.791 to 3.800).

Gearing

- *EE's NoA*

3.700 EE explained its view of the significance of gearing in its allegation of error by Ofcom in the following terms:[829]

[827] Ofcom Statement, §A8.90.
[828] Three, in support of Ofcom's Defence, gave evidence, in Three, W/S Hern I, §§69–77, about the level of ERP over a period of time. As EE later clarified that it was not arguing that Ofcom erred in the value it gave to ERP, we have not considered it necessary to consider that evidence further.
[829] EE NoA, §§181.3,181.4 & 183.

> An increase in the gearing of a company will tend to increase its equity beta.
>
> Similarly, an increase in the average gearing of companies in an index will tend to increase the market wide equity risk premium. As a result, and other things being equal, an increase in the average gearing of companies in an index will tend to reduce the asset beta of a company with constant gearing.
>
> In order to draw inference from a falling asset beta about the absolute level of risk of investing in a company, it is necessary to take into account (and control for) the effect of changes in gearing to the market as a whole (as well as any other factors affecting the equity risk premium).

3.701 Dr Hird said that, other things equal, an increase in market gearing implied an increase in market risk for precisely the same reasons that an increase in firm-specific gearing implied an increase in firm-specific risk.[830]

3.702 He accepted that, since the composition of the market changed,[831] it was somewhat difficult to derive a time-series measure of gearing across the entire market that was meaningfully comparable across time. In particular, Dr Hird said that it was not always possible to conclude that rising/falling average market gearing was associated with rising/falling average market risk if the composition of the market was altering in an offsetting manner.[832]

3.703 In his first witness statement, Dr Hird presented a collection of data which showed the increase in market gearing levels between the 1990s and 2008/early 2009.[833] EE also said that gearing (and thereby ERP) had declined significantly since the GFC and that it was to be expected that the following years would be characterized by continued reductions in gearing.[834]

3.704 Dr Hird argued that Ofcom had adjusted equity betas to asset betas to take account of changes in Vodafone's gearing, but failed to acknowledge that the market as a whole was not maintaining a constant gearing ratio.[835] He provided a formula for adjusting for both elevated Vodafone gearing and elevated market-wide gearing. This converted the asset beta from a period with elevated market gearing to an equivalent asset beta consistent with a more normal market gearing.[836]

3.705 Dr Hird found that using this formula resulted in asset betas (estimated over the period post-2007 when gearing was around 60 per cent or above) being increased by a factor of 1.7[837] to make them directly comparable to the asset betas estimated

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[830] EE NoA, W/S Hird I, §120.
[831] Dr Hird noted the following issues with measuring market gearing:
(a) Higher-risk companies tend to have lower gearing and vice versa. Mining and oil companies, whose revenue is dependent on highly volatile commodity prices, tend to have lower than average gearing. By contrast, regulated utilities which have stable cash flows tend to have higher gearing.
(b) It is also the case that measuring and comparing gearing for financial intermediaries with the gearing of non-financial corporations is somewhat problematic. Financial intermediaries' core business is borrowing to on-lend to their customers. Consequently, one expects such intermediaries to have higher than average gearing. This need not imply that the intermediary is high risk if their debt obligations are appropriately matched to their assets (eg loans).
[832] EE NoA, W/S Hird I, §123.
[833] EE NoA, W/S Hird I, §§124–127.
[834] EE NoA, §181.6.
[835] EE NoA, W/S Hird I, §129.
[836] EE NoA, W/S Hird I, §136.
[837] 1.7 = (1–0.32)/(1–0.6).

between 1990 and the beginning of 2002 (when market gearing was approximately constant at around 32 per cent).[838]

3.706 EE said that: 'If one controls for the changes in gearing of the market as a whole since 2000, one finds that much of the fall in Vodafone's asset beta over this period can be attributed to increases in market gearing rather than a reduction in the absolute riskiness of Vodafone.'[839]

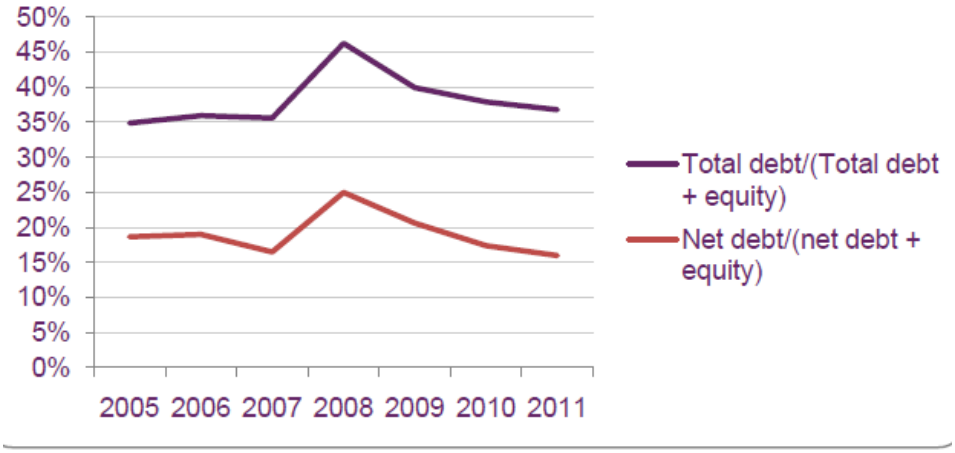
- *Ofcom's Defence*

3.707 In its Defence, Ofcom pointed out that it acknowledged in the Statement that during the GFC the average gearing of companies increased as their market capitalizations fell.[840] It went on in its Defence[841] to review the debt (both total and net debt) to asset ratio of private non-financial corporations from 2005 to 2011 and found that the rise in the ratio had largely been reversed post-GFC.

3.708 Ofcom provided a chart of debt to asset ratios, as set out in Figure 3.7.

FIGURE 3.7

Private non-financial corporations' debt to asset ratio



Source: Ofcom Defence, Figure D.1.

3.709 Ofcom's position in response to EE's allegation of error, relying on the evidence of its expert Professor Franks, was as follows:[842]

> … the evidence strongly suggests that the increase in gearing was short lived and will have had only a temporary influence on market volatility and absolute market risk.
>
> Ofcom therefore does not consider that there has been a fundamental shift in market gearing and risk which would result in an adjustment to Ofcom's beta estimate as EE and Dr Hird contend (or would result in a higher ERP estimate).

[838] EE NoA, W/S Hird I, §137.
[839] EE NoA, §§185 & 186.
[840] Ofcom Defence, Annex D, §§40 & 41.
[841] Ofcom Defence, Annex D, §41; & W/S Franks, §32.
[842] Ofcom Defence, Annex D, §§42 & 43.

- *Three's SoI in support of Ofcom*

3.710 Dr Hern, for Three, considered that Dr Hird's adjustment factor of 1.7 (designed to take into account an increase in market gearing in the period following 2002) was flawed since it was not theoretically correct to adjust beta for a change in market gearing.[843] He claimed that finance theory stated that an increase in market gearing should be reflected in the market ERP. On this basis, Three's evidence was that Dr Hird's adjustment to beta appeared arbitrary and ad hoc with no support in the theoretical literature, nor was there any regulatory precedent for such an adjustment.[844]

3.711 Dr Hern said that, if he were to accept that Dr Hird's ad hoc beta adjustment compensated for a correct adjustment to the ERP, there was no evidence that the ERP had increased over the period since 2002 in a manner that was consistent with Dr Hird's assumption.[845]

3.712 Dr Hern presented data which he said gave a plausible range for the ERP from 5 to 8.7 per cent.[846] He considered that this indicated that Ofcom's ERP estimate was at the bottom end of a range of plausible values but not out of line with market evidence.

3.713 Dr Hern added that his analysis of a range of ERP estimates suggested that what he described as EE's arbitrary adjustment of beta 'to correct for market gearing' was not only unjustified from a theoretical point of view but also led to implausibly high estimates.[847] On the basis of this evidence, he saw no justification for an upward adjustment of the asset beta due to an increase in market gearing.

- *EE's Core Submission*

3.714 In response to Ofcom's Defence, Dr Hird agreed that a permanent increase in market gearing should be reflected in a higher ERP, not in a lower beta, but that this would not be the case if a temporary increase in gearing during the period the beta had been estimated had since reversed. If the effect was only temporary, then the resulting depressed beta should not be used.[848]

3.715 Dr Hird said that the increase in gearing was not just a small 'blip' in market gearing associated with the worst of the crisis but also a large run-up in market gearing prior to the crisis—with market gearing more than doubling between 1999 and 2009.[849]

- *Additional remarks from Ofcom*

3.716 In response to EE's Core Submission, Ofcom argued that Dr Hird had repositioned his original argument by claiming that the difference between making an adjustment to the beta or the ERP depended on whether the increase in market risk was temporary or permanent.[850] Ofcom considered this argument inadmissible but, in any event, it also wholly disagreed. It argued instead that it was fundamentally incorrect to adjust for a temporary change in the ERP by adjusting the beta. Ofcom considered

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[843] Three SoI, W/S Hern I, §103.
[844] Three SoI, W/S Hern I, §103.
[845] Three SoI, W/S Hern I, §104.
[846] Three SoI, W/S Hern I, §105.
[847] Three SoI, W/S Hern I, §108.
[848] EE Core Submission, W/S Hird III, §65.
[849] EE Core Submission, W/S Hird III, §66.
[850] Ofcom letter to the CC of 14 October 2011, Annex 2, p5.

that if market risk had increased, temporarily or otherwise, this should be properly reflected by an increase in the ERP as Ofcom had done. Ofcom argued that the increase in market gearing to which Dr Hird referred began in 2000 and, therefore, could not be considered temporary.

3.717 Ofcom also said that the approach suggested by Dr Hird was a wholly new methodology for estimating the cost of capital. Furthermore, Ofcom saw the consequence of such a methodology as one which would require the regulator to constantly monitor and respond to every market movement by changing its cost of capital. It considered it inappropriate to suggest a new methodology in an appeal process when no submission to this effect was made during the consultation process preceding the appealed decision.

- *Assessment—gearing*

3.718 In its Core Submission, EE accepted that a permanent increase in market gearing should be reflected in a higher ERP, but said that this was not the case for a temporary increase in gearing that had since reversed. The data presented by EE is for the period 2000 to 2009; it shows market gearing increasing to the end of 2008 and then falling slightly through 2009 with Vodafone's gearing following a similar pattern and starting to fall from mid-2009. EE stated that the GFC caused a reduction in market gearing to lower levels which it expected to persist going forwards. However, EE has failed to explain clearly over what period it considers there to have been a temporary increase in the gearing; its arguments are instead focused on the increase in gearing 'over the last decade', which has made it very difficult for us to understand which period it considered to be atypical.

3.719 Further, even if it were possible to specify an 'atypical period', we do not see adequate theoretical justification for EE's proposed methodology for adjusting beta for the increase in market gearing. We are not aware of any prior theoretical or practical use of the formula that Dr Hird proposed, and neither EE nor Dr Hird have cited any such precedent in support of the adjustment.

3.720 We acknowledge that there has been a trend of increasing market gearing over a number of years. To the extent that market gearing has increased (reflecting increased market risk and the expectation of market risk in the future), the ERP is the appropriate place to make any adjustment. We note that Ofcom increased its ERP estimate for the purposes of the 2011 charge control.

3.721 Ofcom itself recognized that there was a short period when market gearing increased as market capitalizations fell and it looked at betas which were measured in the period subsequent to this peak in gearing levels. (Figure 3.7 shows more normal gearing in 2009, 2010 and 2011, so Ofcom's most recent one-year, 18-month and possibly its two-year beta estimates are clear of any effect of the temporary spike in gearing.)

Influence of mining and banking stocks

- *EE's NoA*

3.722 EE stated that the weight given within the FTSE to natural resource companies, particularly mining stocks, had increased over recent years and that the volatility of those stocks had affected the FTSE.[851] It also noted the weight of banking stocks in

[851] EE NoA, §196.

the index and their role in the GFC. EE added that banking stocks had also continued, since the GFC, to be volatile.[852]

3.723 Dr Hird presented evidence on the disproportionate effects of mining, financial and natural resource companies on the FTSE during the GFC and explained the relationship between the mining and financial betas and those of other FTSE-listed industries in the following terms:[853,854]

> … looking only at the recent past period of GFC related stock market crash and rebound, the measured equity betas for mining and banking stocks are extremely high. By definition if an industry is driving movements in the overall index that industry will have an elevated beta. It follows that the equity betas for other sectors must be lower over the same period; reflecting the fact that equity beta measures relative risk and the average equity beta must be equal to 1.0.

3.724 Dr Hird then referred to Figure 24 of the Brattle Group's report of November 2010 which he said showed elevated mining and banking betas and depressed utility and telecoms betas over the relevant period.[855] From this report he cited the following comments from Brattle:

(a) 'We cannot therefore justify a low beta for the MNOs going forward based on a forecast of continuing uncertainty in the financial and mining segments';[856] and

(b) 'Even if ongoing volatility resulted in a reduction to the apparent beta, it would (sic) justify a decrease in the cost of capital overall. If crisis-level volatility were to linger indefinitely, it would imply an increase in the equity risk premium demanded by investors. The two effects—a lower beta for telecoms on the one-hand and a higher equity risk premium on the other—would likely cancel each other out in a cost of capital calculation'.[857,858]

3.725 Dr Hird also stated that measured telecommunications betas since 2008 had been lower than the average over the decade prior to 2008.[859] He added that these measurements were sourced from a period of unprecedented boom, bust and recovery in stock market levels—largely driven by movements in mining and finance stocks in the UK. EE claimed that the volatility of the FTSE caused by those stocks had the following effect on Vodafone:[860] 'The asset beta of Vodafone is therefore likely to have fallen over time, as its level of riskiness has fallen relative to the index. Thus Vodafone's asset beta would have fallen over time even if its absolute level of riskiness had remained constant.'

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[852] EE NoA, fn 230.
[853] EE NoA, W/S Hird I, §§73–76.
[854] EE NoA, W/S Hird I, §78.
[855] EE NoA, W/S Hird I, §78.
[856] EE NoA, W/S Hird I, §80.
[857] EE NoA, W/S Hird I, §83.
[858] Dr Hird explained that it was obvious that there was a typographical error in the omission of the word 'not' from the first senence as only with the correction did the first sentence make sense in the contect of the subsequent sentences (EE NoA, W/S Hird I §84.).
[859] EE NoA, W/S Hird I, §72.
[860] EE NoA, §196.

- *Ofcom's Defence*

3.726 Ofcom rejected EE's hypothesis that the changing composition of the FTSE (combined with the GFC) had resulted in increased risk in the market thus depressing Vodafone's beta.[861]

3.727 Ofcom said that, whilst it was correct that the volatility of the FTSE increased during the GFC, by the end of 2010 average daily volatility for the FTSE All Share had returned to the levels seen for the index prior to 2008 and the one-year average had since fallen below the ten-year average volatility. It said that market volatility (and therefore market risk) had largely mean reverted.[862]

3.728 Given the mean reversion of market volatility and the sharp contraction in the market capitalization of banks, Ofcom said that it was not unreasonable to make a conjecture that any increase in market risk from these stocks was short lived.[863] It added that Dr Staunton (expert for Ofcom) found that the volatility of the FTSE All Share index without mining and banking stocks would have fallen from a peak of 21.2 per cent in August 2009 to 10.7 per cent at the end of June 2011, and that the incremental contribution from mining and banking stocks to the volatility (or absolute risk) of the index had fallen, from a peak of 6 per cent in August 2009 to 0.9 per cent at the end of June 2011.[864]

3.729 Professor Franks argued that Dr Hird's analysis and conclusions as to the contribution of mining and banking to the increasing risk of the market index were incomplete.[865] He stated that Dr Hird had not shown the correlation between the returns of mining and banking stocks to the returns of the rest of the market which was, in his opinion, critical to measuring the impact on market volatility. He referred to what he described as conventional portfolio theory under which, he said, one could not assess the contribution of a security or a sector to the risk of an index (or portfolio) without an analysis of how that sector's returns were correlated with the returns of the other sectors in the index.

3.730 Professor Franks said it was possible that the security whose weight in the portfolio was being increased had a relatively high risk or standard deviation but it also had a relatively low correlation with the returns of the rest of the portfolio. If the security (or securities) whose weight was being reduced had a relatively high correlation with the rest of the portfolio, it was possible that the overall risk of the portfolio could decline as a result of the change in weightings.[866]

3.731 While the betas of mining and banking suggest that changes in sectoral composition of the market index increased the risk of the market during the GFC, Dr Hird's evidence did not directly quantify the size of this increase nor how persistent it was.[867]

- *Three's SoI in support of Ofcom*

3.732 Dr Hern provided analysis of the implied volatility of the FTSE 100[868] which, he said, showed that whilst market volatility was high around mid-2008, it had subsequently

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[861] Ofcom Defence, Annex D, §37.
[862] Ofcom Defence, Annex D, §38(a); & W/S Franks I, §§21–24.
[863] Ofcom Defence, Annex D, §38(b); & W/S Franks I, §§39–42.
[864] Ofcom Defence, W/S Franks I, §41.
[865] Ofcom Defence, W/S Franks I, §35.
[866] Ofcom Defence, W/S Franks I, §37.
[867] Ofcom Defence, W/S Franks I, §38.
[868] Three SoI, W/S Hern I, Figure 3.1.

returned to levels that were much more consistent with long-run 'normal' levels.[869] He stated that this analysis did not show support for the EE assertion that the 'boom' in natural resource stocks, in 2009 and 2010, led to an increase in the overall stock market volatility.

3.733 Dr Hern also said that the implied stock market volatility during the GFC for the US market (S&P500) was higher than for the UK market (FTSE100) despite the FTSE 100 having higher exposure to banking and mining stocks.[870]

- *EE's Core Submission*

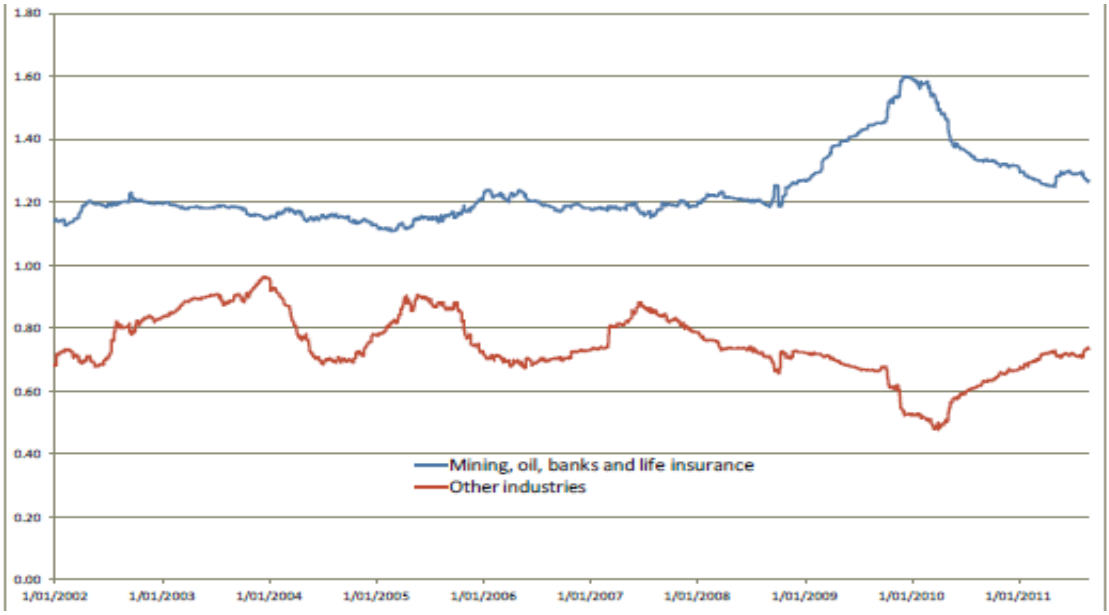
3.734 To demonstrate the effect of mining and banking stocks, Dr Hird presented further evidence that the average path of beta for 'other' (than mining and finance) industries since 2007 was remarkably similar to that of Vodafone's beta and said that the cause of this fall was clearly demonstrated as being the extreme rise in betas for the mining and finance industries.[871,872] So, he said, it was not just Vodafone's beta that was in decline post-2007, rather all industries that were not mining or finance related had, on average, falling betas.[873] Dr Hird's conclusion was that the heightened beta of the mining and banking sectors drove down the average betas for all other industries and that the impact was not restricted to the most intense periods of the crisis, but that it began in 2007 with the initial boom in mining stock valuations and mining betas rising well above 2.[874,875] He said that if it really were reductions in mobile telecommunications risk driving down Vodafone's betas, we would not expect to see almost identical paths in beta for pharmaceuticals, beverages, tobacco or utilities.[876]

3.735 Dr Hird provided a series of graphs to show one-year industry betas over time in a variety of forms: disaggregated (ie ten industry groups separately) as an extension of the Brattle analysis,[877] mining together with oil and gas and life assurance,[878] mining and finance against other (excluding support services and equity investment instruments),[879] and mining and finance versus other as set out in Figure 3.8 below. These all showed a similar pattern to that shown in Figure 3.8.

[869] Three SoI, W/S Hern I, §45.
[870] Three SoI, W/S Hern I, §110.
[871] EE Core Submission, W/S Hird III, Figure 5.
[872] EE Core Submission, W/S Hird III, §54.
[873] EE Core Submission, W/S Hird III, §55.
[874] Relying in particular on EE SoI, W/S Hird III, Figure 8.
[875] EE Core Submission, W/S Hird III, §95.
[876] EE Core Submission, W/S Hird III, §102.
[877] EE Core Submission, W/S Hird III, Figure 8.
[878] EE Core Submission, W/S Hird III, Figure 10.
[879] EE Core Submission, W/S Hird III, Figure 11.

FIGURE 3.8

One-year industry equity betas—mining/finance versus others



Source: W/S Hird III (EE Core Submission), Figure 9.

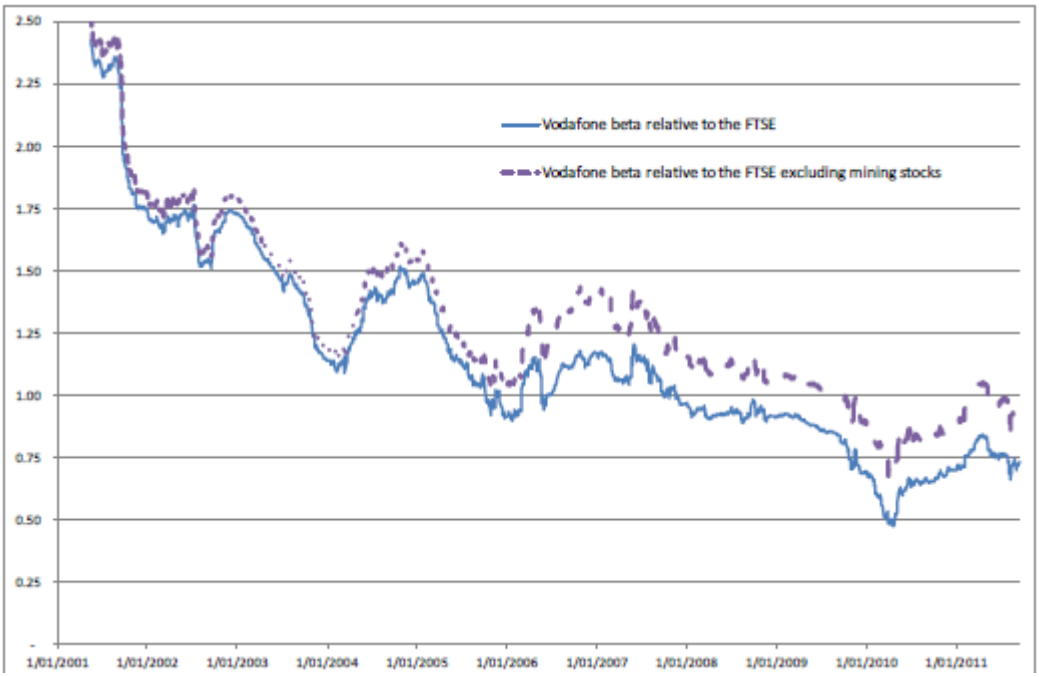
3.736 Dr Hird argued that the impact of mining and banking stocks on market volatility was not the only way in which these sectors could influence measures of Vodafone's beta during the estimation period. His opinion was that had the extreme changes in mining and banking stock valuation that occurred over time been achieved in a very orderly manner, they would not have resulted in heighted market volatility but could still have depressed the measured betas for Vodafone.[880] He said that the impact on market volatility was '… only a part, and probably a small part, of the story'.[881]

3.737 Dr Hird also presented data to show Vodafone's beta measured against the FTSE All Share index and also as measured against the FTSE All Share index excluding mining.[882] He said this showed that prior to 2006 Vodafone's beta was roughly the same regardless of whether it was measured against the FTSE All Share or against the FTSE All Share excluding mining stocks. However, Dr Hird said that post 2006 Vodafone's beta was materially higher if mining was excluded from the FTSE All Share index (see Figure 3.9).[883]

[880] EE Core Submission, W/S Hird III, §72.
[881] EE Core Submission, W/S Hird III, §78.
[882] EE Core Submission, W/S Hird III, Figure 6.
[883] EE Core Submission, W/S Hird III, §81.

FIGURE 3.9

Vodafone one-year beta relative to the FTSE and the FTSE excluding mining stocks



Source: W/S Hird III (EE Core Submission), Figure 6.

- *Additional comments from Ofcom*

3.738 In response to EE's Core Submission, Ofcom said that Dr Hird had originally characterized the impact of increased weight of banking and mining stocks as one of volatility. It considered that the argument was now being presented as one in which, even absent heightened market volatility, a steady increase in mining stock valuations would lift the index which in turn would have a tendency to reduce the beta for all other firms.

3.739 For the following reasons, Ofcom did not agree with the assertion that an increase in banking and mining stock valuations necessarily resulted in a lower beta for all other industries:[884]

(a) Dr Hird had failed to consider that the lower asset beta of mobile phone businesses could be a result of changes in their cost and revenue structures, leading to a perceived reduction in risk.

(b) Dr Hird had not considered the possibility that the betas of mining and banking stocks had increased because the asset betas of telecommunication and utilities stocks had fallen.

(c) Dr Hird had provided no direct evidence to support his assertion that high banking and mining betas caused artificially depressed mobile asset betas.

[884] Ofcom letter to the CC dated 14 October 2011, Annex 2, p6.

- *Assessment—influence of mining and banking stocks*

3.740 EE's initial evidence on this issue placed emphasis on share price movements.[885] We do not find that EE's share price movement evidence demonstrated that mining and banking stocks had increased the risk of the index or depressed the Vodafone beta, as simple graphs of share price movements in themselves tell us nothing about the riskiness of the market portfolio or its component stocks.

3.741 We agree with Professor Franks' comment, for Ofcom, that it is critical to examine the correlation between mining and banking stocks to returns of the rest of the market. Without this, it is unclear whether mining stocks increase or decrease the risk of the market portfolio overall.[886] If, for example, one replaces a highly correlated sector in an index with a sector that has low correlation to the rest of the market, then overall market risk may be reduced as a result of the change in weightings, even if the incoming sector exhibits greater volatility than the outgoing sector.

3.742 In response to Ofcom's Defence, EE emphasized that its argument was not only in relation to increased share price volatility and highlighted again its view that the changes in mining and banking stock betas had depressed the Vodafone beta along with the betas of companies in other industries. EE presented evidence to show the trend in mining and banking stock betas and other industries' betas (see Figure 3.8 above).[887] It also showed that the Vodafone one year beta would be higher if measured against the FTSE excluding mining stocks (Figure 3.9). Whilst Dr Hird's evidence showed an increase in mining and banking betas was contemporaneous with a fall in other industries' betas, we can observe first of all that Dr Hird has not demonstrated causality. We note Ofcom's comments at paragraph 3.739. We are cautious about drawing strong conclusions from these beta movements for the reasons given in paragraph 3.697.

3.743 Dr Hird nevertheless showed that Vodafone's betas for the period post-2006 measured against the FTSE All Share excluding mining stocks were significantly higher than when measured against the FTSE All Share index (see paragraph 3.737). The relevance of these observations turn on the extent to which the effects that Dr Hird highlighted are permanent or temporary and the exact period of time over which the temporary effects occurred.

3.744 We considered the relationship between non-transitory changes in risk and the ERP in paragraph 3.696 above. We stress again here that we would have expected any concerns that EE has about the recognition that Ofcom gave to long-term changes in the riskiness of the market portfolio to have been directed at Ofcom's choice of ERP, not Ofcom's choice of beta. We do not think that Dr Hird's evidence shows that all post-2006 data should be disregarded. In particular, we have not been presented with evidence to suggest how the weight of mining and banking stocks in the index will change over time or that these stocks will have a different effect on the market in the future (in particular how/why they might be expected to revert to the pre-2006 position and why that position should be expected to remain stable).

3.745 Dr Hird's observations about the sharp increase in mining betas and the contemporaneous reduction in the other industries' beta starting in late 2008 (as shown in Figure 3.8) seemed to us to be more directly relevant to the claims in EE's NoA. However, even if there were an argument for excluding a section of 'abnormal' data starting from say late 2008, Figure 3.8 shows that the relevant period ended by

[885] EE NoA, W/S Hird I, Figures 1 & 2.
[886] Ofcom W/S Franks, §35.
[887] EE Core Submission, W/S Hird III, §72.

the time of the beta estimates used in Ofcom's Statement[888] (as the one-year beta for 'other' industries had recovered to around the level of late 2008) and hence Ofcom's one-year beta would appear to be clear of the effect that EE is concerned about. The question in our mind is then whether Ofcom gave appropriate weight to this one-year beta estimate as compared to two- and five-year beta estimates. We consider this matter in paragraphs 3.791 to 3.799 below.

Global financial crisis

- *EE's NoA*

3.746 EE stated that Ofcom's asset beta estimate was based on observations for periods between one and five years, all of which include data affected by the GFC.[889] Dr Hird stated:[890]

> The last three years have been associated with the tail end of a stock market boom, largely led by mining and banking stocks, followed by one of the largest falls in stock market prices in history (precipitated by a financial crisis) and a subsequent sharp rebound … there is no basis for believing that the market conditions affecting the FTSE All Share Index over the period affected by the GFC are representative of the market conditions that investors expect in the future.

3.747 EE did not agree with Ofcom that concerns caused by including in its analysis data from within that period were mitigated by the updating of its analysis to reflect the period from mid-February 2009 to mid-February 2011. It went on:[891]

> In order to control for the distortionary effects on a company's asset beta of a stock market crash, you must therefore control for the distortionary effects of the market rapidly bouncing-back from its lows as well as for the distortionary effects of the initial fall. Neither the dramatic falls of a crash, nor the rapid and dramatic bounce-back in share prices that often follows it, is likely to continue into the future. As a result, once they have played out, Vodafone's asset beta is likely to rise considerably from that estimated over the GFC period.

3.748 EE raised six specific concerns with Ofcom's approach to dealing with data from the GFC.[892] One of these has already been identified (namely that beta and ERP needed to be estimated under the same market conditions)—see paragraph 3.671. The other points raised were:

(a) Ofcom's Statement did not directly address the issue of a company's asset beta being distorted by the market rapidly bouncing back from its lows as well as the initial fall.[893]

(b) Ofcom's attempted comparison of betas from 'pre-crisis', 'mid-crisis' and 'post-crisis' was seriously flawed as it failed to take into account stock market volatility throughout those periods.[894]

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[888] Which were estimated as at 14 February 2011.
[889] EE NoA, §199.
[890] EE NoA, §200; & EE W/S Hird I, §§89 & 90.
[891] EE NoA, §204.
[892] EE NoA, §§205–210.
[893] EE NoA, §205.
[894] EE NoA, §210.

(c) Ofcom should not have used 'up-to-date' but atypical data from a period unlikely to be representative of the period likely to be covered by the charge control.[895]

(d) Ofcom failed to cross-check short-term beta estimates against longer-term betas as the CC did in the Bristol Water case.[896]

(e) Ofcom's explanation for refusing to discount data affected by the GFC (ie that it considered that MCP asset betas had been falling over a longer period) failed to recognize that much of the fall in Vodafone's asset beta since 2004 can be attributed to increases in market gearing.[897,898]

o *Comparison of betas from pre-, mid- and post-crisis*

3.749 Dr Hird described Ofcom's approach as 'superficial'.[899] He went on to say that Ofcom's finding that the post-crisis beta of 0.5 was lower than mid- and pre-crisis beta was flawed. He also said that as a result, Ofcom was wrong to conclude that concerns (expressed by certain MNOs) that the GFC created downward bias on beta were unfounded. [900] Dr Hird said that this was inconsistent with the rolling one-year beta estimate which showed that beta fell until March 2010 and only stopped falling when data from March 2009 (the lowest point on the world stock markets) was omitted from the one-year rolling average.[901] He presented a different view of the pre-, post- and mid-crisis time frames, with the crisis period being between October 2008 and November 2010. This gave a higher post-crisis beta than mid-crisis beta. Dr Hird said that his time frame definitions were 'somewhat arbitrary', but considered them to be less arbitrary than Ofcom's definitions.[902]

o *Up-to-date but atypical data*

3.750 Dr Hird argued in favour of a long period of estimation.[903] He accepted that there was a constraint on using long-term data if the underlying/'typical' beta was likely to have changed over time. If this was the case, there was a trade-off to be made between recent estimation and longer-term data. He argued that there was no basis for preferring recent estimation if the period was clearly atypical. If the 'typical' beta was known to have changed recently, there was no reason to believe that it would be accurately estimated using a measurement period of atypical market activity: ie even if there were a slight decline in beta, there was no need to overestimate that decline by using data from atypical and distortionary time of GFC.

o *Cross-checks against longer-term data*

3.751 Dr Hird said that in Bristol Water the CC had looked at a ten-year period as well as the most recent two years before concluding on the relevant asset beta.[904] He argued that if Ofcom had adopted a similar approach for its Statement, then it would have seen a material fall in Vodafone's beta post-October 2008. The average beta from

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[895] EE NoA, §207.
[896] EE NoA, §208.
[897] EE NoA, §209.
[898] See paragraph 3.706.
[899] EE NoA, W/S Hird I, §110.
[900] EE NoA, W/S Hird I, §§110 & 111.
[901] EE NoA, W/S Hird I, §§110 & 111.
[902] EE NoA, W/S Hird I, §§113–115.
[903] EE NoA, W/S Hird I, §§95 & 96.
[904] EE NoA, W/S Hird I, §§102–107.

March 2004 to March 2011 was 0.83 (compared with Ofcom's 0.56)—from March 2000 to March 2011 the average beta was 1.15.[905]

- *Ofcom's Defence*

3.752 Ofcom rejected EE's allegation that it had failed adequately to take into account that Vodafone's short-term betas were significantly lower as a result of the GFC and were likely to increase considerably over the Price Control period.[906]

o *The need to control for the distorting effect of the stock market bounce-back*

3.753 Ofcom commented that it had addressed, in its Statement, the need to control for this effect. Its Defence against this allegation is covered in paragraph 3.755 below.

o *Flawed comparison of pre-, mid- and post-crisis betas*

3.754 Ofcom considered that the one-year beta was measured over a period which was not subject to higher-than-average market volatility. Ofcom considered that the five-year beta provided a relatively long-run view of the beta, which should also mitigate the risk of a two-year beta being artificially depressed by the GFC. Ofcom took both of these beta estimates into account in its range.[907]

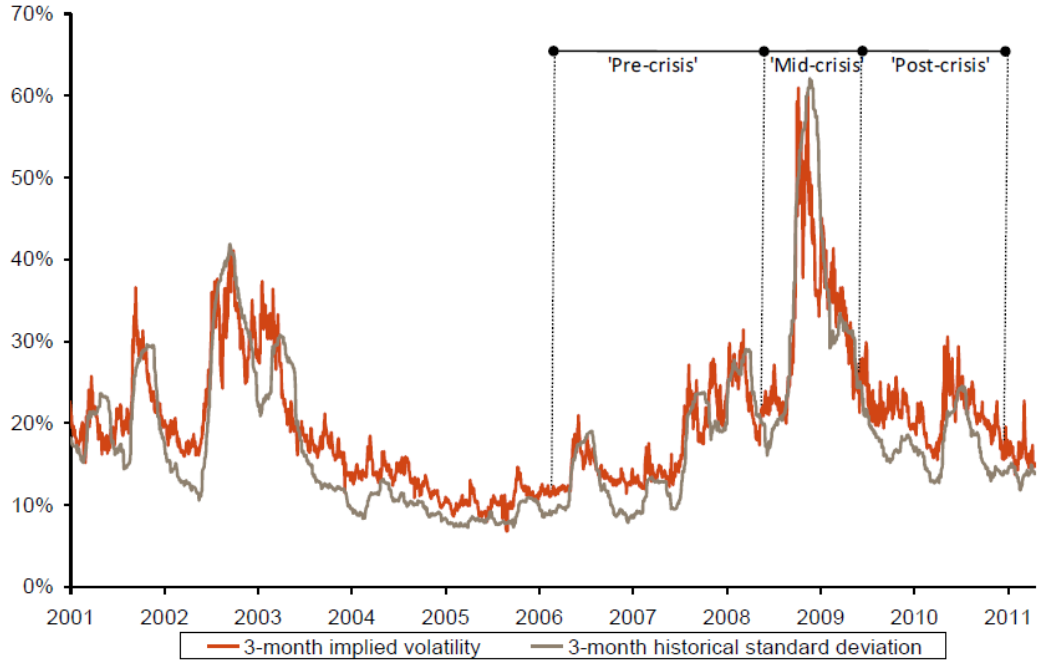
3.755 Ofcom said that its own evidence showed that, following the period which Ofcom termed 'mid-crisis', volatility significantly declined to a level similar to the 'pre-crisis' period.[908] It concluded that there was no evidence of continued distortionary effects as a result of the market bounce-back in this period.

3.756 Ofcom provided a graph which showed the three-month implied volatility and the three-month historical volatility for the FTSE All Share Index, overlaid on the three disaggregated time periods which it used to cross-check its beta estimate (see Figure 3.10). Ofcom considered that its one-year 'mid-crisis' period was broadly consistent with the period which the CC described as exhibiting 'a period of market return volatility' between 8 September 2008 and 1 May 2009 in the Bristol Water determination. It said that the CC also had regard to the FTSE All Share index and noted that a sharp fall in the FTSE due to the GFC started in August 2008 and a period of recovery began in March 2009. Therefore Ofcom's 'mid-crisis' period, which captured this period of increased volatility, appeared reasonable, and included the initial stages of the recovery.[909]

[905] EE NoA, W/S Hird I, §106.
[906] Ofcom Defence, Annex D, §54.
[907] Ofcom Defence, Annex D, §56.
[908] Ofcom Defence, Annex D, §65.
[909] Ofcom Defence, Annex D, §67.

FIGURE 3.10

Historical and implied volatility FTSE All Share 2001 to 2011



Source: Ofcom Defence, Figure D2.

3.757 It submitted that its use of a range of beta estimates and its disaggregation of the GFC period based on market volatility provided sufficient data to make a reasonable cross-check of Vodafone's asset beta to ensure that it was not unduly biased by the GFC.[910]

o *Ofcom should not have used up-to-date but atypical data*

3.758 Ofcom said that the implication that it was prepared to look only at recent data was wrong and that it had taken into account a longer-term (five-year) beta estimate of 0.61 which formed the top end of its range of estimates. Further, Ofcom said that whilst it placed most weight on the two-year estimate, it did not accept that the period covered by this data was atypical: as the cross-checks performed did not suggest that the two-year beta gave an inappropriate value.[911]

3.759 In addition, whilst EE described the measurement period as atypical, Ofcom submitted that periods of volatility were an integral part of financial markets and to ignore these periods completely would result in similarly distortive beta estimates.[912]

o *Ofcom failed to follow the approach of the CC in Bristol Water*

3.760 Ofcom said that it had not erred by failing to carry out a ten-year cross-check as the CC did in the Bristol Water case. Ofcom stated that the water industry was significantly different in nature from the mobile telecommunications industry so that a ten-year period would be inappropriate for assessing the beta of a UK MCP.[913,914]

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[910] Ofcom Defence, Annex D, §60.
[911] Ofcom Defence, Annex D, §73.
[912] Ofcom Defence, Annex D, §74.
[913] Ofcom Defence, Annex D, §76.

3.761 Ofcom also said that estimating a beta for UK MCPs over a ten-year period would not give a reliable estimate for the period of this charge control because the industry had changed significantly over this (ten-year) period due to:

(a) the pace of technology change;

(b) significant decline in prices over the period;

(c) a change in pricing structures (movement away from usage-based charges) and contract terms, which may give rise to materially lower systematic risk; and

(d) changes in the nature of mobile telecommunications usage which may result in significantly different demand characteristics.[915]

3.762 Ofcom also said that including a longer-term estimate of beta would have included the dramatic increase in the beta in 2000 to 2002 and the telecommunications bubble —it said it was arguable that a ten-year beta would include 'atypical conditions'.[916]

3.763 Ofcom said that its two-year beta estimate was 0.50, whereas it selected the mid-point of its range of beta estimates, 0.56, as its point estimate. The use of these cross-checks and alternative beta ranges therefore did slightly increase Ofcom's beta estimate from the figure that Ofcom would have arrived at had it simply adopted a two-year estimate.[917]

o *Ofcom failed to recognize effect of increase in market gearing*

3.764 The Defence of Ofcom on this point is dealt with in paragraphs 3.707 to 3.709 above.

- *Three's SoI in support of Ofcom*

3.765 Dr Hern, for Three, agreed[918] that the severity of the GFC might be regarded as exceptional but said it was far from clear that it was a one-off event. He stated that downside risks to the UK and world economies could lead to a recurrence of increased volatility in the near future.

3.766 A cursory examination of Vodafone's share price around the period of the GFC in mid-2008 showed, he said, that Vodafone's share price fell by around 43 per cent; by comparison, the FTSE fell by 50 per cent over the same period.[919] This suggested to Dr Hern that Vodafone Group as a whole might have been affected to a similar degree by the GFC as the overall stock market. He said that it was not obvious that heightened volatility alone would have lowered the beta substantially.

3.767 Dr Hern said that Ofcom's approach of considering a range of measurement periods from one year to five years was generally consistent with regulatory best practice. It stated that the five-year period over which Ofcom calculated beta exhibited (on average) a level of volatility which was consistent with long-term averages.[920,921]

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[914] Ofcom Defence, Annex D, §§77–79.
[915] Ofcom Defence, Annex D, §80.
[916] Ofcom Defence, Annex D, §82.
[917] Ofcom Defence, Annex D, §60.
[918] Three SoI, W/S Hern I, §46.
[919] Three SoI, W/S Hern I, §48.
[920] Three SoI, W/S Hern I, §51.
[921] It said that the average volatility over the five-year period was 18 per cent compared with 19 per cent for the 20-year period (since 1992).

Three said that there was no evidence to substantiate EE's claim that Ofcom had focused on a very atypical period.[922]

3.768 Dr Hern stated that he did not agree with EE's pre-crisis assessment period as it included the bankruptcy of Lehman Brothers and the US Government takeover of AIG.[923] He considered that his analysis showed that EE's findings were flawed even if its definition of the three periods was used.

3.769 Dr Hern presented a slightly different view of the Vodafone asset beta over the pre-crisis and post-crisis periods as he defined them. He used a six-month rather than one-year beta in order to make the relationship between betas across periods weaker and so he was able to use more up-to-date post-crisis data.[924] He also calculated asset betas for Telefónica and Telenor across the same periods.

3.770 Dr Hern considered that Vodafone's beta had been falling possibly for the reasons set out in paragraphs 3.827 to 3.830. He said that the reduction in the beta during the crisis might have been due to the changing structure of Vodafone's earnings over time, and the resulting trend reduction in its beta, rather than having been due to the impact of the crisis itself.[925]

3.771 Dr Hern stated that in the period post-crisis his analysis indicated that Vodafone's beta had remained relatively stable at 0.57, whereas Dr Hird had found that the beta rose to 0.74. Dr Hern felt that this contradiction arose as his study used a more up-to-date data set. Given his finding, he said that Dr Hird's finding that there was a material increase in the beta after the GFC did not therefore support the conclusion that betas estimated during the crisis were downward biased.[926]

3.772 Dr Hern also said that the betas of Telefónica and Telenor had remained relatively stable before, during and after the crisis.[927] He saw this as evidence of no downward movement in the betas of these comparator mobile operators during the GFC, which he said seemed to contradict Dr Hird's hypothesis of a systematic downward bias over this period.

3.773 To test the robustness of his finding that there was no evidence to suggest that the GFC created a downward bias in beta estimates for mobile operators, Dr Hern undertook two types of statistical analysis. He looked at:

(a) OLS regression with a dummy variable for the crisis to test whether the average betas statistically significantly changed during and after the crisis;[928] and

(b) other statistical properties (expected impact of random shocks on the level of estimated betas and the dependence of estimated betas on the beats observed in the past) using autoregressive moving average (ARMA) models.[929]

3.774 Dr Hern's OLS regression analysis found no statistical evidence that the trend reduction in Vodafone's beta was significantly faster or slower during the crisis when compared with the period beforehand.[930] Similarly for Telefónica he found no evidence of a different trend change in its beta during the crisis when compared with the period

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[922] Three SoI, W/S Hern I, §51.
[923] Three SoI, W/S Hern, §84.
[924] Three SoI, W/S Hern, §85 & fn 40.
[925] Three SoI, W/S Hern, §86.
[926] Three SoI, W/S Hern, §§86–88.
[927] Three SoI, W/S Hern, §89.
[928] Three SoI, W/S Hern, §145.
[929] Three SoI, W/S Hern, §93.
[930] Three SoI, W/S Hern, §§91 & 92.

beforehand. Dr Hern said that these results provided further support to the conclusion that the crisis had no impact on the trend rates of change in mobile operators' betas. Moreover, he found a statistically significant increase in the trend growth rate of Telenor's beta during the financial crisis. If the crisis had caused a downward bias in mobile operators' betas, he would have expected to have observed the opposite effect.

3.775 Dr Hern's ARMA analysis found that for all companies, the betas exhibited different statistical properties in the post-crisis period when compared with the pre-crisis period.[931] He said that while this finding did not necessarily mean that betas were significantly higher or lower after the crisis than before the crisis, it did illustrate that the behaviour of companies' betas were changing over time. To obtain robust beta estimates, he therefore considered it preferable to use the most up-to-date data available and not just data from before the crisis as Dr Hird advocated.

3.776 Dr Hern's overall conclusion on the effect of the GFC was that his analysis showed that the reduction in Vodafone's beta that occurred during it was the continuation of a trend that began several years earlier, driven by the changing structure and risk profile of the companies' earnings.[932] He argued, consequently, that the observation that Vodafone's beta was lower during the crisis than before could not be attributed reliably to the impact of the crisis itself. Moreover, he found no evidence that Vodafone's beta increased significantly once the financial crisis came to an end.

3.777 He went on to state that he had found no evidence that the crisis had a negative impact on the betas of Telefónica and Telenor.[933] Dr Hern said that when he compared the period before the financial crisis to the period during the crisis, his statistical analysis showed no indication of a significant change in the trend growth rates of the three firms' betas.[934]

3.778 However, Dr Hern added that his analysis had shown statistically significant evidence that some statistical properties of the estimated betas for the three comparators had changed over time.[935] He considered that this evidence, supported by his finding that the crisis had no impact on betas, supported the use of the most up-to-date data available to obtain robust beta estimates for mobile telecommunications operators.

- *Assessment—global financial crisis*

3.779 EE argued that Ofcom failed to take into account the fact that Vodafone's short-term betas would be significantly and temporarily lower as a result of the exceptional events associated with the GFC. In addition to arguing that beta and ERP must be considered over periods of similar market conditions (which we will consider overall in paragraphs 3.791 to 3.799 below), it raised five specific issues which we consider below.

o *The need to control for the distorting effect of the stock market bounce back*

3.780 EE argued that Ofcom failed to recognize that the period in which there was a post-crisis bounce-back in share prices was as atypical as the period in which share prices fell. However, Ofcom has shown that its post-crisis period started when the market had reached 'normal' levels of volatility (see Figure 3.10). This suggests that

[931] Three SoI, W/S Hern, §94.
[932] Three SoI, W/S Hern, §95.
[933] Three SoI, W/S Hern, §95.
[934] Three SoI, W/S Hern, §96.
[935] Three SoI, W/S Hern, §97.

the stock market bounce-back did not cause atypical increases in market volatility or market risk in this period. We therefore agree with Ofcom that there is no evidence of continued distortionary effects as a result of the stock market bounce back in its post-crisis period; in our view, EE has not provided this evidence. We consider Ofcom's assessment of the beta in its post-crisis period in paragraphs 3.782 and 3.784 below.

o *Flawed comparison of pre-, mid- and post-crisis betas*

3.781 We were presented with different views of the 'post-crisis' time frame and resulting 'pre-crisis', 'mid-crisis' and 'post-crisis' betas. This segmentation is key to the evaluation of whether the mid-crisis beta was temporarily and abnormally low. It is clear that there are difficulties in determining the appropriate time frames of each period. EE considered the time frames selected by Ofcom arbitrary and proposed alternatives. It started its crisis period later than Ofcom (October 2008 rather than June 2008, although did not explain why) and continued it to November 2010 (when the FTSE All Share first regained 3,000 points) to allow for some recovery. However, Ofcom and Three noted that the pre-crisis period used by EE included the Lehman Brothers bankruptcy and the US Government bailout of AIG. This seems to be a valid criticism of EE's selected time frames, although we agree with EE that there is some inevitable arbitrariness and recognize that drawing firm lines is likely to create anomalies.

3.782 Ofcom found its post-crisis beta to be lower than its pre- or mid-crisis betas, while EE found its post-crisis beta to be higher than its mid-crisis beta but lower than its pre-crisis beta. Three found its post-crisis beta to be in line with its mid-crisis beta (marginally higher) and lower than its pre-crisis beta.

3.783 The difference in these findings is due to EE and Three using different time frames for the three crisis periods than those used by Ofcom,[936] and EE and Three having the benefit of more data than Ofcom (and Three had more data than EE), because they performed their analysis more recently.

3.784 We note the OLS regression analysis provided by Three which supported the view that the crisis had no impact on the rate of change in MNOs' betas. Ofcom's Defence, for its part, showed its three periods superimposed on a volatility chart (Figure 3.10).[937] This showed that Ofcom's mid-crisis period mapped the peak in volatility and that Ofcom's post-crisis period reflected a period when volatility had returned to pre-crisis levels. This is supportive of the periods selected by Ofcom. EE has not demonstrated that Ofcom's pre-, mid- and post-crisis periods were inappropriate periods to use in its analysis or that its definitions were superior.

o *Ofcom should not have used up-to-date but atypical data*

3.785 We do not accept EE's argument that Ofcom erred by using a beta that was estimated from atypical market conditions. Ofcom has looked at one-year, 18-month, two-year and five-year betas. EE has not persuaded us that these betas are uninformative or that Ofcom's process of using these beta measurements to estimate beta is wrong.

3.786 We are persuaded, instead, by the evidence presented by Ofcom and Three suggesting that the time period considered by Ofcom was not wholly atypical. Among

[936] Three SoI, W/S Dr Hern, §51, stated that he did not agree with EE's pre-crisis assessment period but he used the same time periods in order to demonstrate that even on this basis, their findings were flawed.
[937] Ofcom Defence, Annex D, §64.

this evidence, we note in particular that the average volatility over the five-year period was consistent with long-term averages and Three highlighted that periods of high volatility are not necessarily atypical and that 'it was far from clear it [the GFC] was a one off event'(see paragraph 3.765). Indeed, we agree with Ofcom (see paragraph 3.759) that to ignore periods of volatility completely could have a distortive effect. Investors' forward-looking expectations may well have been influenced by the events of the GFC.

- *Ofcom failed to follow the approach of the CC in Bristol Water*

3.787 We agree with Ofcom that there are significant differences in terms of stability between the water supply and mobile telephony industries, with the result that a ten-year period may not reliably estimate the beta for an industry subject to the changes as set out in paragraph 3.761. We are persuaded by Ofcom's arguments for placing more weight on recent data, for example because mobiles are an evolving industry.

3.788 We note that EE itself accepts that there is a constraint on using long-term data if the underlying beta has changed over time (subject to its views on atypical data). As Ofcom had sound reasons to believe that beta has changed over the last ten years, then an approach as used in Bristol Water would not be appropriate.

- *Ofcom failed to recognize the effect of the increase in market gearing*

3.789 We have considered this alleged error in paragraphs 3.718 to 3.721 above.

3.790 Overall, EE has not demonstrated that the equity beta used by Ofcom placed undue weight on beta estimates that were depressed as a result of the GFC. In our view, Ofcom looked at beta estimates from a range of time periods, it considered whether the GFC had affected its estimates and made a judgement on the appropriate input to its cost of capital calculation which has not been demonstrated to be incorrect.

Assessment of the arguments relating to forward-looking estimates and the relationship between beta and ERP

3.791 EE argued that three factors depressed estimates of Vodafone's beta during Ofcom's estimation period.[938] These were:

(a) there was a heightened level of market risk during the GFC;

(b) there was a heightened level of market gearing in the lead up to and during the GFC; and

(c) in the lead up to and during the GFC, the FTSE All Share index was disproportionately and atypically driven by unusually strong movements in banking and mining stocks.

3.792 As set out above, we accept in principle that there could be an issue if beta were assessed from an anomalous period which was not representative of future market conditions. EE's arguments lead us to consider whether the beta assessed by Ofcom was inconsistent with a 5 per cent ERP. Because Ofcom increased its estimate of the ERP to reflect its view of investor expectations, we are therefore considering an ERP

[938] EE Core Submission, W/S Hird III, §6.

consistent with normal to slightly elevated expectations of required returns across the market.

3.793 EE has pointed to unusually increased market gearing, the GFC and the increase in, and volatility of, mining stocks as well as the volatility of banking stocks as reasons to dismiss recent beta estimates on the grounds of inconsistency in estimation. However, EE has not satisfied us that all of the empirical evidence used by Ofcom was atypical as a result of these market conditions.

3.794 We agree with Ofcom that the very unusual market conditions in respect of each of market gearing, market volatility and volatility of mining and banking stocks were transitory and short-lived. We note, in particular, that EE's arguments point to effects that have since reversed by no later than February/March 2010. This means that in factoring a one-year beta into its analysis, Ofcom has included a beta estimate that is unaffected by the market changes/distortions.

3.795 We also do not think that it is right that periods of volatility should be disregarded in their entirety. The reaction of stocks to unusual events may provide useful information to investors and influence their forward-looking expectations of returns.

3.796 Dr Hird's proposal to drop the whole period from mid-2008 (see paragraph 3.675) from the regression is excessive. To our minds the whole period cannot be considered anomalous. We agree with Ofcom that the 18-month, two-year and five-year betas provide useful information given that Ofcom could not be certain that to some degree the unusual conditions would not reappear over the period of the Price Control.

3.797 Estimating a forward-looking beta is not straightforward, there is no prescribed method and a range of factors need to be considered. Judgement is required in interpreting betas as decisions need to be made, for example, regarding the length of time frame to consider, the balance between placing weight on more recent and longer-term data, and factors that may be affecting the underlying data.

3.798 Ofcom has had to balance the merits of longer-term data against those of more recent data and it is our conclusion that it struck an appropriate balance. Ofcom has estimated forward-looking beta and ERP taking account a range of relevant data. Beta and ERP are typically estimated based on different time periods and this has the potential to cause difficulties in times of change. However, Ofcom has had regard to these factors, and we do not consider that EE has shown that Ofcom's judgement was incorrect.

3.799 We therefore find that Ofcom demonstrated in its Statement that it properly considered how to balance longer- and shorter-term estimates of beta and that it had properly considered the effect of the abnormal circumstances EE outlined. In doing so, Ofcom also adjusted its ERP assumption from the 2007 Statement to reflect an increase in expected returns across the market. As EE has not persuaded us that Ofcom assessed the beta from an atypical period, or that it has been inconsistent in its estimation of the beta and ERP, we conclude that Ofcom did not commit the errors that EE claimed.

3.800 In response to our Provisional Determination, EE reiterated its view that in the context of advice provided elsewhere Professor Franks had argued for the exclusion of periods of crisis from beta estimation and that Dr Hern had argued for a high ERP

to be adopted where a below historical average beta was adopted.[939] EE invited us to address this evidence. We make the following points:

(a) EE accept that Professor Franks' terms of reference did not require him to comment on the appropriate periods to estimate beta in this Appeal and so consider that his evidence is not inconsistent. We have considered EE's arguments concerning exclusion of a period of financial crisis above. The relevance of Professor Franks arguing for exclusion of the 1987 stock market crash in another case is not clear.

(b) With regard to Dr Hern's evidence to Ofgem, it is not clear that Dr Hird is comparing like for like. Dr Hird cites a fall in asset beta from 0.41 (five-year beta) to 0.32 (two-year beta) and considers that Dr Hern would apply an ERP of 9.6 per cent to the 0.32 estimate and 5.2 per cent to the 0.42 estimate. There are two points to note:

(i) The slide Dr Hird refers to combined 0.42 with 5.2 per cent ERP and market return of 7.2 per cent and combined the 0.32 with an ERP of 8.2 per cent and market return of 9.6 per cent that it to say that Dr Hird made reference to the wrong figure, which overstates his case.

(ii) In this case Ofcom did not use either a five-year beta, or a two-year beta, rather it assessed a forward-looking beta on the basis of evidence from a range of periods (see paragraph 3.643). It is therefore not clear that Dr Hern's presentation to Ofgem which uses a more binary approach to beta estimation is directly relevant. We have considered Ofcom's approach to balancing ERP and beta estimation, as appealed in this case, above.

Ofcom's reasons for believing MNO risk was declining were flawed

3.801 This section is split between EE's arguments that Vodafone is a poor proxy for UK MNOs and its arguments that Ofcom was wrong to believe that there were systematic risk reasons for the decline in beta.

3.802 As noted in paragraph 3.630, we consider all EE's arguments regarding Vodafone's overseas business in this section (as opposed to assessing it in two places as in the NoA).

Vodafone is a poor proxy for UK MNOs

- *EE's NoA*

3.803 EE stated that: '… asset betas for other MCPs are considerably higher than those for Vodafone which suggests that Ofcom's estimation has been distorted by factors that do not apply equally to other MCPs'.[940]

3.804 EE went on to argue that the greater the extent to which the share price of a UK company was affected by events in foreign markets, the lower its correlation with the FTSE was likely to be.[941] It said that, other things being equal, the beta of a company

[939] EE response to PD, Annex A §§29–31.
[940] EE NoA, §§211 & 212.
[941] EE NoA, §213; & EE NoA, W/S Hird I, §161.

was likely to decline over time as the proportion of its overseas business increased.[942]

3.805 It said that Vodafone's LSE share price movements were driven to a considerable extent by factors other than the riskiness of its UK mobile business: a large and increasing proportion of Vodafone's business was in markets that were *(a)* overseas; and/or *(b)* non-mobile. Indeed, EE described Vodafone's overseas business as being the 'overwhelming majority' of its total—over 98 per cent.[943]

3.806 EE provided evidence to show that the average 'adjusted profit' and EBITDA reported for Vodafone's UK operations as a percentage of global operations 'fell dramatically' between 2001/02 and 2009/10.[944] Nowhere, claimed EE, had Ofcom acknowledged or attempted to control for this effect.[945] It argued that the more movements in Vodafone's share price were driven by factors other than its UK mobile business, the less weight should be placed on Vodafone's observed betas.

3.807 EE added that Vodafone had recently been acquiring fixed network assets in a number of countries,[946] and that companies operating fixed services tended to have lower asset beta.[947] As a result, it considered that one might expect this to have lowered Vodafone's measured asset beta over time.[948]

- *Ofcom's Defence*

3.808 By way of a general point, before responding to EE's allegations, Ofcom asserted[949] that, as there was no means of directly observing the beta of a pure-play UK MCP, '… Ofcom is required to use its judgment as an expert regulator to reach an estimate based on the evidence available'.

3.809 Ofcom submitted that its use of the Vodafone Group as a proxy for a UK MCP was reasonable and that no error had been shown by EE.[950]

3.810 Ofcom claimed that the use of Vodafone as a proxy for estimating the beta of a UK MCP had the following merits:

(a) it was a UK-listed company;

(b) its investors, while global, were likely to include a high proportion of UK investors;

(c) its business was more than 90 per cent mobile; and

(d) it had large exposure to mature European and US mobile markets, both of which were likely to exhibit similar risk characteristics to the UK market.[951]

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[942] EE NoA, §191.
[943] EE NoA, §192.
[944] EE NoA, §§201–218.
[945] EE NoA, §192.
[946] Raising the share of fixed revenues in total revenues from around 4 per cent in 2006 to over 8 per cent in 2010.
[947] EE NoA, §217.
[948] EE NoA, W/S Hird I, §163.
[949] Ofcom Defence, Annex D, §92.
[950] Ofcom Defence, Annex D, §97.
[951] Ofcom Defence, Annex D, §93.

- *Vodafone's non-UK business*

3.811 Ofcom expected that Vodafone's UK business sat somewhere at the middle to lower end of the systematic risk spectrum of its assets (implying that the Vodafone beta would tend to overstate the UK MNO beta).[952] Ofcom accepted that movements in Vodafone's share price would not be solely attributable to its UK business and so, in recognition of this and of the fact that Vodafone had access to international markets and was able to raise finance globally, Ofcom also considered Vodafone against the FTSE All-World index. It found that Vodafone's beta against the All-World was lower than its beta against the UK-based FTSE All-Share index. Ofcom stated that it erred on the side of caution and used the Vodafone beta measured against the FTSE All-Share index in its estimation of the WACC.[953]

3.812 Ofcom did not dispute that the UK business of Vodafone was a relatively small part of the Vodafone Group but it disputed EE's calculation of that part for 2011. It said that Vodafone's UK business contributed 11.9 per cent of group revenue in the year to March 2003 and that in the year to March 2011 the same business had contributed 11.5 per cent of group revenue.[954] On this basis, Ofcom did not consider the observed fall in Vodafone beta over time to be attributable to its overseas business making up an increasing proportion of its revenues.[955]

- *EE's Core Submission*

3.813 In its Core Submission, EE argued that Ofcom's focus in its Defence on revenues was 'obviously misplaced' as the purpose of EE's comparison (ie of EBITDA and adjusted operating profit over time) was to determine the importance of the contribution of Vodafone's UK business to the Vodafone Group's profits. EE explained:[956] 'This is because it is profits, and the expectations of profits, that determine movements in Vodafone's stock price and beta—not revenues.'

3.814 Dr Hird argued that it was unsurprising that the UK operations of Vodafone had a higher share of revenues than profits, given that the UK was a relatively high-cost country to operate in. He also said that Ofcom's assessment of the change in UK revenues as a percentage of total Vodafone revenues over time was highly sensitive to its choice of the 2002/03 base year for the comparison, highlighting that the 2002/03 year chosen by Ofcom was a low point in the ratio for the early part of the last decade.[957]

- *Assessment—Vodafone as proxy for UK MNOs*

3.815 In the absence of a UK pure-play MCP (possibly voice only), Ofcom inevitably had to make use of comparators that exhibit similar, but different, risk profiles. In using the Vodafone beta Ofcom needed to be aware that a significant proportion of Vodafone's business was overseas. This is not disputed by the parties. However, EE considered that the relative size of Vodafone's UK operations had fallen over time and that therefore less weight should be placed on the Vodafone beta now than in the past.

3.816 EE argued in particular that, other things being equal, the beta of a company was likely to decline over time as a proportion of its overseas business increased. For a

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[952] Ofcom Defence, Annex D, §95.
[953] Ofcom Defence, Annex D, §96.
[954] Ofcom Defence, Annex D, §45.
[955] Ofcom Defence, Annex D, §46.
[956] EE Core Submission, §206.
[957] EE Core Submission, W/S Hird III, §40.

company with overseas business, the correlation of its share price with the FTSE will depend on how those overseas parts of its business/overseas markets are correlated with the FTSE. We have not been presented with evidence to show how the riskiness of Vodafone's overseas business compares with that of other firms trading on the FTSE nor any showing how returns from overseas markets are correlated with the UK market. It is not therefore obvious to us a priori that an increasing proportion of business done overseas results in a decline in beta.

3.817 We recognize the point made by EE that in selecting 2003 as the base year for comparison Ofcom chose a point at which the ratio of Vodafone's UK to non-UK revenue was historically low. We also note that investors and analysts look at both revenues and profit measures as indicators of the value the underlying business. On the basis of the EBITDA and adjusted profit information presented by EE, the proportion of overseas business has increased since 2007. In 2007, Ofcom noted caution in using Vodafone's beta given the scale of Vodafone's overseas operations; EE has some justification for arguing that this need for concern has increased. However, for the reasons set out above (in paragraph 3.816), what matters is whether the overseas markets in which Vodafone operates are more or less risky than the UK market.

3.818 Ofcom argued (in paragraph 3.810*(d)*) that the US and European markets are similar. We see factors pointing in different directions. The nature of the overseas businesses that Vodafone has invested in are certainly different from that of a UK MNO. Whilst EE noted that some of the investments are in fixed line businesses which it would expect to have a lower beta, investments are also being made in less mature markets than the UK, which may present higher risk. In the absence of any further quantitative evidence of the betas of different types of telecommunications operation, we cannot support EE's assertion that Ofcom erred simply because Vodafone's exposure to overseas investment increased.

3.819 We note that Ofcom's assessment of the Vodafone beta against the FTSE All-World index did not suggest that the Vodafone beta was understated as a result of being calculated against the FTSE All-Share. Ofcom used the beta measured against the FTSE All-Share as it was the higher measure.

3.820 As there are no pure-play UK-only MNOs, Ofcom ultimately had to make a judgement. Whilst the proportion of overseas business may have increased (dependent on the measure used), given the fact that the effect of the overseas business on beta is uncertain and given that Ofcom checked its estimate against other comparators and the FTSE All-World, we do not consider that EE has demonstrated that Ofcom's approach was wrong. It is not clear that a better method would be to place more weight on US/overseas comparators which operate entirely in a different market as EE has by implication argued.[958]

Other reasons for the decline in beta

- *EE's NoA*

3.821 EE said that Ofcom's Statement referred to analysis which Ofcom said showed a steady decline in Vodafone's two-year equity beta since at least 2004. It said that Ofcom inferred from this that absolute levels of underlying risk in UK MCPs had fallen over that period.[959] EE said that the reasons given by Brattle (advisers to Ofcom) for the fall in equity betas of Vodafone, Telefónica, France Telecom and Deutsche

[958] EE argued that less weight should be placed on Vodafone's beta. Ofcom used overseas comparators as a check.
[959] EE NoA, §178.

Telecom (ie that they might be reflecting actual reductions in absolute perceptions of risk for those companies) were not convincing. It said that the reasons given by Brattle were that investors perceived risk of the companies had reduced as:

(a) '… now consider all four of these companies more like traditional utilities than in the past'; and

(b) that mobile operators' major capex programmes had been completed.

3.822 Dr Hird said that MNOs were not natural monopolies like energy, gas, water and fixed-line utilities. He said that MNOs must compete for customers and faced higher risk as a result. Dr Hird also noted that three of the cited companies were predominantly fixed-line companies.[960] Dr Hird said that even if investors did perceive the fixed-line elements of Telefónica, France Telecom and Deutsche Telecom as more like 'utilities', this did not imply that the benchmark MNO beta should be lower.[961]

3.823 Dr Hird disagreed with the view that the end of major capex programmes lowered MNO risks. He argued that by 2007, when Ofcom last determined an MNO asset beta of 1.2, MNOs had already built their networks. While there was continual investment in those networks, he said that there was no evidence that he was aware of, and none provided by Brattle, that since 2007 there had been a dramatic reduction in capital investment by these companies. Dr Hird argued that more reasonable explanations for the decline in beta were the events associated with the GFC and the general rise in market gearing.[962]

- *Ofcom's Defence*

3.824 Professor Franks said that the asset beta used in the MCT charge controls in 2004 and 2007 was 1.2,[963] compared with an asset beta of 0.56 for 2011. He said that the asset beta of the average company (with assumed market gearing of 20 per cent) would be about 0.8 and that the asset beta used in 2004 and 2007 Price Controls was therefore about 50 per cent higher than that for the average company that made up the index.

3.825 Whilst Ofcom used an asset beta of 1.2 in both the 2004 and 2007 Price Controls, Professor Franks understood that Ofcom believed there was evidence that the decline in Vodafone's asset beta started prior to the 2007 Price Control; but that the decline was recent enough in 2007 for Ofcom to have considered it appropriate at that time to use the same beta range as in the 2004 Price Control.[964]

3.826 Professor Franks said that it was significant that Vodafone's two-year equity beta was lower in March 2007 than in June 2004—1.1 compared with 1.5. The estimated asset beta was also lower—0.9 compared with 1.3. He said that the betas based upon one-year daily data gave a less pronounced picture. The equity beta was slightly lower in 2007 (1.2 compared with 1.25 in 2004) and the asset beta was lower (0.9 compared with 1.1). In both cases, the asset beta is estimated to have fallen between the 2004 and 2007 Price Controls—in one case by 0.4 and in another case by 0.2—depending upon the way the equity beta was measured. Thus, Professor Franks considered that there was some evidence, although not overwhelming, that

[960] EE NoA, W/S Hird I, §99.
[961] EE NoA, W/S Hird I, §§97 & 98.
[962] EE NoA, W/S Hird I, §100.
[963] In 2007 it was 1.16 pre-rounding.
[964] Ofcom Defence, W/S Franks I, §47.

the asset beta had indeed fallen prior to the 2007 Price Control being set by Ofcom.[965]

- *Three's SoI in support of Ofcom*

3.827 Dr Hern, for Three, said that it would not be appropriate to use a longer historical time series of data to estimate a beta for MNOs as there were good reasons why mobile services had become significantly less risky in recent years.[966] These reasons were summarized as:[967]

(a) a steady trend away from (more risky) prepaid customers towards less risky postpaid customers;

(b) a steady trend towards longer contract lengths; and

(c) a steady fall in the price of basket(s) of mobile voice minutes leading to reduced price and income elasticity.

3.828 Dr Hern said that in 2003 around 70 per cent of all mobile subscribers were on pre-paid contracts; this compared with around 60 per cent in December 2010.[968] He stated that revenues from prepaid customers were likely to be more highly correlated with changes in the business cycle than revenues from postpaid customers who were locked in longer-term contracts (generally more than one year) with fixed fees.[969] He claimed that prepaid customers could and would adjust their spending on voice calls with variations in income levels driven by the business cycle and added that Ofcom's 2011 Communications Market Report[970] confirmed that this trend reflected the increasing maturity of the UK mobile telecommunications market.

3.829 Dr Hern went on to state that the trend towards longer contract lengths was another factor likely to have contributed to a decrease in the asset beta of MNO activities in the UK.[971] Before 2005, most pay-monthly mobile connections were sold as 12-month contracts. In 2006 there was a shift towards 18-month contracts and in 2009/10 towards 24-month contracts. In Q2 2010 around 75 per cent of all new pay-monthly contracts were for more than one year; this compared with only 12 per cent in Q1 2005.[972]

3.830 In his evidence Dr Hern went on to identify that there had been a relatively steady downward trend in mobile voice prices and that lower prices would lead to less sensitive usage with regard to changes in price and income levels. He stated that prices for mobile voice for high- and medium-usage baskets in the UK had more than halved between 2003 and 2009 and that it was likely that the income elasticity for mobile voice had also fallen significantly over this period.[973] Given this, Dr Hern considered that taking a long-term historical period to estimate betas would lead to an upwardly biased estimate, since the long term captured structurally different (higher) price levels than the current period.

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[965] Ofcom Defence, W/S Franks I, §50.
[966] Three SoI, §11.2.
[967] Three SoI, W/S Hern I, §52.
[968] Three SoI, W/S Hern I, §54.
[969] Three SoI, W/S Hern I, §55.
[970] Three SoI, W/S Hern I, §56. Ofcom published this report after making its MCT Statement.
[971] Three SoI, W/S Hern I, §57.
[972] Three SoI, W/S Hern I, §58.
[973] Three SoI, W/S Hern I, §61.

3.831 Dr Hern also argued that EE's evidence ignored the fact that UK mobile operators had substantially increased their share of revenues from data over time.[974] He went on to argue that data services were likely to exhibit higher systematic risk than regulated UK MNO activities as they were a relatively new product that was likely to exhibit 'luxury good' characteristics (ie relatively higher price and income elasticities than mobile voice services) and take-up was skewed towards younger consumers who were likely to be more price and income elastic.[975]

- *EE's Core Submission*

3.832 As part of EE's Core Submission, Dr Hird explained that Ofcom's argument was flawed as it did not describe how or why one would expect the factors it set out to lead to a lower level of risk. He said that Dr Hern's arguments, for Three, were also speculation and that if the number of prepaid customers as a percentage of mobile subscribers was important to the determination of beta, then use of Vodafone was a poor proxy as Vodafone had a lower share of prepaid customers than the average for the UK market.[976]

3.833 He said that this speculation flew in the face of the facts that were clear from the rolling asset betas of: *(a)* Vodafone alone, *(b)* other non-banking/mining industry betas and *(c)* the average of such industries. All these cases showed a severe depression of betas associated with non-bank/mining companies during the GFC followed by a recovery. He said that whilst these betas had not yet returned to pre-crisis levels, this was more likely to be explained by continuing heighted instability in the financial sector than by a permanent reduction in the betas.[977]

- *Assessment—other reasons for the decline in beta*

3.834 Ofcom's approach was to look first at the empirical evidence, and then consider whether its estimates were consistent with its knowledge of the industry. We recognize that the decline in estimated asset beta between the 2007 and 2011 Statements is large. As assessed above, we consider the statistical evidence used by Ofcom to be reasonable. We now consider whether there are plausible explanations for this decline.

3.835 The evidence supporting the views on the reasons for changes in systematic risk is limited and includes much interpretation. In our view, the Ofcom/Brattle arguments concerning capex programmes ending are not supported by any evidence. Ofcom's view that mobile companies are viewed by investors as being more like traditional utilities than in the past is reasonable because it has some evidence that mobile revenues have become less exposed to economic conditions: the number of customers on monthly subscriptions has increased over time; a significant proportion of adults are using mobiles as their main method of making and receiving telephone calls; and Ofcom has evidenced a willingness in customers to cut other costs before reducing spend on mobiles.[978] Dr Hird asserted that it was the fixed-line elements of the MNO parent companies that were potentially utility-like but he does not explain this view or why it does not apply to mobile users.

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[974] Three SoI, W/S Hern I, §117.
[975] Three SoI, W/S Hern I, §118.
[976] EE Core Submission, W/S Hird III, §110.
[977] EE Core Submission, W/S Hird III, §112.
[978] Ofcom Statement, §§7.141 & 7.142 & Figure 7.8.

3.836 We found Three's rationale for the fall in MNO betas, which focused on changes to the contract types and lengths as well as income elasticity, to be credible and supportive of Ofcom's position.

3.837 EE has not presented convincing arguments to discredit Ofcom's view that the systematic risk of UK MNOs had been falling over time. We consider that Ofcom has provided a reasonable explanation which supports the empirical data discussed above. We also note the declining trend of Vodafone's asset beta prior to the 2007 Statement. The focus on the sharp decline between the 2007 and 2011 Statements seems to ignore the downwards trend which started pre-2007 and the Ofcom/ Professor Franks view that the 2007 Statement may have used an asset beta that was too high.

Other issues with beta

3.838 EE's other arguments concerning beta fall under the following categories (and we consider them in this order):

(a) Ofcom should have used O2's beta.

(b) Ofcom's cross-checks were flawed (including issues with the US comparators and comparisons to other regulated industries).

(c) Ofcom was inconsistent in using a five-year beta based on weekly data and other betas based on daily data.

Ofcom should have used O2's beta

- *EE's NoA*

3.839 EE noted that in 2007, Ofcom was cautious about placing too much weight on Vodafone's asset beta because of 'difficulties associated with the impact of overseas activities'.[979] As a result, Ofcom placed more weight on O2's asset beta. EE considered that even though O2's asset beta was now a few years old, Ofcom should have placed some weight on this in the 2011 assessment.[980] Dr Hird said that the problems with relying on Vodafone identified by Ofcom in 2007 had only increased in scale over the last four years.[981]

- *Ofcom's Defence*

3.840 Ofcom did not accept EE's view that Vodafone's asset beta had been distorted in recent years and that as a result Ofcom should have placed more weight on O2 data from 2005/06.[982] It added that to have used data on O2 from 2005/06 would have presented a number of issues. First, estimating the two-year beta for O2 would require a data set six to eight years old, and for a one-year beta six to seven years old. This was a relatively long time in the context of an industry that was only just over 25 years old. Second, the contention that O2's equity or asset beta was a better proxy for the systematic risk of a UK MCP was not necessarily one that Ofcom would support. Whilst the UK mobile business of O2 represented a larger proportion of the O2 Group than for Vodafone, the O2 Group was also internationally diversified and

[979] EE NoA, §218.
[980] EE NoA, §218.
[981] EE NoA, W/S Hird I, §180.
[982] Ofcom Defence, Annex D, §99.

included non-mobile operations, which contributed a disproportionately large share of its growth (particularly O2 Germany).[983]

3.841 Ofcom submitted, in summary, that the O2 beta data from 2005 did not represent an 'undistorted' estimate of a UK MCP beta, was out of date, and would not have provided a better data source than the current Vodafone group beta data.[984]

- *EE's Core Submission*

3.842 Dr Hird summarized his view on Ofcom's use of recent Vodafone betas, including its failure to take into account O2's older beta, as follows: 'Whatever the merit of Ofcom's concerns about using beta estimates from 2006 these were trivial compared to the concerns Dr Hird had explained for using recent beta estimates.'[985]

- *Assessment—use of O2's beta*

3.843 We are not persuaded by EE's arguments that Ofcom should have placed some weight on the O2 beta. EE's criticism fails to take account of the fall in Vodafone's beta since 2005[986] and Ofcom's position that the systematic risk of UK MNOs has been falling.

3.844 We agree with Ofcom that, in light of more up-to-date data that was available to it and the cross-checks that could be performed on this, O2 data from 2005 would not have provided a better source of data than the Vodafone beta. Indeed we agree with Ofcom that the information in the O2 beta would be largely out of date. Consequently, we do not find that it erred in not placing more weight on that data.

Ofcom's cross-checks were flawed

3.845 These arguments cover the calculation of the US comparator betas and the cross-checks with other regulated industries.

- *US beta comparators and the exclusion of Clearwire*

o *EE's NoA*

3.846 EE agreed with Ofcom's decision to place some weight on the asset betas of US mobile operators by way of a cross-check but it considered that these betas had been incorrectly estimated by Brattle.[987] It said that when estimated correctly, the estimates suggested that MCP asset betas: *(a)* were higher than estimated by Ofcom; and *(b)* had not materially fallen over time (see Figure 3.11 below).[988] In any event, Dr Hird stated that, given that Vodafone was almost exclusively a foreign firm, one cannot reasonably treat US companies with 'caution' because they are not UK companies without exercising the same caution over Vodafone's recent beta estimates.[989]

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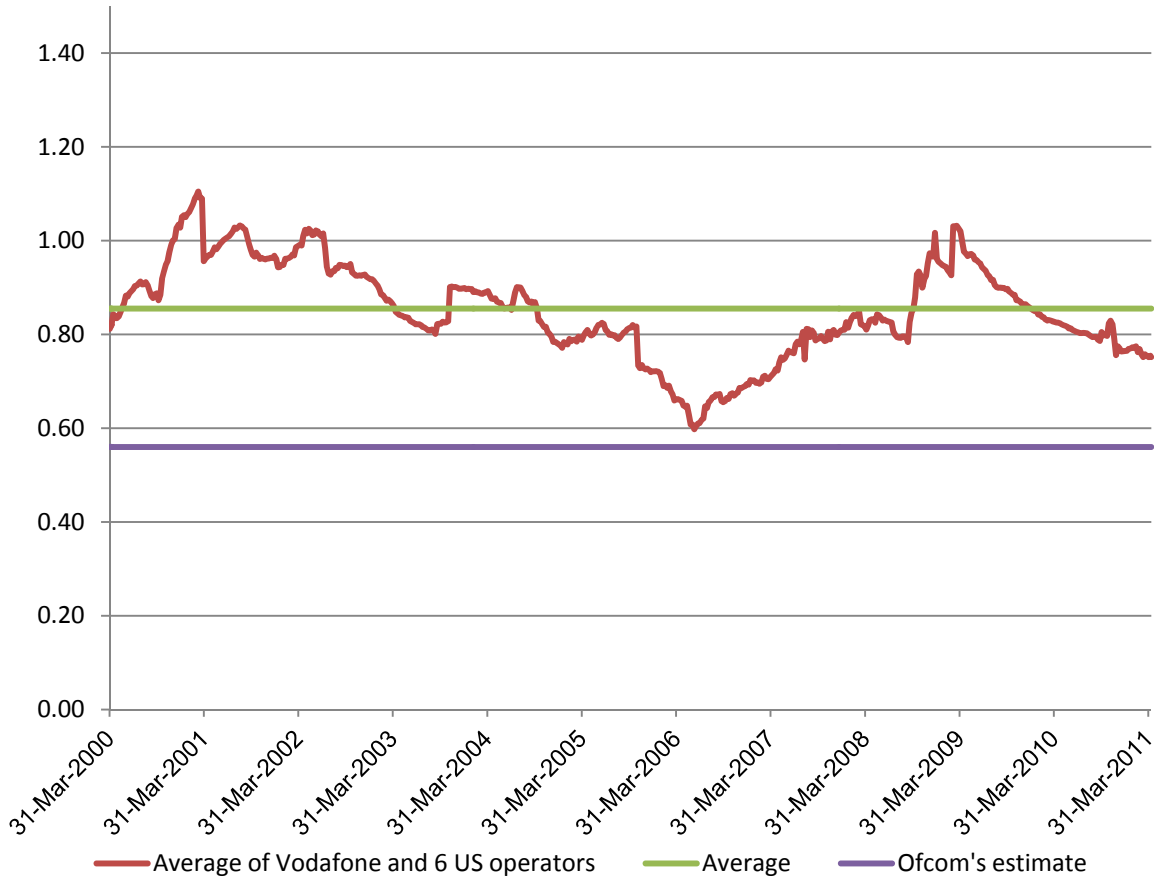
[983] Ofcom Defence, Annex D, §100.
[984] Ofcom Defence, Annex D, §101.
[985] EE Core Submission, W/S Hird III, §57.
[986] EE NoA, W/S Hird I, Figure 4.
[987] EE NoA, §219.
[988] EE NoA, §220.
[989] EE NoA, W/S Hird I, §162.

FIGURE 3.11

Dr Hird's calculation of two-year daily asset betas—Vodafone and all 80 per cent plus mobile operators identified by Brattle



Source: W/S Hird I (EE NoA), Figure 12.

3.847 Dr Hird said that (by his calculations) the average two-year asset beta for the six US firms identified by Brattle over the period from 31 March 2011 had never fallen below Ofcom's estimate of 0.56, and had, on average, been 0.86.[990] He added that it was also relevant to note that, unlike the Vodafone beta estimate, the average of this larger sample showed no obvious upward or downward trend over time and did not uniformly fall over the period of the GFC.[991]

3.848 Dr Hird also presented a calculation of an average beta adjusted for 32 per cent market gearing (Dr Hird's preferred view of the long-run average—see paragraph 3.705). He said that this would increase the average asset beta from 0.86 to 1.09.[992]

3.849 Dr Hird noted also that Vodafone's measured equity beta since the intensification of the GFC in September 2008 had been lower than all six US MNOs identified by the Brattle Group.[993]

[990] EE NoA, W/S Hird I, §148.
[991] EE NoA, W/S Hird I, §149 & Figure 12.
[992] EE NoA, W/S Hird I, §151.
[993] EE NoA, W/S Hird I, §182.

o *Ofcom's Defence*

3.850 In terms of the difference between its/Brattle's estimates of US company betas and the estimates of EE, Ofcom said that it calculated total returns, so that the return reflected the dividend payment as well as the capital gain or loss on the stock itself, whereas Dr Hird/EE focused on capital gains alone.[994] A further difference in the calculation was a slight difference in the time window used, and also that Ofcom used a debt beta of 0.15 compared with Dr Hird's 0.1.[995]

3.851 In revisiting the beta calculations Brattle realized that there was an error in the original calculations used in the Statement. These had relied on the 'class A' shares outstanding, rather than the total shares outstanding. Correcting for this error increased Brattle's asset beta estimates, but still left them well short of Dr Hird's estimates.[996]

3.852 Mr Caldwell (expert for Ofcom/Brattle) noted that the largest impact of the corrections was on the asset beta of Clearwire, raising it from 0.44 to 0.83, although this was still well below Dr Hird's 1.47 estimate. Mr Caldwell went on to explain why he considered that Clearwire Corp and TDS should be excluded from the comparator group.[997]

3.853 He said that Clearwire should carry little weight in a determination of asset beta for a UK MCP. For one thing, Clearwire was not a typical mobile provider, but in the midst of building out a brand new WiMax network across the USA. For another, Clearwire bore substantially more off-balance-sheet liabilities than any of the other US wireless companies, or indeed any of the parent companies of the UK MCPs. The presence of such large off-balance-sheet liabilities materially raised the risks associated with Clearwire equity.[998]

3.854 He noted that two of the six US wireless companies were essentially one and the same. Telephone and Data Systems (TDS) owned 83 per cent of US Cellular. He went on to say that other than its stake in US Cellular, TDS engaged in fixed-line activities. However, these fixed-line activities were small in comparison with its US Cellular interest, generating only 16 per cent of TDS's revenues in 2010. He said that for our purposes then, TDS and US Cellular essentially represented one and the same wireless company, and as a result, their asset beta estimates were not independent.[999]

3.855 Mr Caldwell said that the correction for the shares outstanding figure increased the average of all six companies by 0.12 (from 0.59 to 0.71), but that this had almost no impact on the average excluding Clearwire and TDS (0.62 to 0.66). Mr Caldwell considered that without Clearwire and TDS, even Dr Hird's own calculations would not appear to suggest a substantially higher asset beta than 0.56.[1000]

3.856 In addition, Ofcom found that the principal difference between its/Brattle's estimates of US company betas and the estimates of EE was the measurement of financial debt. EE's results depended on use of a 'net debt' approach to financial leverage but

[994] Ofcom Defence, W/S Caldwell (Brattle), §10.
[995] Ofcom Defence, W/S Caldwell (Brattle), §11.
[996] Ofcom Defence, W/S Caldwell (Brattle), §13.
[997] Ofcom Defence, W/S Caldwell (Brattle), §§15 & 16.
[998] Ofcom Defence, W/S Caldwell (Brattle), §15.
[999] Ofcom Defence, W/S Caldwell (Brattle), §16.
[1000] Ofcom Defence, W/S Caldwell (Brattle), §17.

Ofcom's approach was to look at financial leverage with reference to the face value of long-term debt, ignoring the presence of any cash balances.[1001,1002]

3.857 With regard to measurement of financial leverage, Mr Caldwell noted that in most circumstances, the two measures of financial debt—net debt and the face value of long-term debt—did not vary substantially and thus generated similar asset betas. He said that this similarity existed for several of the US wireless companies, but that for Clearwire in particular the two approaches diverged.[1003]

3.858 He said that the divergence occurred because of large cash balances being held over several years yet considered that, despite the scale of the balances, there were two factors to suggest that it was preferable to exclude them from the calculations.[1004] These reasons were:

(a) network construction; and

(b) off-balance-sheet lease commitments.

3.859 Mr Caldwell noted that the retention of cash balances related in large part to the financing of ongoing construction expenses and operating losses during network build-out, ie that to a large extent the cash balances were already committed.[1005]

3.860 Mr Caldwell accepted that Dr Hird was correct in considering that Clearwire had more cash than debt at times in the period to October 2010. He noted that debt was raised by Clearwire in three tranches and each time the resulting cash was spent on network construction. Mr Caldwell considered that future cash flows to equity holders would depend principally on the earnings power of the WiMax network under construction and not on the cash that appeared on the balance sheet. Mr Caldwell considered Dr Hird's view that Clearwire carried negative debt an illusion as the cash should be seen as network equipment.[1006]

3.861 A second reason for ignoring cash balances was the relative extent of operating leases. Mr Caldwell noted that the six US wireless companies carried substantially more operating lease commitments than either of the US fixed-line companies considered or Vodafone and the other UK MCPs' parent companies. For the US mobile companies, Mr Caldwell considered the scale of the operating lease commitments to require them to be considered separately. He noted that including operating lease commitments more than doubled the apparent leverage of US Cellular, from 9.1 to 21.6 per cent. The comparable effect for Vodafone was to raise apparent leverage by less than three percentage points, from 30.7 to 33.5 per cent.[1007]

3.862 He considered that a 12 to 13 percentage point swing in financial leverage could have a material effect on asset beta and that inclusion of operating lease commitments in the financial leverage calculations would immediately offset and more the impact of recognizing any cash balances.[1008]

3.863 Overall Mr Caldwell considered that network construction expenditure and operating leases pointed away from the use of net debt to measure financial leverage for the US wireless companies. He considered that the effect of using the face value of

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[1001] Ofcom Defence, Annex D, §103.
[1002] Ofcom Defence, W/S Caldwell (Brattle), §18.
[1003] Ofcom Defence, W/S Caldwell (Brattle), §§19 & 20.
[1004] Ofcom Defence, W/S Caldwell (Brattle), §20.
[1005] Ofcom Defence, W/S Caldwell (Brattle), §21.
[1006] Ofcom Defence, W/S Caldwell (Brattle), §§21–25.
[1007] Ofcom Defence, W/S Caldwell (Brattle), §§28–35.
[1008] Ofcom Defence, W/S Caldwell (Brattle), §31.

financial debt instead—as in the Brattle report—demonstrated that asset betas for US wireless companies had not been consistently higher than those for the UK MCPs.[1009]

3.864 Ofcom summarized the impact of its correction on its asset beta estimates for all six of the US wireless companies and provided a comparison with Dr Hird's asset beta estimates for four of the six companies (see Table 3.4 below).

TABLE 3.4 **Asset betas for US wireless companies**

		Brattle			*Hird*	
	% Revenues from wireless	*vs SPX to Sep 10 (Original)*	*vs SPX to Sep 10 (Corrected)*	*vs SPX to Jun 11*	*vs SPX to Oct 10*	*vs All-World to Oct 10*
Clearwire Corp	100	0.44	0.83	0.79	1.47	1.83
Leap Wireless International Inc	100	0.49	0.51	0.44	0.56	0.65
MetroPCS Communications Inc	100	0.49	0.53	0.60	0.64	0.72
United States Cellular Corp	100	0.83	0.88	0.80	0.86	0.98
Sprint Nextel Corp	87	0.66	0.73	0.55	N/A	N/A
Telephone & Data Systems (TDS) Inc	84	0.62	0.75	0.78	N/A	N/A
Average						
All		0.59	0.71	0.66	0.88	1.05
Excl Clearwire and TDS		0.62	0.66	0.60	0.69	0.78

Source: W/S Caldwell I, Table 2.

Notes: Brattle calculations and Exhibit TH3 [EE D/13].

3.865 Ofcom recognized that the recalculated asset beta was 0.66 and said that its conclusion in the Statement, that US asset betas for pure-play wireless operators had declined and the average asset beta was low, remained valid, even taking into account Brattle's revised calculations. It noted that Mr Caldwell also considered that the asset betas for the US wireless companies were *(a)* broadly in line with Ofcom's beta estimate of 0.56 for a UK MCP, and *(b)* not consistently higher than the asset betas for the UK MCPs.[1010]

3.866 Ofcom said that in any event, it did not rely on the US wireless companies' asset betas in arriving at the asset beta estimate for a UK MCP. The US companies were used as a cross-check of asset beta and the direction of travel of the beta.[1011]

- *Three's SoI in support of Ofcom*

o *European betas*

3.867 Dr Hern provided, on behalf of Three, an analysis of the two-year asset betas for 16 European telecommunications providers.[1012] He found that the average asset beta for all of these comparators was 0.47 and the average asset beta for comparators with at least 80 per cent mobile was 0.59. He said that no asset beta came close to Dr Hird's asset beta assumption of 1.2, and with the exception of three outliers (Telia Sonera (asset beta: 0.73), Telenor (asset beta: 0.77) and Tele2 (asset beta: 0.96)), the asset betas clustered in a range of 0.31 to 0.53.[1013] Dr Hern considered the

[1009] Ofcom Defence, W/S Caldwell (Brattle), §§40 & 41.
[1010] Ofcom Defence, Annex D, §105.
[1011] Ofcom Defence, Annex D, §106.
[1012] Three SoI, W/S Hern I, §120.
[1013] Three SoI, W/S Hern I, §121.

European evidence generally to support Ofcom's asset beta assumption of 0.56[1014] for UK MNOs and to be totally inconsistent with the EE assumption of 1.2.

o *US betas*

3.868 On behalf of Three, Dr Hern provided his own assessment of the two-year asset beta for the six US wireless comparators using the following inputs: *(a)* Bloomberg total returns data, Blume adjusted; *(b)* S&P 500; *(c)* daily data up until the 29/10/2010; *(d)* gearing calculated as net debt over current market cap; *(e)* debt beta of zero.[1015]

3.869 Dr Hern noted that for some companies his calculations were closer to Dr Hird's estimates while for others his calculations were closer to Brattle's.[1016] He considered that Clearwire (the company with the largest difference in beta estimate) should not be included in the sample as Clearwire was a pure play mobile broadband operator. Those activities were likely to bias upwards its beta as mobile broadband was more of a luxury product than mobile voice. He stated also that Clearwire was a first-mover with new technology and, therefore, inherently more risky than established business models. Dr Hern also considered that US Cellular should be excluded[1017] from any calculation of the average beta for US comparators because its parent company TDS was already included and including both was likely to lead to a degree of double counting. Excluding these, his calculation of the average beta of US comparators was 0.62.[1018]

o *EE's Core Submission*

3.870 In response to Ofcom's Defence and the attendant evidence of its expert Mr Caldwell (of Brattle Group), Dr Hird said that Mr Caldwell did not simply correct for the error in the Brattle Group's original estimates but introduced new arguments and evidence, to the effect that Clearwire's asset beta should be removed from the sample.[1019] Dr Hird did not agree that either argument put forward for excluding it was valid; he said that there was no explanation for why any expansion plans for Clearwire should increase the measured beta as he considered that this could increase or decrease the beta depending on market circumstance. He noted that Clearwire operated in over 70 markets across the USA.

3.871 Dr Hird also considered that Mr Caldwell made a serious error when he argued that firms with operating leases were higher risk than firms without operating leases. He accepted that operating leverage was an important determinant of the riskiness of an industry and therefore its asset beta. But he said that it was wrong to argue that because one firm had entered into an operating lease and another had not, the first firm had more operating leverage than the other. Dr Hird said that Mr Caldwell had not attempted to investigate the specific nature of the lease arrangements for each company and whether the leases undertaken by Clearwire involved it entering into payments that a benchmark 'normal' operator would not enter into.[1020]

[1014] Dr Hern said 0.53 but we take him to mean the Ofcom estimate of 0.56—see Ofcom Statement, Annex 8, Table A8.4.
[1015] Three SoI, W/S Hern, §126 & Table 5.2.
[1016] Three SoI, W/S Hern I, §127.
[1017] Three SoI, W/S Hern I, §129.
[1018] Three SoI, W/S Hern I, §131.
[1019] EE Core Submission, W/S Hird III, §131.
[1020] EE Core Submission, W/S Hird III, §141.

o *Assessment—Ofcom's cross-checks*

3.872 EE and Ofcom agreed that the use of US mobile operators was a sensible cross-check. However, EE said that Ofcom's estimates were incorrect, and that when estimated correctly they were higher than estimated by Ofcom and had not materially fallen over time. The implication of this is that had Ofcom estimated the betas on the same basis as EE, it would have come to a different conclusion on the appropriate beta to input into its cost of capital calculation.

3.873 In recalculating the betas as part of its Defence, Ofcom/Brattle found an error with its original calculations that it said meant that the estimates should have been higher than stated (although not by as much as EE said). We agree that Ofcom is correct in revising its calculations to use the total shares outstanding. The effect of this is to increase the average beta of the six comparator US MNOs to 0.71 from 0.59.[1021]

3.874 With regard to the arguments for excluding Clearwire and TDS from the sample, we consider Ofcom's arguments to be reasonable, on the grounds that:

(a) Clearwire is currently investing in a new network, has significant off-balance-sheet liabilities and operates in pure-play mobile broadband. Given its current circumstances and risk profile, it is not obviously a suitable comparator for a UK MNO.

(b) TDS is already captured in the average as its beta is closely correlated with its subsidiary, US Cellular. It would be double counting to include both.[1022]

3.875 EE argued that it was not obvious that Clearwire's expansion plans would result in the beta increasing, but rather that new investment could increase or decrease beta depending on the market conditions (see paragraph 3.870). However, Ofcom excluded the company from its sample of companies on the basis that it was not a suitable comparator rather than explicitly on the basis that it had a higher beta as a result of the expansion. This seems reasonable. We also consider (as argued by Three) that as Clearwire operates a 4G network and provides mobile broadband, and as none of the UK operators have such a strong focus on data services and as MCT services have no data service (voice only), this is as much, if not more, of a reason for excluding than the expansion programme.

3.876 The financial leverage measure is a clear difference between Ofcom's and EE's thinking. However, given that we agree it is necessary to exclude Clearwire and TDS (see paragraphs 3.874 and 3.875), the average US asset beta estimate that (if calculated correctly) would have been considered in October 2010 when the Brattle report was completed would have been 0.66 (Ofcom method) or 0.69 (EE method – net debt).

3.877 This is not a material difference and we do not consider it necessary for us to address this issue as Ofcom did not use the US data mechanistically in arriving at its 0.56 asset beta estimate. Rather, Ofcom compared Vodafone's two-year asset beta of 0.53 at October 2010 with asset betas for the other MCPs' parent companies (0.4) and the average US wireless company asset betas of 0.59 and relied at least as much on the former cross-check as the latter (see paragraph 3.644).[1023] Ofcom said

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[1021] We also note that EE's calculations have been conducted on the basis of share price movements and not total returns; we consider this an error, and we therefore place little weight on the actual figures calculated by EE but consider the effect of the arguments just the same.
[1022] Three argued that US Cellular, not TDS. should be excluded. We did not find it necessary to take a view. Ofcom argued for the exclusion of the parent company and EE has not explicitly challenged this.
[1023] Ofcom Statement, §A8.110.

that its revised US estimate (excluding Clearwire and TDS) of 0.66 would not have affected its final judgement—see paragraph 3.865. Given this, we do not think that, given a comparator range with a low point of 0.4 and an upper point of 0.69 (as EE argued), EE has shown Ofcom's final assessment of 0.56 to be an error.

3.878 We would caution against any mechanistic approach to updating beta estimates with regard to overseas comparators. In particular, to do so would need detailed consideration of the different market conditions and company-specific issues. As such, whilst Ofcom's Statement included a miscalculated US beta comparator, we do not consider, taking into account all these factors, that the revised US cross-check figures are sufficiently different (either on Ofcom's debt basis or EE's) from that Ofcom used or from Vodafone's asset beta to demonstrate that Ofcom erred.

- *Overall level of WACC in comparison to other regulators' estimates*

o *EE's challenge*

3.879 EE alleged that Ofcom should have placed more weight on a comparison between its estimated MCP WACC and the WACC estimated by UK utilities regulators.[1024] It said that natural monopoly regulated utilities should have a lower cost of capital than MCPs and noted that Ofcom's estimate for MCPs was at the same level or lower than a number of recent WACC estimates by UK utility regulators.

3.880 EE provided analysis showing the real[1025] pre-tax vanilla WACC[1026] for recent decisions by some UK utilities regulators and the CC.[1027] EE stated that this demonstrated that Ofcom had set a lower cost of debt and a lower cost of equity for MNOs than for all gas, electricity and water regulated businesses surveyed, which was somewhat offset in Ofcom's WACC calculation by it having adopted a lower assumed gearing for MNOs—thereby placing more weight on the cost of equity than on the cost of debt.[1028] EE claimed that the net effect of Ofcom's assumptions was that it had assumed the same overall cost of capital for a mobile operator as had been allowed by Ofgem for gas and electricity network businesses in its most recent decisions, and a lower cost of capital than Ofwat had allowed for water distribution and treatment businesses.[1029]

3.881 EE said that it was unreasonable to assume 'on the basis of the extremely limited Vodafone data' that mobile operators were the same or lower risk than water and energy businesses.[1030] It argued that the other regulated businesses would be expected to have lower risk than mobile telecommunication operators because of the essential nature of the services provided.[1031] Moreover, EE stated that even if customers did curtail consumption of those services, the nature of water and energy network regulation is such that those businesses would be allowed to raise prices to their customers.

3.882 EE argued that the view that mobile telecommunications were higher risk than natural monopoly energy and water businesses was supported by a comparison of their gearing levels. Regulated energy and water businesses generally have levels of

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[1024] EE NoA, §221.
[1025] Real as opposed to nominal.
[1026] We understand that this is calculated as the weighted average pre-tax cost of debt and post-tax cost of equity (EE NoA, W/S Hird I, Table 2). We would normally refer to this simply as the 'Vanilla WACC'.
[1027] EE NoA, W/S Hird I, Table 2.
[1028] EE NoA, W/S Hird I, §166.
[1029] EE NoA, W/S Hird I, §167.
[1030] EE NoA, W/S Hird I, §171.
[1031] EE NoA, W/S Hird I, §168.

gearing around, or in excess of, 60 per cent. It compared this with Vodafone's current and historical average gearing of 30 per cent or less (which it noted was around the same or higher than the other mobile-only companies identified in the November 2010 Brattle report).[1032] It said that the same observation applied to comparisons of Vodafone's gearing and the gearing of the fixed/mobile operators reported in the Brattle report; and that the fixed/mobile operators tended to have materially higher gearing than Vodafone.[1033]

o *Ofcom's Defence*

3.883 By way of response to EE's challenge of its WACC calculation, using other regulated industries as comparators, Ofcom pointed to the CC's previous reports where the CC had noted the 'significant margin of error' associated with calculating the cost of equity and the 'inherent imprecision' associated with the estimation of the WACC.[1034]

3.884 With regard to EE's argument that Ofcom failed to have due regard to a comparison between its estimated WACC for MCPs and the WACC estimated by utility regulators, Ofcom noted that the decisions made by other regulators were taken earlier than the MCT decision, in some cases as far back as 2007, and so considered EE's analysis misleading.[1035]

3.885 Ofcom conducted its own, updated analysis (which normalized all the generic parameters and sought to isolate only the effects of differing beta/gearing estimates) of the comparison figures presented by EE.[1036] This is set out in Table 3.5 below. We refer to the WACC on this basis as the 'normalized WACC'.

TABLE 3.5 **Ofcom MCP WACC compared with other regulated utility normalized WACCs**

	Ofcom Mobile Feb-11	*Ofwat Water-non small Dec-09*	*CC – Bristol Water DPCR5 Aug-10*	*Ofgem: CC view Dec-09*	*Ofgem: CC view CPCR5 Dec-09*
Inflation	2.50%	2.50%	2.50%	2.50%	2.50%
Nominal risk free rate	4.00%	4.00%	4.00%	4.00%	4.00%
Real risk free rate	1.50%	1.50%	1.50%	1.50%	1.50%
ERP	5.00%	5%	5%	5%	5%
Equity Beta	**0.76**	**0.90**	**0.92**	**0.85%**	**0.75%**
Gearing	**30%**	**58%**	**60%**	**65**	**60**
Real cost of equity	5.2%	5.9%	6.0%	5.6%	5.1%
Debt premium	1.5%	1.5%	1.5%	1.5%	1.5%
Debt beta	0.1	0.1	0.1	0.1	0.1
Real pre-tax cost of debt	2.9%	2.9%	2.9%	2.9%	2.9%
Tax	24%	24%	24%	24%	24%
Post tax cost of debt real	2.2%	2.2%	2.2%	2.2%	2.2%
Post tax nominal	6.7%	6.0%	5.9%	5.6%	5.6%
Pre-tax real WACC	6.2%	5.3%	5.2%	4.8%	4.8%

Source: Ofcom Defence—Annex D, Table D.1.

3.886 Ofcom said that the results showed that the real pre-tax WACC for MCPs of 6.2 per cent was significantly above that of other regulated entities, which when normalized fell in a range of 4.8 to 5.3 per cent. It said that this reflected the fact that MCPs faced greater systematic risk than utilities.[1037]

[1032] EE NoA, W/S Hird I, §172.
[1033] EE NoA, W/S Hird I, §174.
[1034] Ofcom Defence, §66.
[1035] Ofcom Defence, Annex D, §109.
[1036] Ofcom Defence, Annex D, §110.
[1037] Ofcom Defence, Annex D, §110.

3.887 Ofcom submitted, however, that the MCP pre-tax real WACC of 6.2 per cent was reasonable by comparison.[1038] It said that the size of the overall reduction, whilst large, was appropriate in light of its general approach to estimating the WACC. Professor Franks said it appeared that the asset beta chosen by Ofcom in the 2007 Price Control may have been too high and as a consequence the MCPs had benefited from a higher WACC over the four-year period of the 2007 Price Control. Given this, he would be cautious in setting a WACC now which was based on an asset beta that was higher than that suggested by the recent evidence, simply in order to avoid a large overall decrease. To do so would risk allowing the MCPs to continue to benefit over the period from 2011 to 2015 from an asset beta that was too high.[1039]

o *Three's SoI in support of Ofcom*

3.888 Dr Hern said that Ofcom's approach to updating the beta estimates was consistent with regulatory best practice and therefore felt that Ofcom should not be unduly influenced by past decisions by other regulators. He compared the asset beta used by Ofcom of 0.56 with recent (2010 to 2011) European regulatory decisions for MTRs and other UK regulatory decisions for 2008 to 2011. He found that Ofcom's estimate of the asset beta was consistent with the average of recent European MTR decisions (average 0.58) and that Ofcom's asset beta lay in the range of the regulated airports and regulated air traffic control NATS (0.47–0.61).

3.889 Dr Hern said that the comparison with the regulated airports appeared to be a valid one as both industries were regulated by pure price cap while operating in a partially competitive environment. He considered that, if anything, one would expect the beta values for regulated airports to be higher as the income elasticity of demand for air travel was higher than for mobile. He noted that a review of various academic studies found an income elasticity of demand for air traffic of 1.3 to 2.4, depending on type of travel and distance, while recent studies on the income elasticity of demand for mobile services all found elasticities below 1.0. Dr Hern said that this suggested that regulated airports faced higher systematic risks than regulated mobile termination. Consequently, Ofcom's asset beta estimate of 0.56, which placed mobile termination in line with airports such as Gatwick and Stansted, did not look out of line while also allowing for a substantially higher beta than regulated water or electricity distribution activities.[1040]

o *Assessment—overall level of WACC in comparison to other regulators' estimates*

3.890 EE argued that Ofcom should have placed more weight on a comparison between its estimated MCP WACC and the WACC estimated by UK utilities regulators.[1041] It said that natural monopoly regulated utilities should have a lower cost of capital than MCPs and noted that Ofcom's estimate for MCPs was at the same level or lower than a number of recent WACC estimates by UK utilities regulators.[1042]

3.891 We would generally urge caution in comparing WACC estimates that have been made by other regulators in different circumstances and at different times, for example in different financial market conditions or for companies of different sizes and with differing levels of gearing. An additional complication is that Ofcom set the

[1038] Ofcom Defence, Annex D, §111.
[1039] Ofcom Defence, W/S Franks I, §§53–55.
[1040] Three, W/S Hern I, §§80–82.
[1041] EE NoA, §221.
[1042] EE NoA, §221.

cost of capital on a nominal basis whereas most other regulators are concerned with real rates. Converting between one and the other is not entirely straightforward.

3.892 Nevertheless, on the face of it, setting a pre-tax vanilla WACC for MCT below that of other regulatory decisions appears unusual and requires explanation.[1043] Ofcom's position was that once these estimates were updated to reflect recent market conditions,[1044] the MCT cost of capital sits above the other utilities. as might be expected given the likelihood that MCT presents higher systematic risk.

3.893 We have some reservations with Ofcom's comparison. One cannot necessarily change one or more parameters in a cost of capital determination (eg the RFR) and assume that other parameters remain unchanged. Often the regulator will have derived a range for the various parameters and will take a view on where to make a point estimate for the overall cost of equity and WACC, given the range for the parameters. Likewise, a regulator's view of the ERP and RFR are likely to be interlinked for the reasons discussed above. We note that Ofcom has used the same debt premium for each utility. However, this may not be appropriate given that this estimate will depend both on the operational risk and gearing of the company.

3.894 For these reasons, we prefer Dr Hern's/Three's comparison of the asset betas. This does not suffer from the same problems concerning differences in the choice of generic market-wide parameters, differences in gearing, and problems in comparing nominal with real rates as do the comparisons of EE and Ofcom. It compares only relative exposure with systematic risk and is therefore much more targeted at the concerns raised by EE. Dr Hern's assessment indicates that Ofcom's asset beta estimate of 0.56 is higher than that of regulated water and electricity distribution activities and in line with regulated airports such as Gatwick and Stansted. There is nothing in this comparison to indicate that Ofcom's beta sits uneasily alongside other regulatory decisions.

3.895 We consider it uncontroversial that the reduction in WACC is significant and agree with Professor Franks when he urged caution '… in setting a WACC now which is based on an asset beta that is higher than that suggested by the recent evidence, simply in order to avoid a large overall decrease'.

3.896 For all of these reasons, we do not find that EE has shown that Ofcom erred, in estimating the WACC at the level it did, by comparison with other regulated industries.

Ofcom used an inconsistent method for estimating five-year beta compared with its other beta estimates

- *EE's challenge*

3.897 EE disagreed with Ofcom's estimate of the five-year beta, pointing out that the estimation method was inconsistent with Ofcom's other beta estimates.[1045] It considered there to be no good reason why Ofcom estimated this variable on a weekly rather than daily basis and said that had Ofcom estimated the five-year beta using a daily sampling period, it would have estimated a beta of 0.88 instead of 0.78. This would have increased the top of Ofcom's range and resulted in a midpoint asset beta of

[1043] EE NoA, W/S Hird I, Table 2.
[1044] Ofcom Defence, Annex D, Table D.1.
[1045] EE NoA, §173.

0.59 instead of 0.56. Dr Hird noted that Brattle and the CC supported the use of daily data where there were no liquidity concerns about the stock.[1046]

- *Ofcom's Defence*

3.898 Ofcom said that despite having a preference for two-year daily statistics, it had regard to a five-year weekly beta 'as a result of the unique market conditions' and that 'it was reasonable to estimate the 5 year beta using weekly data as this provided a sufficient number of data points to ensure a statistically robust estimate of the beta', though it stated that there was a significant margin of estimation error in this area.[1047,1048,1049] Ofcom said that using five-year daily (rather than weekly) data would have had less than 0.2 per cent impact on the WACC.[1050]

3.899 Given its preference for more recent beta estimates, it placed lower weight on the five-year beta.[1051]

- *Assessment—Ofcom's method for estimating five-year beta compared with its other beta estimates*

3.900 EE argued that Ofcom erred because it was inconsistent in using a five-year asset beta estimate based on weekly data when its shorter-term beta assessments were based on daily data. We note that there is no formulaic method for estimating beta and EE has not explained why Ofcom's choice of sampling method could be expected to lead to an erroneous estimate. Whilst we note that an alternative (ie daily data) approach as suggested by EE with more data points is likely to have a smaller margin of error, EE has not shown that Ofcom's estimate was statistically unsound. Given that Ofcom prefers to place more weight on its recent beta estimates than on its five-year estimates, it is not unreasonable in the circumstances to use weekly data for five-year beta and daily data for one-year beta. In our view, EE has not shown that Ofcom's approach was erroneous.

Overall assessment on beta

3.901 For the reasons set out above, EE has not persuaded us that Ofcom erred for the reasons set out in its NoA in relation to estimating beta.

Ofcom's estimation of the RFR

EE's NoA

3.902 EE argued that in estimating the RFR at 1.5 per cent, Ofcom erred by giving too much weight to the low prevailing yields on index-linked gilts.[1052]

3.903 Dr Hird stated that indexed-linked gilts[1053] were in relatively short supply and were in high demand by pension funds, resulting in the price on these gilts being artificially high and the yield artificially low.[1054] Dr Hird noted that in Australia regulators had

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[1046] EE NoA, W/S Hird I, §§116–119.
[1047] Ofcom Defence, Annex D, §§7 & 8.
[1048] Ofcom Defence, Annex D, §9.
[1049] Ofcom Defence, Annex D, §13.
[1050] Ofcom Defence, Annex D, §10.
[1051] Ofcom Defence, Annex D, §13.
[1052] EE NoA, §222.
[1053] Dr Hird used the term 'bond'; in this circumstance it can be used interchangeably with the term 'gilt'.
[1054] EE NoA, §233.1.

ceased to use index-linked gilts as the proxy for the RFR because of the distortion created by pension funds, and he also noted that the purchase of government gilts by the Bank of England had exacerbated short supply in the UK.[1055]

3.904 EE said that it was wrong to assume that the cost of equity fell with the RFR in the CAPM: this was only true if the ERP stayed constant. It said that the RFR and the ERP tended to move in opposite directions—especially in times of recession. If the ERP was based on long-run historical averages, then so should the RFR assessment.[1056]

3.905 EE considered that it was well accepted that the actual cost of equity generally tended to rise during a crisis. It said that whilst the RFR tended to fall, the ERP (proxied by market risk premium) tended to rise by more than the fall in the RFR. Dr Hird said that this result was intuitive, if one recognized that the flight from risky assets to almost riskless assets was the reason for the fall in the RFR. He said that any reasonable estimate of the cost of equity during the period of the crisis would have put such an estimate at an all-time high.[1057] Dr Hird added that the Australian Competition Tribunal had agreed that using historically low RFR during the crisis to set the cost of equity without increasing the market risk premium was likely to underestimate the cost of equity.[1058]

3.906 Dr Hird referred to the 2003 Smithers and Co report which found the cost of equity to be a range of 6.5 to 7.5 per cent. He noted that the 6.5 per cent assumed by Ofcom in its Statement was at the bottom of this range. According to EE, the report noted that if the RFR was lower than 2.5 per cent, this would be offset by an increase in the ERP. He noted that Ofcom had lowered the RFR without increasing the ERP.[1059]

3.907 EE said that a more reasonable estimate of the cost of equity during a UK recession, and following the GFC, was at least the middle of the Smithers and Co range, ie 7 per cent. Given Ofcom's assumption that the ERP is 5 per cent (which EE noted was consistent with the CC's Bristol Water decision), EE considered that 2 per cent RFR should be used.[1060]

Ofcom's Defence

3.908 Ofcom reiterated its rationale, as set out in the Statement, for choosing the RFR that it did. It went on to point to the view of its expert witness, Professor Franks, that the regulator must balance the unusual volatility of the market in government gilts where yields were well below their long-term trend and the need not to give so much headroom to the regulated business so as give it a windfall.[1061]

3.909 Ofcom noted that since the 2007 Price Control, it had increased the ERP estimate by 0.5 per cent at the same time as reducing the RFR estimate by 0.5 per cent—hence the estimated total real market return had not changed. Ofcom disagreed that a threshold suggested in 2003 by Smithers and Co was an appropriate reference point for the RFR over the Price Control period to 2014/15.[1062]

[1055] EE NoA, W/S Hird I, §190.
[1056] EE NoA, §223.
[1057] EE NoA, W/S Hird I, §199.
[1058] EE NoA, W/S Hird I, §201.
[1059] EE NoA, W/S Hird I, §195.
[1060] EE NoA, §§224–226.
[1061] Ofcom Defence, Annex D, §115.
[1062] Ofcom Defence, Annex D, §116.

3.910 Ofcom submitted that, based on the evidence available at the time of the Statement together with a need to exercise caution over the unusual market data, its RFR estimate of 1.5 per cent was reasonable.[1063]

3.911 Ofcom noted that both yields on five- and ten-year government index-linked gilts and implied forward rates had declined further since the Statement in March 2011.[1064]

Assessment—Ofcom's estimation of the RFR

3.912 It appears to be common ground between the parties that high demand from pension funds and quantitative easing have pushed yields down in UK gilt markets and that therefore some care must be taken in interpreting yield data from these markets. EE has not argued that these distortions are significant enough to dismiss the use of index-linked gilts altogether, but noted that in Australia regulators had ceased to use index-linked gilts as a proxy for the RFR.

3.913 Ofcom's Statement clearly shows that it was aware of the potential distortions in the market and gave more weight to the five- and ten-year historic average yields on five- and ten-year index-linked gilts than on the very short-term averages as a result. Given the evidence available at the time of the Statement, in particular that yields on five- and ten-year index-linked gilts had continued to decline, there is no basis to suggest that Ofcom was in error in reducing its estimate below the CC's point estimate of the RFR of 2 per cent in the Bristol Water case. Indeed, Ofcom's estimate of 1.5 per cent sits at the midpoint of the CC's range of 1 to 2 per cent. It is also considerably above the rates that Ofcom observed in the market when it set the Price Control in February 2011 of –0.5 to 0.5 per cent.

3.914 Evidence submitted by Ofcom has shown that yields have declined since the Statement; this supports Ofcom's decision to reduce its estimate in hindsight.[1065]

3.915 With regard to the interaction between the ERP and the RFR, EE argued that Ofcom decreased its RFR estimate but made no change to the ERP estimate. This appears to be in relation to movements between the Statement and the Consultation (see Table 3.2). We consider that the relevant comparison is between the 2007 Statement and the 2011 Statement where Ofcom increased its ERP estimate by 0.5 per cent and reduced its RFR assessment by 0.5 per cent, leaving the market return unchanged at 6.5 per cent. This, in our view, shows that Ofcom was mindful of the tendency of the RFR and ERP to move in opposite directions.

3.916 EE argued that it was 'intuitive' that the ERP should increase by more than the fall in the RFR. We do not regard this unsupported contention as self-evident or generally applicable. We note that EE's assertion that 'any reasonable estimate of the cost of equity during the period of crisis would have been at an all time high' does not seem relevant to the task that Ofcom was faced with in estimating the cost of capital for the period from 2011/12 to 2014/15.

3.917 EE cited the 2003 Smithers and Co report which it said gave the cost of equity as 6.5 to 7.5 per cent.[1066] It is not self-evident that a more reasonable estimate of the cost of equity for the period 2011/12 to 2014/15 would be 7 per cent as EE asserted (paragraph 3.907). We agree with Ofcom that the 2003 Smithers report was not an

[1063] Ofcom Defence, Annex D, §117.
[1064] Ofcom Defence, Annex D, §118.
[1065] Ofcom Defence, W/S Franks, Figure 5 & §60.
[1066] Defined as the return for the average firm with a beta of unity.

appropriate reference point for the RFR over the period to 2014/15 (paragraph 3.909).

Conclusion on the RFR

3.918 As noted in paragraph 3.622, EE, whilst including these arguments under the cost of debt heading, did not link them to Ofcom's estimate of the cost of debt.

3.919 For the above reasons (paragraphs 3.912 to 3.917), we do not find that Ofcom erred in its assessment of the RFR or that there was a resulting error in Ofcom's estimate of the cost of debt.

Conclusion on WACC

3.920 We have assessed EE's arguments in relation to Ofcom's assessment of the beta (paragraph 3.901) which covered:

(a) forward-looking expectations and the relationship between beta and the ERP;

(b) Ofcom's reasons for believing that MNO risk was declining; and

(c) other issues with beta.

3.921 We have assessed EE's arguments in relation to Ofcom's assessment of the RFR (paragraph 3.919).

3.922 For the reasons set out above, we do not find that EE has shown there to be an error in Ofcom's approach to the assessment of the WACC for the reasons alleged.

Part 2

3.923 In this part, we set out and assess Vodafone's alternative models, which it claimed demonstrated that Ofcom's calculation was implausible, and EE's suggested corrections to the alleged errors.

Vodafone's challenge

3.924 Vodafone stated that the 2011 Model did not estimate accurately the true level of LRIC,[1067] and that Ofcom's chosen methodology for the computation of LRIC was unsound in principle and produced implausibly low figures.[1068]

3.925 Vodafone said that if Ofcom had done the calculation of LRIC properly it would have created a model that started with a zero-traffic data point and allowed the network to grow to the present level (so that it could actually produce a reliable view of cost at all levels of traffic).[1069]

3.926 Vodafone stated that its evidence showed that Ofcom would have to rework its model in order to derive a robust estimate of LRIC.[1070] As the 2011 Model was based on the

[1067] Vodafone NoA, §65, & Vodafone NoA, W/S Roche, §4.5.
[1068] Vodafone NoA, §20A.
[1069] Vodafone staff hearing transcript, p20, line 7ff.
[1070] Vodafone NoA, W/S Roche, §4.123.

assumption that certain coverage-related costs were not traffic related, the coverage assets and costs should have been identified separately and Ofcom should have:[1071]

(a) examined for each asset class (on an area by area basis) what volume was required for a minimum coverage network;[1072] and

(b) determined the relationship between efficient cost and traffic between this minimum coverage network and the costs of a full service network on a service-by-service basis. The incremental costs of providing the MCT service could then be ascertained directly based on the subtractional method employed by Ofcom.[1073]

3.927 Vodafone said that this would have been a substantial undertaking.[1074]

3.928 As Ofcom had not done this, Vodafone suggested four alternative models, for three of which Vodafone provided calculations of the associated LRIC.

Vodafone's models

3.929 Vodafone said that it was impossible to adjust Ofcom's 2011 Model without substantial re-engineering so that it grew from the zero-traffic level to the current calibrated level, and hence produced the correct incremental costs at all points of traffic—which would be the better solution and which would have provided a model with an appropriate cost slope. In order to approximate this outcome, Vodafone considered different ways of getting to the last increment.[1075]

3.930 Vodafone said that none of its alternative calculation methodologies were perfect.[1076] It did not advocate that Ofcom should have adopted any of its three alternative calculation methodologies, or that we should now do so, except that absent an adequate LRIC model, these alternative approaches provided an approximation of what might be an accurate LRIC measure, to inform the understanding of the potential magnitude of Ofcom's error in its assessment of the LRIC cost of the MCT service.[1077]

3.931 Vodafone said that one of the alternative methods identified the costs by taking all the non-traffic-related costs out of the model before calculating the final increment and another steepened the cost curve by having very slightly changed parameters for the network build in the world without termination. Both approaches effectively had the same effect: they were steepening the cost gradient for LRIC.[1078]

3.932 The three methods used by Vodafone to derive what it considered a more robust approximate value for the LRIC of the MCT service were all based on adjustments of the 2011 Model as follows:[1079]

(a) The first method used the Ofcom model and Ofcom's subtractional methodology but used Vodafone's zero coverage network.[1080]

[1071] Vodafone NoA, W/S Roche, §4.123.
[1072] Vodafone NoA, W/S Roche, §4.123.
[1073] Vodafone NoA, W/S Roche, §4.123.
[1074] Vodafone NoA, W/S Roche, §4.123.
[1075] Vodafone staff hearing transcript, p42, line 8ff.
[1076] Vodafone staff hearing transcript, p20, line 7ff.
[1077] Vodafone Core Submission, §5.49.1.
[1078] Vodafone staff hearing transcript, p41, line 6ff.
[1079] Vodafone NoA, §80.
[1080] Vodafone NoA, §80.1.

(b) The second method followed that adopted by OPTA, the Dutch telecommunications regulator, to derive a LRIC of MCT services in that, whilst it did not use a zero-coverage network, it asked how an efficient network planner would have differentially designed a hypothetical network in the absence of termination, allowing different network design assumptions to be used in the network in the absence of termination. The approach then used subtraction to derive an increment for termination and to calculate a LRIC for the MCT service.[1081]

(c) The third method calculated the LRIC of MCT services directly (also using Vodafone's zero-coverage network), ie it assumed that the only services provided were MCT services.[1082]

3.933 Vodafone's fourth methodology (the distributed variable costs method) involved calculating the LRIC+ network as currently done by Ofcom. It would also entail calculating a minimum coverage network.[1083] LRIC would then be estimated by allocating all differences in costs between these two models to the individual traffic-related services.[1084] Vodafone did not provide calculations for this methodology.

3.934 Vodafone said that its three alternative calculations provided additional evidence that the 2011 Model produced a LRIC that was too low.[1085]

3.935 Vodafone said that its own models relied on either a more realistic view of the zero-traffic network or a more realistic view of an operator's response to lower demand in a given period. Vodafone said that its view that these alternative models gave a more reliable estimate of LRIC was supported by its own calculations that showed that by removing the assumption that network design parameters only had inter-temporal variability, its LRIC of MCT services was very close to the LRIC of MCT services when the zero-traffic network was appropriately modelled.[1086]

3.936 The three calculation methods used by Vodafone produced the following estimates of the LRIC of the MCT service: the first approach 1.26ppm, the second approach 1.32ppm and the third 1.25ppm (compared with Ofcom's decision of 0.69[1087]).[1088]

3.937 Vodafone therefore argued that LRIC-based MCT charges should be set at 1.25ppm for 2014/15 (in 2008/09 prices).[1089]

3.938 We do not consider it necessary to assess the merit of Vodafone's proposed alternative methodologies because we were not persuaded by EE's and Vodafone's arguments that Ofcom's cost model contained a number of flaws that undermined its ability to produce reliable estimates of LRIC (see part 1 above). However, for completeness, we assess below whether Vodafone's suggested adjustments to the 2011 Model included in its proposed alternative methodologies disclose an error in the 2011 Model.

3.939 Rather than assessing each methodology separately, we assess each of the adjustments suggested by Vodafone in the context of its three alternative methodologies.[1090] The reason for doing this is because Vodafone advances these method-

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[1081] Vodafone NoA, §80.3.
[1082] Vodafone NoA, §80.2.
[1083] Vodafone NoA, W/S Roche, §4.183.
[1084] Vodafone NoA, W/S Roche, §§4.186 & 4.187.
[1085] Vodafone bilateral hearing transcript, p112, line 13, to p113, line 2.
[1086] Vodafone Core Submission, W/S Roche II, §4.4.
[1087] Ofcom Main MCT statement, Table 1.1.
[1088] Vodafone NoA, §81.
[1089] Vodafone NoA, §82.
[1090] These are separate from the proposed adjustments considered elsewhere in this section in relation to Reference Question 2.

ologies not as suitable methodologies to calculate LRIC, but as better proxies for LRIC than Ofcom's 2011 Model. We therefore consider that these adjustments are equivalent to suggested improvements to Ofcom's 2011 charge control model. This approach is also practical as some of the adjustments suggested by Vodafone appear in more than one of Vodafone's alternative methodologies.

3.940 Vodafone suggested the following adjustments to Ofcom's 2011 Model for the calculation of LRIC:

(a) adjustments for errors pleaded in Reference Question 3;

(b) the year zero adjustment;

(c) Ofcom should make different assumptions on:

(i) NMS, spectrum and voicemail;

(ii) proportion of microcells and picocells;

(iii) cell breathing; and

(iv) coverage (see paragraph 3.948).

(d) Ofcom should have used a zero coverage scenario (see paragraph 3.963); and

(e) Ofcom should have used a stand-alone termination model (see paragraph 3.978).

EE's challenge

3.941 EE said that Ofcom should have corrected flaws in its model.[1091] EE alleged the following flaws:

(a) common costs were too high a proportion of total network costs;[1092]

(b) Ofcom modelled spectrum costs incorrectly;[1093]

(c) Ofcom modelled data costs incorrectly;[1094] and

(d) Ofcom calculated the WACC incorrectly.[1095]

3.942 EE said that the ED methodology used by Ofcom led to implausible results.[1096] We set out below our decision separately for first Vodafone's and then EE's proposed adjustments to Ofcom's 2011 Model.

[1091] EE NoA, §159.
[1092] EE NoA, §157.1.
[1093] EE NoA, §157.2.
[1094] EE NoA, §157.3.
[1095] EE NoA, §157.4.
[1096] EE NoA, §157.5.

Vodafone's suggested corrections

Adjustments for errors pleaded in Reference Question 3

3.943 As discussed in paragraph 1.62ff, we do not consider that Vodafone has properly particularized that the challenges set out in Reference Question 3 (in relation to LRIC+) are relevant to the calculation of LRIC (this Reference Question 2). As set out in paragraph 1.64 above in paragraph 78 of their NoA, Vodafone argued that LRIC should be calculated in a way that took account of the modelling errors described in sections 3 and 4 of Mr Roche's report. We therefore consider these suggested adjustments in that context. As the reasoning for the proposed adjustments to LRIC are identical to the reasoning for the proposed adjustments to LRIC+, we do not assess them separately here but, instead, cross-refer to our assessment in Reference Question 3.

3.944 In our determination of Reference Question 3, we identified that Ofcom erred in its modelling of the 2G/3G MSCs. In addition we assessed also Vodafone's allegations that Ofcom erred in respect of the busy day/week split and the modelling of historic datacard market shares in relation to the calculation of LRIC+ and concluded that Ofcom had been shown to have erred in its modelling of those two inputs. We did not find that Ofcom erred in any other respect in relation to the errors alleged in Reference Question 3.

3.945 Vodafone suggested adjustments to Ofcom's 2011 model to correct for the alleged errors in relation to:

(a) the year zero adjustment;[1097]

(b) the treatment of NMS, spectrum and voicemail;[1098]

(c) the treatment of microcell and picocells;[1099] and

(d) cell breathing.[1100]

3.946 In Part 1 of this section we determined that Vodafone has not demonstrated that Ofcom erred in relation to these input assumptions:

(a) for the year zero adjustment, see paragraph 3.452ff;

(b) for the treatment of NMS, spectrum and voicemail, see paragraphs 3.245, 3.252 and 3.260 respectively;[1101]

(c) for the treatment of microcell and picocells, see paragraph 3.129;[1102] and

(d) for cell breathing, see paragraph 3.139.[1103]

3.947 We therefore do not find a basis for making an adjustment in respect of the alleged errors cited in paragraph 3.945. We turn now to consider Vodafone's arguments as listed in 3.940*(c)*(iv), *(d)* and *(e)* above.

[1097] Vodafone NoA, W/S Roche I, §4.139.
[1098] Vodafone NoA, W/S Roche I, §§5.15–5.19, 5.20–5.31 & 5.38–5.40.
[1099] Vodafone NoA, W/S Roche I, §§ 5.36 & 5.37.
[1100] Vodafone NoA, W/S Roche I, §§5.49–5.56.
[1101] Vodafone NoA, W/S Roche I, §§5.15–5.19, 5.20–5.31 & 5.38–5.40.
[1102] Vodafone NoA, W/S Roche I, §§5.36 & 5.37.
[1103] Vodafone NoA, W/S Roche I, §5.49–5.56.

Coverage assumptions

Ofcom's decision

3.948 Ofcom said that LRIC of MCT services were calculated as the cost avoided by not providing off-net termination whilst still providing all other services. Network coverage in rural areas was determined by a number of competitive and commercial factors and Ofcom did not believe that it would be appropriate or practicable to calculate optimal network coverage for a network without off-net termination.[1104]

Vodafone's challenge

3.949 Vodafone stated that in a network that provided no MCT services, coverage of marginal rural areas became less likely and adequate coverage to meet coverage requirements could be achieved without deploying network assets in marginal rural areas. It followed that the last margin of coverage penetration would not have occurred when MCT services were not provided.[1105]

3.950 Vodafone said that with voice termination being a minimum of 25 per cent of the network traffic, and a higher proportion in the past, the modelled network operator would have installed much less extensive area coverage in marginal rural areas and rural coverage would have been developed more slowly. This was because traffic volumes in these marginal areas were low even with a full set of traffic services and the economics of rollout were poor. It was therefore reasonable to assume that with less traffic the business case became even less credible.[1106]

3.951 Vodafone said that this adjustment was analogous to the cell breathing adjustment.[1107]

3.952 Vodafone suggested a number of adjustments to account for this effect, which increased LRIC by 0.1913ppm (which is around 28 per cent of Ofcom's LRIC estimate of 0.69ppm in 2014/15).[1108]

Ofcom's Defence

3.953 Ofcom did not consider that it was appropriate to use a parameter adjustment model to implement a LRIC approach. Ofcom said that it saw merit in the view raised by Three that if the network build parameters were reasonable in the LRIC+ model, there should be no difference between changing volumes over time and changing volumes due to the removal of a service.[1109]

BT's SoI in support of Ofcom

3.954 BT did not consider that adjustments for lower rural coverage in the network without MCT services were appropriate. BT considered that LRIC charges should be calculated with reference to reality and should look at the incremental cost of carrying terminating traffic given the network as it was now and was expected to evolve further, rather than a network that did not offer call termination.[1110]

[1104] Ofcom Decision, §9.87.
[1105] Vodafone NoA, W/S Roche I, §5.57.
[1106] Vodafone NoA, W/S Roche, §5.58.
[1107] Vodafone bilateral hearing transcript, p124, line 24, to p125, line 2..
[1108] Vodafone NoA, W/S Roche, §§5.59–5.70.
[1109] Ofcom Defence, Annex B, §220.
[1110] BT NoA, W/S Richardson, §57d.

Three's SoI in support of Ofcom

3.955 Three noted that LRIC was defined as the costs avoided by no longer providing the service being examined but continuing to provide all other services. Implicit within this definition was the assumption that other services were provided in their current form. Three said that Vodafone assumed that cessation of MCT services would result in other services changing as well.[1111,1112]

3.956 Three referred to the Recommendation which stated that:

> Avoidable costs are the difference between the identified total long-run costs of an operator providing its full range of services and the identified total long-run costs of that operator providing its full range of services except for the wholesale call termination service supplied to third parties.[1113]

3.957 Three considered that Vodafone's removal of coverage levels directly contradicted both the EC Recommendation and the reality of the network cost function. It resulted in coverage costs which were not in fact incremental to MCT being included in LRIC, and in a model which predicted asset counts that would never exist in the real world, either with or without MCT.[1114,1115]

3.958 Three was of the view that in reducing the level of coverage absent MCT, Vodafone changed the nature of services other than MCT. The incremental costs incurred in increasing coverage were common to all services and should not be treated as incremental to a single service.[1116]

3.959 Three also stated that if MCT was charged at LRIC, then the revenues lost by the absence of MCT would by definition be precisely matched by the costs so avoided. The economics of providing coverage would therefore be entirely unaffected and there was therefore no reason to suppose that there would be any change in coverage at all.[1117]

Assessment: coverage assumptions

3.960 We agree with Ofcom and Three that the LRIC of MCT services should be calculated by reference to the costs avoided by no longer providing MCT services, but continuing to provide all other services. If coverage assumptions are changed in the ex-MCT network, then this implies that other services are not provided in their current form. We do not agree that this is the correct approach and we note that it would depart from the Recommendation.[1118]

3.961 We also agree with Three that changing coverage assumptions would depart from the Recommendation which recommends that coverage costs are excluded from the calculation of LRIC. If coverage in the ex-MCT network is reduced, then some coverage costs would implicitly be included in the calculation of the MCT increment.

[1111] Three SoI, §10.49.
[1112] Three SoI, W/S Mantzos 2, §3.44.
[1113] Three SoI, W/S Mantzos 2, §3.46.
[1114] Three SoI, W/S Mantzos 2, §3.7.
[1115] Three SoI, W/S Mantzos 2, §3.55.
[1116] Three SoI, W/S Mantzos 2, §3.47.
[1117] Three SoI, W/S Mantzos 2, §3.52.
[1118] Recommendation (§6) states that within the LRIC model, the relevant increment should be defined as the wholesale voice call termination service provided to third parties. This implies that in evaluating the incremental costs NRAs should establish the difference between the total long-run costs of an operator providing its full range of services and the total long-run costs of this operator in the absence of the wholesale call termination service being provided to third parties.

3.962 We therefore do not consider that Ofcom has erred by not changing the coverage assumption in the ex-MCT network.

Zero coverage scenario

Vodafone's challenge

3.963 Vodafone said that the zero coverage scenario involved first running the all-services network without any coverage network (ie stripping out all non-traffic-related costs) and then running the ex-MCT network without any coverage.[1119] This would not, it said, make a big difference in urban areas where asset build was determined by capacity, but would reduce costs in rural areas where, in the 2011 Model, the coverage network was assumed to be sufficient to carry MCT traffic.[1120] Vodafone considered that its approach was justified as the 2011 Model was over dimensioning and overestimating the amount of the coverage sites and the amount of the coverage costs. Vodafone said that this approach provided the incremental site build that supported the termination traffic (ie how many incremental sites would be needed to provide the termination service).[1121]

3.964 Vodafone said that all the zero coverage scenario did was to count some assets in the rural geotypes as traffic related rather than coverage related (which would be what the 2011 Model would have done had it correctly calculated a lower coverage cost).[1122]

3.965 Vodafone stated that it was not saying that using the zero coverage scenario was the right thing to do or the right measure, but that it was closer to being right than Ofcom's approach.[1123] In particular, the use of a zero-coverage adjustment would resolve the issues related to the excessively low volume of assets being identified as traffic related and the failure to match the recovery of the cost of an asset with its period of use.

3.966 Vodafone said that its zero-coverage scenario treated all radio equipment as incremental to all MCT traffic (as set out in §79.1 in Vodafone's NoA).[1124]

3.967 Vodafone said that it was not correct that the zero-coverage scenario allocated some coverage costs to the MCT increment. Vodafone said that the zero-coverage scenario moved some costs that the Ofcom model currently erroneously classified as non-traffic related into the traffic-related category, where they would have been had Ofcom properly identified the split between traffic- and non-traffic-related costs.[1125]

3.968 Vodafone said that modelling a zero-coverage scenario increased LRIC by 0.2824ppm (which is around 41 per cent of Ofcom's LRIC estimate of 0.69ppm in 2014/15).[1126]

[1119] Vodafone staff hearing transcript, p20, line 7ff.
[1120] Vodafone staff hearing transcript, p21, line 9ff.
[1121] Vodafone staff hearing transcript, p20, line 9ff.
[1122] Vodafone staff hearing transcript, p36, line 2ff.
[1123] Vodafone staff hearing transcript, p46, line 13ff.
[1124] Vodafone staff hearing transcript, p45, line 15ff.
[1125] Vodafone Core Submission, W/S Roche II, §9.17.
[1126] Vodafone Core Submission, W/S Roche, §§5.59–5.70.

EE

3.969 EE stated that it was reasonable to treat some costs as forming part of the coverage network as the initial capacity of the coverage network would not be fully used in all locations. Nevertheless this coverage network should be correctly identified and would be significantly different from that assumed in the 2011 Model.[1127] EE was of the view that of the three alternative calculations methodologies presented by Vodafone, the second approach (ie the OPTA approach) was the most reasonable and a significant improvement over Ofcom's approach to measuring LRIC.[1128]

Ofcom's Defence

3.970 Ofcom said that the zero-coverage scenario put forward by Vodafone was not consistent with the EC Recommendation for how LRIC should be calculated. The EC Recommendation stated that the all-service network from which MCT was decremented should include the coverage network. There would inevitably be some assets in the coverage network that would be used by traffic services.[1129] The Vodafone approach reallocated some of the coverage costs to traffic including MCT.[1130]

BT's SoI in support of Ofcom

3.971 BT said that Vodafone's alternative methods resulted not in a LRIC rate, but in a LRIC+ rate, since they included access costs, and treated terminating traffic as being on a par with other types of traffic.[1131]

Three's SoI in support of Ofcom

3.972 Three said that Vodafone's removal of coverage levels directly contradicted both the 2009 EC Recommendation and the reality of the network cost function. It resulted in costs which were not in fact incremental to MCT being included in LRIC.[1132]

3.973 Three said that Vodafone's reasoning appeared to be based on a view that any asset whose resources were consumed by a service should be viewed as incremental to a service. Such a view was mistaken and wholly incompatible with the basic principle of incremental costing, namely that costs which were not avoided by the cessation of a service were excluded from incremental cost, whether or not those costs were in some sense consumed by that service.[1133]

Assessment: the zero coverage scenario

3.974 We agree with Ofcom and Three that the zero-coverage scenario would depart from the EC Recommendation as it would include coverage costs in the calculation of the LRIC of MCT services.

3.975 We also note that Vodafone said that the zero-coverage scenario was not necessarily the correct approach to calculate LRIC, but was closer to being right than Ofcom's approach. However, as we did not find that Vodafone has demonstrated that Ofcom

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[1127] EE SoI, W/S Hird 2, §116.
[1128] EE NoA, §36.
[1129] Ofcom Defence, Annex B, §§213 & 214.
[1130] Ofcom Defence, Annex B, §214.
[1131] BT SoI, §64b.
[1132] Three SoI, §10.45.
[1133] Three SoI, W/S Mantzos 2, §3.9.

erred in its 2011 Model as set out in Part 1, we do not consider that there is sufficient evidence that the zero-coverage scenario would be closer to be right than Ofcom's approach.

3.976 We also agree with BT that Vodafone's zero-coverage scenario would calculate fully-allocated costs of MCT services (in so far as they are traffic related) rather than the avoidable costs of MCT services when MCT services are treated as the final increment. We do not believe that this is an appropriate approach.

3.977 We therefore do not consider that Vodafone has demonstrated that Ofcom erred by not modelling a zero-coverage scenario.

Stand-alone termination model

Vodafone's challenge

3.978 Vodafone accepted that the third proposed method (stand-alone termination model) did not treat the MCT service as the final increment, but considered it informative as to the stand-alone incremental costs of providing the MCT service. This was of value in light of its case that coverage costs were much lower than Ofcom has assumed.[1134]

3.979 Vodafone said that traffic-related costs were calculated in a linear manner to demand in the 2011 Model and therefore the first increment should be broadly similar to a last increment or to an average increment method.[1135]

3.980 Vodafone said that its stand-alone termination model dealt with the lumpiness of assets, as set out in §79.2 in Vodafone's NoA.[1136]

Ofcom's Defence

3.981 Ofcom said that the stand-alone termination model was not consistent with the EC Recommendation as it would include two sources of common costs. First, the MCT increment was picking up some of the costs that would otherwise have been allocated to coverage, and second, MCT was treated as the first increment rather than the last.

Assessment: stand-alone termination model

3.982 We agree with Ofcom that a stand-alone termination model would be a departure from the Recommendation as it would not treat MCT services as the last increment and because it would include common costs in the calculation of MCT services (and would therefore not calculate the avoidable costs of MCT services).

3.983 We also agree with BT[1137] that Vodafone's stand-alone termination model would calculate fully-allocated (traffic-related) costs of MCT services rather than the avoidable costs of MCT services when MCT services are treated as the final increment. We do not believe that this is an appropriate approach.

[1134] Vodafone Core Submission, §5.49.2.
[1135] Vodafone Core Submission, W/S Roche II, §11.5.
[1136] Vodafone staff hearing transcript, p49, line 9ff.
[1137] As set out in paragraph 3.971.

3.984 We therefore do not consider that Ofcom has erred by not adopting a stand-alone termination model.

EE's suggested corrections

Our draft decision—EE's adjustments to the 2011 Model

3.985 We do not consider that EE has demonstrated that Ofcom should have made adjustments for the alleged flaws set out in its 2011 Model:[1138]

(a) As set out in paragraph 3.363ff, we do not consider that EE has demonstrated that common costs in Ofcom' s model are too high.[1139]

(b) As set out in paragraph 3.252ff, we do not consider that EE has demonstrated that Ofcom modelled spectrum costs incorrectly.[1140]

(c) As set out in paragraph 3.461ff, we do not consider that EE has demonstrated that the ED methodology used by Ofcom led to implausible results.

(d) As set out in paragraph 3.579, we do not consider that EE has demonstrated that Ofcom modelled forecast data usage incorrectly.[1141]

(e) As set out in paragraph 3.580ff, we do not consider that EE has demonstrated that Ofcom modelled administration costs incorrectly.

(f) As set out in paragraph 3.616ff, we do not consider that EE has demonstrated that Ofcom calculated the WACC incorrectly.

Conclusion

3.986 In Part 1 of this section we were not persuaded by EE's and Vodafone's arguments that Ofcom's cost model contained a number of flaws that undermined its ability to produce reliable estimates of LRIC. In this part, we have examined the specific adjustments suggested by EE and Vodafone as part of the alternative models advanced by Vodafone to derive a more robust estimate of LRIC.

Determination

3.987 For the reasons set out in Parts 1 and 2 of this section, we do not find that the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in determining the level of the charge control based on LRIC.

[1138] EE NoA, §159.
[1139] EE NoA, §157.1.
[1140] EE NoA, §157.2.
[1141] EE NoA, §157.3.

Section 4: Reference Question 3

Whether Ofcom erred in determining the level of mobile termination charges that would reflect the adoption of the LRIC+ cost standard (for the reasons set out in paragraphs 238 to 240 of EE's Notice of Appeal (Ground 3), and paragraphs 20A and paragraphs 58 to 62 of Vodafone's Notice of Appeal).

Introduction

4.1 Ofcom's 2011 Model provided calculations of MCT costs based on both LRIC and LRIC+.[1]

4.2 In its statement Ofcom compared MCT charges set on the basis of LRIC and LRIC+[2] and considered the likely effect, to the extent possible, of the incremental effect of shifting from LRIC+ to LRIC in setting MTRs.[3]

4.3 We deal, in section 1 of this determination, with the question of whether or not Vodafone could be said to have properly particularized all the errors alleged in respect of Reference Question 3. Though we believe there to be force in Three's contention that the errors have not been set out in Vodafone's NoA with sufficient clarity we have included in this section our assessment of all of the errors set out in Mr Roche's witness statement. EE also alleged that Ofcom had made errors in its calculation of the LRIC+ of the MCT service.

4.4 Appropriate cross-references are made under the respective reference questions where duplication of our analysis of the evidence and arguments, and of our determination, is unnecessary.

Overview of arguments

Vodafone

4.5 Vodafone alleged six categories of error were made in Ofcom's calculation of LRIC+[4] (which it also proposed as adjustments to the LRIC calculation). The alleged errors included:

(a) data services (four separate errors);[5]

(b) cost drivers (three separate errors);[6]

(c) coverage (three separate errors);[7]

(d) proportion of 3G traffic carried over the 2G network;[8]

(e) voicemail (four separate errors);[9] and

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[1] Ofcom Decision, §A 6.10.
[2] Ofcom Decision, §7.19.
[3] Ofcom Decision, §7.48.
[4] Vodafone NoA, §59.
[5] Vodafone NoA, W/S Roche I, §3.6.
[6] Vodafone NoA, W/S Roche I, §3.47.
[7] Vodafone NoA, W/S Roche I, Table 3.9.
[8] Vodafone NoA, W/S Roche I, Table 3.10.
[9] Vodafone NoA, W/S Roche I, Table 3.11.

(f) consequential changes to calibration.[10]

4.6 Vodafone stated that the combined effect of correcting these errors would increase LRIC+ from 1.6147ppm to 1.9222ppm (in 2014/15), an increase of approximately 19 per cent (and LRIC from 0.6921ppm to 0.7107ppm, an increase of approximately 3 per cent) in 2014/15.[11]

4.7 Vodafone said that we should not deconstruct its adjustments into each component of each adjustment, but should see the adjustment in the relevant bundles they came in (eg for data traffic or voicemail).[12]

EE

4.8 EE alleged that the following errors were made in the calculation of LRIC+ (which EE also alleged as errors in its appeal of the LRIC calculation):

(a) errors in the forecast data usage (see paragraph 4.373);[13] and

(b) that the WACC was too low.[14]

Ofcom

4.9 Ofcom said that the appellants had only sought to criticize certain aspects of the model, but there were a very large number of assumptions which had not been challenged and Ofcom, during the consultation process, had to look at all of the cost modelling assumptions, taking into account the resource and time required to investigate them, the likelihood of obtaining greater clarity, and the materiality of the issues involved. Ofcom said that if perfection was sought in every case it would be impossible to get the charge control completed within a reasonable time frame.[15]

4.10 Ofcom stated that the errors put forward by Vodafone under Reference Question 3 comprised a long tail of points raised by Vodafone, which would have minor consequences for the level of the price control, whether the measure chosen was LRIC or LRIC+.[16] In particular:

(a) these points typified the scattergun approach identified as inappropriate by the CC in the Carphone Warehouse determination;[17] and

(b) in some instances Vodafone combined several alleged errors when quantifying the effect of an error.[18]

4.11 Ofcom stated that the modelling involved in a price control necessarily entailed a substantial element of uncertainty and judgement, and the model itself was a simplification of a real world mobile network.[19]

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[10] Vodafone NoA, W/S Roche I, Table 3.12.
[11] All references to Vodafone's and EE's calculations of the impact of correcting errors on LRIC+ and LRIC in the remainder of this section refer to the LRIC and LRIC+ in 2014/15.
[12] Response to Reference Question 4 in post staff hearing transcript, pp13–15.
[13] EE NoA, §§238 & 239.
[14] EE NoA, §240.
[15] Ofcom bilateral hearing transcript, p7, line 19ff.
[16] Ofcom Core Submission, §68.
[17] Ofcom Core Submission, §68a.
[18] Ofcom Core Submission, fn 24.
[19] Ofcom Core Submission, §68d.

Structure of the determination

4.12 This chapter assesses the arguments that Ofcom erred in its calculation of the LRIC+ of MCT. It looks in turn at whether Ofcom erred in respect of:

(a) data services (see paragraph 4.13ff);[20]

(i) future datacard growth (see paragraph 4.13ff);

(ii) busy day/week split (see paragraph 4.72ff);

(iii) HSPA efficiency adjustment (see paragraph 4.99ff);

(iv) Historic datacard market share (see paragraph 4.122);

(b) cost drivers (see paragraph 4.145ff);[21]

(i) cell site and spectrum (see paragraph 4.146ff);

(ii) 2G/3G MSC (see paragraph 4.176ff);

(c) coverage (see paragraph 4.193ff);[22]

(i) 2G area coverage (see paragraph 4.198ff);

(ii) 2G cell radii (see paragraph 4.215ff);

(iii) 3G area coverage (see paragraph 4.246ff);

(d) proportion of 3G traffic carried over the 2G network (see paragraph 4.272ff);[23]

(e) voicemail (see paragraph 4.315ff);[24] and

(i) percentage of calls ending on voicemail (see paragraph 3.314ff);

(ii) cost driver for voicemail (see paragraph 3.314ff);

(iii) partial build of voicemail platforms (see paragraph 3.314ff);

(iv) resilience (see paragraph 3.314ff);

(f) consequential changes to calibration (see paragraph 4.367ff);[25]

(g) the forecast data usage (see paragraph 4.373ff);[26] and

(h) the WACC (see paragraph 4.398—by way of cross-reference to Reference Question 2).[27]

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[20] Vodafone NoA, W/S Roche I, §3.6.
[21] Vodafone NoA, W/S Roche I, §3.47.
[22] Vodafone NoA, W/S Roche I, Table 3.9.
[23] Vodafone NoA, W/S Roche I, Table 3.10.
[24] Vodafone NoA, W/S Roche I, Table 3.11.
[25] Vodafone NoA, W/S Roche I, Table 3.12.
[26] EE NoA, §§238 & 239.
[27] EE NoA, §240.

The errors alleged by Vodafone and EE

Error in data services—future datacard[28] growth

Ofcom's Statement

4.13 Ofcom said that there were signs that datacard adoption was increasing, for example the percentage of households that had mobile broadband as their only form of broadband doubled between Q1 2009 and Q1 2010 (from 3 to 6 per cent).[29] Ofcom said that at the time of its March 2011 Statement, it appeared that mobile broadband was largely used as a complement to fixed broadband, and only to a limited extent as a substitute in the UK, and Ofcom assumed that it would remain so in its demand forecasts.[30]

4.14 Ofcom said that recent surveys had highlighted the relatively slow speeds delivered by mobile broadband (compared with fixed broadband) and a generally low level of user satisfaction. It was therefore not clear if mobile broadband would continue its very fast growth and become ubiquitous, or reach a plateau at a lower level of take-up. Nevertheless, Ofcom expected mobile broadband to continue to grow: a report by Analysys Mason Research in February 2009 forecast that mobile broadband would reach a penetration of around 27 per cent of the UK population by the end of 2014. Ofcom also expected the datacard market to be given a significant boost by the nascent tablet market, which could access fixed networks through WiFi and mobile networks through a SIM card. However, Ofcom noted that historical growth appeared to have been be a little below the forecasts in that report.[31] Ofcom therefore forecast a 19 per cent penetration at the end of 2014/15, and 27 per cent by the end of 2020/21.[32]

4.15 Ofcom stated that with the rapid growth in subscribers, lower pricing, and the availability of HSPA,[33] the usage per datacard rapidly rose to around 900MB per month by the end of 2008/09, but that since then growth appeared to have moderated. Based on recent data, Ofcom assumed that usage per device would decrease from about 1,050MB in Q1 2010/11 to 1,000MB over the model period, noting that mobile broadband was still in its early stages and historical trends might not be a good predictor for the future.[34]

4.16 Ofcom did not believe that not modelling a 4G network constrained the forecasts of the number of datacard subscribers. Ofcom explained that excluding 4G technology from its forecast meant that the data usage projected on Ofcom's 2G/3G cost model was likely to be lower than for an operator offering 2G/3G and 4G technology, but it considered that the total number of datacards could be similar for a network with and for one without 4G.[35]

4.17 Ofcom noted that using lower datacard penetration assumptions would make very little difference to the LRIC calculations and that in principle the LRIC for MCT services should not be sensitive to the volume of data traffic. This was because if network assets were infinitely divisible, more data traffic would not cause the cost of

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[28] Datacards provide access to mobile broadband for devices such as laptop computers.
[29] Ofcom Decision, §§A6.74 & A6.66.
[30] Ofcom Decision, §A6.66.
[31] Ofcom Decision, §A6.67.
[32] Ofcom Decision, §A6.67.
[33] HSPA and HSPDA stands for High Speed Packet Access.
[34] Ofcom Decision, §A6.68.
[35] Ofcom Decision, §A6.75.

carrying an increment of termination voice traffic to change. However, Ofcom said that in practice the modularity of assets could cause some variation in LRIC.[36]

Vodafone's challenge

4.18 Vodafone stated that datacards that could be installed inside a laptop computer were originally mainly marketed to enterprise customers, but, since 2007, most sales had been made in the consumer market, and comprised external USB sticks ('dongles') that could be readily used by a laptop or desktop PC to allow mobile, wireless broadband.[37]

4.19 Vodafone said that over the period 2007 to 2009 there had been considerable growth in the datacard market, from a low base. However, more recently growth had slowed, and the market had been characterized by rising churn and a shift in new connections from contract to pre-pay subscriptions to allow for more irregular use. This had been coupled with a broader view that such mobile broadband was primarily a complement to fixed broadband rather than a substitute for it (and which was unlikely to change even with 4G technologies[38]).[39] Vodafone noted that fixed broadband was capable of providing a higher bandwidth at a lower cost than mobile broadband.[40] Vodafone provided extracts from Ofcom's August 2010 Communications Market Report and an Enders report that it said supported this view.[41]

4.20 Vodafone stated that Ofcom's model continued to project rapid and accelerating market growth of datacards on 3G into the future, which was unrealistic.[42] See also Table 3.1 below.

TABLE 3.1 **Datacard market growth**

£ million

Ofcom: datacard market growth—annual increase in subscribers		*Customers*		
		Low	*Medium*	*High*
Year to June 2008—annual growth	Actual		1.07	
Year to June 2009	Actual		1.61	
Year to June 2010	Actual		1.06	
Cum market growth	Actual		3.98	
Year to June 2011	Forecast	1.54	2.02	2.57
Cum market growth	Forecast	5.52	6.00	6.55
Year to June 2012	Forecast	1.18	1.66	2.13
Year to June 2013	Forecast	1.03	1.63	2.19
Year to June 2014	Forecast	0.88	1.54	2.18
Year to June 2015	Forecast	0.74	1.42	2.09
Cum market growth	Forecast	9.36	12.25	15.15

Source: Table 3.2 in W/S Roche I (Vodafone).

4.21 Vodafone said that the actual number of datacards in June 2010 was 3.98 million and Ofcom's model forecast 6.0 million datacards for June 2011. However, Vodafone's own market intelligence indicated that the number of datacards in March 2011 was around [✂], well behind Ofcom's estimates for June 2011.[43] Vodafone also pointed out that the absolute growth in datacards in Ofcom's model of around 2 million in the

[36] Ofcom Decision, §§A6.76 & A10.17.
[37] Vodafone NoA, W/S Roche I, §3.7.
[38] Vodafone NoA, W/S Roche I, §3.20.
[39] Vodafone NoA, W/S Roche I, §3.8.
[40] Vodafone NoA, W/S Roche I, §3.9.
[41] Vodafone NoA, W/S Roche I, §§3.10 & 3.12.
[42] Vodafone NoA, W/S Roche I, §§3.13 & 3.16.
[43] Vodafone NoA, W/S Roche I, §§3.14 & 3.15.

year to June 2011 was higher than the actual absolute growth of 1.1, 1.6 and 1.1 million in the year to June 2008, 2009 and 2010, respectively.[44]

4.22 Vodafone argued that Ofcom's forecasts of future datacard uptake and the forecast data use of datacards should therefore be reduced to reflect current trends.[45]

4.23 Vodafone also said that Ofcom's forecast of very high datacard penetration and usage was incompatible with Ofcom's assumption to exclude 4G technology from the model.[46] Vodafone said that if there was to be growth in the future in mobile datacard devices it would not be on 3G, but on the future 4G technology. Vodafone also expected that as 4G dongles became available, there would be a switch away from 2G and 3G dongles,[47] resulting in a decline of the use of 3G datacards.[48,49] Vodafone stated that Ofcom should have excluded from its forecast future datacard usage demand which was dependent on the availability of 4G technology, since it was irrational to factor in demand for a service which the modelled 2G/3G network could not meet.[50]

4.24 Vodafone expected that the average use of data per 3G customer would reduce in the future as some operators were beginning to reduce data use of some high-volume users.[51] Vodafone alleged that Ofcom ignored the fact that MNOs were actively using strategies to divert data traffic from their networks on to, for example, Wi-Fi in order to make more efficient use of limited network capacity.[52] Vodafone also considered that data traffic on the 3G mobile network would further reduce because of widespread access to Wi-Fi networks, either in the home or outside the home and because almost all current generation smartphones had Wi-Fi capabilities.[53]

4.25 Vodafone suggested using Ofcom's low scenario (instead of the medium scenario) until Q4 of 2013/14 for datacard penetration, which Vodafone then assumed to fall by 0.25 per cent per quarter thereafter.[54] Vodafone said that making this adjustment would increase the LRIC+ by 5.2 per cent (or 0.0843ppm) and would reduce LRIC by 1.4 per cent (or –0.0095ppm).[55]

4.26 Vodafone stated that Ofcom had placed undue reliance on Three's data volumes even though Three had aimed, by its marketing strategy, to achieve a disproportionately high share of total data traffic.[56] Vodafone also said that Ofcom had stopped collecting traffic data in June 2010 for modelling purposes and that it should have requested more current data in its decision.[57]

EE SoI in support of Vodafone

4.27 EE stated that in reaching its decision Ofcom had had access to data to June 2010 (as set out by Vodafone in paragraph 4.20) which showed slowing market growth. Despite this, Ofcom forecast accelerating growth. EE said that Ofcom's failure to

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[44] Vodafone NoA, W/S Roche I, Table 3.2.
[45] Vodafone NoA, W/S Roche I, §3.17.
[46] Vodafone, W/S Roche 2, §7.24.
[47] Vodafone NoA, W/S Roche I, §§3.21 & 3.25.
[48] Vodafone, W/S Roche I, §3.26.
[49] Vodafone NoA, W/S Roche I, §3.17.
[50] Vodafone Core Submission, §5.58.5.
[51] Vodafone NoA, W/S Roche I, §3.24.
[52] Vodafone Core Submission, §5.58.6.
[53] Vodafone, W/S Roche I, §3.22.
[54] Vodafone, W/S Roche I, §3.27.
[55] Vodafone, W/S Roche I, §3.28.
[56] Vodafone Core Submission, §5.58.6 [sic].
[57] Vodafone Core Submission, W/S Roche 2, §7.18.

recognize that the datacard market had passed a turning point was now being confirmed by the more recent operator evidence.[58]

4.28 [✂][59] EE stated that Orange experienced a [✂] per cent decrease in datacard traffic between March 2010 and April 2011 and that [✂].[60] EE also stated that T-Mobile's data volumes were [✂] as Orange's data volumes.[61]

4.29 EE said that it had revised down its datacard forecasts in the light of the decline in datacard traffic [✂].[62] The new forecasts were [✂].[63]

4.30 EE stated that there were other more general indications that future datacard traffic growth was likely to be lower than previously thought.[64]

4.31 EE also expected that Ofcom's charge control would require higher data prices as well as higher prices for other mobile retail services, which would lead to a reduction in the demand that would otherwise have occurred.[65] See also paragraph 4.373ff.

4.32 EE considered that Vodafone's suggested amendments to Ofcom's model for future datacard growth were reasonable.[66] EE, making its own calculations, said that the adjustment for datacard forecasts would increase LRIC+ by 8.3 per cent (or 0.1059ppm) and would increase LRIC by 1.9 per cent (or 0.0158ppm).[67]

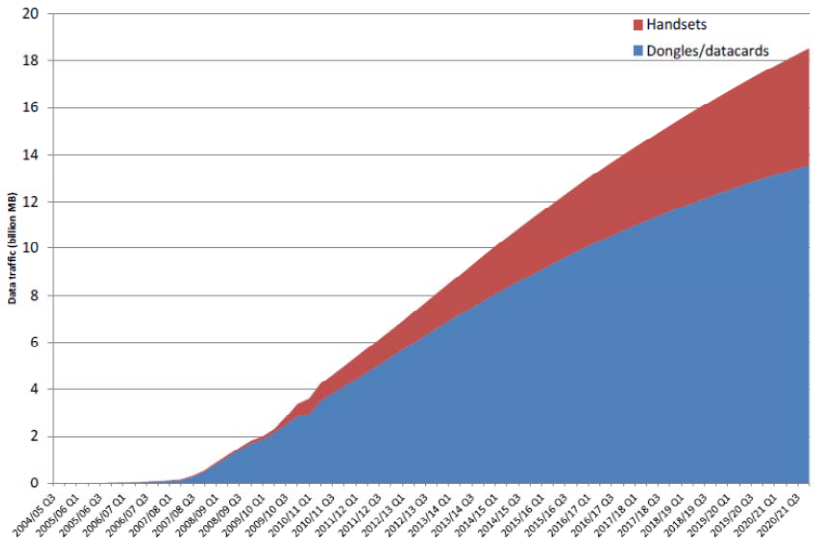
4.33 EE added that even the packet data forecast in Ofcom's model now looked implausible.[68]

4.34 EE stated that it was not sufficient for Ofcom to say that the data that it had for the first quarter of 2010/11 was still above the estimate in the model. A reasonable forecast should, said EE, take account of the factors that were likely to shape future traffic volumes.[69] EE provided the following graph (Figure 4.1), which showed the total packet data growth assumed in Ofcom's model, split by datacards and handset data consumption.[70]

[58] EE SoI, W/S Hird 2, §16.
[59] EE NoA, W/S James, §§12–14.
[60] EE SoI, W/S Hird 2, §15.
[61] EE NoA, W/S James, §14.
[62] EE NoA, W/S James, §15.
[63] EE NoA, W/S James, §16.
[64] EE SoI, W/S Hird 2, §17.
[65] EE SoI, W/S Hird 2, §18.
[66] EE SoI, W/S Hird 2, §20.
[67] EE SoI, W/S Hird 2, §21.
[68] EE Core Submission, W/S Hird 4, §18.
[69] EE Core Submission, W/S Hird 4, §19.
[70] EE Core Submission, W/S Hird 4, §17.

FIGURE 4.1

Data traffic forecast in Ofcom's 2011 Model



Source: EE.

4.35 EE stated that Ofcom's forecast for overall data traffic was likely to be significantly overstated as it relied on rapid ongoing growth in both datacard and handset data traffic. Datacard traffic was [✂] and handset data traffic on its own could not be expected to grow so rapidly as to also fulfil the role of datacard traffic in the forecast growth.[71]

4.36 EE stated that growing smartphone penetration could be expected to enable more subscribers to be able to access the Internet while they were on the move, but most smartphone users (who may occasionally use the Internet on their smartphone) had much lower data usage than the average users of dongle/datacards who might, for example, be sending and receiving large files. Ofcom's 2011 Model estimated average data usage of 30MB for handsets at the end of 2009/10 compared with 1,099MB per datacard/dongle.[72] However, EE's own view was that a dongle user used [✂] more data than a smartphone user.[73]

4.37 EE provided excerpts from the January 2011 Real Wireless report to Ofcom.[74] This report stated that the timescale of relevance to this report extended beyond the five-year period over which most analysts conducted forecasts. Even within that period there was a very large variation among analysts as to the growth rates to be expected and this range of uncertainty would only increase as forecasting periods were extended. This did not, said the report, relate to any deficiencies in the fore-casts, but to the intrinsic uncertainty involved in such an early stage market as mobile broadband. In barely four years, the market had already seen multiple shifts in the nature and volume of traffic associated with successive waves of devices, applica-tions, pricing offers and network performance. Over the next ten years, as LTE,[75]

[71] EE Core Submission, W/S Hird 4, §7i.
[72] EE Core Submission, W/S Hird 4, §18.
[73] EE staff hearing transcript, p6, line 7ff.
[74] EE Core Submission, W/S Hird 4, Exhibit 4, TH1.
[75] *Long Term Evolution—Technol*ogy standard which forms part of the development of 4G mobile systems that started with 2G and 3G networks.

WiMAX,[76] LTE-Advanced and WiMAX 2 were introduced, many more such shifts could be expected, making forecasting extremely difficult.

Telefónica SoI in support of Vodafone

4.38 Telefónica agreed with Vodafone that Ofcom's model overestimated the likely growth of volumes of mobile datacard services over the price control period.[77]

4.39 Telefónica stated that it forecast the future use of datacards, dongles and tethered devices to be stable at [✂] Ofcom's estimate (of more than 7 million customers[78]).[79]

4.40 Telefónica stated that consumers had begun to use their data-enabled smartphones to access mobile data on other devices. For example, users could connect their smartphones to their laptop computers and use the mobile device to transmit data to and from the laptop (referred to as 'tethering'). Handsets tethered to devices in this way were responsible for the use of similar amounts of data to traditional datacards and dongles and for that reason were included in Telefónica's internal estimates.[80]

4.41 [✂][81]

Ofcom's Defence

4.42 Ofcom explained that dongles and datacards were one source of packet data traffic in the 2011 Model. Packet data traffic was also driven by the number of handsets and the level of data usage[82] on handsets.[83]

4.43 Ofcom said that the forecast of datacards needed to be considered within the context of all packet data forecasts as it was the total packet data forecast (including data on handsets) that drove network build and cost recovery in the 2011 Model.[84]

4.44 Ofcom explained that forecasts for the volume of packet data on dongles/datacards and handsets were performed separately. However, these forecast volumes were combined for the network build and cost recovery calculation. In terms of modelled costs, the important factor was the total volume of packet data that passed over the network.[85]

4.45 Ofcom said that the volume of packet data traffic was an important consideration for the LRIC+ calculation, because the greater the volume of data traffic, the greater proportion of fixed and common costs that were allocated to packet data traffic rather than voice traffic (including MCT), which meant that the higher the volume of packet data traffic, the lower the LRIC+ of MCT.[86]

4.46 In principle, the volume of packet data traffic would be irrelevant to the avoidable cost of MCT. However, because of the modularity of assets and because of timing issues, changes to the data traffic volumes would cause small changes to the LRIC

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[76] *Worldwide Interoperability for Microwave Access*—Type of wireless technology based on the IEEE 802.16 standard.
[77] Telefónica SoI, §29.
[78] Telefónica SoI, W/S Wardle, §66.
[79] Telefónica SoI, W/S Wardle, §5f.
[80] Telefónica SoI, W/S Wardle, §64.
[81] Telefónica letter in response to staff hearing questions, p2.
[82] ie the amount of data downloaded.
[83] Ofcom Defence, Annex B, §17.
[84] Ofcom Defence, Annex B, §§25ii & 26.
[85] Ofcom Defence, Annex B, §18.
[86] Ofcom Defence, Annex B, §19.

estimate.[87] Ofcom also stated that the growth in datacards had very little impact on LRIC (less than 3 per cent in 2014/15—based on Ofcom's high and low scenarios).[88]

4.47 Ofcom explained that it based its forecast of datacard growth on historical trends and forecasts from other sources. It pointed to Analysys Mason research from February 2009 that forecast that mobile broadband penetration would reach 27 per cent by the end of 2014. Ofcom noted that, at the time of making its forecasts, growth in data-cards had slowed slightly and it had therefore used a less aggressive forecast than suggested by Analysys Mason's primary research; 19 per cent penetration instead of 27 per cent.[89]

4.48 Ofcom said that because the market for mobile data was still developing and responding to new technological developments and retail offerings, any growth forecast of packet data was very uncertain and prone to forecasting error.[90]

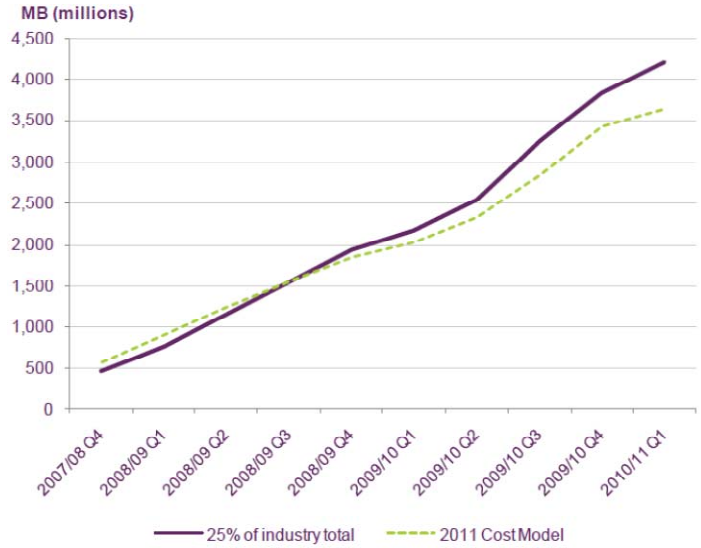
4.49 Ofcom said that its 2011 Communications Market Report, which it published after its MCT Statement, provided evidence of a slowing in the growth of datacard take-up (take-up of mobile broadband increased by just 2 per cent in 2010), but the report also showed that over the same period packet data volumes passing over the mobile networks had increased by 67 per cent, which was considerably above the level forecast by the 2011 Model. This growth was attributable largely to the growth in the use of smartphone mobile handsets, which might in part reflect their usage as substi-tutes for datacards (as handset users were also able to use their smartphones to send and receive data from their laptop or home computer).[91]

4.50 Ofcom believed that, taken as a whole, the 2011 Model data forecasts (ie datacard and handsets together) represented a realistic view of future data demand on an average efficient operator network. Ofcom said that the 2011 Model's packet data volumes were below the industry volumes (for a 25 per cent market share MCP) in the most recent data available to Ofcom. Thus, in so far as Ofcom had made an error, it was to *underestimate* (rather than overestimate) data demand.[92] See also Figure 4.2 below.

[87] Ofcom Defence, Annex B, §19.
[88] Ofcom Defence, Annex B, §25i.
[89] Ofcom Defence, Annex B, §23.
[90] Ofcom Defence, Annex B, §25ii.
[91] Ofcom Defence, Annex B, §27.
[92] Ofcom Defence, Annex B, §28.

FIGURE 4.2

Actual and modelled packet data traffic



Source: Ofcom Defence, Figure B.1.

4.51 Ofcom said that it sought to adopt a technology-neutral approach to cost modelling and the preferred scenario for technology choice was a national network deploying 2G and 3G/HSPA technologies. Ofcom did not consider that such migration as might happen from 3G dongles to 4G devices was a relevant factor to consider when estimating traffic under such an approach. Where datacard demand could be met using existing, established technologies by the networks in question, then that volume should be captured within the 2011 Model. Where demand could only be met by 4G technology, then, said Ofcom, it would be reasonable to exclude it.[93]

4.52 Ofcom also stated that 4G services were unlikely to become available to users for some years, and any migration from 2G/3G datacards to 4G datacards would not begin until that time. Ofcom said that there was no basis for any suggestion that, simply because 4G technology spectrum was not yet available, take-up of datacards would slow. Ofcom noted that mobile broadband was seen primarily as complementary to, rather than as a replacement for, fixed broadband. There was no good reason for considering that consumers would cease to see datacards as a useful complement to their existing fixed-line broadband services simply because 4G services were not yet available.[94]

4.53 Ofcom also noted that it modelled a decline in the usage[95] per datacard.[96]

4.54 Ofcom said that the effective cut-off date for making change to its data forecasts had been in mid-January 2011. Ofcom said that the Real Wireless report, the Enders report and the YouGov report were not available to it at the time of making the decision on the data growth forecasts.[97]

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[93] Ofcom Defence, Annex B, §25iv.
[94] Ofcom Defence, Annex B, §25iii.
[95] ie a reduction in the amount of data downloaded.
[96] Ofcom Defence, Annex B, §25v.
[97] Ofcom staff hearing transcript, p11, line 12ff.

BT SoI in support of Ofcom

4.55 BT pointed out that Ofcom's model was intended to be a snapshot in time based on the best available information (in this case based on the information available at the end of 2010) and that the model should be fit for purpose, in that it should produce a robust and accurate answer, but that it was not necessary or even possible for the model to anticipate every possible development in mobile demand and technology.[98]

4.56 BT argued that, given that forecasts were inevitably uncertain and subject to change and given that the impact of any error in these assumptions would be minor, the modelling was clearly producing sufficiently accurate and robust answers.[99]

4.57 BT stated that modelling 4G services may lead to lower levels of network costs.[100] Further, BT argued that the CC agreed, in the 2007 MTR appeal, that the deployment of new technology ought not to lead to an increase in the prices charged for a regulated service.[101]

Three SoI in support of Ofcom

4.58 Three said that there was some substitution between smartphones and datacards/ dongles.[102] It stated that Ofcom's Communications Report (August 2011) showed that handset data usage was 62 Mbit/month (which was higher than the assumption in Ofcom's model.[103] Three also said that 2011 Communications Market Report showed that overall data volumes passing over mobile networks increased by 67 per cent year on year in 4Q 2010 compared with the model's prediction of an increase of 64 per cent.[104]

4.59 Three said that on its own network average data usage on handsets was currently around [✂]MB/month and datacard consumption was around [✂] MB/month.[105] It said that data usage on handsets on its network had grown rapidly over the last year ([✂]) per month, driven largely by smartphones (and the smarter the phone, the greater the data use).[106]

4.60 Three said that datacards and smartphones generally utilized the mobile network broadly in proportion to the volume of data downloaded,[107] but that datacards with the newest technology may make a more efficient use of the network.[108]

Vodafone reply to Ofcom Defence

4.61 Vodafone, in reply to Ofcom's defence said that data use in handsets would not offset Ofcom's forecasting error for datacards (see paragraph 4.50), because:

(a) Ofcom's chart (see paragraph 4.50) overstated the gap between packet data of the average operator and actual data because Ofcom's model assumed a 23.4 per cent market share, rather than the 25 per cent market share used in the

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[98] BT SoI, W/S Richardson, §27.
[99] BT SoI, W/S Richardson 2, §27a.
[100] BT SoI, W/S Richardson 2, §27d.
[101] BT SoI, W/S Richardson 2, §27c.
[102] Three staff hearing transcript, p6, line 14ff.
[103] Three staff hearing transcript, p6, line 20ff.
[104] Three SoI, §10.8.
[105] Three staff hearing transcript, p7, line 3ff.
[106] Three staff hearing transcript, p7, line 3ff.
[107] Three staff hearing transcript, p7, line 19ff, & p8, line 15ff.
[108] Three staff hearing transcript, p8, line 5ff.

graph (Vodafone stated that the difference was only around half as big when adjusted for this).[109]

(b) Whilst Ofcom's graph showed an underestimate of packet data of 8 per cent based on historic data, its evidence showed an overestimate of future datacards of [✂] per cent by June 2011.[110]

(c) Three, offering unlimited data usage, was not typical of the average 2G/3G operator, [✂][111] [112] [113]

(d) Vodafone said that it did not consider that the growth in smartphones would offset the excessive datacard forecasts in Ofcom's model, because smartphones were also able to access data through public Wi-Fi access points.[114] Vodafone considered that Ofcom's forecasts may be correct for the demand of packet data overall, but Ofcom's forecast ignored that some of this data would be provided through Wi-Fi access points.[115]

Assessment: error in data services—future datacard growth

2010/11

4.62 It appears that, on the basis of the information available to Ofcom at the time of the decision, the absolute growth in the forecast number of datacard subscribers for 2010/11 was implausible. Absolute volume growth had already reduced in the previous year (from 1.6 million to 1.1 million—see Table 3.1 in paragraph 4.20) and this, combined with various market features that were consistent with a levelling off of absolute growth in datacard use, indicates that it was unlikely that growth would accelerate significantly in 2010/11. Notwithstanding this, Ofcom assumed an acceleration (an almost doubling) of the absolute growth in datacard usage in 2010/11 compared with the prior year to a subscriber growth of 2 million subscribers.

4.63 However, whilst Ofcom's forecast for datacards in 2010/11 appears to be implausible, Ofcom said that it was packet data rather than datacard usage that drove cost allocation to data in its model. Ofcom argued that its forecast of packet data as a whole was not materially incorrect (see Figure 4.2 in paragraph 4.50) because whilst it may have overestimated datacard use, it had underestimated the use of data services through handsets, and that both forecasting errors cancelled each other out.

4.64 We consider that looking at packet data as a whole (rather than at datacard growth in isolation) was an acceptable and pragmatic approach in this particular circumstance, where Ofcom was modelling highly uncertain forecasts and where the technologies through which data is consumed were difficult to predict and changing rapidly.

4.65 Whilst Vodafone has demonstrated that Ofcom's forecast datacard growth for 2010/11 was implausible, given that actual packet data consumption at the time of Ofcom's modelling was greater than the modelled packet data consumption (and given that overall packet data volumes appear to have grown faster than forecast in

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[109] Vodafone Core Submission, W/S Roche 2, §7.32.
[110] Vodafone Core Submission, W/S Roche 2, §7.33.
[111] EE NoA, W/S James, §18.
[112] Vodafone NoA, W/S Roche I, §3.24.
[113] Vodafone Core Submission, W/S Roche 2, §§7.34 & 7.35.
[114] Vodafone bilateral hearing transcript, p119, line 20ff.
[115] Vodafone bilateral hearing transcript, p120, line 10ff.

the 2011 Model until 4Q 2010—see paragraph 4.58), we do not consider that this caused Ofcom to err as alleged in its modelling of packet data volumes.

4.66 We therefore do not find that Vodafone has demonstrated that Ofcom erred in its forecast for data services growth for 2010/11.

2011/12 onwards

4.67 We also consider that packet data is a more appropriate measure of data consumption than datacard volumes for the remainder of the forecasting period (for the reasons set out in paragraph 4.63). We note that Vodafone's primary evidence related to datacard growth forecasts rather than packet data growth forecasts and that Vodafone did not provide any supporting evidence that Ofcom's packet data forecast beyond 2010/11 is incorrect.

4.68 Even for datacard volumes, Vodafone and EE did not provide any explicit evidence supporting the lower forecast for datacard volumes for the period beyond 2010/11. Vodafone merely provided plausible reasons why Ofcom's forecasts may be too low, for example the need for 4G technologies to drive growth and the roll out of Wi-Fi networks. In respect of the volume of data consumed by each subscriber we consider that the evidence presented to us is not sufficient to indicate that Ofcom erred in the assumption it made. In particular we note that Ofcom already reflected a small decline in the volume of data consumed by each subscriber in the 2011 model.

4.69 We do not consider that the reasons given by Vodafone are sufficient to show that Ofcom's datacard forecast in the period beyond 2011/12 is incorrect. We note also that the forecasts for the period beyond 2011/12 included in Ofcom's Model for the use of datacards in 2011/12 until 2014/15 are not significantly out of line with historic growth as presented by Vodafone in its evidence—see Table 3.1 in paragraph 4.20. Vodafone's evidence indicated that in the three years to June 2009/10, absolute subscriber growth was between 1.1 and 1.6 million per year and absolute growth forecasts in Ofcom's Model for June 2011/12 to June 2014/15 are on average on the upper end of the range of historic growth. Ofcom recognized that growth had been slowing prior to its decision and as a result took a more cautious approach to growth until 2014/15 than that suggested in the Analysys Mason research.

4.70 EE stated, in paragraph 4.31, that Ofcom's charge would lead to price increases, in particular for data, which would lead to a reduction in the demand for data. We set out in paragraphs 4.393 and 4.396 that EE has not demonstrated that future data prices would rise or that rising data prices would reduce demand for data to levels below those assumed in Ofcom's 2011 Model (see EE's assertion in paragraph 4.31).

Conclusion

4.71 For these reasons we conclude that it has not been demonstrated that Ofcom has erred in its forecast for datacards for the period 2011/2012 onwards.

Error in data services—busy day/week split

Ofcom's decision

4.72 Ofcom said that it included a share of traffic in weekdays ratio in the 2011 Model. The data provided by the MCPs indicated that the share of traffic in weekdays ratio was about 80 per cent for voice and data services.[116]

Vodafone's challenge

4.73 Vodafone explained that as the peak traffic in the network (ie traffic in the network busy hour) determined the dimensioning of equipment, so the relationship between the annual total traffic and the peak (or busy hour) traffic was important.[117]

4.74 Vodafone said that Ofcom's model derived the busy hour traffic from the forecast of total traffic in each quarter in three steps:[118]

(a) the proportion of traffic that occurred at the weekend—this was held by Ofcom to be a constant across all services;

(b) the number of weekdays in each quarter; and

(c) the proportion of weekday traffic that was in the busy hour (which was the only variable that differed between data and voice in Ofcom's model[119]).

4.75 Vodafone said that in the past Ofcom's model had taken the annual total traffic divided by 250 to derive the traffic estimate for a busy day, and then multiplied this by a busy hour/day ratio to reach the peak hour traffic level. This approach had always ignored weekend traffic, which in Vodafone's view took into account the difference between the average busy hour of the network and the busy hour at each individual cell.[120,121]

4.76 Vodafone said that, as a result of data obtained under section 135 of the Act, Ofcom had changed the model so that in the 2011 Model 20 per cent of all traffic occurred at the weekend, with the remaining 80 per cent on weekdays. Ofcom had then computed a peak hour traffic volume by reference to the weekday traffic volumes, rather than the total traffic volumes, with a resulting decrease in the peak hour load.[122]

4.77 Vodafone said that Ofcom had applied the same percentage adjustment (20 per cent) to all traffic types, including data. Whilst Ofcom's model reflected the fact that data demand was more evenly spread across the weekday than voice demand (by means of a lower busy hour/day ratio than voice), Ofcom's model [✂][123] [✂] rather than Ofcom's assumption of 20 per cent). Vodafone said that this overstated the relative peak level of data and thus allocated too much cost to data.[124]

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[116] Ofcom Decision, §A6.113.
[117] Vodafone NoA, W/S Roche 1, §3.29.
[118] Vodafone Core Submission, W/S Roche 2, §7.40.
[119] Vodafone Core Submission, W/S Roche 2, §7.41.
[120] Vodafone NoA, W/S Roche 1, §3.32.
[121] Vodafone NoA, W/S Roche 1, §3.30.
[122] Vodafone NoA, W/S Roche 1, §3.32.
[123] Vodafone NoA, W/S Roche 1, §3.34.
[124] Vodafone NoA, W/S Roche 1, §3.33.

4.78 Vodafone stated that if the weekend adjustment for data was 25 per cent, rather than 20 per cent, then LRIC+ in 2014/15 would increase by 0.80 per cent (or 0.0129ppm) and LRIC would decline by 1.1 per cent (or –0.0076ppm).[125]

4.79 Vodafone stated that Ofcom's rejection of the current data on the week/weekend split of traffic was based on speculative concerns as to how data volumes might develop in future and said that it was irrational to reject the use of reliable evidence in favour of mere speculation.[126]

4.80 Vodafone said that there was no good reason to expect data traffic profiles to develop in such a way as to cause the network busy hour to coincide in future with the data busy hour.[127] Vodafone stated that a calculation of the busiest hour relevant for network cost recovery must be on a resource weighted basis, including the deflating of data volumes for the rising resource efficiency of HSPA, and increasing[128] voice traffic to allow for the Erlang[129] weighting.[130] It was therefore unlikely and unproven that future data traffic rises for the average 2G/3G operator would change the data busy hour into the network busy hour, particularly given that this was a hypothetical effect, rather than a current fact. Vodafone also commented that Three had an asymmetry in its market share between voice and data versus the average 2G/3G operator—a share of 10 per cent of the handset market and a share of up to 50 per cent in data volumes.[131,132] Ofcom's caution ran the risk, said Vodafone, of not allowing the operators to make a reasonable return on their regulated service rather than allowing them any excessive return.[133]

4.81 Vodafone said that in addition, Ofcom had unjustifiably smoothed the level of peak demand. In Vodafone's view, the cell busy hour (rather than the overall network busy hour) was the key driver for peak demand, since the MNO must dimension each cell separately to meet peak demand. Smoothing the peak as Ofcom had done tended to understate the cell busy hour in some cells, and to lead to underdimensioning of the network.[134]

EE SoI in support of Vodafone

4.82 EE stated that [✂] and that Ofcom's assumption of 20 per cent was likely to be incorrect, considering that Vodafone and EE represented two out of three 2G/3G UK operators.[135]

4.83 EE estimated that making an adjustment for the busy hour/total traffic relationship would increase LRIC+ in 2014/15 by 0.75 per cent (or 0.0161ppm) and would reduce LRIC by 4.0 per cent (or –0.0337ppm).[136]

4.84 EE said that data started with a very similar busy hour profile to voice, but it had changed fairly dramatically over the last two and a half years. This was because more, and a wider variety of, data services had become available. For example,

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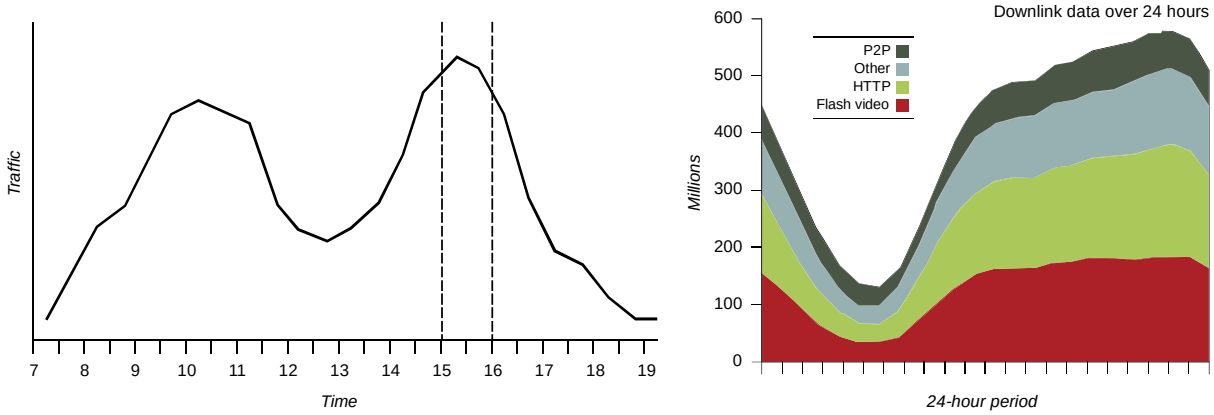
[125] Vodafone NoA, W/S Roche 1, §3.35.
[126] Vodafone Core Submission, §5.61.1.
[127] Vodafone Core Submission, §5.61.4.
[128] Vodafone used the word 'conflate', given the context in which this term was used we think they meant 'increase'.
[129] An adjustment to reflect that voice traffic requires a certain amount of spare capacity in the network (ie the need to maintain sufficient channels to provide a high probability of successful call set-up).
[130] Vodafone Core Submission, W/S Roche 2, §7.45.
[131] Vodafone Core Submission, W/S Roche 2, fn 40.
[132] Vodafone Core Submission, W/S Roche 2, §7.47.
[133] Vodafone Core Submission, W/S Roche 2, §7.47.
[134] Vodafone Core Submission, §5.61.5.
[135] EE SoI, W/S Hird 2, §22 and EE NoA, W/S James, §§25–29.
[136] EE SoI, W/S Hird 2, §21.

downloading large files to a laptop (a fairly common service) would typically run overnight and over a longer period, whereas data for gaming-type services were very real time and interactive, but carried quite small volumes of data.[137] EE said that operators were managing the peaks and troughs in data traffic to try to smooth that profile out.[138] EE also stated that the network consumption from smartphones was higher than for dongles, as dongle data could be more easily managed and because dongles had a lower signalling load.[139] EE said that the type of data service used, rather than the device used, drove network consumption.[140]

4.85 EE stated that the position of Three did not provide a good guide to the position of the other MCPs because Three, with relatively few customers, had promoted its data services heavily to utilize the capacity on its network. In terms of future trends, EE said that the Real Wireless report from January 2011 suggested that the late afternoon might remain the overall busy hour because *(a)* voice traffic fell away sharply from this peak while *(b)* data traffic was close to its peak during this time while its actual peak occurred much later in the evening when voice traffic was negligible.[141] EE provided excerpts from the January 2011 Real Wireless report to Ofcom.[142] This report included the following graphs (Figure 4.3) on the busy hour for voice and data.

FIGURE 4.3

Changing diurnal nature of mobile traffic
(a) traditional voice (b) mobile broadband



Source: Exhibit 4 TH1 to W/S Hird 4 (EE).

4.86 EE also stated that it considered Ofcom's forecasts of data traffic growth to be likely to be very optimistic.[143]

Ofcom's Defence

4.87 Ofcom explained that the proportion of voice and data traffic that occurred at the weekend was one parameter that went into calculating the proportion of voice and

[137] EE staff hearing transcript, p5, line 12ff.
[138] EE staff hearing transcript, p6, line 3ff.
[139] EE staff hearing transcript, p7, line 16, & p8, line 12ff.
[140] EE staff hearing transcript, p8, line 41ff.
[141] EE Core Submission, W/S Hird 4, §25.
[142] EE Core Submission, W/S Hird 4, Exhibit 4 TH1.
[143] EE Core Submission, W/S Hird 4, §25.

data that occurred in the busy hour. Ofcom said that any adjustment to weekend traffic needed to be seen within the context of the final data and voice proportions in the busy hour.[144] Ofcom explained that in the 2011 Model a difference was introduced between the proportions of data and voice in the busy hour based on the information provided to Ofcom. It noted that in the 2007 cost model data and voice used the same proportions for traffic in the busy hour.[145]

4.88 Ofcom said that it expected the network busy hour to be driven by the data busy hour in the future and this was the reason why it did not make a different assumption for the proportion of data that occurred at the weekend.[146]

4.89 Ofcom explained that MCPs experienced a smoother profile of data traffic than other forms of traffic. Ofcom also noted that different MCPs experienced this phenomenon to varying degrees. For the majority of MCPs, the voice busy hour was also the network busy hour. However, packet data services were still developing. Given the rapid growth in packet data volumes, Ofcom said that it was likely that in the near future the data busy hour would become the network busy hour for all operators, [✂]. When this occurred the proportion of data in the busy hour could become greater than the proportion of voice in the busy hour, [✂]. At the very least, once the data busy hour became the network busy hour Ofcom expected the proportion of voice in the busy hour to decline and the proportion of data to increase. Ofcom said that this would cause the proportions to flip with data having a larger proportion within that busy hour than voice.[147,148,149]

4.90 Ofcom said that, as a result, it had been somewhat cautious when adjusting the proportion of data and voice in the network busy hour given that these proportions were likely to be changing in future,[150] and therefore it did not believe that any further adjustment as suggested by Vodafone was necessary.[151]

Assessment: error in data services—busy day/week split

4.91 Vodafone and EE said that a higher proportion of data traffic occurred at the weekend than assumed in Ofcom's model.

4.92 Ofcom does not appear to disagree with this statement, but said that it decided to use the same split between weekday and weekend traffic for data and voice (ie an assumption of a 20 per cent share of data traffic at the weekend instead of the approximately [✂]) in the 2011 Model, because it wanted to be cautious in its approach as it expected the data busy hour to become the network busy hour in the near future.

4.93 We do not consider that Ofcom has sufficiently justified its use of a different assumption for the percentage of data traffic that occurs at the weekend (ie 20 per cent) than was indicated by the evidence provided by the operators (ie that data traffic was evenly split over the course of the week, ie a share of weekend data traffic of 27 to 28 per cent).

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[144] Ofcom Defence, Annex B, §32.
[145] Ofcom Defence, Annex B, §34.
[146] Ofcom staff hearing transcript, p42, line 1ff.
[147] Ofcom staff hearing transcript, p41, line 17ff.
[148] Ofcom Defence, Annex B, §33.
[149] Ofcom staff hearing transcript, p42, line 8ff.
[150] Ofcom Defence, Annex B, §34.
[151] Ofcom Defence, Annex B, §35.

4.94 Ofcom said that it expected the data busy hour to become the network busy hour because of the rapid growth in packet data volumes and because [✂]. However, we note that Three has a much higher market share for data than for voice (see paragraph 4.124). We also consider that EE provided persuasive evidence why the data busy hour may not necessarily be expected to become the network busy hour (see paragraph 4.85) in the future.

4.95 In our view Vodafone has demonstrated that Ofcom did not use an appropriate figure for the amount of data traffic that occurs at the weekend. It does not appear that it would have been difficult for Ofcom to use the appropriate figure. Even if Ofcom is correct that the data busy hour will become the network busy hour in the future, Ofcom has not addressed the question of whether this effect will be correctly captured by using an assumption for the weekday/weekend split that understates data usage at the weekend and so has not provided a reasoned explanation as to why it did not use the data available to it.

4.96 We therefore conclude that Vodafone has demonstrated that Ofcom erred in understating the proportion of data traffic that occurred at the weekend.

4.97 Vodafone also stated that Ofcom had unjustifiably smoothed the level of peak demand, because it did not correctly take the cell busy hour into account. Vodafone provided no supporting evidence why this would be the case. We therefore do not consider that Vodafone has demonstrated that Ofcom erred by not making an adjustment for the cell busy hour in its 2011 Model.

Conclusion

4.98 We conclude that Vodafone has demonstrated that Ofcom erred in understating the proportion of data traffic that occurred at the weekend.

Error in data services—HSPA efficiency adjustment

Ofcom's decision

4.99 Ofcom said that Vodafone suggested a slightly higher value for the HSPA efficiency parameter to reflect the likelihood of further efficiency gains through HSPA+[152] enhancements. As far as Ofcom was aware, HSPA+ was not yet deployed in any UK mobile network and there was no clear indication of planned deployments. On the basis of this evidence, Ofcom said that excluding future HSPA+ enhancements appeared to be an appropriate reflection of the choices that would be made by a hypothetical efficient national MCP today and was consistent with its approach to charge controls in other market reviews (eg BT network charge control, BT leased lines charge control and the BT wholesale broadband access control) where nascent technologies at low levels of deployment had been excluded from the cost modelling.[153] Ofcom also considered that this approach was consistent with its technology-neutral approach in this and other recent charge controls.[154]

4.100 Ofcom said that adjusting the HSPA efficiency to account for HSPA+ improvements would not have a material impact on the LRIC unit cost of termination.[155]

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[152] HSPA+ refers to later versions of HSPA technology that increase the efficiency of data delivery.
[153] Ofcom decision, §9.49.
[154] Ofcom decision, §A6.157.
[155] Ofcom decision, fn 674.

Vodafone's challenge

4.101 Vodafone stated that although the model was forward-looking with regard to traffic volumes, it reflected only the current level of implemented technology with regard to high-speed data. Ofcom's model did not reflect the fact that faster variants of HSDPA were in the process of being implemented (the model only used HSDPA at speeds up to those currently in implementation, ie 14.4mbps,[156] but did not include faster and more efficient variations, such as 28.8mbps and beyond).[157] Vodafone stated that as a result, the model overestimated the resource consumption of data services in the future.[158] Vodafone said that future enhancements beyond the 14.4mbps in Ofcom's 2011 Model were not long-run expectations. Three, it said, was aiming to have 80 per cent of its network upgraded to HSPA+ by the end of 2011.[159,160]

4.102 Vodafone argued that it was wrong, in principle, for Ofcom to take no account of expected future enhancements to technology in its modelling, given that its future traffic forecasts took account of such enhancements. Ofcom's expectations as to future growth in data volumes depended on assumptions that there would be enhanced technology to deliver faster data speed.[161,162]

4.103 Vodafone stated that by its failure to recognize the future technological enhancements that the efficient operator was bound to introduce to allow for or enable the modelled forecast growth in data traffic, Ofcom was penalizing the efficient operator by not allowing it to recover the efficiently incurred cost of termination.[163]

4.104 Vodafone said that it was wrong to characterize Vodafone's case as depending on speculative developments, or enhancements which were remote in time. The research document on which Vodafone relied in support of this element of its case was presented, in final form, to Ofcom in January 2011 (ie before Ofcom's decision) and would have been commissioned some time before.[164]

4.105 Vodafone considered that it was hard to understand how the vast increase in data in Ofcom' s model would actually be carried on 3G technology, at a price people would be willing to pay for it.[165]

4.106 Vodafone said that Ofcom's model acknowledged the greater efficiency of HSPA up to 14.4mbps by the use of an HSPA efficiency factor of 6. To reflect further efficiency gains from 3G and 4G networks in the future, Vodafone suggested an adjustment of this factor to a value of 7.[166] Vodafone said that this adjustment would increase LRIC+ in 2014/15 by 1.8 per cent (or 0.0308ppm) and would reduce LRIC by 1.6 per cent (or –0.0108ppm).[167]

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[156] Megabit per second.
[157] Vodafone NoA, W/S Roche 1, §3.36.
[158] Vodafone NoA, W/S Roche 1, §3.37.
[159] Vodafone Core Submission, W/S Roche 2, §7.53.
[160] Vodafone Core Submission, §5.65.2.
[161] Vodafone Core Submission, §5.65.3.
[162] Vodafone Core Submission, W/S Roche 2, §7.54.
[163] Vodafone Core Submission, W/S Roche 2, §7.57.
[164] Vodafone Core Submission, §5.65.1.
[165] Vodafone bilateral hearing transcript, p118, lines 8ff.
[166] Vodafone NoA, W/S Roche 1, §3.39.
[167] Vodafone NoA, W/S Roche 1, §3.28.

4.107 EE said that the appropriate assumption for the evolution of HSPA technology in Ofcom's cost model should be based on evidence for the UK operators as well as longer-term forecasts.[168]

4.108 EE stated that it [✂].[169]

4.109 EE estimated that making an adjustment for HSDPA would increase LRIC+ in 2014/15 by 1.8 per cent (or 0.0386ppm) and would reduce LRIC by 1.7 per cent (or –0.0139ppm).[170]

4.110 EE said that in order to be able to employ HSPA+, handsets (as well as the equipment[171]) needed to be compatible with this technology.[172] EE said that some dongles were currently compatible with the HSPA+ technology, and some smartphones would employ it soon, but that it would take a while before such handsets were widely present in the customer base.[173]

4.111 EE said that it was [✂]. EE said that this would not make a major difference in the usage or the efficiency of carrying data services (and would not require a change in the HSPA parameter in Ofcom's model of 6[174]), but was an initial step in a series of further enhancements over time, and as those later enhancements were implemented, data could be carried much more efficiently across the network.[175] EE said that the next big step would happen [✂].[176]

4.112 EE said that HSPA+ could be achieved with relatively minor expenses (ie it would be substantially cheaper than building additional sites[177]).[178] [✂][179]

4.113 EE said that the 2011 Model ignored the enhancements to HSPA ([✂]) with the consequence that Ofcom had incorporated the cost-reducing aspects of growing data traffic but had excluded the cost implications of technology upgrades that were being implemented to support that traffic.[180]

4.114 EE said that the principle of technology neutrality related to the value of regulators not distorting operators' incentives to manage their networks and technology choices in the most efficient manner. Modelling the rollout of HSPA+ and incorporating this into a path of prices to apply until 2014/15 would not affect operators' incentives.[181] Furthermore, including an HSPA adjustment would not increase the voice termination rate, but rather the rate of its decline.[182]

4.115 EE stated that improvements in HSPA together with the associated growth in data volumes over time would not lead to increases in the cost of voice termination or

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[168] EE SoI, W/S Hird 2, §24.
[169] EE NoA, W/S James, §31.
[170] EE SoI, W/S Hird 2, §25.
[171] EE staff hearing transcript, p12, line 22ff.
[172] EE staff hearing transcript, p12, line 3ff.
[173] EE staff hearing transcript, p13, line 8ff.
[174] EE staff hearing transcript, p19, line 21ff.
[175] EE staff hearing transcript, p14, line 11ff.
[176] EE staff hearing transcript, p18, line 24ff.
[177] EE staff hearing transcript, p12, line 22ff.
[178] EE staff hearing transcript, p12, line 7ff.
[179] EE staff hearing transcript, p19, line 6ff.
[180] EE Core Submission, W/S Hird 4, §7iv.
[181] EE Core Submission, W/S Hird 4, §28.
[182] EE Core Submission, W/S Hird 4, §29.

even a higher cost than would be the case if both these factors had been excluded.[183]

Ofcom's Defence

4.116 Ofcom considered that it was appropriate to exclude future HSPA enhancements (HSPA+) from its modelling.[184] This was because:

(a) HSPA+ has not yet been deployed in any UK mobile network and there was no clear indication of planned deployments.[185]

(b) Ofcom's approach to cost modelling was predicated on the principle of technology neutrality, now more often referred to as 'anchor pricing'. Ofcom considered that customers should be no worse off as a result of the introduction of new technology and regulated firms should have appropriate incentives to introduce new technology where it was efficient to do so. In the context of MCT, anchor pricing involved setting charges by reference to the costs of using the established 2G and 3G technologies, and where new technology was introduced (eg 4G), this would be subject to the same cap as if it were delivered using 2G or 3G technology.[186] Therefore, if better technology for the delivery of data services caused the regulated rate for voice services, specifically MCT, to rise, this would be an undesirable regulatory outcome.[187]

4.117 Ofcom said that it did not model HSPA+ because of the uncertainty associated with the related forecasts.[188] Ofcom said that its forecast data volumes were consistent with the technologies used in its modelling[189] and that if it had, for example, included 4G in its 2011 Model it would have expected higher data demand.[190] However, Ofcom also considered that some of the third party forecasts which it took into account when making the forecasts for the 2011 Model might have included the effect of HSPA+.[191]

BT SoI in support of Ofcom

4.118 BT considered that the purpose of Ofcom's modelling was to give a snapshot of costs fit for the purpose of setting termination rates for a limited time. BT noted that Vodafone's evidence was published after the start of the current control period and that Ofcom had to draw a line to produce a fit-for-purpose estimate based on the best available information.[192]

Assessment: error in data services—HSPA efficiency adjustment

4.119 We consider that Ofcom has an element of discretion in applying its regulatory judgement in relation to the treatment of future technologies. It appears to have followed its general approach in similar situations in other charge controls, where it has excluded nascent technologies at low levels of deployment from the cost modelling. Whilst we

[183] EE Core Submission, W/S Hird 4, §30.
[184] Ofcom Defence, Annex B, §40.
[185] Ofcom Defence, Annex B, §40.
[186] Ofcom Defence, Annex B, §41.
[187] Ofcom Defence, Annex B, §42.
[188] Ofcom staff hearing transcript, p43, line 18ff.
[189] Ofcom staff hearing transcript, p45, line 21ff.
[190] Ofcom staff hearing transcript, p46, lines 12–20.
[191] Ofcom staff hearing transcript, p46, line 13ff.
[192] BT NoA, W/S Richardson, §28.

note in this context that from the evidence provided to us, HSPA+ was [currently] in the process of being rolled out at [✂], EE stated that a rollout at this level did not justify a move from 6 to 7 for the HSPA efficiency factor. We also noted that evidence provided by EE indicated that not all devices would necessarily be able to benefit from the improved performance of HSPA+. We therefore agree with Ofcom that there were uncertainties associated with the HSPA+ related forecasts.

4.120 Vodafone said that it was implausible that data services would grow at the rate assumed in the 2011 Model without the faster speeds resulting from HSPA+ deployments and the lower costs of providing data services associated with the HSPA+ deployment. However, Vodafone did not provide any supporting evidence for this statement.

Conclusion

4.121 For these reasons, we do not consider that it has been demonstrated that Ofcom erred by not modelling HSPA+ in its 2011 Model.

Error in data services—historic datacard market share

Ofcom's decision

4.122 Ofcom said that in the 2011 Model, between 2003/04 and Q1 2010/11 the market share of the hypothetical operator declined from 25 per cent prior to the entry of the 3G-only operator to 23.4 per cent.[193]

4.123 Ofcom did not consider that it should use a different market share for handsets and datacards. This was because Ofcom was modelling a hypothetical average efficient national MCP and Ofcom believed that keeping the market share identical for both handsets and datacards best reflected a hypothetical average efficient operator.[194]

Vodafone's challenge

4.124 Vodafone explained that Ofcom's model assumed that the average operator had an equal market share of both voice-capable devices (handsets) and datacards.[195] Vodafone stated that this did not reflect reality. It said that Three had by far the largest market share of datacards, reflecting in part that Three had a low share of handsets, which enabled it to fill its network with datacard traffic.[196] Vodafone said that Three's datacard market share was 39 per cent, implying only a 15 per cent market share for the average 2G/3G MNO. Vodafone also said that it was likely that Three's usage per datacard customer was significantly higher than that of the 2G/3G MNOs.[197]

4.125 Vodafone also said that Ofcom's calibration of the 2011 Model was impaired because Ofcom compared the model outputs with those of the average 2G/3G MNO. Since the model did not, alleged Vodafone, use the correct market shares for an average 2G/3G operator (and was probably also applying an excessive usage per average 2G/3G operator datacard customer), it assumed that the average operator was

[193] Ofcom Decision, §A6.92.
[194] Ofcom Decision, §A6.77.
[195] Vodafone NoA, W/S Roche 1, §3.41.
[196] Vodafone NoA, W/S Roche 1, §3.42.
[197] Vodafone NoA, W/S Roche 1, §3.43.

carrying more data traffic than was in fact the case. Thus the model was dimensioning more network equipment than was actually required.[198]

4.126 Vodafone stated that if the model was to be calibrated correctly, it needed to take account of the average 2G/3G operator's data traffic, as well as the average 2G/3G operator's voice traffic. Ofcom's calibration was unsound, to the extent that it used the average 2G/3G operator's voice traffic, and an erroneous measure of the average 2G/3G operator's data traffic. It was not calibrating to the situation arising in the real world.[199]

4.127 Vodafone said that there were two consequences of Ofcom's assumption that, in the historic period, the average efficient 2G/3G operator had carried significantly more data traffic than it actually had:[200]

(a) Had the average efficient 2G/3G operator actually had to carry the higher volume of data traffic that the model was assuming, its network build would have had to have been greater. The calibration had thus been performed on a false premise —with respect to datacards and datacard traffic and the resulting required network build, the model did not reflect the average 2G/3G operator. Thus the present cost base of the model was not in alignment (it understated it) with the traffic levels of the representative operator. This led to an overall underestimation of all costs and hence of all cost recoveries in the model.[201]

(b) Given the way that the ED methodology worked in allocating cost recovery into years on the basis of the traffic in that year, the overstatement of historic traffic in total had tilted the cost recovery of all services into the past in an excessive manner. Thus future cost recovery was understated for all services for the representative operator.[202]

4.128 Vodafone suggested using a more accurate historic market share of datacards for the average 2G/3G MNO, and to then trend this upwards for the future until it reached a 25 per cent market share.[203] Vodafone said that this adjustment would increase LRIC+ in 2014/15 by 1.4 per cent (or 0.0240ppm) and would increase LRIC by 3.7 per cent (or 0.0247ppm).[204]

4.129 Vodafone noted that both the 2007 and 2011 Models showed a market share of the hypothetical efficient operator for handsets that was not constant but varied across time to reflect the slow increase in the size of Three.[205] Vodafone said that Ofcom assumed that the average 2G/3G operator had historically exactly the same market share for datacard customers as handset customers, even though Three's market share for data was much higher (39 per cent) than for voice.[206]

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[198] Vodafone NoA, W/S Roche 1, §3.44.
[199] Vodafone Core Submission, §5.68.
[200] Vodafone Core Submission, W/S Roche 2, §7.72.
[201] Vodafone Core Submission, W/S Roche 2, §7.72, 1st bullet.
[202] Vodafone Core Submission, W/S Roche 2, §7.72, 2nd bullet.
[203] Vodafone NoA, W/S Roche 1, §3.45.
[204] Vodafone NoA, W/S Roche 1, §3.46.
[205] Vodafone Core Submission, W/S Roche 2, §§7.61 & 7.65.
[206] Vodafone Core Submission, W/S Roche 2, §7.66.

EE SoI in support of Vodafone

4.130 EE estimated that making an adjustment for the historic datacard market share would increase LRIC+ in 2014/15 by 1.5 per cent (or 0.0334ppm) and would reduce LRIC by 2.3 per cent (or –0.0181ppm).[207]

4.131 EE stated that Ofcom's arguments on Three's historic datacard market share failed to recognize that factors specific to Three implied that its traffic was not representative of that of a 2G/3G operator which was the intended basis of Ofcom's model. With relatively few customers and voice traffic, Three had sought to fill the spare capacity on its network with low-priced data services.[208]

4.132 EE considered that a hypothetical 2G/3G operator was best estimated with regard to the data of the actual 2G/3G operators and Three's data should be excluded.[209]

Ofcom's Defence

4.133 Ofcom stated that the 2011 Model estimated the costs of a hypothetical average efficient national MCP and was based on the use of technologies and spectrum bands that had been deployed in the UK. The model did not assess or represent the costs of any particular existing MCP.[210]

4.134 Ofcom accepted that there was a difference between market shares for handsets and datacards based on observed MCP data. However, the 2011 Model was designed to reflect a hypothetical average efficient national MCP and was not trying to mimic a particular business case or commercial operator outcome. Keeping the market share identical for both handsets and datacards was a competitively neutral modelling assumption and best reflected a hypothetical average efficient operator. The fact that the actual position of at least some of the UK MCPs was different was irrelevant.[211]

4.135 Ofcom explained that the 2011 Model was calibrated to the total cost of 2G/3G operators only (ie T-Mobile, Orange, Vodafone, O2[212]).[213] Ofcom said that it did not check whether its modelling assumption of a higher historical data market share (compared with the actual market share for the 2G/3G operator) had significantly affected the cost of these operators such that the calibration would have been different.[214] It considered that the 2G/3G operator may have had sufficient spare capacity to provide the additional data services of the hypothetical operator without incurring additional cost over the period that was used for the calibration, particularly considering that data services had a much smaller network utilization than voice services.[215] Ofcom also considered that any error in the calibration of the 2011 Model needed to be seen in the context that some 2G/3G operators had market shares in voice above the market share assumed in Ofcom's model (Ofcom said that it did not adjust MNO costs for the upper and lower bands when calibrating the 2011 Model[216]).[217]

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[207] EE SoI, W/S Hird 2, §27.
[208] EE Core Submission, W/S Hird 4, §7v.
[209] EE Core Submission, W/S Hird 4, §31.
[210] Ofcom Defence, Annex B, §5.
[211] Ofcom Defence, Annex B, §45.
[212] Ofcom staff hearing transcript, p38, line 14.
[213] Ofcom staff hearing transcript, p37, line 6ff.
[214] Ofcom staff hearing transcript, p37, line 6ff.
[215] Ofcom staff hearing transcript, p37, line 12ff, & p37, line 25ff.
[216] Ofcom staff hearing transcript, p38 & 39, line 17ff.
[217] Ofcom staff hearing transcript, p38, line 13ff.

BT SoI in support of Ofcom

4.136 BT stated that the purpose of Ofcom's model was to assess the costs of a 'hypothetical efficient operator', not of an 'average efficient operator',[218] and said that the European Commission recommended that the minimum efficient share was 20 per cent.[219]

4.137 BT argued that the fact that Three had taken a large share of the datacard market was no justification for increasing the mobile termination rate and considered that fixed networks and their customers should not have to pay more to compensate the incumbent MNOs for having performed poorly in the datacard market.[220]

Assessment: historic datacard market share

4.138 Vodafone said that whilst Ofcom had used the actual costs of the existing 2G/3G operators to calibrate the 2011 Model, it had not used the corresponding actual historic datacard market shares. Ofcom assumed the same historic market share for datacards as for handsets in the 2011 Model, even though they differed significantly. We agree with Vodafone that this treatment is inconsistent.

4.139 We note in particular that Vodafone stated that Ofcom appeared to have made an adjustment to the market share of the hypothetical efficient operator in the 2011 Model to take into account the actual market shares of the 2G/3G operators. (See paragraph 4.129.)

4.140 We also note that Ofcom said that it did not perform any checks as to whether the differential market share for voice and data of the 2G/3G operators would impact on the calibration of the 2011 Model.

4.141 We do not consider that Ofcom's statement that some 2G/3G operators had a higher than average voice share is relevant, because Ofcom stated that it performed its calibration mainly in relation to the average of all the 2G/3G operators—see paragraph 4.367.

4.142 Ofcom claimed that there may be spare capacity. This would allow the actual 2G/3G networks to carry the higher data traffic volumes associated with the higher assumed datacard market share of the hypothetical operator (compared to the actual market share of the 2G/3G operators). However, we have not seen evidence of spare capacity and we do not consider it self-evident that there might be sufficient available capacity to the actual 2G/3G networks to meet the levels assumed for the hypothetical operator.

4.143 We considered BT's comments that the EC Recommendation recommends that when setting the LRIC of the MCT service the minimum market share assumption should be 20 per cent for the hypothetical efficient operator. However, the EC Recommendation explicitly contemplates a deviation from the recommended approach where the market conditions in the territory of that Member State would imply a different minimum efficient scale. We also note that Ofcom would still have included a market share assumption for data of greater than 20 per cent for data services in later years of the 2011 Model. We therefore do not consider that the EC Recommendation can be used, in this instance, to support Ofcom's approach.

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[218] BT NoA, W/S Richardson, §30.
[219] BT NoA, W/S Richardson, §30.
[220] BT NoA, W/S Richardson, §31.

Conclusion

4.144 We find Vodafone's case in respect of this alleged error convincing and so determine that Ofcom erred in the modelling of the historic datacard market shares in the 2011 Model.

Cost drivers

General

Overview of Vodafone's challenge

4.145 Vodafone explained that cost drivers were a crucial part of the network dimensioning and the network cost recovery. They specified how much use was made of a particular asset in relation to particular services, and hence influenced the dimensioned asset volumes. For example, on-net voice calls used the radio access network on two separate legs, whereas an inbound voice call was on one leg only[221]—thus the relative weighting in the cost driver relating to their dimensioning was 2:1.[222] Vodafone said that there were three[223] errors in two categories related to cost drivers:

(a) cell site and spectrum cost driver adjustment;[224] and

(b) 2G/3G MSC cost driver adjustment.[225]

Cost drivers—cell site and spectrum

Ofcom's decision

4.146 Ofcom said that it had adjusted the cost drivers related to some radio network assets to account for the Erlang over-provisioning of voice traffic. Ofcom did not consider that a similar adjustment was necessary for the allocation of cell site costs, since the number of cell sites was driven both by coverage requirements and network capacity demand and therefore the impact of Erlang over-provisioning for voice traffic might not be a significant cost driver of cell site costs. Ofcom considered that it would be significantly more complex to carry out a more detailed assessment of the impact and, given the time and resource required to do so, Ofcom concluded that this would be disproportionate to the likely change in the model outputs. Therefore, Ofcom reflected the Erlang over-provisioning for voice traffic in capacity-driven radio network assets such as cell site equipment, 2G TRXs, 2G BSCs, 3G RNCs and backhaul, but did not apply any adjustments to the cell site cost drivers where the relationship with Erlang over-provisioning was less clear.[226]

Vodafone's challenge

4.147 Vodafone said that there were several areas where data had been assumed to consume a higher proportion of particular resources in the allocation of costs than in

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[221] This is because in an on-net voice call both the caller and recipient are using the network, whereas for an inbound call only the recipient is on the network.
[222] Vodafone NoA, W/S Roche 1, §3.47.
[223] We grouped the summary of the pleadings and our assessment of the alleged error in respect of the cell site and spectrum cost drivers together.
[224] Vodafone NoA, W/S Roche 1, Table 3.7.
[225] Vodafone NoA, W/S Roche 1, Table 3.8.
[226] Ofcom Decision, §A6.127.

the dimensioning of assets (mainly related to the cell site and spectrum cost recovery drivers).[227] Vodafone stated that for cell site equipment the volume of equipment dimensioned for voice had been increased to maintain sufficient channels to provide a high probability of successful call set-up, but that this had not been done for cell site assets and spectrum. Vodafone argued that as the only reason for the existence of a cell site was to carry mobile traffic equipment as the cell site asset in itself could not carry traffic (as it comprised only the civil works), the cost of the cell site should be recovered in a manner consistent with the equipment that was installed on the site.[228]

4.148 Vodafone said that Ofcom's reasoning, that the coverage properties of cell sites accounted for the different treatment of cell sites and cell site equipment, was not appropriate for the purpose of calculating LRIC+, as costs needed to be recovered from the services that used the cell site.[229] Vodafone said that it would have been internally consistent to make the same adjustment to cell sites as to cell site equipment.[230] Vodafone said that the inconsistent use of the cost drivers would create a mismatch between the equipment and the cell sites that were allocated to different services.[231] Ofcom's model proxied an equi-proportionate mark-up, and using different costs drivers did not deliver an equi-proportionate mark-up as it allocated common costs disproportionately to some services (and therefore underestimated the cost of MCT services).[232]

4.149 Vodafone argued that the cell site and spectrum cost drivers were not neutral: they were already weighted to reflect intensity of asset use, but they—inexplicably—excluded the Erlang weighting (at least in so far as they were installed to provide capacity, rather than coverage).[233]

4.150 Vodafone explained that the Erlang-weighted cost driver for cell site equipment was representative of the resource use of cell site equipment and Ofcom had not attempted to explain why the use of the cost driver that was previously used for cell site equipment was still appropriate to use for cell sites.[234] Ofcom's reasoning in relation to coverage costs would equally apply to cell site equipment and did therefore not justify the use of different cost drivers for cell sites and cell site equipment.[235]

4.151 Vodafone said that this adjustment was relevant for the LRIC calculation in a different way as costs did not need to be allocated between services in the LRIC calculation, but needed to be allocated between voice and data.[236]

4.152 Vodafone said that spectrum was 'fundamentally "consumed"' by the 2G and 3G radio equipment at the cell sites, and thus its cost driver should accurately reflect the way in which the radio equipment at each cell site made differential use of spectrum for differential call types.[237] Vodafone added that the cost drivers for spectrum needed to be adjusted in a similar manner to cell sites. Spectrum was only used in proportion to the resource usage of the radio equipment at every site. Vodafone

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[227] Vodafone NoA, W/S Roche 1, §§3.51 & 3.52.
[228] Vodafone said that Ofcom had created two new drivers for cell site equipment recovery ('2G total traffic alloc' and '3G radio interface traffic alloc'), but used the 'all radio traffic' driver for cell site assets (Vodafone NoA, W/S Roche 1, §§3.58 & 3.59).
[229] Vodafone staff hearing transcript, p25, line 10ff.
[230] Vodafone staff hearing transcript, p26, line 1ff.
[231] Vodafone staff hearing transcript, p26, line 14ff, & p26, line 23ff.
[232] Vodafone staff hearing transcript, p27, line 19ff.
[233] Vodafone Core Submission, §5.71.1.
[234] Vodafone Core Submission, W/S Roche 2, §7.86.
[235] Vodafone Core Submission, W/S Roche 2, §7.89.
[236] Vodafone staff hearing transcript, p25, line 5ff.
[237] Vodafone NoA, W/S Roche 1, §3.50.

suggested that spectrum should therefore be recovered by the same cost driver as used for cell site equipment.[238]

4.153 Vodafone argued that a change to Ofcom's model to account for the cell site and spectrum cost drivers could be made quite easily,[239] and said that both adjustments together would increase the LRIC+ in 2014/15 by 2.3 per cent (or 0.0408ppm) and LRIC by 0.3 per cent (or 0.0024ppm).[240] Of this, the majority was accounted for by the cell site cost driver adjustment (74 per cent for LRIC+ and 100 per cent for LRIC).[241]

4.154 Vodafone accepted that the entire 5MHz 3G carrier was used in 3G transmission, but argued that the cost driver should be set in relation to how spectrum was shared between services.[242]

EE SoI in support of Vodafone

4.155 EE stated that the 2011 Model did not adequately take into account the extent to which voice services utilized cell site and spectrum resources more intensely than data services.[243]

4.156 EE said that spectrum was utilized in the same way as radio network equipment and the same cost allocation approach should be applied to both spectrum and for radio network equipment, so that costs were allocated to services in the way that the services utilized those assets. Further, as the only purpose of a cell site was to host the radio equipment, it was appropriate that the cost of cell sites should also be allocated on the same basis as the allocation approach for radio network equipment.[244]

4.157 EE said that even with Ofcom's view of coverage, a substantial share of cell sites were driven by network capacity demand and hence their costs should be allocated based on Erlang to reflect accurately the actual cost drivers.

4.158 EE also said that in estimating LRIC+, common network costs had been allocated based on network routing factors and hence not applying an adjustment would lead to coverage cell sites being treated inconsistently with other assets for no sound reason.[245] EE claimed that because no distinction of coverage and capacity costs was needed for the calculation of LRIC, Ofcom's argument in its decision that such a change was not practical was wrong.[246]

4.159 EE agreed that there was some complexity involved in separating out coverage and capacity-related costs so as to allocate these on a different basis. However, EE considered that Ofcom's model should be capable of identifying the capacity component of costs. In particular, if the calculation of the LRIC estimate worked as Ofcom claimed, then the effect of Ofcom's subtractional step should be to eliminate all coverage costs from that estimate, leaving only capacity costs, and the choice of cost

[238] Vodafone NoA, W/S Roche 1, §3.60.
[239] Vodafone Core Submission, §5.71.3.
[240] Vodafone NoA, W/S Roche 1, §3.61.
[241] Vodafone response to post staff hearing questions, p19, and Vodafone NoA, W/S Roche 1, Table 5.1.
[242] Vodafone Core Submission, W/S Roche 2, §7.92.
[243] EE Core Submission, W/S Hird 4, §7vi.
[244] EE SoI, W/S Hird 2, §28.
[245] EE Core Submission, W/S Hird 2, §30.
[246] EE Core Submission, W/S Hird 2, fn 6.

allocation for coverage costs was irrelevant as long as it was applied identically to the model with and without termination minutes.[247]

4.160 EE stated that there was a relationship between resource usage and the amount of spectrum.[248] EE explained that a single call on the 3G network would physically utilize all the carrier of spectrum, but it would only marginally load it, ie a 3G carrier of spectrum could support many simultaneous calls, each of which added a small amount of noise/interference to the system. Eventually the carrier noise would reach a level where no additional calls of reasonable quality could be added.[249] An increase in the number of customers on a single 3G carrier led to higher power requirements and ever increasing noise on the carrier.[250] All else being equal, this would have an impact on throughput and coverage distance from the site.[251]

4.161 EE estimated that making an adjustment for the cell site and spectrum cost driver would increase LRIC+ in 2014/15 by 3.1 per cent (or 0.0686ppm) and would increase LRIC by 1.3 per cent (or 0.0097ppm).[252]

Ofcom's Defence

4.162 Ofcom explained that (network) cost drivers were used in the 2011 Model for dimensioning network assets and for allocating the costs of assets (capex and opex) to different traffic services.[253]

4.163 Ofcom said that cell sites were deployed on the basis of coverage and projected traffic, but that it considered that deployment of radio equipment was most significantly driven by traffic.[254] Ofcom said that applying an Erlang uplift to an asset where the cost driver was primarily traffic seemed reasonable, but for cell sites (which were deployed both by reference to coverage and traffic), applying the Erlang uplift was less objectively justified.[255] Ofcom illustrated this by stating that cell site equipment was processing traffic and, as traffic grew, a larger piece of equipment was needed. The cell site, which was a passive structure, however, would not grow in the same way in relation to traffic (eg it would not need a larger rooftop as traffic grew or more floor space, masts or infrastructure[256,257]). Ofcom said that there was a very strong relationship between the amount of traffic processed and the size of the cell site equipment, whereas that was not necessarily the case for a passive structure.[258]

4.164 Ofcom referred to its statement, where it stated that it did not consider that an adjustment was necessary for the allocation of cell site costs, since the number of cell sites was driven both by coverage requirements and network capacity demand and therefore the impact of Erlang over-provisioning[259] for voice traffic might not be a significant cost driver of cell site costs. Ofcom also considered that it would be

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[247] EE Core Submission, W/S Hird 4, §35.
[248] EE Core Submission, W/S James 2, §11.
[249] EE Core Submission, W/S James 2, §10.
[250] EE Core Submission, W/S James 2, §11.
[251] EE Core Submission, W/S James 2, §11.
[252] EE SoI, W/S Hird 2, §31.
[253] Ofcom Defence, Annex B, §49.
[254] Ofcom staff hearing transcript, p22, line 4ff.
[255] Ofcom staff hearing transcript, p22, line 4ff.
[256] Ofcom staff hearing transcript, p26 line 3ff.
[257] Ofcom staff hearing transcript, p27 line 3ff.
[258] Ofcom staff hearing transcript, p26 line 16ff.
[259] As a voice connection needs to be always on, whereas data could be sent in parcels, voice uses more resource than data, requiring an adjustment in Ofcom's modelling.

significantly more complex to carry out a more detailed assessment, and that doing this would be disproportionate given the likely change in the model outputs.[260]

4.165 Ofcom stated that Vodafone's suggested adjustment for all cell sites overstated the impact of Erlang over-provisioning as Vodafone's adjustment would be made to all cell sites, including coverage sites, which would need to be excluded from this adjustment. Ofcom said that the proportion of coverage cell sites changed over time and therefore an assessment would need to be made annually to calculate the proportion of coverage sites, which it claimed would be disproportionate given the small adjustment to LRIC proposed by Vodafone.[261]

4.166 Ofcom submitted that spectrum was not necessarily only used in proportion to the resource usage of the radio equipment. For example, the transmission and reception of information in 3G networks used the entire (5MHz) spectrum carrier. Therefore, it was not appropriate to adjust the cost drivers for Erlang over-provisioning in the allocation of spectrum costs. The relative efficiencies of spectrum usage for different services were taken into account in the cost driver used for allocating the costs of spectrum to different services (for example, in allocating the costs of 3G spectrum the cost driver took into account the higher efficiency of delivering 3G data service relative to 3G voice service via a parameter known as the 'data downlift').[262]

BT SoI in support of Ofcom

4.167 BT said that there may be a case that some of the equipment cost would be avoided if no terminating traffic was provided, but the cell site infrastructure probably would not be avoided to the same extent. It was therefore logical to treat those costs differently for the purpose of calculating MTRs.[263]

Assessment: cost drivers—cell site and spectrum

4.168 Vodafone said that Ofcom should have used the same cost driver for cell sites and spectrum as for radio equipment because they were all used for the provision of voice and data services.

4.169 We consider that, given that radio equipment, cell sites and spectrum are a common cost to both data and voice services and that some simplification is essential for modelling purposes, choosing the appropriate cost drivers will necessarily be subject to a certain level of regulatory judgement.

4.170 We do not consider that Vodafone's reasoning demonstrates that using its preferred cost allocation methodology (of using the same cost driver for cell sites, spectrum and radio equipment) would be a superior solution to the one Ofcom implemented.

4.171 We agree with Ofcom's reasoning that cell site equipment can be distinguished from cell sites and spectrum in the degree to which they are traffic related. We were persuaded by Ofcom's reasoning that cell sites would not necessarily grow with traffic in the same way as cell site equipment and that 3G spectrum is not necessarily used in the same proportion by voice and data services as radio equipment (see paragraph 4.166).

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[260] Ofcom Defence, Annex B, §§51 & 53.
[261] Ofcom Defence, Annex B, §54.
[262] Ofcom Defence, Annex B, §56.
[263] BT staff hearing transcript, p10, line 25ff.

4.172 We were also persuaded by Ofcom that changing the cell site and spectrum cost driver would require an assessment in how far a further modification of the cost driver would be required for cell sites and spectrum at coverage sites. Ofcom considered that undertaking such an analysis would be disproportionate considering the relatively limited impact the change in the cost drivers for cell sites and spectrum would have on the calculation of LRIC and LRIC+. Vodafone itself estimated an impact in 2014/15 of 0.3 per cent on LRIC and 2.3 per cent on LRIC+[264]—but this was before any further potential reduction as a result of a different treatment of cell sites and spectrum at coverage sites.

4.173 With regard to EE's argument that the identification of coverage sites would not be necessary for cost allocation using LRIC and LRIC+ (albeit for different reasons), in our view the argument was not supported with sufficient evidence or analysis to demonstrate that such an assumption would be appropriate.

4.174 In our view Ofcom's judgement that it would not be proportionate to make additional adjustments to the cell site and spectrum cost driver has not been shown to be an error.

Conclusion

4.175 We therefore consider that it has not been demonstrated that Ofcom erred in the use of the cost drivers for cell sites and spectrum.

Cost drivers—2G/3G MSC

Ofcom's decision

4.176 Ofcom said that in the April 2010 Model, all 2G traffic was still handled by 2G monolithic MSCs until 2020/21. In the 2011 Model, part of this traffic was diverted to combined 2G/3G MSCSs/MGWs from 2007/08, with 80 per cent of 2G traffic processed by 2G monolithic MSCs in 2007/08 down to 0 per cent in 2011/12. These values were chosen based on the latest inventory data provided by the four national MCPs.[265]

Vodafone's challenge

4.177 Vodafone stated that Ofcom's 2011 Model included a new asset of combined 2G/3G MSC servers because 2G and 3G traffic was no longer served by separate MSCs. Ofcom modelled this by phasing out 2G MSC servers over the period of 2007/08 to 2011/12 and by converting 3G MSC servers into combined 2G/3G MSCs.[266]

4.178 Vodafone said that this change had not been properly implemented, because the 2011 Model recovered costs from the combined 2G/3G MSC servers through 2G services from 2003/04 onwards, before the 2G/3G MSC servers were dimensioned (ie before 2007/08).[267]

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[264] See paragraph 4.153.
[265] Ofcom decision, §A6.165.
[266] Vodafone NoA, W/S Roche 1, §§3.62–3.64.
[267] Vodafone NoA, W/S Roche 1, §3.65.

4.179 Vodafone said that adjusting for this alleged error would increase LRIC+ in 2014/15 by 1.9 per cent (or 0.0343ppm) and LRIC by 2.8 per cent (or 0.0194ppm).[268]

EE SoI in support of Vodafone

4.180 EE agreed with Vodafone that Ofcom had incorrectly modelled the recovery of the MSC servers by assuming that some of the costs of servers that were only able to handle 3G traffic should be recovered from 2G traffic.[269] EE estimated that making an adjustment for the 2G/3G MSC cost driver would increase LRIC+ in 2014/15 by 2.2 per cent (or 0.0504ppm) and would increase LRIC by 4.8 per cent (or 0.0295 ppm).[270]

Ofcom's Defence

4.181 Ofcom agreed that the use of a single cost driver for allocating the costs of the (combined) 2G/3G MSC resulted in the cost of this asset being allocated to 2G in advance of 2G traffic being processed by the 2G/3G MSC. This was due to the transition of 2G traffic to 2G/3G MSCs being modelled as a gradual process and because the cost driver used for allocating the costs of the combined 2G/3G MSC did not make any adjustment for this transition period.[271]

4.182 However, Ofcom noted that the glide path for the price control was based on the unit cost of MCT in 2014/15, by which time all 2G traffic would be processed by the 2G/3G MSC. This meant that the risk of over-recovery was not present by the time charges were brought into line with projected costs.[272]

4.183 Nevertheless Ofcom stated that while investigating Vodafone's claim it had identified a computational error related to the recovery of 2G/3G MSC costs. This was because all of the 2G traffic was assumed to run over the 2G/3G MSC as soon as that asset was introduced, when in fact only a proportion of the 2G traffic ran across the 2G/3G MSC in early periods of its deployment. This was computationally incorrect since the 2011 Model also assumed that all 2G traffic was recovering the costs of 2G MSCs. To correct for this, the element output of the 2G/3G MSC would need to be reduced by the proportion of 2G traffic that was not passing over it.[273]

4.184 Ofcom said that the error was distinct from any alleged error of judgement on appropriate parameter choices (and that it therefore considered that an adjustment of this error was justified).[274] In addition, it said that the error correction was very straightforward.[275] Ofcom stated that although this error was distinct from the issue raised by Vodafone, when corrected it did address the anomalies that Vodafone had identified. For instance, it would stop 2G/3G MSC cost being recovered from 2G traffic before such 2G traffic started to be processed by the asset.[276]

4.185 The impact of this correction was to increase the 2G/3G MSC cost per element output as calculated by the ED algorithm, which in turn increased both the LRIC and

[268] Vodafone NoA, W/S Roche 1, §3.68.
[269] EE SoI, W/S Hird 2 §32.
[270] EE SoI, W/S Hird 2, §33.
[271] Ofcom Defence, Annex B, §60.
[272] Ofcom Defence, Annex B, fn 77.
[273] Ofcom Defence, Annex B, §§61.
[274] Ofcom bilateral hearing transcript, p113 to p114.
[275] Ofcom bilateral hearing transcript, p113 to p114.
[276] Ofcom Defence, Annex B, §62.

LRIC+ cost of MCT. The LRIC estimate in 2014/15 increased to 0.72ppm and the LRIC+ to 1.66ppm (both in 2008/09 prices).[277]

Three in support of Ofcom

4.186 Three said that the error Ofcom identified was that the 'network element output' for 2G/3G MSCs was too high in the period before 2G traffic was serviced exclusively by 2G/3G MSCs.[278]

4.187 Three agreed that there was an inconsistency between the level of traffic serviced by 2G/3G MSCs, and the cost driver used to recover the costs of 2G/3G MSCs. Specifically, the network element output calculated for 2G/3G MSCs failed to reflect the changing proportion of 2G traffic that was serviced by 2G/3G MSCs.[279]

4.188 Three stated that the error identified by Ofcom represented a different perspective on one of the objections raised by Vodafone and noted that the adjustment proposed by Ofcom was very similar to that sought by Vodafone.[280] The only difference of substance between the two adjustments appeared to be that Vodafone's proposed adjustment was confined to the core 2G/3G MSC server and certain other elements linked directly to that asset, whereas Ofcom's adjustment also extended to the ports which were connected to 2G/3G MSCs. If the scope of Ofcom's adjustment was modified to exclude these ports, then it replicated the impact of Mr Roche's adjustment on LRIC perfectly.[281] Three stated that the choice between the two adjustments was therefore a matter of scope and that it considered Ofcom's adjustment to be more appropriate, since there seemed no good reason for 2G/3G MSC ports to be treated differently from the 2G/3G MSC.[282]

4.189 Three stated that, subject to the question of whether an error of 0.03ppm could be considered material, it did not dispute the need for an adjustment.

Assessment: cost drivers—2G/3G MSC

4.190 Vodafone said that it was an error that the costs of the combined 2G/3G MSC were recovered from 2G services before these servers were dimensioned (ie before these servers carried 2G traffic). Ofcom agreed that the costs of this asset were allocated to 2G before 2G traffic was processed by the 2G/3G MSC.

Conclusion

4.191 We therefore find that Vodafone has demonstrated that Ofcom erred in the modelling of the 2G/3G MSC cost driver.

4.192 However, we note Ofcom's correction published on 15 October 2011 and consider that this addresses the error alleged.

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[277] Ofcom Defence, Annex B, §61.
[278] Three SoI, W/S Mantzos 2, §4.34.
[279] Three SoI, W/S Mantzos 2, §4.32.
[280] Three SoI, §10.12.
[281] Three SoI, W/S Mantzos 2, §4.37.
[282] Three SoI, W/S Mantzos 2, §4.38.

Coverage

Introduction

4.193 Ofcom, in its decision, made assumptions for the area coverage and population coverage of the network of the hypothetical efficient operator. Area coverage is the percentage of the geographic area of the UK that has mobile phone reception and population coverage is the percentage of the UK population having access to mobile phone services.

4.194 Ofcom's model makes assumptions on the proportion of the geographic area of the UK and the UK population covered by both 2G and 3G services (split by up to nine geotypes) in its 2011 Model.

Vodafone's challenge

4.195 Vodafone said that the Ofcom model embodied several related errors in respect of coverage: 2G area coverage, 2G coverage radii and 3G area coverage.[283]

Coverage—2G area coverage

Ofcom's decision

4.196 Ofcom said that it had increased the long-term 3G area coverage to 81.2 per cent by 2020/21 (ie 90 per cent of the 2G coverage).[284]

4.197 Ofcom said that for a 2G/3G operator it estimated that long-term 2G population coverage would be just below 99 per cent. As part of the calibration process for the 2011 Model, Ofcom very slightly reduced the long-term population coverage from that used in the 2010 Model.[285]

Vodafone's challenge

4.198 Vodafone said that in its 2011 Model Ofcom had reduced the 2G coverage (ie the area of the UK and the population in the UK having access to mobile phone services) from the level in the 2007 and 2010 Model from a final depth of 99 per cent population coverage and 96.78 per cent area coverage to 98.36 per cent population coverage and 90.30 per cent area coverage.[286]

4.199 Vodafone considered that the 2011 Model was incorrect in its assumptions on future 2G coverage and that Ofcom should not have modelled a decrease (and if anything it should have modelled an increase) in the level of future 2G coverage in its 2011 Model compared with the 2007 Model.[287] This was because the introduction of collaborative site sharing in Ofcom's 2011 Model enhanced operators' area coverage.[288]

4.200 Vodafone explained that site sharing in Ofcom's model implied the abandonment of 45 per cent of each operator's macro sites. Vodafone said that out of each pair of

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[283] Vodafone NoA, W/S Roche 1, §3.69.
[284] Ofcom Decision, §A6.144.
[285] Ofcom Decision, §A6.106.
[286] Vodafone NoA, W/S Roche 1, §3.70.
[287] Vodafone NoA, W/S Roche 1, §§3.71 & 3.72.
[288] Vodafone NoA, W/S Roche 1, §3.72.

competing sites held by sharing operators, the one which would be abandoned would be the less satisfactory one. In rural areas, where sites were primarily for coverage, the less satisfactory one was likely to be the one that offered inferior area coverage. Successful site sharing therefore implied that, even where the number of sites used by a given operator remained constant, an improved coverage area was achieved.[289] Vodafone also suggested that operators would benefit from access to additional sites under site sharing and that site sharing lowered the marginal cost of sites, increasing the likelihood that new sites would be built.[290]

4.201 Vodafone stated that when adjusting for 2G coverage, LRIC+ in 2014/15 would increase by 0.2 per cent (or 0.0042ppm) and LRIC would reduce by 0.0 per cent (or 0.0002ppm).[291]

4.202 Vodafone said that the lower actual levels of 2G coverage than assumed in Ofcom's 2007 Model might have been the result of reducing margins, increasing costs and the difficulties of finding sites and that site sharing was a partial solution to these problems.[292,293]

4.203 Vodafone noted that Ofcom was continuing to pressure the operators to increase area coverage, with its work on 'not-spots'.[294,295]

4.204 Vodafone stated that whilst Ofcom argued that it had already taken account of site sharing as a feature which would facilitate the provision of additional coverage, the extent of current site sharing recognized in Ofcom's model at the point of calibration was very limited, and it took no further account of the extent to which an increased scale of site sharing in future would have further effects on the extent of 2G and 3G coverage.[296]

EE SoI

4.205 EE did not believe that a change in Ofcom's forecast 2G coverage was justified. This was because [✂].

4.206 EE stated that Ofcom had based its assumptions for area coverage on the average for MCPs and that this was the correct approach.[297] EE considered that this was what Ofcom had done and, as such, EE did not believe that the forecasts for the 2G coverage should be changed.[298]

Ofcom's Defence

4.207 Ofcom said that the 2011 Model had a 2009/10 2G coverage of 97.7 per cent population coverage and 84.8 per cent of area coverage, whereas these were forecast as 99 per cent population coverage and 96.8 per cent area coverage in the 2007 Model.

4.208 Ofcom did not agree that the 2011 Model was in error in relation to 2G forecast coverage because, even if site sharing were to make some previously marginal 2G

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[289] Vodafone NoA, W/S Roche 1, §3.73.
[290] Vodafone NoA, W/S Roche 1, §3.74.
[291] Vodafone response to post-staff-hearing questions, p22.
[292] Vodafone Core Submission, W/S Roche 2, §7.104.
[293] Vodafone Core Submission, §5.78.2.
[294] Areas with no mobile network coverage.
[295] Vodafone Core Submission, W/S Roche 2, §7.104.
[296] Vodafone Core Submission, §5.78.1.
[297] EE Core Submission, W/S Hird 4, §7viii.
[298] EE Core Submission, W/S Hird 4, §38.

sites less marginal, the cost efficiency of site sharing was not the only factor that would affect forecast coverage. The information submitted to Ofcom by the MCPs showed that the average 2G coverage in 2009/10 was less than that forecast by the 2007 Model. As a result, 2G coverage in 2009/10 in the 2011 Model was reduced to match actual average MCP coverage. This reduction in historical coverage resulted in a lower forecast final 2G coverage (compared with the 2007 Model) because 2009/10 coverage was used as the base from which the model then projected future coverage. By starting from a lower base of coverage, this resulted in a lower degree of coverage in the final forecasting period (ie 2020/21).[299]

Assessment: coverage—2G area coverage

4.209 Vodafone stated that 2G coverage in Ofcom's 2011 Model should have been at least as high as in the 2007 Model. This was because Ofcom introduced site sharing in its 2011 Model which would lead to greater 2G coverage (mainly due to the synergies that would flow from site sharing) and because Ofcom was pressurizing operators to increase their area coverage.

4.210 We agree with Vodafone that the introduction of site sharing should, everything else being equal, increase the 2G coverage in Ofcom's model.

4.211 However, we note that Ofcom stated that it reduced the 2G coverage assumption in the 2011 Model compared with the 2007 Model given that actual coverage in 2009/10 was lower than the coverage projected in the 2007 Model.

4.212 We were not persuaded that it would be incorrect to reduce coverage in the 2011 Model compared with the 2007 Model, when weighing up the reasons supporting an increase in coverage (eg due to site sharing) and the reasons supporting a reduction in coverage (ie that actual coverage was lower than it was forecast in Ofcom's 2007 Model).

4.213 We also note that EE considered that Ofcom's forecast 2G coverage in the 2011 Model was broadly in line with operators' forecasts.

Conclusion

4.214 In light of the evidence and arguments presented to us, we do not find that Ofcom erred in reducing its forecast of 2G coverage in the 2011 Model compared with the 2007 Model.

Coverage—2G cell radii

Ofcom's decision

4.215 Ofcom said that the 2G cell radii parameter in the 2011 Model had the same value as in the 2007 Model. In addition, there was a 1 per cent decrease in cell radii in each geotype between 2007/08 and 2010/11. This had been added as part of the 2011 Model calibration process.[300] This had resulted, Ofcom said, in a better alignment of

[299] Ofcom Defence, Annex B, §69i.
[300] Ofcom decision, Table A6.4.

the 2G site numbers with the average number of deployed 2G cell sites in the 2011 Model compared with the 2010 Model.[301]

Vodafone's challenge

4.216 Vodafone said that Ofcom was wrong to reduce the 2G cell radii as part of the calibration process.[302] Vodafone considered that increasing the number of sites by reducing the cell radii from 2006/07 onward, which increased the proportion of costs that were not traffic related, was wrong from the point of view of incremental cost modelling.[303] Vodafone said that this would only be correct for the purposes of obtaining a LRIC result if the under-dimensioning problem related to a low coverage outcome rather than a low 'capacity' outcome.[304] It said that Ofcom's calibration of 2G cell radii showed that Ofcom was indifferent to the identification of costs between coverage and capacity.[305,306] Vodafone said it was illogical that the number of sites needed for coverage would change over time, because the physics of the site remained constant over time.[307] Vodafone considered that the number of sites went up over time in these areas because of traffic increases.

4.217 Vodafone said that for the LRIC+ estimate it made no difference if cell sites were coverage sites or sites built in response to capacity requirements. But for the LRIC calculation this was important because lower cell radii created a bigger coverage network and Ofcom's model assumed that the costs of coverage sites and equipment were not incremental to any traffic services.[308,309]

4.218 Vodafone said that as a result, Ofcom's model built more coverage sites (to maintain coverage levels), but this did not reflect reality,[310] because it was implausible that some 15 years after service launch new coverage sites were needed. Vodafone argued that any new sites would be installed to meet additional traffic demands, in particular considering that Ofcom's own coverage standard allowed 10 per cent outdoor non-coverage.[311]

4.219 Vodafone suggested that in order to resolve this error, the 2G macrosite utilization factors should be adjusted (from 90 to 85 per cent) rather than the 2G cell radii.[312]

4.220 Vodafone stated when reversing the 2G cell radii adjustment, LRIC+ in 2014/15 would decrease by 0.6 per cent (or –0.0115ppm) and LRIC would decrease by 0.4 per cent (or –0.0026ppm).[313] The offsetting utilization adjustment then would increase LRIC+ in 2014/15 by 0.6 per cent (or 0.0102ppm) and LRIC would increase by 1.6 per cent (or 0.0113ppm).[314] The net effect would be a decrease in LRIC+ in 2014/15 by 0.1 per cent (or 0.0013ppm) and an increase of LRIC of 1.2 per cent (or 0.0087ppm).[315]

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[301] Ofcom's decision, §A6.148.
[302] Vodafone bilateral hearing transcript, p92, line 5ff.
[303] Vodafone Core Submission, W/S Roche 2, §4.43.
[304] Vodafone Core Submission, W/S Roche 2, §4.39.
[305] Vodafone response to post staff hearing questions, p3.
[306] Vodafone Core Submission, W/S Roche 2, §5.54.
[307] Vodafone bilateral hearing transcript, p92, line 21.
[308] Vodafone NoA, W/S Roche 1, §3.80.
[309] Vodafone bilateral hearing transcript, p89 line 23, to p91 line 1.
[310] Vodafone NoA, W/S Roche 1, §3.78.
[311] Vodafone NoA, W/S Roche 1, §3.79.
[312] Vodafone NoA, W/S Roche 1, §§3.81 & 3.82.
[313] Vodafone response to post staff hearing questions, p22.
[314] Vodafone response to post staff hearing questions, p22.
[315] Vodafone response to post staff hearing questions, p22.

4.221 Vodafone stated that the set of cell site rules adopted in the model for dimensioning for coverage had no objective reality but did have a crucial bearing on the identification of incremental cost and that Ofcom needed to demonstrate that it was representative of the real initial network that an operator would build in the absence of traffic.[316]

EE SoI in support of Vodafone

4.222 EE stated that the 2011 Model incorporated an assumption that the design radii of cell sites decreased over time. This assumption had no basis in real networks and reduced the accuracy of the model. Ofcom could instead achieve calibration to MCPs' reported data by setting a lower design utilization for all periods in the model.[317]

4.223 EE explained that the maximum cell radius of any particular 2G base station was a fixed quantity reflecting its technical capabilities and the nature of the surrounding terrain. The capabilities of 2G cells had not been decreasing over time. However, Ofcom had artificially altered the capabilities of 2G cells in certain years in order for its model to produce realistic outputs.[318]

4.224 EE explained that there was an important difference between the design radius of a cell and its effective radius. A design radius should be an input to Ofcom's model and an effective radius should be an output. A cell site might be capable of operating with a radius of 4km, but only needed to operate with an effective radius of 1km because of the close proximity of other cells due to high demand. This provisioning of cell sites was predominantly driven by traffic rather than coverage requirements. A reduction in traffic would reduce the average number of cell sites required. This was different from assuming a design radius of 1km because although the same number of cell sites is provisioned, all would appear to be required for coverage, and none would be dispensed with if traffic were to decrease.[319]

4.225 [✂][320]

4.226 EE further noted that Ofcom stated that the reason it had assumed decreasing 2G cell radii was to improve the calibration of the 2011 Model, rather than believing that 2G cell radii were actually falling. EE therefore considered that Vodafone's proposed approach reflected reality better than the assumptions adopted by Ofcom.[321]

4.227 EE considered that it was critical that a model intended to estimate LRIC be capable of provisioning the correct number of cell sites in response to a change in traffic. Ofcom presented its model as achieving this by reference to its calibration over 2006 to 2009. However, because this outcome was achieved by its change to cell radii, this did not mean that Ofcom's cost model would correctly estimate the change to network design in response to the removal of termination minutes. EE said that artificially reducing cell radii caused Ofcom's estimate of LRIC to be biased downwards.[322]

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[316] Vodafone Core Submission, W/S Roche 2, §4.45.
[317] EE Core Submission, W/S Hird 4, §7ix.
[318] EE Core Submission, W/S Hird 4, §42.
[319] EE Core Submission, W/S Hird 4, §43.
[320] EE NoA, W/S James, §38.
[321] EE SoI, W/S Hird 2, §36.
[322] EE Core Submission, W/S Hird 4, §44.

4.228 EE considered that Vodafone's suggested correction (to lower the design utilization for cell sites) was reasonable, as the revised utilization assumption was applied to all time periods and not just the 2007/08 to 2010/11 period affected by high demand growth, and as design utilization, as used in Ofcom's model, described the extent to which an asset could be utilized before additional capacity was provided (eg for redundancy for unusually high demand or unexpected events), design utilization would not necessarily be expected to increase with greater traffic.[323]

4.229 EE said that the adjustment for 2G cell radii alone would increase LRIC+ in 2014/15 by 0.1 per cent (or 0.0009ppm) and would increase LRIC by 3.9 per cent (or 0.0279ppm).[324] For the calculation of LRIC, the 3.9 per cent adjustment consisted of an adjustment of 1 per cent for reversing out the 2G cell radii calibration and an adjustment of 2.8 per cent for the change in the utilization assumption.[325] For the calculation of LRIC+, the 0.1 per cent adjustment consisted of a reduction of 0.5 per cent for reversing out the 2G cell radii calibration and an increase of 0.6 per cent for the change in the utilization assumption.[326]

Ofcom's Defence

4.230 In its defence Ofcom referred to its decision, where it stated that 2G cell radii in the 2011 Model were reduced by 1 per cent annually between 2007/08 and 2010/11 as part of the model calibration process. The cell radii were reduced to increase the number of cell sites deployed in the 2011 Model and to bring them into line with the average number of cell sites deployed by the MCPs.[327] Ofcom argued that reducing the 2G cell radii, as done in the 2011 Model, to aid calibration was reasonable for the following reasons:[328]

(a) There had been an increase in the average number of 2G cell sites deployed by MCPs between 2007/08 and 2010/11.[329] This increased the density of cell sites within a geotype resulting in a reduction in the effective cell radii in that geotype. The 2011 Model accordingly adjusted the cell radii to reflect this increased cell density.[330]

(b) Increasing traffic over the modelling period would result in higher macro-site utilization, as more traffic was carried per cell site, and therefore it was more appropriate to reduce the cell radii (as Ofcom had done) instead of the macro-site utilization factor (as Vodafone now proposed) in order to improve calibration of the 2011 Model.[331]

4.231 Ofcom said that it was a matter of judgement as to which parameter to adjust in the calibration process.[332] Ofcom said that it adjusted the cell radii because if more cells were added, implicitly, the cell radii would reduce.[333]

4.232 Ofcom said that Vodafone's suggested adjustment would imply that although the traffic loads in the networks were going up, utilization per cell site would reduce,

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[323] EE Core Submission, W/S Hird 4, §§45 & 46.
[324] EE's reply to question 2 in post-staff-hearing questions.
[325] EE's reply to question 2 in post-staff-hearing questions.
[326] EE's reply to question 2 in post-staff-hearing questions.
[331] Ofcom Defence, Annex B, §71.
[328] Ofcom Defence, Annex B, §74.
[329] Ofcom Defence, Annex B, §74i.
[330] Ofcom Defence, Annex B, §74ii.
[331] Ofcom Defence, Annex B, §74iii.
[332] Ofcom bilateral hearing transcript, p112, line 12ff.
[333] Ofcom bilateral hearing transcript, p112, line 2ff.

which was counterintuitive to the way a network was built.[334] Ofcom said that its decision on the 2G cell radii was made purely on the grounds of how a network designer would try to adjust these parameters to cope with the increase in cell sites. There was no consideration as to whether the position might be different for a LRIC estimate at that point in time.[335]

4.233 Ofcom said that cell sites were added for coverage and for capacity reasons. For example, if a new building reduced the reach of a cell site, a new cell site would be needed to re-establish coverage (and cell sites may also be built to provide deeper and better coverage—for example, to fix coverage holes in roads where there was no coverage).[336] There was therefore no clear conclusion that any additional cell sites would be built purely as a result of meeting extra capacity demand.[337]

Assessment: coverage—2G cell radii

4.234 Ofcom calibrated the number of 2G cell sites in its 2011 Model by reducing 2G cell radii. Vodafone said that the effect of this in Ofcom's model was to increase the size of the coverage network and to reduce effectively the traffic-related costs allocated to MCT services (and in turn LRIC) because the coverage network is excluded from the calculation of the LRIC of MCT services.

4.235 We assess this alleged error separately for LRIC+ and LRIC below.[338]

LRIC+ calculation

4.236 Vodafone said that for the LRIC+ estimate it made no difference if cell sites were coverage sites or sites built in response to capacity requirements.

4.237 We also consider that, given that Vodafone's and EE's calculations indicate that reversing out the 2G cell radii adjustment would change LRIC+ by 0.6 per cent, it is likely that it would have been disproportionate for Ofcom to find an alternative way to calibrate the model for the purpose of calculating LRIC+.

4.238 We therefore consider that Vodafone has not demonstrated that Ofcom erred in adjusting 2G cell radii for the purpose of calculating LRIC+.

LRIC calculation

4.239 Vodafone said that it was implausible that additional cell sites should be built in the coverage network as a result of the 2G cell radii calibration adjustment, given the length of time that 2G networks were already deployed at the time of the calibration adjustment (ie in the period of 2007/08 to 2010/11). We note that this is supported by evidence from EE that shows that [✂].

4.240 However, Ofcom pointed out that there were instances when 2G cell sites were still built for coverage purposes (for example if a new building was built). We note that EE's evidence largely related to the end of the period for which Ofcom changed the 2G cell radii assumption.

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[334] Ofcom bilateral hearing transcript, p112, line 14ff.
[335] Ofcom bilateral hearing transcript, p119, line 1ff.
[336] Ofcom bilateral hearing transcript, p119 to p120.
[337] Ofcom bilateral hearing transcript, p119 to p120.
[338] An assessment of the alleged error in respect of LRIC properly falls under Reference Question 2 but it is practicable to set out our assessment of this specific point in respect of both LRIC and LRIC+ here under Reference Question 3.

4.241 We were therefore not persuaded that it is implausible that additional cell sites were built for coverage purposes.

4.242 In any case, we note that Vodafone's and EE's submissions indicate that reversing out the 2G cell radii adjustment would have either a negative effect on LRIC or would result in a small increase of 1 per cent. Considering that it is plausible, as stated by Ofcom, that some 2G sites may be built for coverage purposes, the effect on LRIC may be smaller than this.

4.243 We agree with Ofcom that adjustments that are made as part of the calibration process are to some extent regulatory judgements. Given that Ofcom's calibration adjustment to 2G cell radii appears to only have had a small impact on the calculation of LRIC, given that it is plausible that some 2G cell sites would have been built for coverage during this period and given that Ofcom would likely have needed to consider a number of alternative calibration adjustments and their potential interplay with other calibration adjustments in the 2011 Model, we consider that it would likely have been disproportionate for Ofcom to find an alternative way to calibrate the model.

4.244 We therefore consider that it has not been demonstrated that Ofcom erred by making an adjustment to 2G cell radii as part of its calibration process in the calculation of LRIC.

Conclusion

4.245 We consider that it has not been demonstrated that Ofcom erred by making an adjustment to 2G cell radii as part of its calibration process.

3G area coverage

Ofcom's decision

4.246 Ofcom made a number of changes to parameter values in the 2011 Model related to 2G and in particular 3G area coverage. These included:[339]

(a) a reduction in the extent of cell site sharing to 90 per cent of sites (down from 100 per cent)–Ofcom said that for technical and geographical reasons it would not be possible to share all macrocell sites. It believed that 90 per cent of macrocell sites being shared was an appropriate reflection of network deployment by a hypothetical efficient national MCP;[340] and

(b) an increase of 3G area coverage to 90 per cent of 2G coverage as a result of site sharing.

4.247 Ofcom said that it had increased the long-term 3G area coverage in the 2011 Model to 81.2 per cent by 2020/21 (ie 90 per cent of the 2G coverage) taking into consideration Vodafone's comment, in response to its consultation, on the likelihood of 3G equipment being deployed at all new sites and information on [✂] forecast 3G area coverage.[341]

[339] Ofcom Decision, §9.52.
[340] Ofcom Decision, §A6.143.
[341] Ofcom Decision, §A6.144.

4.248 Ofcom said that for a hypothetical average efficient 2G/3G operator it believed that long-term 3G population coverage of just below 92 per cent was appropriate. 3G population coverage had been increased slightly from the 2007 Model. This was due to assumed implementation of site sharing, which made coverage viable in some previously uneconomic areas. Once site sharing had been introduced, 3G population coverage increased to 97.6 per cent.[342]

Vodafone's challenge

4.249 Vodafone said that 2G and 3G coverage would be the same over time.[343] It stated that the assumption in the 2011 Model that the 3G coverage area would persistently be less than the 2G coverage area was incorrect when considering the availability of site sharing,[344] and because there were factors which would favour the installation of 3G coverage over 2G, notably the increasing use of 3G for voice and data, particularly by smartphones, Vodafone considered that it was more likely that newly shared sites would use 3G equipment rather than 2G equipment.[345,346,347]

4.250 Vodafone stated that when adjusting for 3G coverage, LRIC+ in 2014/15 would increase by 0.7 per cent (or 0.0124ppm) and LRIC would increase by 0.1 per cent (or 0.0004ppm).[348]

4.251 Vodafone said that for technical reasons, 3G cell radii were smaller than 2G cell radii, but that this difference was marginal.[349] However, Vodafone considered that this would in practice be addressed by changing the dimensioning parameters of 2G cell sites to coincide with the 3G cell radius (which would have the effect of increasing the 2G cell site numbers, but this was efficient with site sharing[350]).[351]

4.252 Vodafone stated that, whilst Ofcom argued that it had already taken account of site sharing as a feature which would facilitate the provision of additional coverage, the extent of current site sharing recognized in Ofcom's model at the point of calibration was very limited, and it took no further account of the extent to which an increased scale of site sharing in future would have further effects on the extent of 2G and 3G coverage.[352]

EE

4.253 [✂][353]

4.254 EE stated that it expected its 3G coverage by 2014 would be [✂] below Vodafone's expected coverage of 97 per cent. EE stated that the appropriate level of 3G coverage should be determined based on the average forecasts for each of the operators.[354]

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[342] Ofcom decision, §A6.106.
[343] Vodafone NoA, W/S Roche 1, §3.84.
[344] Vodafone NoA, W/S Roche 1, §3.83.
[345] Vodafone Core Submission, W/S Roche 2, §7.106.
[346] Vodafone NoA, W/S Roche 1, §3.83.
[347] Vodafone Core Submission, §5.78.3, and Vodafone Core Submission, W/S Roche 2, §7.106.
[348] Vodafone response to post-staff-hearing questions, p22.
[349] Vodafone Core Submission, W/S Roche 2, §7.108.
[350] Vodafone Core Submission, W/S Roche 2, §7.110.
[351] Vodafone Core Submission, W/S Roche 2, §7.109.
[352] Vodafone Core Submission, §5.78.1.
[353] EE NoA, W/S James, §36 & Table 3.
[354] EE SoI, W/S Hird 2, §37.

4.255 EE, in its core submission, considered that Ofcom's 3G coverage assumptions were reasonable (in contrast to W/S Hird 2 (EE)).[355] However, EE later stated that the forecasts assumed in Ofcom's model were below the average and even the bottom end of the range of the forecasts (for area coverage) that were submitted in response to Ofcom's section 135 requests. EE also said that Ofcom's comments appeared to have related to population coverage rather than area coverage.[356,357]

Ofcom's Defence

4.256 Ofcom considered that the 2011 Model was not in error in relation to the 3G forecast coverage assumptions. Modelled 3G coverage in 2009/10 was estimated based on the information submitted to Ofcom by the MCPs and this was forecast to increase until 2014/15. Ofcom said that modelled 3G coverage was then increased to account for site sharing. Nevertheless, forecast 3G coverage was less than 2G coverage because 3G coverage in 2009/10, used as the basis for the subsequent forecast, was significantly lower than 2G coverage in the same year.[358]

4.257 Ofcom noted that in its decision it increased 3G coverage from the level assumed in the 2007 Model due to the assumed implementation of site sharing, which made coverage viable in some previously uneconomic areas.[359]

4.258 Ofcom said that both 2G coverage and 3G coverage were adjusted during the model calibration process.[360] Ofcom added that as part of the calibration process for the 2011 Model, it had very slightly reduced the long-term coverage assumptions from those used in the April 2010 Model for total population coverage, but not 3G coverage, which in the 2011 Model was increased both by reference to the 2010 Model and the 2007 Model.[361]

4.259 Ofcom said that the 2011 Model was calibrated to MCP cell site data, which included periods when site sharing was operational.[362] Ofcom said that data submitted to it suggested that the extent of site sharing in 2009/10 was between 15 and 25 per cent of macrosites.[363]

4.260 Ofcom said that when it made its forecast for 2G and 3G coverage, it considered forecast data (based on July 2010 section 135 information requests) together with historic information in defining the average coverage by geotype. Ofcom noted, however, that some information provided in response to the section 135 information request was incomplete, ie it contained area coverage information only or was not disaggregated on a geotype basis as specified in the MCT Cost Model.[364]

4.261 Ofcom later stated that its 3G area coverage was only below the MCP's own projections in the final year (2014/15) and that Ofcom only had responses from two MCPs for 2014/15.[365]

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[355] EE Core Submission, W/S Hird 4, fn 2.
[356] EE's response to staff hearing questions, 13 October.
[357] EE hearing transcript comment letter, 8 November 11, p2.
[358] Ofcom Defence, Annex B, §69ii.
[359] Ofcom Defence, Annex B, §64.
[360] Ofcom Defence, Annex B, §66.
[361] Ofcom Defence, Annex B, §65.
[362] Ofcom Defence, Annex B, §69.
[363] Ofcom Defence, Annex B, fn 85.
[364] Ofcom response to staff hearing questions, p4.
[365] Ofcom letter to CC of 17 November 2011.

4.262 Three explained that Ofcom's model assumed that in 2021 population coverage would be 98.4 per cent for 2G and 97.5 per cent for 3G.[366]

4.263 Three noted that Vodafone's reasoning for assuming a similar 3G coverage to that of 2G was because of site sharing.[367]

4.264 Three argued that 3G coverage would continue to be below 2G coverage. This was because the 2011 Model did not assume that any deployment of 2G equipment would automatically be accompanied by a deployment of 3G equipment (and that not all 2G sites would have 3G transmitters[368]). Furthermore, even where the model did assume that 2G and 3G equipment would be deployed on the same site, the 3G cell radius would be smaller because, in the 2011 Model, 3G was being provided using the 2.1GHz frequency, whereas 2G was provided using the 1,800MHz frequency.[369]

4.265 Three said that where 3G services were delivered over 2.1GHz, and 2G services were delivered over 1,800MHz, there would still be a gap between 2G and 3G coverage because the 3G cell radii would inevitably be smaller due to the inherent propagation characteristics of those frequencies.[370] Sites in rural areas tended to be spaced to provide a level of acceptable coverage, but in urban areas they tended to be built closer together for capacity reasons. Therefore, in urban areas 2G and 3G coverage could be said to be similar, but in a national network including rural/sub-urban geotypes it would be necessary to build more 3G sites in order to maintain the same coverage with 3G as with 2G.[371]

4.266 Three added that if 3G was carried over 900 or 1,800MHz spectrum, then it would have the same coverage as 2G.[372]

Assessment: coverage—3G area coverage

4.267 Vodafone said that Ofcom should have used the same coverage forecast for 3G as for 2G. This was because site sharing would incentivize operators to increase 3G coverage levels to the level of 2G coverage. It claimed that a further reason for increased 3G coverage was the increasing use of smartphones.

4.268 EE expected that its [✂].

4.269 Ofcom said that it had taken site sharing into account in its decision and also pointed out that 3G coverage was currently significantly lower than 2G coverage.

4.270 We have not been persuaded that it was incorrect for Ofcom to model a lower coverage for 3G compared with 2G in the 2011 Model. We have reached this conclusion having weighed up the reasons supporting equal 3G and 2G coverage (ie site sharing, newly shared sites would use 3G equipment rather than 2G and [✂]) and the reasons supporting a lower 3G coverage compared with 2G coverage (ie that actual 3G coverage was significantly lower than 2G coverage in 2009/10, despite

[366] Three SoI, W/S Mantzos 2, §4.8.
[367] Three SoI, W/S Mantzos 2, §4.10.
[368] Three Core Submission, §8.3b.
[369] Three SoI, §10.15.
[370] Three SoI, W/S Sheppard, §5.3.
[371] Three SoI, W/S Sheppard, §5.4.
[372] Three bilateral hearing transcript, p49, line 19, to p50, line 10.

some level of site sharing already being in place, and that Ofcom assumed that only 90 per cent of sites would be shared).

Conclusion

4.271 We consider, therefore, that Vodafone has not demonstrated that Ofcom erred in its forecast of 3G coverage in the 2011 Model.

Proportion of 3G traffic carried over the 2G network

Ofcom's decision

4.272 Ofcom said that even though a subscriber may use a 3G-capable handset, a significant proportion of that user's voice traffic was still routed via the 2G network. This was either because the operator chose to route voice traffic over the 2G network, or because the user disabled the 3G functionality of their handset. To allow for this possibility, Ofcom assumed that a proportion of all voice traffic originated and terminated by a 3G handset user was routed over the 2G network. In the April 2010 Model[373] this proportion was held at 40 per cent for the entire modelling period.[374]

4.273 Ofcom said that the proportion of 3G traffic carried over the 2G network in its 2011 Model (the 2G/3G traffic parameter) was reasonable for the period to date, as this was informed by the data from the national MCPs with both 2G and 3G networks—which formed the technology mix of Ofcom's hypothetical efficient national network. Ofcom accepted that assuming that this value stayed constant until 2020/21, or beyond, might not seem reasonable. With MCPs continuing to expand their 3G coverage and subscribers continuing to acquire 3G-capable handsets, one would expect an efficient operator increasingly to migrate its network traffic to the 3G layer (Ofcom said that it made the assumption that the proportion of handsets that were 3G-enabled would reach 78 per cent by 2020/21, up from 33 per cent in Q4 2009[375]).[376]

4.274 Ofcom said that the proportion of traffic for 3G users that was routed on to the 2G network would decline over time. Given that 3G was the more efficient technology, it was rational for a 2G/3G network to run ever more of the 3G-handset-generated traffic over the 3G network. In the 2011 Model Ofcom assumed that the proportion of 3G traffic carried over 2G declined gradually from 40 per cent in Q4 2009/10 to 0 per cent by Q4 2020/21.[377]

Vodafone's challenge

4.275 Vodafone explained that the reason why a call from a 3G handset would be routed via the 2G network was because the signal was better from the 2G network either for coverage reasons or because the 3G cells were capacity constrained due to data usage.[378]

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[373] The April 2010 Model is the model that Ofcom published together with its April 2010 consultation document. The 2011 Model is effectively an improved version of the April 2010 model.
[374] Ofcom decision, §A6.82.
[375] Ofcom decision, §A6.83.
[376] Ofcom decision, §A6.88.
[377] Ofcom decision, §A6.89.
[378] Vodafone NoA, W/S Roche 1, §3.87.

4.276 Vodafone explained that for the period up to 2009/10 Ofcom had modelled a constant 40 per cent probability that a call from a 3G handset would be made or received on 2G. Vodafone noted that despite a rising proportion of handsets that were 3G capable, the proportion of total voice traffic on 3G had remained more or less constant on its network over the last two years.[379]

4.277 Vodafone stated that for periods after 2009/10, Ofcom had modelled a decline in the percentage to 31 per cent in 2010/11, to 15 per cent in 2013/14, to 6 per cent in 2016/17 and zero by 2020/21.[380]

4.278 Vodafone argued that it was clearly to be expected that a significant proportion of voice calls made on a 3G handset would continue to utilize the 2G network for as long as 2G was in service.[381] Whilst Vodafone accepted that rising coverage in 3G should lead to a reduction in the proportion of calls to and from 3G handsets which were carried on a 2G network, this was offset by rising data demands which increased the likelihood of 3G capacity shortfalls. Ofcom's adjustments were too drastic and ignored the need for networks to maintain voice traffic on 2G to maximize the 3G bandwidth available for data services.[382]

4.279 Vodafone suggested using a more modest stepped decline of equal annual steps from 40 to 10 per cent by 2020/21, rather than the steep immediate drop-off forecast by Ofcom. It said that implementing this change in the model would, in 2014/15, increase LRIC+ by 2.0 per cent (or 0.0365ppm) and would reduce LRIC by 1.3 per cent (or –0.0090ppm).[383]

4.280 Vodafone stated that Ofcom's proposal that MCPs would discriminate in favour of voice traffic to manage congestion on their networks implied that MCPs would block data traffic at peak periods, to an extent that was inconsistent with Ofcom's assumptions as to the forecast level of data traffic.[384]

4.281 Vodafone considered it was implausible that, in the future, 3G callers would be deliberately denied the opportunity to make any of their calls on 2G, even where callers using 2G-only devices were continuing to use the 2G network, and even though this service denial could lead to a loss in quality of service to such callers.[385]

4.282 Vodafone suggested that Ofcom should not have adjusted its input assumption for the level of 3G traffic carried over the 2G network in its calibration and should have used an alternative method to calibrate the 2011 Model which would not have had this effect, and could better have reflected reality.[386] Vodafone considered it implausible that the 0 per cent handover percentage on voice could be derived from a forecast of cell sites.[387]

EE's SoI in support of Vodafone

4.283 EE said that there were 3G handset calls that were carried on 2G because there was no 3G coverage, but the parameter that was in dispute was the percentage of calls,

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[379] Vodafone NoA, W/S Roche 1, §3.88.
[380] Vodafone NoA, W/S Roche 1, §3.89.
[381] Vodafone NoA, W/S Roche 1, §3.91.
[382] Vodafone NoA, W/S Roche 1, §3.90.
[383] Vodafone NoA, W/S Roche 1, §3.92.
[384] Vodafone Core Submission, §5.81.1, and Vodafone Core Submission, W/S Roche 2, §7.119.
[385] Vodafone Core Submission, W/S Roche 2, §7.115.
[386] Vodafone Core Submission, §5.81.2.
[387] Vodafone Core Submission, W/S Roche 2, §7.119.

when there was 3G coverage, that would be routed on 2G because of local congestion issues.[388]

4.284 EE said that there was a large base of customers who switched their 3G handsets deliberately to 2G to obtain better battery performance. It explained that battery consumption was higher on 3G compared with 2G, in particular in areas with marginal coverage, where the handsets constantly switched between 2G and 3G. EE pointed out that switching to 2G coverage only would provide customers with poor data performance, and most operators tried to educate customers to switch their devices to the 3G network.[389]

4.285 EE stated that the proportion of its 3G traffic currently carried on its 2G network was around [✂] per cent, which was consistent with Ofcom's assumption as to the position in 2010/11. However, around [✂] per cent of traffic was likely to continue to be carried on EE's 2G network in 2020/21 and beyond.[390]

4.286 EE considered that Ofcom's error appeared to arise in large part from the fact that it had not recognized that the main reason why 3G traffic was carried on a 2G network was in order to maintain reception for 3G voice calls.[391] EE explained that 3G cell sites became congested when local traffic demand (ie for 3G voice calls or 3G data) exceeded the available capacity of the site. When this happened, EE's commercial practice was typically to discriminate against 3G data traffic in favour of time-critical 3G voice traffic. In other words, the provision of 3G data services would be slowed down, reducing site congestion and thereby assisting in the maintenance of reception for 3G voice calls (the provision of 3G voice calls could not be slowed down in this way, without the call terminating or the quality of the call deteriorating).[392] However, despite this action, congestion still tended to shrink the 3G cell coverage to a degree. As a result, some 3G voice calls would drop off the network unless handed back to the 2G network—which is what EE said was done.[393] EE considered that this practice was likely to continue into the future, because, whilst the quality of 3G coverage would increase over time, 3G smartphone data traffic demand was growing rapidly while 3G spectrum remained relatively scarce.[394]

4.287 EE also noted that the proportion of 3G traffic carried on the 2G network was likely to be less for EE than for the other 2G/3G operators. [✂][395]

4.288 EE claimed that implementing the adjustments for 3G calls carried over the 2G network would increase LRIC+ in 2014/15 by 2.8 per cent (or 0.0666ppm) and would increase LRIC by 3.2 per cent (or 0.0280ppm).[396]

4.289 EE stated that Ofcom's assumption that no calls made to and from 3G handsets would be routed over 2G by 2020/21 was inconsistent with the available evidence from the 2G/3G MCPs and was based on an assumption of the replacement of 2G assets which was inconsistent with the 2011 Model.[397] EE also noted that Ofcom's

[388] EE staff hearing transcript, p17, line 1ff.
[389] EE staff hearing transcript, p17, line 7ff.
[390] EE NoA, W/S James, §40.
[391] EE NoA, W/S James, §41.
[392] EE NoA, W/S James, §44.
[393] EE NoA, W/S James, §43.
[394] EE NoA, W/S James, §44.
[395] EE NoA, W/S James, §45.
[396] EE SoI, W/S Hird 2, §33.
[397] EE Core Submission, W/S Hird 4, §7x.

model assumed asset lives for key 2G cell equipment of eight to nine years. This did not support an assumption that sunk 2G costs would be replaced by 2020/21.[398]

Ofcom's Defence

4.290 Ofcom submitted that there was no material error in the 2011 Model assumptions related to the routing of 3G traffic over 2G.[399]

4.291 Ofcom said that the 2011 Model, when it made adjustments to the 3G traffic carried over the 2G network, referred to situations where a customer switched their 3G phone deliberately to 2G and where an operator deliberately routed a 3G call over the 2G network (and where a 3G network was available)—described as forced routing by Three. It did not include 3G calls that could not be made over 3G due to a lack of coverage and were carried over 2G instead.[400]

4.292 Ofcom explained that since voice calls from 3G handsets would not always be delivered over the 3G radio access network, the 2011 Model included a parameter for the proportion of calls from 3G handsets that would be routed over the 2G network.[401]

4.293 Ofcom explained that because 3G was the more efficient technology it was rational for a 2G/3G MCP to run ever more of the 3G-handset-generated calls over the 3G network and therefore it was appropriate to reduce the proportion of traffic on the 2G network over time. With MCPs continuing to expand their 3G coverage and subscribers continuing to acquire 3G-capable handsets, one would expect an efficient operator increasingly to migrate its network traffic to 3G.[402]

4.294 Ofcom considered that the growth in data traffic did not imply that the 2011 Model should allow a proportion of 3G traffic to be routed over 2G in perpetuity. Ofcom noted that Three stated in its response to the second consultation that although in the short term it would be efficient for 2G/3G operators to choose to route 3G traffic on to the 2G network due to existing sunk 2G costs, in the future 2G/3G operators would replace 2G capacity with 3G capacity, meaning that there would be no need for such routing behaviour. Moreover, MCPs would be able to manage congestion on 3G by discriminating in favour of voice traffic over packet traffic when the traffic demand exceeded the 3G cell capacity.[403] Ofcom also said that spectrum liberalization and the availability of 2.6GHz spectrum would increase 3G capacity which would reduce 3G capacity constraints.[404]

4.295 Ofcom said that it was appropriate to let the parameter fall from 40 to 0 per cent by 2020/21 as this was consistent with the forecast of the number of 3G cell sites provided by the MCPs. Ofcom said that the rate of decline was adjusted as part of its calibration process resulting in a relatively steeper decline in earlier years compared with later years.[405]

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[398] EE Core Submission, W/S Hird 4, §50.
[399] Ofcom Defence, Annex B, §80.
[400] Ofcom staff hearing transcript, p47, line 20ff.
[401] Ofcom Defence, Annex B, §76.
[402] Ofcom Defence, Annex B, §80i.
[403] Ofcom Defence, Annex B, §80ii.
[404] Ofcom staff hearing transcript, p48, lines 4ff & 14ff.
[405] Ofcom Defence, Annex B, §80iii.

4.296 Ofcom said that as with most modelling assumptions, setting the value of this parameter involved making future-looking judgements.[406]

4.297 Ofcom said that spectrum liberalization and the availability of 2.6GHz spectrum would increase 3G capacity, which would reduce 3G capacity constraints.[407]

Three's SoI in support of Ofcom

4.298 Three stated that Ofcom's model routed 3G traffic on to the 2G network for two reasons.[408]

4.299 First, coverage-based routing: where assumed 3G coverage was weaker than assumed 2G coverage, and 3G traffic could not be serviced by the 3G network, the model automatically routed 3G traffic on to the 2G network, to reflect the roaming that is essential if 3G subscribers are to remain connected to the network.[409]

4.300 Second, forced routing: where assumed 3G coverage matched assumed 2G coverage, and 3G traffic could be serviced by the 3G network, the model allowed the hypothetical operator deliberately to route some of that traffic on to the 2G network. This 'forced routing' was additional to that necessitated by coverage limitations.[410]

4.301 Three said that it was the forced routing element to which the 40 per cent of 3G traffic up to the end of 2009/10 was applied. Ofcom's model then forecast a falling profile for forced routing, reducing to 20 per cent by the end of 2012/13, and zero by the end of 2020/21.[411]

4.302 Three stated that it was not entirely clear whether Vodafone's objection and proposed profile were based on forced routing only or on a combination of forced routing and coverage routing.[412]

4.303 Three stated that the parameter that was the subject of Vodafone's allegation was about the rate of decline in 'forced routing' assumed by the model. Yet Vodafone appeared to refer to coverage limitations in its appeal. If part of Vodafone's objection to the rate of decline in 'forced routing' was based on coverage reasons then, said Three, it misunderstood the concept of 'forced routing' in the model and ignored the availability of coverage-based routing.[413]

4.304 Three stated that coverage limitations should therefore be irrelevant to the issue of forced routing. Yet Vodafone referred to coverage limitations in its consideration of forced routing.[414]

4.305 Three said that if the profile that Vodafone proposed for forced routing was partly influenced by coverage considerations, then making an adjustment may have the effect of double counting the effect of coverage limitations by repeating a reason for

[406] Ofcom Defence, Annex B, §80v.
[407] Ofcom staff hearing transcript, p48, line 21ff, and p49, line 6ff.
[408] Three SoI, §10.18.
[409] Three SoI, §10.18a.
[410] Three SoI, §10.18b, and Three SoI, W/S Mantzos 2, §4.20.
[411] Three SoI, W/S Mantzos 2, §4.17.
[412] Three SoI, W/S Mantzos 2, §4.20.
[413] Three SoI, §10.19.
[414] Three SoI, W/S Mantzos 2, §4.20.

routing that should already have been taken into account by the coverage-based routing mechanism.[415]

4.306 Three said that Vodafone additionally contended that more 3G voice traffic would be routed on to 2G networks to maximize the 3G bandwidth available for data services. However, Three said that reducing the burden on the 3G network necessarily increased the burden on the 2G network. As such, it said that Vodafone implicitly assumed that the incremental cost of voice services on 2G was lower than the incremental cost of voice services on 3G. It added that this assumption was inconsistent with both Ofcom's model and the alternative models proposed by Vodafone.[416]

4.307 Three also noted that increasing the assumption on the extent of forced routing reduced costs for the 3G network, but increased the costs of the 2G network.[417] Three pointed out that both Ofcom's model and Vodafone's models showed that the incremental cost of 3G MCT was lower than that of 2G MCT (and by extension that the incremental cost of voice services was lower on 3G than on 2G). This suggested to Three that it would be irrational for the hypothetical operator to choose to route traffic that could be serviced on the 3G network on to the 2G network.[418] Three stated that making the adjustment as proposed by Vodafone would increase the present value of costs in Ofcom's model by £1.5 billion.[419]

Assessment: the proportion of 3G traffic carried over the 2G network

4.308 Vodafone said that Ofcom's model made an assumption for the switch of traffic from 3G to 2G that was too low. This was because rising data demands would increase the likelihood of 3G capacity shortfalls and that Ofcom's adjustment would be incompatible with Ofcom's data growth forecasts. It added that Ofcom's adjustment would also imply that operators would need to block data traffic at peak periods and would need to deny 3G callers the opportunity to make their calls over 2G.

4.309 EE added that the 0 per cent assumption in 2021 was incompatible with the available evidence of 2G/3G MCPs and was based on an assumption of the replacement of 2G assets which was inconsistent with the 2011 Model. However, EE did not provide supporting evidence or explanations for these views, except to state that it considered it likely that it would carry around [✂] per cent of its 3G traffic on its 2G network in 2020/21 and beyond.

4.310 We were persuaded by Ofcom's and Three's reasoning that an efficient operator would be incentivized to route as much traffic as possible over 3G, considering that this was the more efficient technology. In particular we were persuaded by Three's explanation that making a long-term assumption of 3G traffic being carried over 2G would imply the inefficient provision of 2G capacity in the long term.

4.311 We note that the exact future profile for the 2G/3G traffic parameter is a forecast and as such is to be expected to be subject to forecasting errors, and we agree with Ofcom that it would need to apply regulatory judgement when making such a forecast. We do not consider that Vodafone and EE provided sufficient reasoning why the profile assumed by Ofcom was incorrect. We note, in particular, that EE considered that Ofcom's forecast for 2010/11 was not unreasonable.

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[415] Three SoI, W/S Mantzos 2, §4.21.
[416] Three SoI, §10.20.
[417] Three SoI, W/S Mantzos 2, §4.23.
[418] Three SoI, W/S Mantzos 2, §4.24.
[419] Three SoI, W/S Mantzos 2, §4.25.

4.312 Vodafone provided no supporting evidence to substantiate its assertion that Ofcom's adjustment was incompatible with Ofcom's data growth forecasts.

4.313 We also consider that calibration adjustments are an area where Ofcom needs to apply regulatory judgement. Vodafone has provided insufficient supporting evidence for its claim that an alternative calibration adjustment would have been more appropriate or that Ofcom should not have made an adjustment to the 2G/3G traffic parameter as part of the calibration process. For example, it appears that Vodafone's reasoning (in relation to calibration) relates only to the 0 per cent assumption for 2021, but it appears that Ofcom only made a calibration adjustment to the speed of decline (see paragraph 4.295) and not to the 0 per cent assumption.

Conclusion

4.314 We therefore do not consider that Vodafone has demonstrated that Ofcom erred in its modelling of the proportion of 3G traffic carried on the 2G network.

Voicemail

Ofcom's decision

4.315 Ofcom said that it modelled voice minutes terminating on voicemail as a new traffic service in the 2010 Model. This was to recognize that calls to voicemail fell within the defined markets, while acknowledging that this traffic did not utilize the radio access network. This traffic was not included in dimensioning the radio access network, but was included in the voice minutes used for cost recovery in calculating the unit cost of termination. A new asset type, voicemail server, had therefore been added to the 2011 Model to capture the costs associated with terminating voicemail traffic.[420]

4.316 Ofcom said that voicemail-terminated calls and handset-terminated calls did not incur the same level of termination costs. Therefore, Ofcom added the costs of the voicemail platform in the 2011 Model (by adding a new asset, the voicemail server) and recovered a proportion of the costs through incoming voice minutes terminating on voicemail. The net effect was that the cost of voice termination was a blend of the costs of the respective voicemail-terminated calls and handset-terminated calls.[421]

Vodafone's challenge

4.317 Vodafone argued that Ofcom had modelled voicemail incorrectly.[422]

4.318 Vodafone said that in the 2011 Model Ofcom had included voicemail not as a separate service, but as an alternative route for certain call types, ie inbound and on-net voice, with a new voicemail platform asset.[423]

4.319 Vodafone said that adjusting for all the alleged errors (below) relating to voicemail would increase LRIC+ in 2014/15 by 1.1 per cent (or 0.0199ppm) and would increase LRIC by 1.0 per cent (or 0.0074ppm).[424]

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[420] Ofcom Decision, §9.55.
[421] Ofcom Decision, §A6.129.
[422] Vodafone NoA, W/S Roche I, §3.93.
[423] Vodafone NoA, W/S Roche I, §3.98.
[424] Vodafone NoA, W/S Roche I, §3.92.

Voicemail—percentage of calls ending on voicemail

4.320 Vodafone said that Ofcom had assumed that 4 per cent of inbound calls terminated on voicemail. This related to all terminating traffic, ie inbound from off-net and the second leg of an on-net call.[425]

4.321 Vodafone stated that this was incorrect because a significant proportion of calls that ended up on voicemail were calls where the customer did not accept the call (Vodafone said that this was the case for [✂] per cent[426] of their customers). The radio access network resources were being used in such cases, given that there was a variable ring time (on the handset) before the call defaulted to voicemail.[427]

4.322 Vodafone said that Ofcom should have therefore adopted a lower proportion than 4 per cent for calls that terminated on voicemail in order to recognize this pattern of call routing. Vodafone considered that a 3 per cent figure would be more appropriate as an estimate of the percentage of calls that terminated on voicemail and never passed across the radio access network.[428]

4.323 Adjusting for the error relating to the percentage of calls ending on voicemail would increase LRIC+ in 2014/15 by 0.7 per cent (or 0.0133ppm) and would increase LRIC by 1.0 per cent (or 0.0072ppm).[429]

Voicemail—cost driver for voicemail

4.324 Vodafone stated that voicemail services also made use of the core network in order to route calls to the voicemail platform, but that Ofcom's model did not capture this (and therefore suggested that an adjustment be made to the 'all voice traffic' and 'all core traffic' driver).[430]

4.325 Vodafone said that adjusting for this alleged error would increase LRIC+ in 2014/15 by 0.2 per cent (or 0.0035ppm) and would increase LRIC by 0.0 per cent (or 0.0003ppm).[431]

Voicemail—partial build of voicemail platforms and resilience

4.326 Vodafone stated that Ofcom's model dimensioned voicemail platforms so that proportions of voicemail platforms (rather than whole units) could be constructed and that an insufficient number of platforms were built in Ofcom's model as the number of platforms required ignored any need for resilience.[432]

4.327 Vodafone said that Ofcom's model built partial assets only in very minor instances and this was not a major issue.[433] Vodafone said that the bigger issue was that Ofcom's model (through the utilization assumption) did not provide a sufficient number of voicemail platforms to have spare capacity in case one platform was out of service.[434]

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[425] Vodafone NoA, W/S Roche I, §3.99.
[426] Vodafone NoA, W/S Roche I, fn 21.
[427] Vodafone NoA, W/S Roche I, §3.100, and Vodafone Core Submission, §5.84.3.
[428] Vodafone NoA, W/S Roche I, §3.101.
[429] Vodafone reply to post-staff-hearing questions, p15.
[430] Vodafone NoA, W/S Roche 1, §§3.103 & 3.104.
[431] Vodafone reply to post-staff-hearing questions, p15.
[432] Vodafone NoA, W/S Roche I, §3.105.
[433] Vodafone staff hearing transcript, p24, line 6ff.
[434] Vodafone staff hearing transcript, p24, line 6ff.

4.328 Vodafone said that the small number of voicemail platforms being built in Ofcom's model meant that the effective utilization factor of each platform must reflect the need to keep a significant margin for resilience, ie sufficient capacity to withstand the loss of a whole platform. Vodafone's 72 per cent utilization was, it said, set to take account of this consideration over most of the modelling period, whereas Ofcom's 90 per cent assumption was not.[435]

4.329 Vodafone said that adjusting for this alleged error relating to the partial build of voicemail platforms would increase LRIC+ in 2014/15 by 0.0 per cent (or 0.0006ppm) and would increase LRIC by 0.0 per cent (or 0.0000ppm).[436]

4.330 Adjusting for the alleged error relating to the resilience assumptions would increase LRIC+ in 2014/15 by 0.1 per cent (or 0.0024ppm) and would increase LRIC by 0.0 per cent (or 0.0000ppm), ie it had no impact on LRIC.[437]

EE SoI in support of Vodafone

4.331 EE said that implementing its adjustments for voicemail (ie including voicemail as a core network traffic driver and including only whole units of voicemail platforms) would increase LRIC+ in 2014/15 by 0.4 per cent (or 0.0106ppm) and would reduce LRIC by 0.1 per cent (or 0.0012ppm).[438]

Voicemail—percentage of calls ending on voicemail

4.332 EE was not convinced that Vodafone's proposed adjustment of the proportion of calls that ended up on voicemail was warranted. While Vodafone noted that a smaller percentage of calls than Ofcom assumed went directly to voicemail (EE noted that currently [✂] of total voice traffic terminating on EE's network consisted of voicemail deposits that terminated directly at the voicemail platform[439]), for the other calls ending up on voicemail there would be some cost difference with a call that was successful. By retaining Ofcom's 4 per cent assumption, EE said that a lower overall level of costs would be calculated which would thus recognize some cost difference between successful calls and calls that are diverted to voicemail after ringing.[440]

Voicemail—cost driver for voicemail

4.333 EE agreed with Vodafone that the model incorrectly excluded voicemail traffic as a core network traffic driver.[441] EE stated that all voicemail traffic utilized MSC and network management capacity. EE also stated that almost all voicemail traffic was routed along the core network unless by chance its local mobile switching centre (MSC) hosted a voicemail platform. For instance, of EE's [✂] MSCs,[442] only [✂] would have co-located voicemail platforms where traffic required no further transmission service. Given that there was a transmission cost for calls going to voicemail from those MSCs, EE claimed that this suggested that over 50 per cent of voicemail-deposited traffic would incur such costs.[443]

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[435] Vodafone, NoA, W/S Roche I, §7.127 (4th bullet).
[436] Vodafone reply to post-staff-hearing questions, p15.
[437] Vodafone reply to post-staff-hearing questions, p15.
[438] EE SoI, W/S Hird 2, §33.
[439] EE NoA, W/S James, §49.
[440] EE SoI, W/S Hird 2, §43.
[441] EE SoI, W/S Hird 2, §44.
[442] See correction in EE NoA, W/S James 2.
[443] EE NoA, W/S James, §48.

4.334 EE stated that whether termination of a call to a handset was shorter or longer than the termination of a call to voicemail would depend on where the call originated. A call made in Glasgow could terminate to a handset in Glasgow (indeed many calls were likely to be to other people in the same city or area)—and that such calls would use minimum transmission.[444] On the other hand, a call from Glasgow that ended up on EE's voicemail platform may go across EE's transmission network to one of the [✂] sites that hosted EE's voicemail platform.[445] It was, therefore, wrong to dismiss the core network resources used by voicemail calls as being immaterial.[446]

Voicemail—partial build of voicemail platforms and resilience

4.335 EE stated that only whole units of voicemail platforms could be provided.[447] EE stated that voicemail platforms required material cost outlays and could not be purchased in perfectly scalable units. The minimum outlay for a replacement voicemail platform of the type used by EE was [✂].[448]

4.336 EE stated that it might appear that Ofcom's model was simply paying for voicemail assets in advance. However, the resulting partial voicemail assets were then used as an input into the depreciation function and were used to calculate parameters that were instrumental in setting the path of cost recovery. Therefore, said EE, the model behaved as it was building partial voicemail assets.[449]

4.337 EE stated that Ofcom had overestimated the utilization of voicemail services on the basis of the evidence of Vodafone and EE. EE stated that resilience did impact on the number of voicemail platforms and EE's level of utilization for voicemail platforms was consistent with that assumed by Vodafone.[450] EE said that its ability to provide voicemail capability to its subscribers was valued highly by them. Consequently, EE considered it imperative to provide a reasonable level of redundant capacity on its voicemail platforms. In practice, this meant that EE maintained at least [✂] voicemail platforms in separate locations,[451] and operated each at a utilization of no more than [✂] on average before considering capacity upgrades.[452]

4.338 EE stated that Ofcom provided no evidence for its use of a 90 per cent utilization other than that this was consistent with other asset types.[453]

Ofcom's Defence

4.339 Ofcom explained that voicemail was not explicitly included in the 2007 Model and that in the 2010 Model Ofcom included voicemail traffic, but not the voicemail server as a specific platform. Following consultation responses, Ofcom then incorporated a dedicated asset to the voicemail service in the 2011 Model.[454]

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[444] EE Core Submission, W/S Hird 4, §54.
[445] EE Core Submission, §§13 & 13.1.
[446] EE Core Submission, W/S Hird 4, §54.
[447] EE SoI, W/S Hird 2, §45.
[448] EE NoA, W/S James, §50.
[449] EE reply to question 3 in post-staff-hearing questions.
[450] EE SoI, W/S Hird 2, §46.
[451] We note that this statement appears inconsistent with EE's statement in paragraph 4.334 that EE had [✂] sites at which it installed voicemail platforms.
[452] EE NoA, W/S James, §51.
[453] EE Core Submission, W/S Hird 4, §55.
[454] Ofcom staff hearing transcript, p13, line 16ff.

Voicemail—percentage of calls ending on voicemail

4.340 Ofcom said that Vodafone raised in consultation the point that some of the calls that ended up on voicemail would ring on the handset first (ie used the radio access network), but Ofcom considered that any related adjustment would be small and that, given other areas that were contested by MNOs, it would have been disproportionate to make this possible adjustment a focus of Ofcom's attention.[455]

4.341 Ofcom said that it estimated voicemail traffic as 4 per cent of incoming (2G and 3G) voice traffic based on data gathered from the MCPs.[456]

4.342 Ofcom said that although it was likely that some calls might terminate on voicemail servers as a result of being diverted by the called party, and that some use would be made of radio access network resources in these cases, Vodafone had provided nothing of substance to justify its assertion that the call set-up associated with diverted calls warranted a 25 per cent reduction in voicemail terminated minutes (ie a reduction from 4 to 3 per cent). It said that the use of radio access network resources for call set-up was obviously considerably less than in the case of a voice call of the same duration, given that no use was made of those assets throughout the time period when the message was being deposited (this being the time period in respect of which per-minute MCT charges would arise).[457]

4.343 Ofcom explained that the 4 per cent estimate of the number of calls that ended up on voicemail was a reasonable estimate when taking into account the limited impact on LRIC from using an assumption of 5 per cent instead. Ofcom recognized that it only had relevant data for the percentage of calls that ended on voicemail from Vodafone when it made its decision, but it considered it would have been disproportionate, in the time available to make the MCT charge control decision, to request more information from other MNOs.[458]

Voicemail—cost driver for voicemail

4.344 Ofcom accepted that it was possible for voicemail traffic to be routed across MSCs in some instances when depositing them on voicemail servers. However, this did not mean that the core network assets (eg MSCs and core transmission) were used to the same extent as for handset-terminated incoming calls. Ofcom said that the core network resource usage from calls terminating on voicemail would be lower, as in most cases the routing of these calls would be over shorter paths relative to handset-terminated calls. Therefore, adjusting these cost drivers in the 2011 Model to include all voicemail traffic, as suggested by Vodafone, was not appropriate. Ofcom noted that Vodafone had not provided any evidence in support of its argument that all voicemail traffic should be included in these cost drivers.[459]

4.345 Ofcom also said that it would be difficult to estimate robustly the allowance that might be reflected in these cost drivers to account for the possibility that voicemail routing might use some of these assets in some instances.[460]

4.346 Ofcom considered that, given the balance between the difficulty in robustly estimating the network resource usage by voicemail and the materiality of the adjustment

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[455] Ofcom staff hearing transcript, p15, line 14ff.
[456] Ofcom Defence, Annex B, §82.
[457] Ofcom Defence, Annex B, §86i.
[458] Ofcom staff hearing transcript, p13, row 25ff.
[459] Ofcom Defence, Annex B, §86ii.
[460] Ofcom Defence, Annex B, §86iii.

(around 1 per cent of the costs of MCT on Vodafone's own calculations), excluding voicemail traffic from these cost drivers on the basis that 4 per cent of incoming voice traffic terminated on voicemail servers remained reasonable.[461]

Voicemail—partial build of voicemail platforms and resilience

4.347 Ofcom said that in the 2011 Model, voicemail servers required in each year were calculated as whole units (ie the number required was rounded up). This asset demand was then input into the commissioning network design algorithm that commissioned the assets in advance of their actual need. This approach was not specific to the modelling of voicemail servers and was used with all asset types. Ofcom said that the same general approach to network asset deployment was also used in the 2007 Model.[462]

4.348 Ofcom said that it did not have any information as to what the correct number for the utilization of voicemail should be in the model, but considered that 90 per cent was a reasonable assumption.[463] It stated that this estimate represented the assumed utilization during the network busy hour and took into account an allowance for under-utilization of assets in practical deployments. Utilization factors were used with all assets and varied depending on the asset type. Ofcom noted that a 90 per cent utilization factor was also used for other asset types, for example microcells, pico-cells and 2G BSC-PCU.[464]

4.349 Ofcom said that Vodafone had provided no evidence in support of its suggestion of using a 72 per cent utilization for voicemail servers.[465]

Assessment: voicemail

4.350 Vodafone alleged four different errors in relation to voicemail:[466] the percentage of calls terminating on voicemail, the cost drivers for voicemail, a partial build of voicemail platforms and the resilience assumptions.

Voicemail—percentage of calls ending on voicemail

4.351 Ofcom said that it would have been disproportionate to make the percentage of calls ending on voicemail a focus of its attention in its MCT charge control decision, given the time available to make that decision and considering that it would have had to make additional information requests to MNOs.

4.352 In light of the evidence given of the size of the alleged error, we are not persuaded that Ofcom erred in coming to this conclusion. Nor have we been persuaded by any other arguments or evidence that Ofcom erred in its modelling of the proportion of traffic that ended on voicemail.

4.353 We therefore consider the Vodafone did not demonstrate that Ofcom erred in its modelling of the proportion of traffic that ended on voicemail.

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[461] Ofcom Defence, Annex B, §86iii.
[462] Ofcom Defence, Annex B, §88.
[463] Ofcom staff hearing transcript, p16, line 25.
[464] Ofcom Defence, Annex B, §89.
[465] Ofcom Defence, Annex B, §89.
[466] It is actually five errors when including the error in relation to the impact of voicemail on the NMS. However, Vodafone considered this error immaterial.

Voicemail—cost driver for voicemail

4.354 We are persuaded that it was likely to be difficult for Ofcom to estimate robustly the allowance that might be reflected in the cost drivers to account for the possibility that voicemail routing might use some of the core network assets in some instances.

4.355 We were not persuaded that, given the balance between the difficulty in robustly estimating the network resource usage by voicemail and the potential size of the related adjustment (Vodafone estimated that the impact of correcting this error would 0.2 per cent on LRIC+ and 0.0 per cent on LRIC),[467] further investigations and adjustments of Ofcom to the cost drivers for voicemail were likely to be proportionate.

4.356 In any event, we consider that, even if Ofcom made an incorrect assumption for the cost drivers for voicemail in the 2011 Model, the error would be immaterial (Vodafone estimated that the impact of correcting this error would be 0.2 per cent on LRIC+ and 0.0 per cent on LRIC).[468]

4.357 We therefore consider that Vodafone has not demonstrated that Ofcom has erred in the calculation of the cost drivers for voicemail.

Voicemail—partial build of voicemail platforms

4.358 From the evidence presented, it was unclear to us whether Ofcom's model built partial voicemail assets. We consider that Ofcom's explanation that the apparent building of partial assets was related to the commissioning of assets and that no partial assets were actually built in Ofcom's model has not been overturned by the evidence provided by Vodafone and EE.

4.359 If the 2011 Model did incorrectly build partial voicemail assets, then we consider that the suggested adjustment to correct this error shows that the error is immaterial (Vodafone estimated that the impact of correcting this error would impact 0.0 per cent on LRIC+ and 0.0 per cent on LRIC).[469]

4.360 We therefore consider that Vodafone has not demonstrated that Ofcom erred by modelling partial voicemail platforms.

Voicemail—resilience

4.361 We agree, based on evidence provided by EE, that Ofcom's assumption on the number of voicemail platforms may imply an insufficient level of resilience.

4.362 Ofcom appears to have used an approximation for the level of voicemail box utilization in the 2011 Model, which appeared to be based on similar approximations for other assets.

4.363 We accept Ofcom's defence that it was appropriate to make an assumption for the utilization of voicemail boxes, considering the small impact that using a different assumption would have on the level of LRIC and LRIC+ (Vodafone estimated that the

[467] See paragraph 4.325.
[468] See paragraph 4.325.
[469] See paragraph 4.329.

impact of correcting this error would be 0.1 per cent on LRIC+ and 0.0 per cent on LRIC).[470]

4.364 In any event, we consider that, even if Ofcom made an incorrect assumption on the level of resilience in the 2011 Model, the error would be immaterial (Vodafone estimated that the impact of correcting this error would be 0.1 per cent on LRIC+ and 0.0 per cent on LRIC).[471]

4.365 We therefore consider that Vodafone has not demonstrated that Ofcom erred in not modelling a higher level of resilience.

Conclusion

4.366 We consider that Vodafone has not demonstrated that Ofcom erred in its modelling of voicemail.

Consequential changes to calibration

Ofcom's decision

4.367 Ofcom said that the MCT cost model was a bottom-up model of network costs. This meant that cost components were identified at a granular level and cost causation relationships were defined to link the quantity of each of these cost components with outputs and other cost drivers. Once this bottom-up model was built, Ofcom calibrated parts of the model against financial and network parameter data from the national MCPs. This was done to ensure that Ofcom's model of a hypothetical efficient operator reasonably matched the infrastructure deployment of the national MCPs (at an average level).[472]

Vodafone's challenge

4.368 Vodafone stated that the errors alleged above necessitated a recalibration of the model to ensure that the model aligned with operators' real world experience.[473] Vodafone explained that, for example, the adjustment to data with respect to weekend traffic would have led to a smaller traffic peak and thus less 3G equipment being built by the model.[474] As a result, Vodafone proposed the following calibration adjustments: a small increase in TRX utilization and a small decrease in 3G site and carrier utilization.

4.369 Vodafone said that the calibration adjustments would increase LRIC+ by 0.5 per cent (or 0.0087ppm) in 2014/15 and would reduce LRIC by 1.0 per cent (or –0.0073ppm).[475]

4.370 Vodafone said that after these adjustments, the model would be closer to the operator actual than the original model outcome.[476]

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[470] See paragraph 4.330.
[471] See paragraph 4.330.
[472] Ofcom Decision, §9.62.
[473] Vodafone NoA, W/S Roche I, §3.107.
[474] Vodafone NoA, W/S Roche I, §3.110.
[475] Vodafone NoA, W/S Roche I, §3.92.
[476] Vodafone NoA, W/S Roche I, §3.119.

Assessment: consequential changes to calibration

4.371 We consider that it is plausible that any changes to Ofcom's model may require a recalibration of the model. However, we consider that recalibration would be a consequential change as a result of correcting errors and any recalibration would fall for proper consideration under Reference Question 7.

Conclusions

4.372 Subject to our views on the nature of Vodafone's pleaded case, as set out in the Introduction to this determination, in respect of the errors alleged by Vodafone in Ofcom's calculation of the LRIC+ cost of providing MCT, we conclude that Ofcom erred by understating the proportion of data traffic that occurred at the weekend (the busy day/week split), in its modelling of the historic data card market shares and in its modelling of the 2G/3G MSC cost driver.

EE's appeal

Forecast data usage

Ofcom's decision

4.373 Ofcom said that MCPs criticized the MCT cost model as the per MB LRIC+ wholesale cost of data in the model was higher than the observed retail prices. In other words, there was concern that the 2010 Model seemed to allocate too great a proportion of common costs to data services compared with observed market outcomes for retail data pricing.[477]

4.374 Ofcom stated that the average cost per MB of data in its cost model was [✂]p in Q2 2010/11. Revenue per MB differed between operators and ranged from [✂] per MB, but the lower end of the range did not include revenues sold in bundles and the higher end included international roaming revenues. The median revenue per MB was [✂]p per MB.[478]

4.375 Ofcom said that due to the high volumes and relatively low retail price, operators appeared to make a loss on dongle data when compared with the LRIC+ output from the MCT model. For data on handsets, the majority of operators appeared to have set retail prices above the LRIC+ produced by the 2011 Model. When dongle and handset revenues were taken together, it appeared that average revenues were below the LRIC+ produced by the MCT model for four MCPs, but above for [✂].[479]

4.376 Ofcom said that the 2011 Model estimated the path of long-run prices. Data was still a relatively new service and the current prices were unlikely to reflect long-run stable prices.[480] It was in fact typical of product life cycles, where there were customer acquisition costs, for firms to invest in growth by charging low prices initially and then 'harvesting' the revenues from the installed customer base in later periods.[481]

4.377 Ofcom said that even if the model was to produce unit cost estimates that appeared different from observed retail revenues, this did not mean that the model was pro-

[477] Ofcom Decision, §A9.101.
[478] Ofcom Decision, Annex 9, Table A9.7.
[479] Ofcom Decision, §A9.109.
[480] Ofcom Decision, §A9.120.
[481] Ofcom Decision, §A9.122.

ducing erroneous outputs. The 2011 Model was an all-service model and even if the LRIC+ unit cost of data was above the unit retail price of data, it was likely that the LRIC+ for other services would be below the observed retail price.[482]

4.378 Ofcom presented a price cost analysis by Enders, which indicated that the current average revenues for dongle services may be below 'average' costs, but that at the total data level, average revenues may be at or around average costs. Enders' price-cost comparison also indicated a significant (positive) margin on incremental costs.[483]

4.379 Ofcom said that there were a number of caveats to bear in mind in any comparison of observed retail prices with outputs from the 2011 Model. First, the 2011 Model was by construction a network cost model and so no analysis was made of the efficient level of retailing costs. In principle, a deduction for retailing costs would be necessary in comparing the derived retail prices with modelled (network-level) costs.[484]

4.380 Ofcom concluded that it was difficult to estimate the retail price of data robustly due to much data usage being consumed as part of bundles of other services and the fact that data services were still relatively nascent (whereas the 2011 Model was based on lifetime network costs). Ofcom did not consider the unit costs for data produced by the 2011 Model to be too far out of line with the utilization adjusted retail prices.[485]

EE's challenge

4.381 EE argued that one of the factors influencing the level of LRIC+ was the assumption about the volume of future mobile data services.[486] EE said that a major reason for the assumed reduction in mobile termination costs compared with Ofcom's 2007 review was that a large share of network costs were now assumed to be recoverable from data services (particularly under LRIC+).[487]

4.382 EE said that Ofcom's data usage forecasts were flawed, as Ofcom assumed that data volumes would continue to grow rapidly despite the increase in data prices that would result if data were priced consistently with Ofcom's model.[488]

4.383 EE said that Ofcom had overstated the likely cost recovery from data services. It said that this was because Ofcom had failed to take into account the magnitude of the difference between the retail prices for data services and the implied costs under its model after adjusting for operators' retail costs.[489]

4.384 EE said that the unit costs for packet data in the 2011 Model were much higher than the retail prices that MNOs were charging in the UK market.[490] EE noted that Ofcom in its Statement had recognized that:

(a) operators appeared to make a loss on dongle data when compared with the LRIC+ output from the MCT Model;

(b) for data on handsets, the majority of operators appeared to have retail prices above the LRIC+ produced by the 2011 Model; and

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[482] Ofcom Decision, §A9.119.
[483] Ofcom Decision, §A9.115.
[484] Ofcom Decision, §A9.119.
[485] Ofcom Decision, §A9.128.
[486] EE NoA, §238 & 239.
[487] EE NoA, W/S Hird I, §49.
[488] EE NoA, §§238 & 239.
[489] EE NoA, §157.3.
[490] EE NoA, W/S Hird I, §49.

(c) when dongles and handset revenues were taken together, it appeared that average revenues were below the LRIC+ produced by the MCT Model.[491]

4.385 EE noted that Ofcom nonetheless concluded that the unit costs for data produced by the 2011 Model were not too far out of line with the utilization adjusted retail prices. However, it said that Ofcom also acknowledged that its comparison of retail prices with the implied cost recovery from data services ignored that the retail prices also needed to recover operators' retail costs.[492]

4.386 EE believed that the omission of retail costs was a major flaw in Ofcom's assessment of the reasonableness of its allocation of costs to data services (and away from voice services including termination). EE said it was surprising that Ofcom recognized this flaw and yet reached the conclusion that cost and revenues were not 'too far out of line'.[493]

4.387 EE said that significant price increases for data services resulting from cuts in MTRs would further undermine future data traffic growth and make Ofcom's data forecasts even more unlikely.[494]

Ofcom's Defence

4.388 Ofcom said that, within the context of retail data pricing being a poor metric for calibration and the current uncertainty around retail data pricing, the data outputs from the 2011 Model were satisfactory, and that Ofcom's modelling of data services (traffic projections and cost allocation) was reasonable and proportionate.

4.389 Ofcom referred to its decision (see paragraph 4.373) and highlighted the following caveats and concerns with respect to the use of observed retail prices to calibrate the 2011 Model:[495]

(a) Retail prices made a poor metric by which to calibrate a model because such an approach relied on an arbitrary allocation of revenue from part of a bundle.[496]

(b) Even if the LRIC+ unit cost of data were above the observed retail price, it was likely that the LRIC+ for other services would be below the corresponding retail price.[497] Ofcom said that according to the Enders analysis, the average revenue per GB for voice and non-voice services combined was at least three times that of the network cost of a GB of network usage (and possibly up to six times greater).[498]

(c) The 2011 Model estimated the path of long-run unit charges designed to recover the present value of lifetime network costs. Data was still a relatively new service and the observed current prices may not reflect long-run stable prices.[499]

EE's reply to Ofcom's Defence

4.390 EE made the following comments on Ofcom's Defence:

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[491] EE NoA, W/S Hird I, §49 (referencing Ofcom's Statement, §A9.109).
[492] EE NoA, W/S Hird I, §50 (referencing Ofcom's Statement, §§A9.128 & A9.118).
[493] EE NoA, W/S Hird I, §51.
[494] EE Core Submission, W/S Hird 4, §7ii.
[495] Ofcom Defence, Annex B, §47.
[496] Ofcom Defence, Annex B, §47i.
[497] Ofcom Defence, Annex B, §47ii.
[498] Ofcom Defence, Annex B, §47ii.
[499] Ofcom Defence, Annex B, §47iii.

(a) Whilst Ofcom noted that the fact that data was sold as part of a bundle made it difficult to use data prices as a metric to calibrate the model, and that it was difficult to estimate data prices precisely, there was no reason for believing that the approach that Ofcom had used to estimate data prices was biased downwards. As such, Ofcom should not now argue that there was no value in comparing how far apart the model's cost allocation to data services was from estimated current data prices.[500]

(b) Whilst Ofcom argued that the revenue from other services might be above the '*network costs*' implied in the model, this was comparing retail revenues with network costs and ignored that retail revenues also needed to cover retail costs. The Statement calculated that network costs comprised only 40 per cent of an MCP's total costs.[501] Moreover, Ofcom had found that overall revenues were not greater than overall costs in that they did 'not observe super-normal profits'.[502] As such, MCPs did not have excess profits to absorb the cuts in MTRs without raising their retail prices including for data services.[503]

(c) Whilst Ofcom argued that 'data is still a relatively new service and the observed current prices may not reflect long-run stable prices', it quoted EE that as data traffic 'generates capacity constraints on our network, retail data prices will have to change'. This point suggested that Ofcom's forecast cost recovery from data services was even more unreliable. In particular, if data prices were already unsustainably low and would need to rise, then even higher prices resulting from MTRs being cut to LRIC would be expected to further undermine future growth in data traffic, and suggested that the forecast of rapid growth in data volumes shown in paragraph 4.34 (and hence cost recovery from data services) would not eventuate.[504]

Assessment: forecast data usage

4.391 EE said that Ofcom's data usage forecasts were flawed because Ofcom, in its forecast, had not taken into account that data prices would be higher if data was priced in line with Ofcom's model.

4.392 EE also said that Ofcom was wrong when it concluded that data revenues were not too far out of line with costs, because it should have deducted retail costs from the data revenues when making its analysis.

4.393 We do not consider that EE has established that prices for data services would actually rise in the future. We also consider that EE has not demonstrated that retail prices for data services would need to rise as a result of cuts in MTRs.

4.394 We consider that, even if retail prices for data services were below LRIC+, this does not demonstrate that such prices are unsustainable and therefore have to rise. This is because LRIC+ is calculated on a the basis of fully allocated network costs, whereas the minimum sustainable price for data services is more likely to be determined by the marginal cost of providing data services (which would be lower because it would exclude common network costs).

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[500] EE Core Submission, W/S Hird 4, §21.
[501] Ofcom Statement, Table A9.6.
[502] Ofcom Statement, §2.5.
[503] EE Core Submission, W/S Hird 4, §22.
[504] EE Core Submission, W/S Hird 4, §23.

4.395 We do not consider that EE has provided sufficient evidence to demonstrate that data revenues do not cover marginal costs. We do not consider that merely pointing out that network costs are only 40 per cent of MCPs' total costs amounts to sufficient evidence to show that data service revenues do not recover marginal costs. We also note in this context that EE has not provided sufficient evidence that common costs are not recovered by MNOs, but only stated that MNOs did not make super-normal profits.

4.396 Furthermore EE has provided no evidence that, if data prices were to rise in the future, this would reduce demand for data services to a level below that assumed in Ofcom's 2011 Model.

Conclusion

4.397 We therefore do not consider that EE has demonstrated that Ofcom erred in its assumptions on the cost recovery from data services.

WACC

4.398 We do not consider that EE demonstrated that Ofcom erred in its calculation of the WACC for the reasons set out in response to Reference Question 2.[505]

Determination

4.399 For the above reasons,[506] we find that Ofcom erred in determining the level of mobile termination charges that would reflect the adoption of the LRIC+ cost standard, as alleged, by understating the proportion of data traffic that occurred at the weekend (the busy day/week split), in its modelling of the historic data card market shares and in its modelling of the 2G/3G MSC cost driver.

[505] See paragraph 3.620ff.
[506] Subject to the concerns about whether these errors are in fact properly pleaded as discussed at paragraphs 1.44 to 1.61.

Section 5: Reference Question 4

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in deciding to adopt a four-year transition period over which mobile termination rates would be reduced to the level of the LRIC cost standard, rather than over a three-year period (for the reasons set out in paragraphs 4.1 to 4.17 and 6.1 of BT's Notice of Appeal).

Reference Question 5

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in failing to make a one-off adjustment to the rate at the start of the control to current levels calculated in accordance with the LRIC+ cost standard (for the reasons set out in paragraphs 5.1 to 6.1 of BT's Notice of Appeal).

Introduction

5.1. Ofcom's Statement was published on 15 March 2011. The charge control came into effect on 1 April 2011. It is a four-year charge control and, under the four-year glide path, MTRs would reach their LRIC level at the start of the fourth year, ie just over three years from publication of the Statement. Ofcom explained the mechanics of the glide path in the following way: it 'reduces charges in a series of steps during the charge control period to reach the benchmark in the final period'[1] and it is 'a glide path based on a constant percentage change [in each year] (rather than a constant price change, ie in pence per minute)'.[2]

5.2. BT, supported by Three, claimed that Ofcom should have adopted a three-year, rather than a four-year, glide path. In addition, BT argued that Ofcom erred in failing to immediately reduce the starting rate of MTRs to the current LRIC+ level, with effect from April 2011.

5.3. Ofcom's decision was made in the context of the Recommendation, which recommends that MTRs should be reduced to the level of LRIC by 31 December 2012 (subject to any objective cost differences of the types specified in points 9 and 10 of the Recommendation). Ofcom must have the utmost regard to the Recommendation; however, it may depart from the Recommendation where there are good reasons to do so.

The level of MTRs under possible glide paths

5.4. BT asked that 'there be adopted a reduction of MTR to the LRIC+ level (1.61ppm) with effect from April 2011 and then reducing the rate in two equal steps to the pure LRIC level by April 2013'.[3,4] BT also phrased this as 'to reduce the starting rate of MTRs to the *current LRIC Plus level* (1.61ppm) with effect from April 2011'.[5]

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[1] Ofcom Statement, §10.3.
[2] Ofcom Statement, §10.4.
[3] BT NoA, §7.1.2.
[4] All prices in this section are expressed in terms of 2008/09 prices for the sake of clarity.
[5] BT NoA, §5.1, emphasis added.

5.5. Ofcom alleged that there was an error in BT's pleadings. Ofcom made the point that 1.61ppm was the 2014/15 LRIC+ level, not the *current* LRIC+ level, because both LRIC and LRIC+ were falling over time.[6]

5.6. In its Core Submission, BT accepted the corrections to its proposed rates put forward by Ofcom but stood by the words it used in its NoA. BT therefore pleaded that the rate should be reduced to 1.98ppm in 2011/12; 1.35ppm in 2012/13; and 0.72ppm in 2013/14, which would be the level of LRIC in that year.[7] However, Ofcom subsequently reported that it had corrected an error in its calculations and adjusted the glide path accordingly.[8] Therefore we have adjusted BT's pleaded rates. We understand BT's pleadings to be:

- under Reference Question 4, BT seeks to reduce the length of the glide path to three years, falling to the 2013/14 level of LRIC in the third year and then to the 2014/15 level of LRIC in the fourth year. BT would maintain Ofcom's system of a constant percentage reduction to MTRs in each of the first three years; and

- under Reference Question 5, BT seeks a three-year glide path with MTRs as above in 2013/14 and 2014/15, except the first year of the charge control would set MTRs equal to the level of LRIC+ in that year, with a constant ppm reduction over the next two years.

5.7. The possible glide paths are listed in Table 5.1 and illustrated in Figure 5.1.

TABLE 5.1 **LRIC, LRIC+ and proposed glide paths (ppm, 2008/09 prices)**

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
LRIC	0.89	0.82	0.78	0.75	0.72
LRIC+	2.11	2.04	1.90	1.77	1.66
Ofcom proposed glide path	4.18	2.69	1.74	1.12	0.72
BT 3-year glide path (no adj)	4.18	2.36	1.33	0.75	0.72
BT 3-year glide path (one-off adj)	4.18	2.04	1.40	0.75	0.72

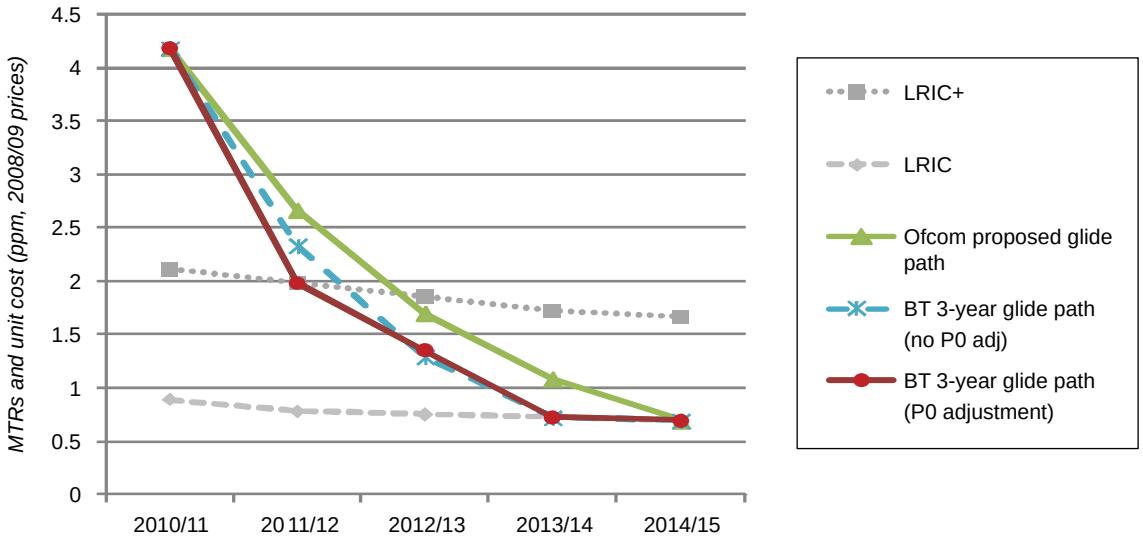
Source: Ofcom, email to CC of 9 December 2011, CC calculations.

Note: In 2011/12 the charge control rate was 2.664ppm from 1 April 2011 to 31 October 2011 and 2.693ppm from 31 October 2011 to 31 March 2012.

[6] Ofcom Defence, Annex E, §11.
[7] BT Core Submission, §77.
[8] Letter from Ofcom, 25 October 2011.

FIGURE 5.1

LRIC, LRIC+ and proposed glide paths



Source: Ofcom [email to CC of 9 December 2011], CC calculations.
Note: In 2011/12 the charge control rate was 2.664ppm from 1 April 2011 to 31 October 2011 and 2.693ppm from 31 October 2011 to 31 March 2012.

Reference Question 4—Glide path duration

Ofcom's decision

5.8. In its Statement, Ofcom set out a number of factors in favour of a shorter glide path, and a number of factors in favour of a longer glide path. It then attempted to balance these considerations in order to reach a decision. Ofcom summarized its position as follows:[9]

> Having considered the overall benefits of setting MTRs to pure LRIC, our starting point is that we should implement pure LRIC prices as quickly as we reasonably can, so that consumers gain as a result. Balancing this principle is the need to allow sufficient time for industry (and consumers) to adjust as prices change.

5.9. Ofcom considered that in practice the relevant assessment was between a three-year glide path and a four-year glide path.[10]

Shorter glide path

5.10. Ofcom's primary argument in favour of a shorter glide path (in practice a three-year glide path) was as follows:[11]

> The economic objectives for intervention in termination markets: where the charge control intervention is designed primarily to prevent harm to competition from the exercise of SMP (or allocative inefficiency from

[9] Ofcom Statement, §10.28.
[10] Ofcom Statement, §10.32.
[11] Ofcom Statement, §10.33.1.

above-cost pricing), this suggests aligning charges as quickly as possible to costs (other things being equal).

5.11. Ofcom also noted that in one-way access regulation regulators typically preferred longer charge control periods in order to incentivize regulated firms to invest and reduce costs. It said that in the context of termination markets, because termination assets were also used to provide other services (such as origination) and because there was competition in other services such as retail mobile access and origination, relatively little weight needed to be accorded to this factor.[12]

5.12. Ofcom further noted the relevance of two-sided markets: when regulated MTRs were reduced operators could still achieve cost recovery by raising prices on the retail side. It said that this implied that 'reductions in MTRs that are quicker than the rate of cost reduction in MCT should not compromise cost recovery—provided the waterbed effect is sufficiently strong and provided that tariffs on the other side of the market can adjust sufficiently quickly'.[13]

Longer glide path

5.13. Ofcom set out the factors on which depended what it saw as the arguments in favour of a longer glide path (in practice four years as opposed to three years). In summary, these were:

(a) *Strength of the waterbed effect:*[14] Ofcom considered this effect to be incomplete and so it anticipated some profit reduction for MCPs from reduced MTRs. The greater the reduction, ie the weaker the waterbed, the more cautious Ofcom considered it should be in reducing MTRs.

(b) *Potential size of the reduction in MTRs and the impact on profitability:*[15] The reduction in MTRs is large, compared with the level of MTRs under the previous charge control. In light of that and the incomplete waterbed effect, Ofcom considered that the typically lower EBITDA margins in the UK, as compared with other Member States, meant that a longer glide path was appropriate for the UK than might be appropriate in other Member States.

(c) *Speed of adjustment of tariffs and capex plans:*[16] In view of average contract lengths and handset lives, Ofcom expected that nearly all tariff and handset pricing combinations could be adjusted over a three-year time frame—which would be consistent with a four-year glide path—and said that it was wary of effects on investment in mobile networks, which was (and is expected to remain) significant.

5.14. Ofcom then summarized its reasons for deciding on a four-year, rather than three-year, glide path in the following way:[17]

> Insofar as changes in MTRs require changes to retail prices, we consider such changes should proceed at a pace that does not risk generating unintended consequences or disruption, ultimately harming consumers.

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[12] Ofcom Statement, §§10.33.2–4.
[13] Ofcom Statement, §§10.33.5–6.
[14] Ofcom Statement, §10.34.1.
[15] Ofcom Statement, §§10.34.2 & 10.34.7.
[16] Ofcom Statement, §10.34.8.
[17] Ofcom Statement, §§10.37–10.40.

> In deciding to apply a four year glide path we have taken account of our duties under section 3, section 4, section 47 and section 88 of the Act ...

5.15. Ofcom acknowledged that its approach would mean a departure from the Recommendation which recommends that MTRs should be set at LRIC by the end of December 2012, but considered that to have followed it:[18]

> ... would entail costs which would put at risk the efficiency and competition benefits of lower MTRs over the charge control period including the risk of an adverse impact on investment ... We therefore consider that a glide path to pure LRIC by 1 April 2014 represents a proportionate approach to, on the one hand, consumer and competition benefits from early reductions and, on the other, the desire to allow industry sufficient time to adjust and to minimise the risk of unintended consequence in UK mobile markets.

BT's challenge to the glide path duration

5.16. BT claimed that Ofcom had erred in selecting the four-year glide path. It argued instead for a three-year glide path.[19]

5.17. BT alleged that Ofcom made two errors in allowing a four-year transition to LRIC:[20]

> Ofcom provided no good reason for departing from the Recommendation, and accordingly failed in its duty to take utmost account of it; and
>
> In the absence of good reason to adopt it, a four year transition was clearly an inferior solution to a three year transition in that it unjustifiably delays the benefits to consumers which would accrue from lower MTRs.

5.18. Section 4 of BT's NoA set out the following further arguments as to why none of Ofcom's three reasons for adopting a four-year glide path was soundly based.

The strength of the waterbed effect[21]

5.19. BT agreed that the waterbed effect was unlikely to be complete[22] (acknowledging that this conclusion was in line with the latest academic research[23]) and so there would probably be some profit reduction for MCPs [in aggregate] when MTRs were reduced[24] but stated that:[25] '... [this] provides no reason why Ofcom should not have concluded that the MNOs' excessive profits from call termination should be removed as quickly as possible.'

5.20. In support of that conclusion BT argued that the excess profits on mobile termination represented a 'cross-subsidy' from FCPs to MCPs,[26] adding that Ofcom and the European Commission had found that there was no justification for this 'cross-subsidy'. It went on to state that:

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[18] Ofcom Statement, §10.40.
[19] BT NoA, §§3.4, 4,16 & 7.1.2 plus an additional one-off adjustment at the start of the period—see below and BT NoA, §7.1.1.
[20] BT NoA, §§3.4.1 & 3.4.2.
[21] BT NoA, §§4.2–4.6.
[22] BT NoA, §4.3.
[23] W/S Richardson I, §17.
[24] BT NoA, §4.5.
[25] BT NoA, §4.6.
[26] BT NoA, §§4.5.1 & 4.5.2.

> the effect is not such as would unduly strain the MNOs in any event. For instance a 1ppm reduction would reduce the large three incumbent MNOs' combined EBIDTA by just 0.6% if the waterbed effect is 80% complete.[27]

5.21. BT summed up its reasoning on this point in its NoA in the following way:[28]

> ... Ofcom is vague about the nature or size of... [unintended consequences or disruption, ultimately harming consumers], and the consequence of being overly cautious about the speed of reduction of prices is to delay the realisation of the *intended* consequences of the new approach to the setting of MTRs. Ofcom ought to have placed more weight on the speedy realisation of these intended benefits, and less weight on purely speculative fears of unintended consequences.

Potential size of the reduction in MTRs and the impact on profitability[29]

5.22. In response to Ofcom having identified that '[T]he reduction in MTRs is large, compared with the MTR itself',[30] BT stated that the size of the reduction in MTRs from the rate at the end of the last control period (4.18ppm) was irrelevant because, on the basis of the previous MTRs, the MNOs had 'enjoyed substantial windfall profits on the provision of mobile termination services'.[31,32]

5.23. BT also alleged that: 'Ofcom failed to take into account the fact that a slower reduction to pure LRIC would unjustifiably perpetuate the cross-subsidy of MNOs by fixed line customers.'[33]

5.24. BT gave the following reasons for this statement:[34]

> First, it gives rise to unwarranted discrimination: the fact that MNOs in the UK earn lower EBITDA than do MNOs in other large EU Member States provides no reason to burden fixed line phone operators and their customers to compensate for this difference. Secondly, such a cross-subsidy offends against the principle of technological neutrality. Thirdly, it fails to take into account that the Recommendation itself does not recognize lower relative profitability for MNOs as a good reason for delay in the transition to a pure LRIC cost methodology. Fourthly, it fails to take into account the likely effects of the merger between Orange and T-Mobile on the EBITDA margins of the major MNOs in the UK in any event.

Speed of adjustment of tariffs and capex plans[35]

5.25. BT alleged that Ofcom had no proper foundation for its hypothesis that a three-year transition period would put at risk the efficiency and competition benefits of lower MTRs.[36] It went on to challenge particular elements underlying that hypothesis:

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[27] BT NoA, §§4.5.1 & 4.5.2.
[28] BT NoA, §4.6.
[29] BT NoA, §§4.7–4.11.
[30] Ofcom Statement, §10.34.2.
[31] BT NoA, §4.7.
[32] BT NoA, §4.9.
[33] BT NoA, §4.10.
[34] BT NoA, §4.11.
[35] BT NoA, §§4.12–4.17.

(a) Ofcom had failed to explain the reason for its being wary of rapid change and, in any event, such wariness was misplaced;

(b) Ofcom had failed to assess the impact of a faster transition to LRIC on MCPs' ability to finance their investment programmes;

(c) if the waterbed was incomplete there would likely be only a small impact on MCPs' revenues and profits;

(d) Ofcom had taken no account of the impact of the speed of transition on fixed networks; and

(e) Ofcom had failed to take any account of the likely benefits to investment.[37]

5.26. BT noted that one possible reason for Ofcom to be 'wary' of more rapid adjustment was a possibility that the MCPs would be locked into contracts that changes in regulation have rendered unprofitable. In this case, the argument would be that MCPs cannot raise prices to existing postpay customers without releasing those customers from their minimum contract period (and hence MCPs would fail to earn back their substantial acquisition costs).

5.27. Mr Richardson for BT argued that this reasoning did not apply in this case. He argued that postpay customers had a net outbound calling ratio of 2.2:1, on average, and so at lower MTRs the net level of termination fees payable on those customers fell and they became *more* profitable, rather than less.[38]

5.28. BT also claimed that:

> Ordinarily, capex for technology development and network re-organisation consequent upon a spectrum award would be justified on its own terms (a particular rate of return against some indicated hurdle rate). There is no reason to tolerate inefficiency and the imposition of burdens in one area so as to make investment decisions easier in another.[39]

Three's SoI in support of BT

5.29. Three added its own arguments in support of BT's challenge.[40] In respect of the significance of the Recommendation, Three stated that in the context of the length of the glide path Ofcom appeared to have had little, if any, regard to the harmonizing objective of the Recommendation.[41]

5.30. Three went on to allege that 'Ofcom's arguments around the strength of the waterbed effect and its relevance to the glide path decision were brief and contradictory'.[42]

5.31. Three supported the arguments of BT criticizing Ofcom's reliance on the scale of the reduction and its fear of the impact on MCPs' profitability.[43] It noted that in absolute terms much larger reductions were required in both 2004 and 2007 (and on appeal by the Competition Commission). In 2004, Ofcom required Orange and T-Mobile to

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[36] BT NoA, §4.13.
[37] BT NoA, §§4.14 & 4.15.
[38] BT NoA, W/S Richardson 1, §§30–32.
[39] BT NoA, §4.15.1.
[40] Three SoI, sections 3–5.
[41] Three SoI, §3.10.
[42] Three SoI, §5.4.
[43] Three SoI, §§5.7–5.12.

reduce their rates by 3.8ppm in one year compared with a 3.5ppm reduction over the full four years of the charge control set by Ofcom in the Statement.[44]

5.32. Three also argued that if Ofcom judged it acceptable to introduce a large proportion of the required change in the first year (1.516ppm), it was not clear why a further three years would be required to absorb the remaining 1.974ppm reduction.[45]

5.33. Three challenged Ofcom's concern about the potential effect of rapid change on mobile prices.[46] It commented in the following terms on Ofcom's statements that the shorter the glide path, the greater the potential impact on mobile prices, and that it was wary of any rapid change that might lead to undesirable structures or levels of retail prices which, Ofcom claimed, a more gradual decline in MTRs would avoid:

> The first sentence may be correct [the shorter the glide path, the greater potential impact] but would seem to be a good thing in circumstances where Ofcom's decisions in the Statement will increase competition and have benefits for consumers. The second sentence [wariness of the consequences of rapid change] begs the question of what evidence there is of a risk of 'undesirable structures or levels of retail prices' resulting from a three- rather than four-year glide path (or, indeed, from reducing MTRs to pure LRIC by 31 December 2012 in line with the Recommendation). Ofcom does not cite any.[47]

5.34. In respect of Ofcom's fears about the effects of rapid change on investment, Three stated that the investments Ofcom referred to would become required for the provision of services in competitive markets (rather than the provision of MCT), and indeed would become largely driven by data services, and hence the incentives to invest would not become driven by the level of MTRs.[48] Three also argued that the investment case of MCPs would be based on long-term profit opportunities rather than those that depend on the precise level of MTRs during this charge control period.[49]

Ofcom's Defence

5.35. Ofcom reiterated the reasoning set out in its Statement and stated that its decision: '... involved an exercise of discretion, balancing the benefits of a move to pure LRIC against the risks of disruption to retail prices and/or investment by MCPs.'[50]

5.36. It went on, in Annex E to its Defence, to describe its decision to implement a four-year glide path as an 'archetypal exercise of regulatory judgement'.[51]

5.37. Ofcom denied that the Recommendation *required* it to introduce LRIC-based MTRs by December 2012 but rather that:[52]

> ...[t]he obligation on Ofcom was ... to undertake an analysis of the relative merits of the various alternatives by reference to its statutory

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[44] Three SoI, §5.8.
[45] Three SoI, §5.11.c.
[46] Quoting Ofcom's Statement, §§10.34.8–10.34.10.
[47] Three SoI, §5.14.
[48] Three SoI, §5.19.
[49] Three SoI, §5.21.
[50] Ofcom Defence, §68.
[51] Ofcom Defence, Annex E, §6.a.
[52] Ofcom Defence, Annex E, §24.

> duties, and to take utmost account of the Recommendation in the course of that analysis. That is exactly what Ofcom did.

5.38. Ofcom said that it took into account the transfer from fixed line users to MCPs alleged by BT but stated that BT's estimate of the effect of the MTR reductions on MCPs' profitability was wrong on two grounds.[53,54]

5.39. Ofcom said that first, BT failed to realize that the levels of both LRIC and LRIC+ would fall over time, and so BT miscalculated the levels of LRIC and LRIC+ in the intermediate years of the charge control. This led BT to propose MTR charges in those intermediate years that were inconsistent with BT's arguments and consequently to underestimate the effects of a three-year glide path on MCPs' profitability.[55]

5.40. It said that second, BT based its calculation on the number of minutes of calls from fixed lines to mobile in 2010. It should also have included all calls terminating on a mobile network that were not originated from a UK mobile operator (eg calls from other countries). This again led to BT underestimating the effects of a three-year glide path on MCPs' profitability.[56]

5.41. Ofcom calculated the effect of different glide paths on MCPs' revenues. It reasoned:[57]

> In the absence of a waterbed effect and assuming static termination volumes and costs, Ofcom estimated that the revenue loss for MCPs over a four-year glide path might be about £0.6bn (in 2008/09 prices) when comparing revenue in 2014/15 with revenue in 2010/11, and that the difference between a four-year and three-year glide path would be around £60 million in year 1 (in 2008/09 prices), and diminishing thereafter.

5.42. Ofcom reiterated the point made in its Statement that EBITDA margins in the UK were typically lower than in other large EU Member States.[58]

5.43. With regard to the speed of adjustment to tariffs, Ofcom explained its concerns in more detail as follows:[59]

> Ofcom's concern was not that MCPs would be unable to change their retail tariffs, but was rather that MCPs would be required to make large changes too quickly if a shorter glide path were adopted. Ofcom also considered that MCPs may need to make a series of incremental retail price adjustments before a new price equilibrium is established, and Ofcom was concerned that the glide path should allow enough time for this.

5.44. Ofcom held this view because it said that the average postpay contract length in the UK mobile market was less than two years and average handset life was around two to three years. On this basis, it would expect that *most retail prices* could reasonably

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[53] Ofcom Defence, Annex E, §29.b.
[54] See paragraph 5.20 above.
[55] Ofcom Defence, Annex E, Appendix 1, §1c–d. BT accepted that this was correct; see BT Core Submission §77.
[56] Ofcom Defence, Annex E, Appendix 1, §1a–b. BT appeared to accept this criticism; in its Core Submission it included a calculation of the revenue impact taking into account these revenues from 'other' operators (BT Core Submission, Table 1).
[57] Ofcom Defence, Annex E, §15c. We believe that the final point is wrong: the difference would be slightly larger in years 2 and 3 (assuming constant or increasing calls to mobile volumes), but not sufficiently larger to affect the overall argument.
[58] Statement §10.34.7.
[59] Ofcom Defence, Annex E, §§47 & 48.

be adjusted within a two-year time frame (which it said would be consistent with a three-year glide path). Over a three-year time frame Ofcom claimed that *nearly all tariff and handset pricing combinations could be adjusted* (which it said would be consistent with a four-year glide path).[60]

Interventions in support of Ofcom

5.45. EE stated that it broadly agreed with and supported Ofcom's position as set out in Annex E of its Defence.[61] It first made two general points alleging errors in BT's calculations for failing to take into account the decline of both the LRIC and LRIC+ based charges during the control period[62] and reiterating its position that a swifter move to a LRIC based charge control would result, in its view, in exacerbating the harm caused by adopting LRIC.[63] It went on to make specific points supporting arguments made by Ofcom itself[64] adding also that Ofcom's Decision could reasonably be characterized as a three-year transition period.[65]

5.46. Vodafone's intervention relied on the submissions of Ofcom in Annex E of its Defence.[66] It relied also on a number of additional points:

(a) BT was wrong to proceed on the assumption that it was economically efficient to set MCT charges at the LRIC measure or at a measure below that of LRIC+.[67]

(b) A reduction in MCT revenues was likely to lead to an increase in retail prices so creating a clear risk of a reduction in the number of subscribers. Those effects would be exacerbated by MCT charges being reduced further and faster than envisaged in Ofcom's Decision.[68]

(c) It was unclear to what extent fixed-line consumers would benefit from reducing MTRs more quickly because of BT's own pricing decisions.[69]

5.47. Telefónica also intervened in support of Ofcom and submitted a witness statement from Mr Lawrence Wardle, Regulatory Manager at Telefónica, which dealt principally with the likely impact on its tariffs and business strategy of the lower MTRs under a shorter glide path.

Assessment on duration of the glide path

5.48. While we accept that there is regulatory judgement involved in Ofcom's decision on the length of the glide path, this is not to say that Ofcom's choice is not open to challenge if, for example, the reasons given for its choice are manifestly unsound or if Ofcom has failed to adequately justify its choice between alternatives, particularly if, on the face of it, Ofcom appears to have adopted an inferior solution.

5.49. With regard to EE, Vodafone and Telefónica's interventions, to the extent that these interventions challenged the assumption that LRIC was the appropriate cost standard we consider that these arguments were examined in Reference Question 1 and we

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[60] Ofcom Statement, §10.34.8.
[61] EE SoI in support of Ofcom §5.
[62] EE SoI in support of Ofcom §9.
[63] EE SoI in support of Ofcom §10.
[64] EE SoI in support of Ofcom §§14–17.
[65] EE SoI in support of Ofcom §13.
[66] Vodafone SoI in support of Ofcom §2.
[67] Vodafone SoI in support of Ofcom §§4 & 5.
[68] Vodafone SoI in support of Ofcom §§6–9.
[69] Vodafone SoI in support of Ofcom §§10–22.

found no error in Ofcom's conclusion. Therefore in approaching this question we believe it is correct to treat LRIC as the most appropriate level of MTRs. The choice of LRIC or LRIC+ may have consequences for MCPs' profits and the number of mobile subscribers, and reductions in MTRs may not be fully passed on to fixed-line users—but those factors were taken into account when determining the appropriate level of MTRs, and Ofcom found that any negative effects were outweighed by positive effects (especially effects on competition, and that lower MTRs would benefit fixed-line users to some extent). That determination having been made, we have addressed this question from the starting point that in any given year, having MTRs closer to LRIC is *prima facie* a good thing. The only relevant detriments are those that arise from faster adjustments in MTRs.

5.50. In light of Ofcom's own argument in favour of a three-year glide path (see paragraphs 5.8 and 5.10), and the fact that BT's case focuses on whether Ofcom had good reason for then preferring a longer glide path, we assess the arguments around each of the reasons Ofcom provided, namely:

(a) the waterbed effect was unlikely to be complete so a reduction in MTRs would lead to a reduction in the MCPs' profitability;[70]

(b) the reduction in MTRs was large compared with current MTRs and there may be a significant impact on MCPs' revenue;[71]

(c) the speed of adjustment might lead to a risk of:

(i) undesirable structures or levels of retail prices which a more gradual decline in MTRs would avoid;[72] and

(ii) disruption to investment decisions which ultimately would not be to the benefit of end-users.[73]

5.51. We then comment on the significance of the Recommendation.

The strength of the waterbed effect

5.52. We agree that the waterbed effect is likely to be incomplete and that this implies that reducing MTRs will affect MCPs' profitability. We discuss the extent of this below. We note that, when considering the glide path, Ofcom used figures of 80 per cent and 50 per cent to illustrate possible levels of the waterbed effect.[74] Given Ofcom's view, elsewhere in the Statement,[75] that there is a strong waterbed effect, we consider that 80 per cent is a more appropriate figure on the basis of which to consider this effect.

The potential size of the reduction in MTRs and the impact on profitability

5.53. We agree that BT miscalculated the impact on MCPs' profitability on two grounds—as Ofcom submitted (and as BT appears to have accepted).[76]

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[70] Ofcom Statement, §§10.34.1 & 10.37.
[71] Ofcom Statement, §§10.34.2–7 & 10.38.
[72] Ofcom Statement, §§10.34.8–10, 10.39 & 10.40.
[73] Ofcom Statement, §§10.34.8, 10.35, 10.39 & 40.
[74] Ofcom used these figures following the example of Mr Richardson for BT, but did not suggest that they were unreasonable.
[75] See for example Ofcom Defence, Annex A, §60 and Core Submission, §32b. We discuss the waterbed in more detail under allocative efficiency in Reference Question 1.
[76] See paragraphs 5.5 & 5.6 above.

5.54. Ofcom's observation that a three-year glide path would result in larger annual reductions in MTRs is true but is not of itself an argument for or against a four-year glide path.[77] With respect to the size of the reduction relative to the actual level of the MTRs, what is important is the difference between the effects of a four-year and a three-year glide path.[78] This difference is small relative to the movement from existing levels that will occur in the first year under either glide path. In any case, Ofcom's concern is for the effects on pricing and investment decisions. For investment decisions the relative size of the reduction is less important than the absolute size. For pricing decisions the absolute size of the reduction is again important but should be set against prevailing prices and not the current level of MTRs. Although parties have made calculations on the effect on EBITDA of a three-year glide path, as noted above, what is important is the difference between the effects of a four-year and a three-year glide path, not the absolute effect of a three-year glide path in isolation.

5.55. We calculate that a 1ppm reduction would reduce the three large incumbent MCPs' combined EBIDTA by around 0.9 per cent if the waterbed effect is 80 per cent complete or by around 2.25 per cent if the waterbed effect is 50 per cent complete[79] (using figures of 80 per cent and 50 per cent for illustration, following the example of Mr Richardson for BT and Ofcom[80]). The difference between the effects of a four-year and three-year glide path (with no one-off adjustment) in the first year would be around one-third of this 1ppm reduction: 0.3 per cent of EBITDA if the waterbed effect is 80 per cent complete, or 0.75 per cent if the waterbed effect is 50 per cent complete. Hence, the difference between a three-year and four-year glide path is very small using either illustration of the strength of the waterbed effect. We do not consider either difference, in particular that based on an 80 per cent waterbed effect (in our view the more appropriate figure, as noted above), to be a compelling argument in favour of a four-year instead of a three-year glide path.

5.56. We have adjusted Ofcom's calculation of the effect of different glide paths on MCPs' revenues to use an 80 per cent waterbed effect (consistent with Ofcom's view that the waterbed effect is strong). This implies that using a three-year rather than four-year glide path the MCPs face a combined revenue loss of £12 million in year 1. Again, the small size of this revenue loss in the context of mobile sector revenues does not provide good support for a four-year glide path.[81]

5.57. We also considered whether Ofcom's observation that UK MCPs are typically less profitable than MCPs in other Member States supports a four-year glide path.[82] This argument appeared to be directed at Ofcom's departure from the Recommendation that Member States set MTRs at the LRIC level by the end of 2012, which we discuss below. We do not believe that lower MCP profitability in the UK compared with other Member States in itself supports an argument for a four-year glide path.

Speed of adjustment—the risk of disruption to pricing

5.58. We consider that there is merit in BT's and Three's criticisms of Ofcom's reliance on its wariness of the effect of rapid change on retail prices. Ofcom's argument on this is vague, with no explanation as to why MCPs' ability to adjust most postpay tariffs

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[77] Ofcom Statement, §10.34.2.
[78] Ofcom Statement, §10.34.2.
[79] Based on calculations of BT at BT NoA, §4.5 and Richardson I, §20, corrected for the inclusion of calls from sources other than UK fixed lines as per Ofcom's comment (see paragraph 5.40 above).
[80] W/S Richardson I, §§19 & 20; and Ofcom Defence, Appendix 1 to Annex A, §1b–d.
[81] BT submitted that in the most recent year for which figures were available, the three largest MCPs earned combined revenue of over £18 billion. See BT Core Submission §85.
[82] See paragraph 5.13 above.

within two years would be unsatisfactory.[83] Ofcom's argument is not intrinsically in favour of a long glide path; merely an unspecified concern about problems that could arise from having a glide path that is 'too short'.

5.59. Ofcom has not provided any evidence or reasoning as to why a three-year glide path would require MCPs to make changes 'too quickly' whereas a four-year glide path would not, or that a three-year glide path would not permit enough time for 'incremental retail price adjustments'. In relation to the former, we again note that the absolute value of the changes in MTRs is small relative to changes required in previous charge controls. In relation to the latter, even if a series of adjustments is required, Ofcom has provided no reasoning as to why the position after each adjustment on a three-year glide path would not be superior to that on a four-year glide path. Since the ultimate goal is to set MTRs at LRIC, it seems to us to follow that a three-year glide path will, over its whole duration, lead to results closer to this goal than will a four-year glide path.

5.60. We were told that, while a user is under contract, a change in prices making the customer worse off entitles that user to cancel the contract before its minimum term—which may mean that MCPs are unable to earn back acquisition costs from that customer.[84] However, the longest permitted consumer contract length in the UK is two years, and hence we believe that all prices can be adjusted within two years.[85] Ofcom's view that 'nearly all' tariff and handset pricing combinations could be adjusted within three years apparently reflects the recovery of handset subsidies.[86] Our view is that acquisition costs (including handset subsidies) are sunk costs and that in any case MCPs would generally seek to recover these costs within the minimum contract period. We were therefore unconvinced that this provided a rationale for more than two years to adjust prices (ie a four-year glide path). As Ofcom noted, since pre-pay users are not subject to a contract with a minimum duration, 'it seems likely that pricing adjustments can be made immediately for pre-pay tariffs'.[87]

5.61. Mr Richardson went further than this with his argument that postpay customers became more profitable as MTRs fell because the net level of termination fees payable in respect of their net outbound call ratio reduced. This argument would imply that there is no reason to worry about lower MTRs even within existing customers' contract periods. However, we do not accept Mr Richardson's argument because it relies on incorrect facts and incomplete reasoning.

5.62. On the facts, the outbound:inbound ratio of 2.2:1 that Mr Richardson quoted is incorrect for two reasons. First, it reflects a calculation error by Ofcom—and Ofcom subsequently corrected this figure to 1.5:1.[88] Second, due to data limitations, Ofcom included mobile to fixed calls when calculating this ratio. Mobile to fixed calls do not attract MTRs and so artificially inflate the ratio. We believe that the correct figure is very close to 1:1.[89] In other words, postpay customers as a whole are associated with approximately balanced outgoing and incoming MTR payments. This implies that some postpay customers will become less profitable or even unprofitable as a result of a lower MTR in the first year—and MCPs will not be able to increase the prices

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[83] Ofcom Statement, §10.34.8.
[84] EE, W/S Dunn I, §44.
[85] We understand that some business contracts may be longer, but none of the parties have argued that this would be a significant concern.
[86] See comment by Mr Stewart for Ofcom at its Bilateral Hearing (p137 of transcript). We note that we have seen no evidence that recovery of handset subsidies takes more than two years.
[87] Ofcom Statement, §10.34.9.
[88] See letter of 18 October 2011 from Ofcom to all parties, discussed in more detail in the Introduction to Reference Question 1.
[89] As outlined in the introduction to Reference Question 1.

paid by this group. Mr Richardson's argument did not take this into account. Although other postpay customers will become more profitable, increased competition for those customers might encourage MCPs to try to offer them improved terms before their contracts expire, thus losing that benefit of increased profitability. Therefore we do not believe that postpay customers as a whole would become more profitable, as Mr Richardson contended, and they may become less profitable.

5.63. Although we reject this last argument by BT, we do not consider that any issues around speed of adjustment to pricing justify a four-year glide path.

Speed of adjustment—the risk of disruption to investment decisions

5.64. Ofcom appeared to argue that lower MTRs could affect investment decisions either by affecting MCPs' ability to invest (cashflow issues) or their incentives to invest, whereas BT argued that neither ability nor incentives would be affected.

5.65. Ofcom's argument seems to us to be primarily about reduced cashflows and their consequences for capital expenditure.[90] Ofcom argued that: 'It would be difficult to conclude that a potential revenue impact of £600 million (ie the impact of the reduction in MTRs to pure LRIC if made over a period of time before the waterbed effect could work through) could not have an effect on capex in the short term.'[91]

5.66. There are two issues with Ofcom's quantification of this impact. The first is that it is based on a reduction of MTRs from the 2010/11 level of 4.18ppm to the 2014/15 level of 0.69ppm. As Ofcom has itself argued,[92] the relevant comparison is between the two levels that Ofcom is choosing between—in this case, the difference between a four-year and a three-year glide path. As noted in the Decision,[93] in the absence of a waterbed effect that is around £60 million in year 1.

5.67. The second is that in quantifying the size of the effect Ofcom assumes that either there is no waterbed effect—contrary to its general assumption that the waterbed effect is strong and might be 80 per cent complete—or there are delays in the operation of the waterbed effect.

5.68. However, the evidence of Professor Valletti for Ofcom suggested that there is an immediate waterbed effect for postpay customers and the waterbed effect for pre-pay customers is delayed by six months after regulation takes effect.[94] This does not seem to support serious short-term concerns about the waterbed effect and so Ofcom's 'potential revenue impact of £600 million' is likely to be severely overstated. We argued above that a more realistic estimate of the revenue impact may be around £12 million. Even if there are some delays in the waterbed effect, the total effect across all four MCPs would be in the tens of millions in any year of the price control. This is a very small figure in the context of MCPs' total cashflows.

5.69. We also note that Ofcom provided no reasoning or evidence that the MCPs have significant cashflow issues that would prevent them from carrying out profitable investments. Nor has any such evidence been provided in support of Ofcom by any other party.

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[90] Ofcom Defence, Annex E, §§52 & 53.
[91] Ofcom Defence, Annex E, §§52 & 53.
[92] See for example Defence, Annex A, §9, where Ofcom says 'some of the arguments and evidence presented … are misleading, as they artificially inflate the likely effects by using different frames of reference (such as the 2010/11 level of MTRs…)'.
[93] Ofcom decision, §10.34.5.
[94] W/S Valletti 1, §§26 & 27.

5.70. With regard to incentives, we accept the line of reasoning proposed by Three[95] that as the profitability of investment decisions is not affected by, or not greatly affected by, the level of MTRs then the glide path chosen should not significantly affect investment incentives.

5.71. In the Statement, Ofcom's two primary examples of significant capex requirements were 'forthcoming spectrum awards … and associated network re-organisation as well as technology developments (eg UMTS at frequencies previously used for GSM and ultimately LTE deployments)'.[96] However, we find persuasive the arguments of BT and Three that, in practice, a shorter glide path is unlikely to affect the incentives for these investments. In addition, we have taken into account the relatively small scale of the effect on MCP revenues of the difference between a three- and four-year glide path as compared with the overall size of those revenues.

5.72. We are accordingly unconvinced by Ofcom's arguments about the risk of disruption to investment and consider that, as pleaded by BT and Three, they do not show adequate justification for choosing a four-year instead of a three-year glide path.

The Recommendation

5.73. The Recommendation recommends that MTRs should be reduced to the level of LRIC by 31 December 2012 (subject to any objective cost differences of the types specified in points 9 and 10 of the Recommendation). Ofcom would fail to meet this date under either a three-year or four-year glide path (under the three-year glide path, MTRs would reach LRIC levels on 1 April 2013).

5.74. We note that Ofcom did not refer to any objective cost differences. In this context, Ofcom differentiated the UK from other Member States only by observing that MCP profits were typically lower in the UK than in other Member States. As discussed above, we do not believe that the level of MCP profitability in the UK justifies this departure. We do not consider that Ofcom's departure from the Recommendation of itself demonstrates that Ofcom erred, but we do believe that the Recommendation is a relevant factor that favours the adoption of a shorter glide path.

Conclusion

5.75. As Ofcom elected to adopt a LRIC cost standard and recognized in principle that it should align prices with LRIC as quickly as it reasonably could, we find there to be force in BT's arguments, supported by Three, that Ofcom needed good reasons to adopt the longer option. We agree with BT and Three that the reasons for preferring a four-year glide path are not convincing. Additionally, while both a three-year and a four-year glide path would miss the target date of the Recommendation, we have been presented with no compelling reason why the greater departure from it is justified.

Determination of Reference Question 4

5.76. We therefore find that Ofcom erred in deciding to adopt a four-year transition period over which mobile termination rates would be reduced to the level of the LRIC cost standard, rather than over a three-year period.

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[95] See paragraph 5.34 above.
[96] Ofcom Statement, §10.35.

Reference Question 5—One-off adjustment

5.77. BT argued that 'Ofcom erred in failing immediately to reduce the starting rate of MTRs to the current LRIC Plus level with effect from April 2011'.[97]

Ofcom's position on one-off adjustment

5.78. In the Statement, Ofcom did not give any consideration to the possibility of a one-off adjustment of the form now proposed by BT. In its Defence Ofcom stated:[98]

> As regards a P0 adjustment of the sort now proposed by BT, none of the parties (including BT and Three) argued in favour of such an adjustment during the consultation process which preceded the Statement. Ofcom cannot be faulted for not making an adjustment which no one was proposing at the time of the Statement.

5.79. Ofcom did acknowledge elsewhere that:[99] 'Three argued that there should be no glide path at all and that Ofcom should have moved immediately to the pure LRIC level on 1 April 2011.'

5.80. This is in a sense a P0 (or one-off) adjustment (albeit to a different level) but Ofcom went on to make the point that: '... Three briefly suggests in its SoI that there should be no glide path at all, i.e. that MTRs could have been reduced to the prevailing pure LRIC rate immediately.[100] This is not contended for by BT, and cannot be raised by Three as intervener.'[101]

5.81. We accept Ofcom's argument on that point but consider that it is open to BT to challenge, as it has in its NoA, the absence of a one-off adjustment.

BT's arguments for a one-off adjustment

5.82. Ofcom said in the Statement that the costs of termination 'have fallen faster than was predicted in 2007, MCPs obtained the benefits of higher efficiency, as well as lower input costs and higher volumes than we expected in 2007'.[102] BT argued:[103]

> The fact that actual costs were so far below the permitted MTR prices results primarily from Ofcom's own previous errors in the assessment of MNO's [sic] actual costs, not from efficiency gains achieved by them over the lifetime of the previous charge control period. For that reason, BT submits that Ofcom's decision to reduce MTRs from their present rates to pure LRIC rates exclusively by means of a glide path was manifestly the wrong one ...

5.83. BT also put forward three 'positive reasons' to support a one-off adjustment which it claimed correspond to scenarios in which Ofcom has stated[104] it would consider a one-off adjustment.

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[97] BT NoA, §5.1.
[98] Ofcom Defence, Annex E, §6b.
[99] Ofcom Defence, Annex E, fn 5.
[100] Three SoI, §6.2.
[101] Ofcom Defence, Annex E, §63.
[102] Statement §7.16.
[103] BT NoA §5.1.
[104] Ofcom, Charge control review for LLU and WLR services, Ofcom Consultation, 31 March 2011, paragraph 3.96.

Allocative efficiency

5.84. BT argued that there were clear allocative efficiency benefits from lower MTRs and argued 'the fact that Ofcom has clearly decided to prefer pure LRIC to LRIC Plus indicates that the most efficient price is below LRIC Plus and hence that a starting charge at the LRIC Plus level … would necessarily offer substantial benefits over [Ofcom's proposed glide path]'.[105]

New regulation

5.85. BT claimed that the move to LRIC was: 'a significant, new approach to MTR price control and thus should be viewed as in essence representing the introduction of a new control.'[106] BT said that it relied on a statement, made by Ofcom, that it might consider one-off reductions where charges were previously unregulated.[107]

Elimination of distortion of competition

5.86. BT further submitted that: 'The immediate reduction to LRIC Plus rates would reduce the competitive impact of the difference between MTRs and fixed termination rates ("FTRs") ... .'[108]

5.87. As to the scale of that distortion BT asserted that 'the contribution made to mobile networks' fixed and common costs by FNOs from the payments of mobile termination charges would be over 20 times greater than the equivalent contribution passing in the other direction by way of fixed termination charges paid by MNOs'.[109]

Three's SoI in support of BT

5.88. Three's SoI stated its support for BT's arguments, but did not meaningfully develop BT's arguments or evidence.

Ofcom's Defence

5.89. With regard to BT's submission on the cause of the difference between actual costs and MTRs, Ofcom said in its Defence that an analysis of the disparity '... would have been extremely difficult to undertake' and, further, that it '... would not ultimately have affected Ofcom's assessment, which was focussed not on the "deservedness" of the MCPs' profits but on the potential of reduced MTRs to impact on retail mobile prices and investment levels respectively'.[110]

5.90. Considering BT's three 'positive arguments' in turn Ofcom accepted that 'reducing the regulated MTR from above the LRIC+ level will likely enhance allocative efficiency (considering this factor alone)'[111] but said it took that into account as part of its balancing exercise ie set against the 'risks' of a swifter reduction in MTRs.[112] In other words, Ofcom acknowledged that there is a valid argument in favour of a one-off adjustment.

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[105] BT NoA, §5.5 and W/S Richardson 1, §§47–52.
[106] BT NoA, §5.6 and W/S Richardson 1, §§54 & 55.
[107] BT NoA, W/S Richardson I, §54.
[108] BT NoA, §5.7 and goes on to refer to W/S Richardson 1, §§56–68.
[109] BT NoA, §5.10.
[110] Ofcom Defence, Annex E, §35.
[111] Ofcom Defence, Annex E, §68a.
[112] Ofcom Defence, Annex E, §68b.

5.91. Ofcom rejected BT's suggestion that a LRIC-based approach for setting MTRs constituted new regulation.[113] Ofcom argued that this would in any case only be relevant in circumstances where the previous charges were unregulated and the imminent imposition of a glide path gave service providers an incentive to increase charges before the charge control began, in order to benefit from a higher glide path 'starting point'. It said that those circumstances did not apply here. Further, Ofcom explained that BT had sought to place inappropriate reliance on a passage taken out of context from a consultation document, in relation to a charge control for a different set of services, which did not represent a general statement of Ofcom's policy.[114]

5.92. With respect to the BT's contention concerning the competitive impact of the difference between MTRs and FTRs, Ofcom accepted that competitive impacts weigh in favour of lower MTRs and hence a one-off adjustment (although it disputed BT's estimate of the size of the effect[115]) but, again, stated that it took this into account as part of its balancing exercise.[116]

5.93. Against these three points, Ofcom referred to the disadvantages and potential risks from making rapid, large adjustments to lower MTRs, as laid out in its consideration of the length of the glide path and discussed above.

Interventions in support of Ofcom

5.94. Vodafone and Telefónica intervened in support of Ofcom making similar arguments to those identified above in respect of their interventions on the duration of the glide path. Telefónica added that BT was incorrect to argue that a one-off adjustment was necessary to reduce a distortion of competition between MCPs and FNOs.[117]

5.95. EE relied on the two general points already referred to (in respect of its intervention on the duration of the glide path) and added the following specific arguments:

(a) it alleged that BT's case was based on the false assumption that Ofcom's previous estimate of LRIC+ was too high, allowing the MCPs 'windfall profits'. EE argued that MCPs were entitled to earn profits under regulation if they reduced their costs, and that if profits were driven by increasing demand or falling input costs, these were also likely to be influenced by MCPs' behaviour and so again it was not unreasonable for them to benefit;[118]

(b) BT was wrong to suggest that a one-off adjustment would be 'wholly consistent with Ofcom's policy';[119] and

(c) to the extent that any weight should be attributed to the factors relied on by BT Ofcom rightly concluded that those considerations were outweighed by the risk of undermining investment and of making undesirable pricing changes more likely.[120]

[113] Ofcom Defence, Annex E, §69.
[114] Ofcom Defence, Annex E, §66.
[115] Ofcom Defence, Annex E, Appendix 2.
[116] Ofcom Defence, Annex E, §73.
[117] Telefónica SoI in support of Ofcom §6.
[118] EE SoI in support of Ofcom §19.
[119] EE SoI in support of Ofcom §20.
[120] EE SoI in support of Ofcom §21.

Assessment on one-off adjustment

5.96. We note that it is usual practice for Ofcom to use a glide path in its charge control decisions, usually with no one-off adjustment, from regulated prices under one price control period to a new price control period. As it pointed out in the Defence, Ofcom has stated that it has 'a strong preference for glide paths, rather than [one-off] adjustments, to align charges to costs'.[121] We therefore consider that MCPs would have a reasonable expectation of such a glide path and no one-off adjustment, and in this context the failure of any party to propose a one-off adjustment during the consultation process strengthens that expectation.

5.97. In order to find in favour of BT we would have to find either that the discrepancy between forecast costs and actual costs is relevant to the glide path or that BT's 'positive arguments' had sufficient force to overcome Ofcom's reasons for not including a one-off adjustment.

5.98. We were not persuaded that the reasons for MCPs' actual costs of termination being below permitted MTRs are necessarily relevant to the consideration of a one-off adjustment. We note that BT has claimed, but has not attempted to demonstrate, that the primary reason for the decline in costs was growing demand and falling input prices (as opposed to improved efficiency). Ofcom argued, and BT did not dispute, that this would have been extremely difficult to assess. BT has also failed to make a link between the reason for the decline and costs and the considerations around a one-off adjustment. BT argued that: 'There was no basis for preserving MNOs' ability to charge MTRs so greatly in excess of costs.'[122] However, Ofcom argued that it would cause disruption to pricing. We found in our assessment of Reference Question 4[123] that this argument had some validity for changes within the first two years of the control and BT provided no additional reasoning as to why Ofcom's argument has no force here.

5.99. Without good reason to believe that BT's claim is correct and that Ofcom's counter-argument does not apply, this reasoning does not justify a one-off adjustment.

5.100. On BT's first 'positive argument', we note that this relies on the most allocatively efficient level of MTRs being at or below LRIC+. We examined this issue in Reference Question 1 and found that this was probably, but not necessarily, true.[124] Therefore this argument may on balance support BT's proposed one-off adjustment (albeit with less force than BT claimed) but Ofcom did (rightly) take it into account in weighing the allocative and competitive arguments for lower MTRs against the costs of larger reductions in MTRs at the start of the charge control.

5.101. On BT's second 'positive argument', we agree with Ofcom that this charge control does not constitute new regulation and that the lack of a one-off adjustment does not in any case give MCPs an incentive to game the system by distorting the 'starting point'. Further, for the reasons given by Ofcom we do not agree with BT that the 'statement' relied upon by it points to a one-off reduction in this instance being consistent with a stated Ofcom policy.

5.102. It is common ground between BT and Ofcom that BT's third 'positive argument' favours a more rapid adjustment towards LRIC but, again, we accept Ofcom's view that this is a factor to be taken into account in the overall assessment.

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[121] Ofcom Defence, Annex E, §66b.
[122] BT NoA, §5.1.
[123] See paragraph 5.60 above.
[124] As outlined in the allocative efficiency section of Reference Question 1.

Conclusion

5.103. We find that the relevant considerations in Reference Question 4 and Reference Question 5 have many similarities. In both cases we have found (and Ofcom agrees) that there is a good argument for more rapid adjustment (a shorter glide path with lower MTRs in each intermediate year), namely the goal of reaching the 'desirable' level of LRIC sooner. We have then assessed the arguments against rapid adjustment.

5.104. In assessing the arguments in favour of a one-off price adjustment, however, the primary consideration is the effect on prices in the first year. We consider that Ofcom's arguments about the difficulties in adjusting prices in the first year have some force, especially bearing in mind the new price control came into effect 17 days after the publication of the Decision and that the MCPs would not reasonably have anticipated a one-off starting adjustment based on Ofcom's usual practice and the arguments put forward during the consultation process.[125] In that context, we consider that there is merit to Ofcom's arguments, since the MCPs would have faced difficulties in adjusting the prices paid by postpay customers in the short term (and for a large proportion of postpay customers they would not be able to increase prices at any point in the first year).[126] We do not consider that BT has provided any valid additional reason in favour of a one-off adjustment to lower MTRs in the first year. We also note that the Recommendation does not provide any reason to find in favour of or against a one-off adjustment.

Determination of Reference Question 5

5.105. For the above reasons, we are not persuaded by BT that Ofcom erred in failing to make a one-off adjustment to the rate at the start of the control to current levels calculated in accordance with the LRIC+ cost standard.

[125] It has been contended that the MCPs should have worked on the expectation of a reduction in MTRs. That may be true, but we note that they would not have expected the exact rate (for example, Three told us that [✂]; see W/S Ness §§3.46–3.48) and that feeding through changes in regulated charges to changes in retail prices necessarily takes some time.
[126] As discussed in paragraphs 5.61 & 5.62 above, we rejected Mr Richardson's arguments for BT that existing postpay customers would become more profitable as a result of lower MTRs.

Section 6: Reference Question 6

Whether (for the reasons set out in paragraphs 5.1 to 5.19 of Three's Notice of Appeal) the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in relying on a costs model that overstated certain costs associated with certain radio equipment, specifically one or more of the items encompassed within the following descriptions in Ofcom's publicly-available costs model:

(a) 2G cell site equipment;

(b) 2G TRXs;

(c) 2G BSCs;

(d) 3G cell site equipment; and

(e) 3G RNCs.[1]

Introduction

6.1 The level of the charge control imposed by Ofcom was based on its estimates of the LRIC of providing MCT in 2014/15. Ofcom's estimates were derived from a cost model. There were many inputs into this model and an important part of Ofcom's charge control process was to decide upon the appropriate values for these inputs.

6.2 Three argued that Ofcom had used costs for certain equipment that were wrongly overstated and as a result had set MTRs too high. There were two main limbs to Three's argument. First, Three argued that evidence as to the cost of this equipment, derived from a variety of sources including known prices from manufacturers, showed that the figures used by Ofcom were wrong to a substantial degree. Second, Three argued that Ofcom had incorrectly increased its estimates of these costs in order that its total modelled costs would reconcile better with high-level accounting figures obtained from the 2G/3G MCPs.[2] An important point of discussion is the use of 'bottom-up' and 'top-down' processes for estimating the values of inputs.

6.3 Three also provided considerable argument and evidence relating to how Ofcom had reconciled its bottom-up and top-down analysis through a process of 'calibration'. This, it said, supported its claim relating to radio equipment costs.

6.4 Our determination is structured as follows:

(a) Ofcom's decision in relation to the input data and cost modelling approach;

(b) Three's challenge as in its NoA, and BT's SoI in support of Three;

(c) Ofcom's Defence and the SoIs from Vodafone, EE and Telefónica in support of Ofcom;

(d) Three's Core Submission and Ofcom's Core Submission and other information; and

[1] TRX—transceiver. BSC—base station controller, RCN—Radio Network Controller.
[2] The 2G/3G MCPs were O2, Orange, T-Mobile and Vodafone. Three is a 3G-only MCP.

(e) assessment of the arguments presented and conclusions.

Ofcom's decision

6.5 Ofcom's overall approach was to obtain bottom-up data relating to equipment costs from the MCPs to populate a bottom-up model and to obtain top-down accounting data to ensure that the overall result was reasonable. It brought these together through its calibration process. It discussed its approach in its Statement:

> The MCT cost model is a BU [bottom-up] model of network costs. This means that cost components are identified at a granular level and cost causation relationships are defined to link the quantity of each of these cost components with outputs and other cost drivers. Once this BU [bottom-up] model is built, we calibrate parts of the model against financial and network parameter data from the national MCPs. This is done to ensure that our model of a hypothetical efficient operator reasonably matches the infrastructure deployment of the national MCPs (at an average level).[3]

6.6 Ofcom described its approach as a 'hybrid' of the bottom-up and top-down approaches:

> In this charge control, as in previous MCT cost modelling, we are using a hybrid approach, with the intention of capturing the strengths of both top-down and bottom-up approaches. The model has been developed as a BU [bottom-up] cost model, but it has also been calibrated by adjusting the unit replacement cost levels and cost causality relationships of different cost components, so as to ensure the model is reasonably in line with the national 2G/3G MCPs' actual costs in historical years.[4]

Input data for Ofcom's cost model

6.7 Ofcom obtained initial data for cost benchmarks from stakeholder submissions and answers to data requests.[5] Ofcom used these as the basis of its initial bottom-up cost estimates for 2014. Part of this process involved the adjustment of equipment costs as they change (typically decline) over time. Three did not challenge that aspect of Ofcom's process.

6.8 Ofcom requested data relating to network equipment volumes ('asset counts') and accounting costs from the national MCPs. These were key inputs for its calibration process. Ofcom said that although none of the national MCPs had been able to provide complete responses to its detailed request, it regarded the information received as sufficiently comprehensive for calibrating its BU (bottom-up) cost model.

6.9 Ofcom's calibration process involved adjustment to a number of inputs so that high-level metrics of the modelled hypothetical MCP corresponded well to those of an average efficient national MCP.[6] Ofcom's process entailed calibrating both 'asset counts' (the number of assets of various types required by the hypothetical operator) and costs. The aim of the asset count calibration exercise was to ensure that the

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[3] Ofcom's Statement, §9.62.
[4] Ofcom's Statement, Annex 7, §A7.2.
[5] Ofcom Defence, Annex C, §§22–25.
[6] Ofcom's Statement, Annex 7, §A7.11.

high-level asset counts produced by the model were consistent with those of national MCPs.[7] The aim of the cost calibration exercise was to adjust model inputs so that the levels of gross book value (GBV), net book value (NBV) and operating costs (opex) produced by the model were broadly consistent with average operator data.[8]

6.10 Ofcom consulted on this charge control based on its 2010 Model. Various points were raised by stakeholders and Ofcom responded to these.[9] In particular, Ofcom agreed that the inclusion of handset costs in the GBV and NBV calculation (a point raised by Vodafone) was incorrect and so Ofcom amended its calculation in the 2011 Model. Other changes were also made to the 2011 Model in response to the consultation.

6.11 Ofcom said that having considered stakeholder responses and further refined key input parameters, it considered the 2011 Model to be well calibrated to an average efficient national 2G/3G MCP.[10]

Three's NoA

Introduction

6.12 Three argued that Ofcom had set rates too high because in the 2011 Model it had relied on costs associated with certain items of radio access network equipment ('radio equipment'[11]) that were wrongly overstated.[12] It provided detailed cost estimates to support this claim. These cost estimates covered 2G TRXs and 2G BSCs, 2G macro-, micro- and pico-cell equipment, 3G macro-, micro- and pico-cell equipment and 3G RNCs. We refer to these as 'radio equipment'.[13]

6.13 Three said that one reason these costs had been overstated was that Ofcom had wrongly increased the input costs associated with the radio equipment when it had made adjustments to the 2010 Model to reconcile the 2010 Model's predictions with the top-down historical data. Three noted that the 2010 Model had included lower radio equipment costs than the previous 2007 Model. Three said that for the 2011 Model, Ofcom had replaced input costs used in the 2010 Model with those from Ofcom's 2007 Model. Three argued that Ofcom's process whereby it made these adjustments was not consistent with the Recommendation (see paragraph 6.16). Three argued that Ofcom should not have increased these input costs, but rather the 2010 Model cost inputs had been too high and should have been reduced on the basis of the 'bottom-up' evidence.[14]

6.14 Three said that the effect of Ofcom reversing its earlier radio equipment cost reduction (ie that between the 2007 and 2010 Models) had been to increase the LRIC of MCT in the final year of the charge control by approximately 0.18ppm.[15] Three also provided an estimate of the full scale of the alleged errors (including the reduction it said should have been made to the cost inputs used in the 2010 Model), indicating

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[7] Ofcom's Statement, Annex 7, §A7.14.
[8] Ofcom's Statement, Annex 7, §A7.32.
[9] Ofcom's Statement, Annex 7, §A7.40 et seq.
[10] Ofcom's Statement, Annex 7, §A7.46.
[11] We have followed Three's terminology ('radio equipment') rather than Ofcom's ('radio asset network equipment'). This is solely for ease of reading and we do not have a view as to which term is more correct.
[12] Three NoA, §1.2.
[13] Three NoA, W/S Hunt.
[14] Three NoA, §2.8.
[15] Three NoA, §2.9.

that the effect on the MTRs in 2014/15 was up to 0.29ppm.[16] It said that there would be a consequent impact in the MTRs in preceding years.

6.15 We set out Three's arguments regarding the modelling of radio equipment costs under the following headings:

(a) the effect of the Recommendation;

(b) evidence of unit costs;

(c) Ofcom's approach to calibration; and

(d) impact on the charge control.

The effect of the Recommendation

6.16 Three stated that in setting a price control for MCT, Ofcom was specifically required by Article 19(1) of the Framework Directive to take the 'utmost account' of the European Commission's Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU*,* C(2009) 3359 final (the Recommendation).[17] It drew attention to the following paragraphs of the Recommendation:[18]

> 1. When imposing price control and cost-accounting obligations in accordance with Article 13 of Directive 2002/19/EC on the operators designated by National Regulatory Authorities (NRAs) as having significant market power on the markets for wholesale voice call termination on individual public telephone networks (hereinafter referred to as 'fixed and mobile termination markets') as a result of a market analysis carried out in accordance with Article 16 of Directive 2002/21/EC, NRAs should set termination rates based on the costs incurred by an efficient operator. This implies that they would also be symmetric. In doing so, NRAs should proceed in the way set out below.
>
> 2. It is recommended that the evaluation of efficient costs is based on current cost and the use of a bottom-up modelling approach using long-run incremental costs (LRIC) as the relevant cost methodology.
>
> 3. NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly.

6.17 Three said that the following recitals to the Recommendation were also relevant:[19]

> (9) In a competitive environment, operators would compete on the basis of current costs and would not be compensated for costs which have been incurred through inefficiencies. Historic cost figures therefore need to be adjusted into current cost figures to

[16] Three NoA, §5.17.
[17] Three NoA, §5.2.
[18] Three NoA, §3.6.
[19] Three NoA, §3.7.

reflect the costs of an efficient operator employing modern technology.

(10) Operators which are compensated for actual costs incurred for termination have few incentives to increase efficiency. The implementation of a bottom-up model is consistent with the concept of developing a network for an efficient operator whereby an economic/engineering model of an efficient network is constructed using current costs. It reflects the equipment quantity needed rather than that actually provided and it ignores legacy costs.

(11) Given the fact that a bottom-up model is based largely on derived data, eg network costs are computed using information from equipment vendors, regulators may wish to reconcile the results of a bottom-up model with the results of a top-down model in order to produce as robust results as possible and to avoid large discrepancies in operating cost, capital cost and cost allocation between a hypothetical and a real operator. In order to identify and improve possible shortcomings of the bottom-up model, such as information asymmetry, the NRA may compare the results of the bottom-up modelling approach with those resulting from a corresponding top-down model which uses audited data.

6.18 Three said that Ofcom was thus obliged to take 'utmost account' of paragraph 2 of the Recommendation which indicated that a bottom-up model should be used. Three said that this meant that the regulator should form a judgement as to what equipment would be needed by an efficient operator and then use the 'current costs' of that equipment derived from information supplied by, for example, equipment vendors. It cited Recitals 9 to 11 of the Recommendation in support of this.

6.19 Three said that there was an obligation on Ofcom to ensure that it used bottom-up cost data that was accurate. It said that paragraph 3 and Recital 11 of the Recommendation indicated that reconciliation with a top-down model should be used only to improve the robustness of a bottom-up model by allowing the regulator to identify and improve possible shortcomings.[20]

6.20 Three said that Ofcom had not followed the Recommendation in its approach to top-down reconciliation of the 2011 Model and/or had not achieved what it set out to achieve because it had erred in the values used for certain bottom-up unit costs.

Evidence of unit costs

6.21 Three argued that the unit costs generated by the 2011 Model for the radio equipment in 2014/15 were incorrect, because these unit costs were derived from historic cost figures that were incorrect. Three characterized these as factual errors. It contended that the unit cost values generated by the 2011 Model for the most recent historic years prior to the taking of the Decision were inconsistent with the historic unit cost evidence.[21,22]

[20] Three NoA, §5.3.
[21] Three NoA, §5.5.
[22] Three said that it focused on 2009 for ease of reference but that the issue applied to all recent historic years. Three NoA, fn 19.

6.22 Three said that its evidence indicated that the costs used in the 2011 Model were overstated by several multiples of the amount.[23] It provided three witness statements which in combination identified the relevant equipment specifications and prices for these.[24] This evidence suggested that, on average, capital unit costs used by Ofcom were typically around [✂] times those estimated by Three and that operating unit costs used by Ofcom were in aggregate around [✂] times those estimated by Three.[25,26]

6.23 Ofcom's model was based on the costs of a hypothetical operator using both 2G and 3G networks. Three is a 3G-only operator and said that it did not have direct evidence of the costs of 2G items. It said that, in estimating the cost of 2G equipment, it relied upon reasonable inferences that could be drawn from the prices for similar more sophisticated equipment. It contended that it could be reasonably inferred that the price of 2G radio equipment would be a similar price to, or—more likely—less than, the price of 3G radio equipment as *(a)* 2G equipment had been produced for longer and was subject to less ongoing research and development and *(b)* all else equal, it was illogical to pay a premium for less sophisticated and more outdated equipment.[27]

6.24 As well as direct cost evidence, Three said that the following evidence was relevant:

(a) Ofcom had reduced both unit capital costs and unit operating costs for the radio equipment in the 2010 Model from the 2007 Model on the basis of bottom-up evidence.

(b) Ofcom had subsequently reversed these reductions to address the disparity between reported and predicted GBV.

(c) There was no suggestion in Ofcom's decision or elsewhere that the radio equipment costs in the 2011 Model, or the adjustments from the 2010 Model values, had been justified by any evidence of actual historic unit costs.[28]

Ofcom's approach to calibration

6.25 Three said that Ofcom's calibration exercise and flaws in it provided further evidence that radio equipment costs in the 2011 Model were wrong.[29] It argued that:

(a) Ofcom had erred in calibrating GBV over the period 2006 to 2009 only and/or in concluding that the 2011 Model calibrated well if the GBV predicted by the 2011 Model for 2006 to 2009 was similar to that reported by the national MCPs for the same years. It said that Ofcom's GBV calibration exercise ought to have covered a substantial proportion of the maximum asset life of the installed assets.[30]

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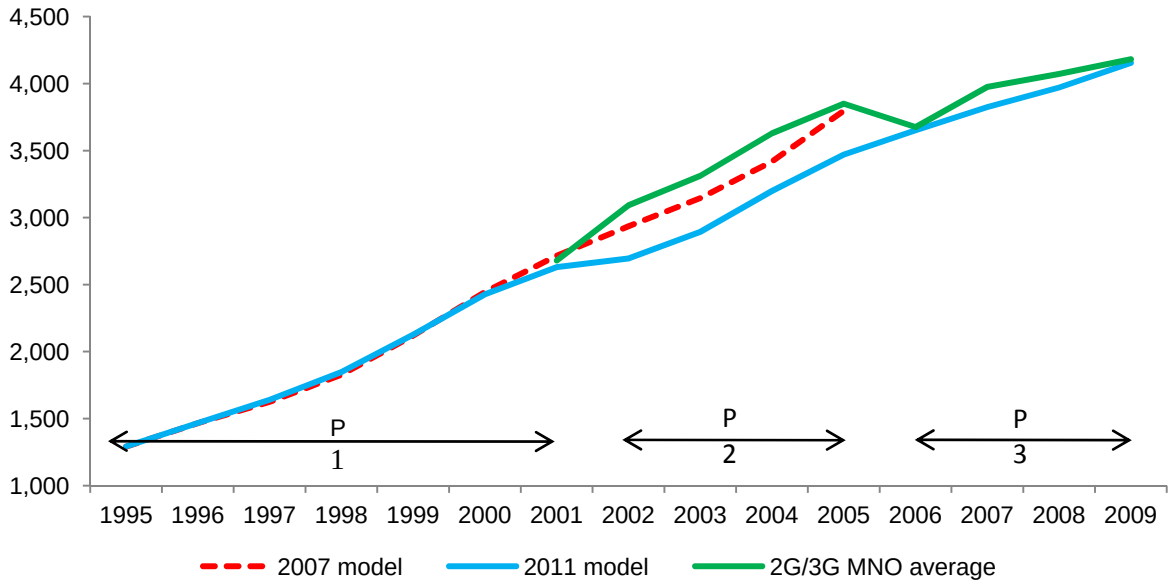
[23] Three NoA, §5.7.
[24] Three NoA, W/S Binucci; Three NoA, W/S Mantzos I; & Three NoA, W/S Hunt.
[25] Three NoA, W/S Manzos I, Table 2 and Table 3. Indicative figures of [✂] and [✂] times based on CC calculation of the average of the percentage difference in the costs shown between 2011 Model column and the column from W/S Hunt. These indicative figures are not weighted by numbers deployed, or by the costs of the assets.
[26] We note that two items listed in Three's NoA, W/S Manzos I, Table 3 drive this [✂] times figure. 3G RNCs and 2G BSCs are 36 times and 39 times greater in the model than in Mr Hunt's witness statement (CC calculation). No party has highlighted this or suggested that it should affect our view of Three's case.
[27] Three NoA, §5.9.
[28] Three NoA, §5.10.
[29] Three NoA, §5.12.
[30] Three NoA, §5.13(a).

(b) Ofcom's 2011 Model did not calibrate well over a longer period. The 2011 Model significantly understated actual GBV for the period 2001 to 2005.[31] It said that whilst the GBVs predicted by the 2007 and 2011 Models were closely matched for the period 1995 to 2001 ('P1'), and at the end of the period both closely match actual GBV, the 2011 Model understated actual GBV, and also predicted lower GBV than that predicted by the 2007 Model for the period 2002 to 2005 ('P2'). It illustrated this claim with Figure 6.1 below.

FIGURE 6.1

Network GBV (£m)



Source: Three NoA.

(c) The understatement during period P2 had been caused by the 2011 Model understating the cost of new assets deployed during P2. This could be due to an understatement of either unit cost or the number of assets or a combination of both; asset cost was more likely to be the issue because the number of assets was less likely to be wrong.[32,33] Mr Mantzos said that it was less likely that the asset count at the end of P2 in 2005 was understated, because unlike Ofcom's GBV calibration, which only started in 2006, Ofcom's asset count calibration explicitly covered 2005.[34]

(d) Absent other adjustments, understatement of unit costs in period P2 could be expected to result in GBV in period P3 also being understated. Ofcom proceeded on the basis that error was in relation to period P3 when it was likely to have been solely or mainly in relation to period P2.[35]

(e) With no correction in P2, the only way the model could generate a GBV matching actual data in P3 was to overstate the cost of new assets deployed in P3.[36]

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[31] Three NoA, §5.13(b) & Figure 1.
[32] Three NoA, W/S Mantzos I, §5.16.
[33] Three NoA, §5.13(c).
[34] Three NoA, W/S Mantzos I, §5.17.
[35] Three NoA, §5.13(d).
[36] Three NoA, §5.13(e).

(f) The conclusion that P3 asset costs were overstated is supported by comparison of the GBV and NBV calibrations—the widening gap between the results during P3 indicated that P3 unit costs were overstated.[37]

(g) If Ofcom had sought to correct the GBV discrepancy in P2 by adjusting the cost of new assets in P2, it was likely to have improved the GBV reconciliation for P3 even though P3 new asset costs were the same (or reduced). As 2014/15 costs were based on reductions from current costs, a correction limited to P2 would not materially affect LRIC values for 2014/15, whereas a correction relation to P3 would have this effect.[38]

6.26 Three said that it did not challenge the use of top-down calibration in principle. However, it said that 'Ofcom ought to have continued to ensure the model made sense from a "*bottom-up*" perspective at all times given the requirement of the Recommendation to use a bottom-up model and Ofcom's objective to do exactly that'. Three said that when reconciling GBVs, Ofcom had to ensure that any adjustments it made were consistent with the other evidence available to it. Three alleged that Ofcom had erred in adjusting the cost figures in a manner that was inconsistent with the actual prices observed in the market. If in doubt, Ofcom should have preferred its evidence of specific historic unit costs over the less certain conclusions to be drawn from difficulties in reconciling aggregated historic GBV data.[39]

6.27 Three argued that the calibration exercise in respect of operating costs provided further evidence that the recent unit operating costs were likely to be overstated.[40]

Impact on the charge control

6.28 As set out in paragraph 6.14, Three said that correcting the error would reduce LRIC and thus the MTRs in 2014/15 by up to 0.29ppm.[41] Mr Mantzos said that decreasing the recent unit capital and operating costs for radio equipment in the 2011 Model would not mean that other recent unit costs within the model would have to be increased in order to maintain top-down calibration.[42]

6.29 Mr Mantzos said that it did not follow that there would be any counterbalancing effect on unit costs in 2014/15 or on LRIC as:

(a) such increases to recent unit costs for non-radio equipment would need to be supported by bottom-up evidence; and

(b) in the case of GBV calibration, decreases in unit capital costs for radio equipment during P3 would be counterbalanced by changes required to improve GBV calibration by increasing asset costs during P2.[43]

6.30 He said that in an ideal world, and subject to proportionality considerations, a comprehensive recalibration over the whole modelling period would be performed alongside the necessary reductions in recent unit capital and operating costs for radio equipment. However, should this prove difficult or be considered disproportionate in the time available during the appeal, he considered that the weight of both

[37] Three NoA, §5.13(f).
[38] Three NoA, §5.13(g).
[39] Three NoA, §5.14.
[40] Three NoA, §5.15.
[41] Three NoA, §5.17.
[42] Three NoA, W/S Mantzos I, §5.44.
[43] Three NoA, W/S Mantzos I, §5.46.

bottom-up and existing top-down evidence was sufficient to support a reduction in recent P3 unit costs, deferring a full recalibration of the model to Ofcom's next review of MCT charges.[44]

BT's SoI in support of Three

6.31 BT said that as a significant purchaser of electronic telecommunications equipment (albeit not radio equipment), it would fully expect equipment costs to decline over time given the effect of efficiencies, of competition between suppliers, and of advances in technology.[45]

Ofcom's Defence

Overview

6.32 Ofcom said that Three had presented its case as an alleged factual error, when Three's complaint really related to Ofcom's calibration of its model which it said was a matter of regulatory judgement.[46] It also said that Three attached inappropriate weight to its own experience as regarded the costs of specific individual items.[47]

6.33 Ofcom said that the primary objective of the 2011 Model had been to identify the LRIC of MCT. Information on aggregate level costs was likely to be more robust than the more granular cost information on which Three sought to rely. This was because:

(a) the model was a simplification of reality and would not capture all the elements or features of a real-world mobile network;

(b) individual network elements would often be purchased as packages or as part of wider deals and/or may involve additional activities (and hence costs) to fully deploy and operate them; and

(c) more granular cost estimates were likely to be vulnerable to the cost-allocation decisions specific to individual operators.[48]

6.34 Ofcom considered that achieving better calibration on the costs of individual network assets (ie pieces of equipment) at the expense of achieving a good fit at the aggregate network level would compromise the robustness of the model. It said that achieving better specification of the costs of individual network elements was desirable, but this should not be at the expense of the accuracy of aggregate-level calibration.[49]

6.35 When compared with the aggregated costs provided by MCPs to Ofcom (both radio-equipment-level costs and total network costs), the 2011 Model provided a closer fit than either of the amended models proposed by Three.[50]

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[44] Three NoA, W/S Mantzos I, §5.48.
[45] BT SoI, §3.
[46] Ofcom Defence, §64.
[47] Ofcom Defence, Annex C, §3(a).
[48] Ofcom Defence, Annex C, §3(b).
[49] Ofcom Defence, Annex C, §3(c).
[50] Ofcom Defence, Annex C, §3(d).

Modelling approach

6.36 The 2011 Model had been based on a hypothetical average efficient operator, using 2G and 3G/HSPA technologies; it was not designed to mirror or replicate any specific MCP. In practice, therefore, for a given MCP, market share, network design, technology choice and costs actually incurred will differ from those of the hypothetical average efficient operator.[51]

6.37 The 2011 Model (like other MCT models prior to 2011) was a 'hybrid' model which sought to draw on the benefits of both a bottom-up and top-down approach.[52,53] As the 2011 Model was based on a 2G/3G MCP, the top-down financial and technical data reported by Vodafone, O2 and EE had been used, rather than the data from Three, which operated only a 3G network (Three's bottom-up data was taken into account in the model[54]).[55]

6.38 The model calibration process was iterative; the benchmarking of financial and technical metrics involved not only the average of top-down data from the MCPs but also the minimum to maximum (min–max) range provided by the top-down data from the MCPs.[56]

6.39 As an example, Ofcom said that if the bottom-up model underestimated network GBV over a number of years, this might be due to many possible alternative parameter assumptions (or combinations thereof). Having identified the most plausible parameter to adjust (or combination of parameters to adjust), the model would then be re-run and the model metrics compared with the top-down data from the 2G/3G MCPs. If the modelled GBV was then better aligned after the second run of the model, and if all other key financial and asset count metrics remained satisfactory compared with MCP top-down data, the calibration process would then cease.[57]

Regulatory judgement

6.40 Ofcom said that the selection and calibration of data involved regulatory judgement at every stage and that choices could not be characterized as binary in terms of right or wrong. In determining the inputs for the model, Ofcom had regard to historic data; but the process was not simply one of plugging in specific items of historical cost information.[58]

6.41 It said that Three's appeal was in substance a challenge to the regulatory judgements made by Ofcom as regarded the level of disaggregated input costs to be used in the model and the adjustments considered necessary in the light of the top-down data supplied by the MCPs. Ofcom considered that Three's appeal was directed at a difficult area of regulatory judgement. In this field, Ofcom as expert regulator should be allowed a generous margin of discretion.[59]

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[51] Ofcom Defence, Annex C, §5–6.
[52] Ofcom Defence, Annex C, §12.
[53] Ofcom sets out its view of these benefits in Ofcom Defence, Annex C, §§8–11.
[54] Ofcom response to CC's Provisional Determination, Appendix 1.
[55] Ofcom Defence, Annex C, §13.
[56] Ofcom Defence, Annex C, §14.
[57] Ofcom Defence, Annex C, §15.
[58] Ofcom Defence, Annex C, §32.
[59] Ofcom Defence, Annex C, §32.

The Recommendation

6.42 Ofcom said that it had had utmost regard to the Recommendation as it was required to do. It said that its approach in using a top-down calibration was correct as a matter of principle and was consistent with the Recommendation.

6.43 Ofcom argued that Three did not clearly explain how it considered Ofcom to have departed from the Recommendation and argued only that Ofcom had adjusted the cost figures in a manner that was inconsistent with the actual prices observed in the market.[60] Ofcom did not consider this to be an error as if the calibration stage was to serve any useful function it may necessitate adjustments to the initial bottom-up inputs.

Overstatement of radio equipment costs

6.44 Ofcom said that Three had provided a snapshot of certain radio equipment assets and relied excessively on individual items of cost data. It said that cost data at this level of specificity provided by a particular MCP must be treated with caution; network components were purchased in different ways and in different combinations by different MCPs and the components listed may omit other relevant categories of costs necessary to fully deploy or operate the assets (referred to as 'wraparound capital costs' by one MCP—see paragraph 6.63*(c)*).[61]

6.45 Ofcom said that comprehensive data at a high level of specificity may be difficult for it to obtain from MCPs and may be of variable quality. It said that:

(a) Three's specific figures for 2G assets were based on inferences.

(b) The cost evidence submitted by Three differed from the cost data which Three had submitted in response to both of Ofcom's section 135 information requests on equipment costs. Ofcom noted that:

(i) the figures in W/S Hunt were higher than those previously provided to Ofcom; and

(ii) in Three's response to the July 2010 information request, the unit costs for the individual radio equipment assets were grouped under a single capex figure.

(c) The shifting nature of the data provided by Three at each stage of the process underlined the variability of equipment costs estimates.

(d) Three's assumptions regarding the costs of micro-cells and pico-cells was not borne out by the bottom-up evidence from Orange and T-Mobile which indicated that micro-cells were less expensive than even one-sector macro-cells and, in turn, pico-cells were significantly less expensive than micro-cells.[62]

6.46 Ofcom said that the aim of the 2011 Model was to estimate the efficient costs of a network as a whole for the purposes of obtaining the costs of a single service (MCT) rather than seeking to estimate the capex and opex associated with individual net-

[60] Ofcom Defence, Annex C, §33.
[61] Ofcom Defence, Annex C, §37.
[62] Ofcom Defence, Annex C, §38.

work assets as an end in itself. As a result, the granular asset cost estimates provided by Three did not provide a sound basis for impugning the 2011 Model.[63]

6.47 Ofcom considered that a more appropriate method of verifying the fidelity of the 2011 Model, and of comparing it with Three's alternative cost estimates, was by reference to the aggregated data received from MCPs which comprised GBV and opex for the radio equipment taken as a whole.[64]

6.48 Ofcom provided a graph to show actual and modelled radio equipment GBV. This showed the actual figures provided by [✂] between 2006 and 2009 and the modelled figures under three scenarios *(a)* the 2011 Model, *(b)* the 2011 Model with radio equipment costs for 2005/06 to 2007/08 as assumed in the 2010 Model and *(c)* the 2011 Model with radio equipment costs for 2008/09 as assumed in the evidence of Mr Hunt, a witness of fact for Three.[65]

FIGURE 6.2

[✂]

6.49 Ofcom said that the figure showed that:[66]

(a) The 2011 Model sat well within the upper and lower bounds of the MCP GBV for the radio equipment (as provided in the response to the July 2010 information request) and the radio equipment GBV in the 2011 Model increased over time in a manner consistent with the actual MCP data.

(b) If the 2011 Model was used with either the asset cost assumptions proposed by Mr Hunt or the radio equipment MEA trends from the 2010 Model, then while the modelled radio equipment GBV would lie within the upper and lower bounds of the MCP data, the modelled GBV would trend downwards from 2008 to 2009, which was at odds with the trend of the MCP radio equipment GBV data.

6.50 Given this, Ofcom considered that the asset investment costs in the 2011 Model were reasonable both in terms of the level of costs and the trend in costs over time. It said that the alternatives put forward by Three did not perform as well against the MCP data since the trend was not consistent with the trend in the MCP data.[67]

6.51 Ofcom undertook a similar exercise with regard to opex costs; it said that the opex costs in the 2011 Model lay at the top end of what might be expected but tracked the trend of expenditure well. Ofcom said that the figures implied by Three were for some years closer to midpoint but the step change profile was at odds with actual data.[68]

FIGURE 6.3

[✂]

[63] Ofcom Defence, Annex C, §39.
[64] Ofcom Defence, Annex C, §40.
[65] Ofcom Defence, Annex C, §40.
[66] Ofcom Defence, Annex C, §§41–42.
[67] Ofcom Defence, Annex C, §43.
[68] Ofcom Defence, Annex C, §44–46.

6.52 Ofcom said that opex costs represented a smaller share of radio equipment accounting costs than capital costs—even on Three's case its revisions to opex contributed less to a change in the level of LRIC than its revisions to capex.[69]

6.53 In conclusion, for both capex and opex, Ofcom rejected Three's claim that its cost evidence rendered the 2011 Model unreliable. In particular, Ofcom submitted that while the specification of the 2011 Model should pay heed to the bottom-up costs provided by MCPs, Three's proposed reliance on granular asset cost estimates carried a serious risk of understating the true level of costs considered in the round.[70] It pointed to its comparison of the 2011 Model and Three's proposed alternatives with the available data for radio equipment costs as a whole; and to comparison with total network costs—see Figures 6.2 and 6.3 above and Ofcom Defence, Figures C4 and C5.

Calibration

GBV and NBV—network level

6.54 Ofcom said that the calibration undertaken for the 2011 Model was, and remained, appropriate as:

(a) Calibration over a longer period would be possible but would risk being disproportionate, since:

(i) the timing of MCP 3G roll-outs was different and may be the cause of the average MCP GBV increasing markedly around 2002 and then declining significantly around 2006;

(ii) GBV had a 'memory' which meant that calibration even in a single year included information on past periods (up to equipment lifetime); and

(iii) achieving calibration on the multiple finance and asset count metrics increased the complexity of the exercise.[71]

(b) The four-year period for financial metrics used in the 2011 Model exceeded that used in the 2010 Model (in which a three-year period was used). No one had challenged the 2010 Model calibration period as part of the consultation.[72]

(c) A period of four years was towards the upper end of the period used in previous market reviews.[73]

6.55 Ofcom did not consider that it had erred in its approach to calibration or that its modelled radio equipment costs (taken as a whole) were overstated. It said that more generally, the diagnosis offered by Mr Mantzos appeared to overlook other explanations for the observed relationship between actual and modelled GBV. In particular, Ofcom observed that the modelled GBV being below the MCP average 2002 to 2005 (ie P2) could be a reflection of MCP investment cycles rather than the alleged understatement of new assets deployed in P2. It said that in periods of significant investment, capex would increase, causing GBV growth to be above average in such

[69] Ofcom Defence, Annex C, §47.
[70] Ofcom Defence, Annex C, §48.
[71] Ofcom Defence, Annex C, §50(a).
[72] Ofcom Defence, Annex C, §50(b).
[73] Ofcom Defence, Annex C, §50(c).

periods, and the step change in the MCP GBV from 2002 corresponded to a period in which there was significant 3G network rollout.[74]

6.56 Ofcom did not accept that the comparison of modelled and actual NBV could be relied on to support the claim that Ofcom had overstated the cost of replacing radio equipment assets in the period 2006 to 2009 (ie P3). It said that it placed greater weight on GBV calibration than on NBV calibration as:

(a) top-down NBV data would be sensitive to differences and changes in the depreciation approaches employed by the MCPs; and

(b) NBV would be more sensitive to a change in capex in a given year than would GBV as a given amount of capex would have a bigger proportionate impact on NBV than GBV.[75]

6.57 Ofcom considered that the 2011 Model calibrated better in terms of GBV than would the alternative versions of the 2011 Model based on the assumptions underlying Mr Mantzos' calculations.[76]

6.58 It said that uplifting unit investment costs in the period 2002 to 2005 (ie P2) could not be presumed to have an immaterial effect on the LRIC of MCT in 2014/15. This was because the 2011 Model outputs were based on an ED approach in which the path of unit costs were determined by three factors: lifetime traffic, the MEA trends for all assets over the lifetime of the network, and the requirement that all costs be recovered (in present value terms).[77]

6.59 With regard to Three's view that Ofcom should have ensured that the model continued to make sense from a bottom-up perspective at all times, Ofcom said that Three placed excessive reliance on the individual items of bottom-up cost data.[78]

6.60 In conclusion, Ofcom maintained that the 2011 Model was well calibrated with respect to GBV and this conclusion was not contradicted by the evidence on NBV, particularly given Ofcom's view that GBV should be given primacy.[79]

Opex—network level

6.61 Ofcom said that in comparing 2001 and 2009 alone, the modelled opex increased more than the average operator opex. Ofcom said it was notable that the opex trend in the 2011 Model tracked the operator average well until 2008 and it was only in 2009 that the modelled opex trend diverged from the actual data. It was very difficult to judge whether the decline in MCP average opex in 2009 was a one-off event which would reverse the following year (as was the case between 2005 and 2007) or whether the decline was a structural shift. Moreover, the modelled opex was well within the min-max range of the MCP top-down opex.[80]

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[74] Ofcom Defence, Annex C, §52.
[75] Ofcom Defence, Annex C, §53.
[76] Ofcom Defence, Annex C, §54.
[77] Ofcom Defence, Annex C, §55.
[78] Ofcom Defence, Annex C, §56.
[79] Ofcom Defence, Annex C, §57.
[80] Ofcom Defence, Annex C, §§59–61.

Vodafone's SoI in support of Ofcom

6.62 Vodafone said that whether or not Three was correct in its assertion regarding the costs of procurement of radio equipment, it was incorrect in its assertion that the adoption of lower costs for the procurement of radio equipment should be implemented without any other change. Vodafone said that, given that Ofcom's calibration of the model outputs to actual operator outputs was reasonable—even if it were correct to reduce the costs of procuring radio equipment—it would be necessary to increase the costs of other modelled assets in a manner that would allow the model to achieve overall calibration. In such circumstances, a correction of any error in the assumed costs of procuring radio equipment would need to be accompanied by a reassessment of the assumed costs of other classes of modelled assets in order to achieve a successful calibration.[81]

6.63 Vodafone made the following points:

(a) The model was of necessity a simplified model of a real mobile network, and recognized only 80 classes of assets, which were used to represent a much larger range of assets deployed in a real world network. In order to represent the totality of the network, unit costs adopted in the model must be adjusted.[82]

(b) A fundamental difficulty with Three's proposed approach was that it focused only on the unit costs for certain network assets, and did not recognize that the overall objective of the model was to achieve calibration at a higher level of generality.[83]

(c) Three's approach of relying on external supplier prices to estimate the unit costs of specific assets was flawed as it ignored both the costs necessary fully to deploy or operate such assets and any uplift to recognize the costs of all network equipment not specifically modelled. Collectively, Vodafone referred to these as 'wraparound costs' which needed to be factored in to any unit cost in the model.[84]

EE's SoI in support of Ofcom

6.64 EE said that in its 2002 MTR determination, the CC had taken the view that 'Comparing the two sets of numbers is the only way of gaining confidence that the numbers that will be relied upon reflect both a reasonable degree of efficiency and are achievable'. It said that in that case, the CC had found that the bottom-up model estimates were likely to understate significantly the level of efficient costs.[85]

6.65 EE argued that this two-level approach was required because cost data at a high level of specificity was unreliable. In particular, there could be significant uncertainty over the appropriate cost level as equipment functionality and economic life could vary for the same type of equipment and different operators might be able to negotiate different combinations of prices as part of their overall agreements with vendors.[86]

6.66 EE argued that Three was on extremely weak ground in this respect, given that:
(a) as a 3G operator it did not purchase and therefore had no direct evidence of the cost of some of the 2G radio equipment falling within the scope of its appeal;

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[81] Vodafone SoI in support of Ofcom against Three, §§2 & 3.4.
[82] Vodafone SoI in support of Ofcom against Three, §3.1.
[83] Vodafone SoI in support of Ofcom against Three, §3.2
[84] Vodafone SoI in support of Ofcom against Three, §3.3.
[85] EE SoI in support of Ofcom, §8.2.
[86] EE SoI in support of Ofcom, §9.1.

(b) assumptions on which Three relied in order to infer certain costs were inconsistent with data submitted by other operators; and *(c)* the equipment cost evidence submitted by Three as part of its appeal differed from the evidence that it submitted to Ofcom during the consultation process.[87]

6.67 Ofcom had commented that the relevant granular cost data provided by operators during its review was 'patchy', and EE said that there was a large range within that data with differences of up to 8.5 times between the unit costs data for specific pieces of equipment.[88]

6.68 EE agreed with Ofcom's explanation as to why its calibration exercise was justified and also agreed that in these circumstances GBV calibration was likely to be the most reliable of the different calibration exercises.[89]

6.69 EE said that the 8.5 times difference in unit cost data it had cited referred specifically to MSCs. It said that for another major cost item, macro-cell sites, the difference was 5.1 times, and other significant cost items had differences of around 3 times. EE found that there were smaller cost items which had even larger difference in the submitted unit cost data than for MSCs (for example, 3G upgrades).[90]

6.70 EE's technical experts examined the differences in the data submitted by T-Mobile and Orange, and found that for some equipment T-Mobile had submitted only hardware costs while Orange submitted the full cost of acquiring and installing the equipment. EE said that network design was another source of differences in the data provided. It said that at the time of the merger T-Mobile had [✂] as many Base Station Controllers (BSCs) as Orange due to having a consolidated, centralized network. However, T-Mobile's BSCs would [✂].[91]

Telefónica's SoI in support of Ofcom

6.71 Telefónica endorsed Ofcom's approach but said that it had nothing to add on this matter.[92]

Three's Core Submission

6.72 Three said that it was striking that none of EE, O2 or Vodafone had sought to contradict Three's factual evidence on the unit costs of radio equipment or present their own competing evidence. It said that the points raised about the quality of its evidence were without merit, and in particular that Three's evidence expressly included all the costs of planning, installation, testing and maintenance, ie the costs Vodafone described as wraparound.[93]

6.73 Three confirmed that its cost evidence submitted in this appeal was different from that previously provided to Ofcom but said that this proved nothing. It said that the original information was caveated and was provided without knowing how Ofcom would use it and without the input of professional advisers. It said that its evidence in

[87] EE SoI in support of Ofcom, §11.
[88] EE Core Submission, §220.
[89] EE Core Submission, §221.
[90] EE letter to CC dated 2 November 2011, p6.
[91] EE letter to CC dated 2 November 2011, p6.
[92] Telefónica SoI (in support of Ofcom in the BT/Ofcom appeal), §3.
[93] Three Core Submission, §11.8(b).

this appeal was intentionally conservative (as supported by Ofcom's point on micro-cells and pico-cells—see paragraph 6.45*(d)*).[94]

6.74 Three opposed as a matter of principle the idea of multiplying the radio equipment costs several times over so as to make allowance for missing costs. It referenced Vodafone's submission in advance of the technical hearing where it was explained that voice call termination used different proportions of different items of equipment and that it could therefore make a significant difference whether costs were allocated to one place or another.[95] Three acknowledged that bottom-up evidence was subject to uncertainties. However, it said that top-down evidence was also subject to significant uncertainties. Because neither top-down nor bottom-up evidence was likely to be perfect, both sources of evidence should be considered and reconciled.[96]

6.75 In response to Ofcom's Defence, Three said that whilst Ofcom had explained some of the uncertainties surrounding bottom-up evidence received for radio costs, these uncertainties were equally present for all asset categories, so there was no valid reason to suppose that any adjustment should have been focused on radio equipment assets. Moreover, it seemed unlikely that there was any valid reason to suppose that the 2007 Model's unit cost values were an appropriate default position: since those values were forecast estimates at the time that model was prepared, they could not have been informed by top-down evidence and must have been based on bottom-up forecasts. It seemed highly unlikely that bottom-up forecasts would be subject to less uncertainty than the reporting of bottom-up actual data.[97]

6.76 Addressing points made in Ofcom's Defence,[98] Three said that Ofcom's argument that Three's alternative unit cost values should be rejected because they resulted in a less good fit with the top-down information (ie the calibration did not work) was flawed. Three said that its complaint referred only to unit costs in 2009 and beyond, not to unit costs in preceding years. It said that it did not have access to the detailed information Ofcom had, or should have had, in order to suggest a path of unit costs in preceding years, and that Three had proposed no such path. It said that it was therefore not possible to infer GBVs or NBVs from the unit costs it had proposed.[99]

6.77 Three considered that Ofcom's exclusive use of top-down evidence, rather than bottom-up evidence, directly contravened the Recommendation, which explicitly warned against such action: 'However, any modification of the bottom-up model must take into account the necessity of showing the costs of an efficient operator; it should not be done merely to bring the results of both models closer'.[100]

Ofcom's Core Submission

6.78 Ofcom's Core Submission reiterated a number of points made in its Defence. In addition, Ofcom said that:

(a) Its bottom-up cost modelling represented a simplification of the reality: it took some 80+ individual assets as the basis for estimating the costs associated with a mobile network. The purpose was not to estimate the capex and opex associ-

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[94] Three Core Submission, §11.8(d) & (e).
[95] Three Core Submission, §11.8(c).
[96] Three Core Submission, §11.15.
[97] Three Core Submission, §11.17.
[98] Ofcom Defence, Annex C, §§40–63.
[99] At Three's hearing, Mr Mantzos disputed the calibration line Ofcom attributed to Three's evidence in its Defence. Ofcom responded to this, noting as a matter of factual accuracy that Mr Mantzos had explicitly used the unit costs from the 2010 Model to show the impact of his suggested changes to the LRIC. (Ofcom letter to CC dated 23 November 2011, Table 2, p3).
[100] Three Core Submission, §11.18, referencing EC Explanatory Note, §4.1.

ated with any individual network asset as an end in itself, but to produce an estimation of the efficient costs of a network as a whole. Some relevant costs may well be missed by such an approach; and adjustments may therefore be needed at the calibration stage to avoid any serious mismatch with the MCP's aggregated asset cost data.[101]

(b) Such aggregated asset cost data provided a more appropriate method of verifying the fidelity of the 2011 Model than the detailed individual receipts for particular network assets on which Three's case depended. When measured against aggregated GBV data, the 2011 Model assumptions on investment costs performed better than the alternatives proposed by Three.[102]

6.79 It said that if, contrary to Ofcom's submissions, the CC were to conclude that certain radio equipment costs were overstated, then it should be noted that any significant departure from the assumptions of the 2011 Model was likely to require further recalibration of the model, to ensure that the outputs remained appropriate at a network level.[103]

Information from Ofcom

6.80 At the hearing, Ofcom told us that the figures in [✂].[104,105]

6.81 Ofcom's Defence explained that, in response to its 2009 information request, it received bottom-up information on individual network asset replacement costs from Orange, T-Mobile and Three. For equipment groupings within the network, information on at least one of GBV, NBV or opex was provided by Orange, T-Mobile and O2. However, the responses received were somewhat limited in nature and did not provide comprehensive data across all categories.[106] This information was used in the 2010 Model.

6.82 Following the second consultation, Ofcom issued a further information request to the MCPs in July 2010 which included further questions in relation to the replacement costs of individual network assets (including RAN assets) and a question on the opex, capex, GBV, and NBV at a higher level of aggregation (ie by grouping individual network assets). Ofcom said that the responses received were again mixed.[107]

6.83 Ofcom's Defence included the responses of the other operators.[108,109] We note that the data from other operators shows higher costs than those provided by Three but that the unit costs provided by the other operators still appear to be significantly lower than those used in the model. For example:

(a) [✂] data on 3G Macrocell equipment (3 Sector) is a capex unit cost of [✂] (it provides no data on carrier costs).[110] This compares to Mr Hunt's estimate for a

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[101] Ofcom Core Submission, §111(b).
[102] Ofcom Core Submission, §111(c).
[103] Ofcom Core Submission, §111(g).
[104] Ofcom hearing transcript, p144, lines 12–13.
[105] We note that Three in its comments on factual accuracy told us that [✂]. We also note EE's evidence which said that T-Mobile's evidence was for hardware only and not associated costs (see paragraph 6.70).
[106] Ofcom Defence, Annex C, §23.
[107] Ofcom Defence, Annex C, §25.
[108] Ofcom Defence, Annex C, §25, fn 29.
[109] These were received from EE (for T-Mobile and Orange separately) and Three.
[110] Ofcom Defence, Annex C, §25 & Ofcom Defence, exhibit DF4.99.

3G Macrocell equipment (3 sector, 1 carrier) of [✂] and the 2011 Model of £114,553;[111] and

(b) [✂] data on 3G microcell equipment was a capex unit cost of [✂].[112] This compares to Mr Hunt's estimate for 3G microcell equipment (1 sector, 1 carrier) of [✂] and the 2011 Model of £77,492.[113]

Assessment

Introduction

6.84 On the face of it, Three's challenge, supported by evidence showing significant differences in actual compared with modelled radio equipment costs, appears to have merit. Consequently, we scrutinized particularly carefully Ofcom's Defence.

6.85 We have structured our assessment such that we first consider Ofcom's comments on the suitability and correctness of Three's evidence of radio equipment data. Secondly, we consider Ofcom's and Vodafone's argument that the simplified nature of the model means that bottom-up unit costs need to be increased. Thirdly, we consider whether Ofcom placed too much weight on top-down analysis, fourthly whether Three's arguments on calibration support its case and fifthly whether the alleged error is a matter of judgement on which Ofcom should be given substantial discretion. Finally, we give our determination of Reference Question 6.

Three's radio equipment cost data

6.86 Three provided an assessment of the radio equipment costs, which showed the capital costs (in 2009) to be around [✂] of those used by Ofcom and the operating costs to be [✂] of those used by Ofcom (see paragraph 6.22).[114]

6.87 We considered Three's approach to preparing these cost estimates to be reasonable, although we were mindful of the fact that they represented one operator's views and that that operator was not a 2G operator. We noted Ofcom's comment at the hearing that other operators' [✂] and that the figures in Ofcom's annex to its Defence provided a similar picture.

6.88 In order to estimate 2G costs, Three assumed that 2G costs would be no greater than the equivalent 3G costs because *(a)* 2G equipment had been produced for longer and was subject to less ongoing research and development and *(b)* all else equal, it was illogical to pay a premium for less sophisticated and more outdated equipment. We do not consider it unreasonable for Three to assume that 2G and 3G costs were broadly similar, however we note that any number of arguments might be made as to the relative costs. We note that [✂] data also showed the 2G and 3G equivalent equipment (macro-, micro- and picocell) as having the same cost,[115] whilst [✂] data showed 3G equipment as having higher costs than 2G equipment.[116] We regard Three's 2G figures as broad, rather than accurate, estimates.

6.89 In our view the importance of the accuracy of Three's estimates depends upon the context of their use. Three has claimed that Ofcom's figures are several times higher

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[111] Three NoA, W/S Mantzos I, Table 2.
[112] Ofcom Defence, Annex C, §25 & Ofcom Defence, exhibit DF4.99.
[113] Three NoA, W/S Mantzos I, Table 2.
[114] We note Three's statement that it had used 2009 as an example but said that its arguments applied to all recent years.
[115] Ofcom Defence, exhibit DF4.99.
[116] Ofcom Defence, exhibit DF4.106.

than the appropriate figures (see paragraph 6.22), so it is not essential that Three's estimates are highly accurate for it to succeed.

Ofcom

6.90 Ofcom identified a number of issues with Three's data (see paragraphs 6.44 and 6.45). It argued that equipment may be purchased in different combinations by different MCPs and may have costs associated with installation (see paragraph 6.44). With regard to installation costs, we note that Three had provided details including its assessment of these (see paragraph 6.72). With regard to the purchasing of equipment in different combinations, we consider that Ofcom had not explained how this might reasonably be expected to create a difference of the scale of the alleged error, or that would substantially contribute to that scale.

6.91 We appreciate Ofcom's point (see paragraph 6.45*(a)*) that Three's specific figures for 2G assets were based on inference, we do not think that the fact that Three does not purchase 2G equipment means that no weight should be placed on its evidence. We note that if we were to look only at the differences between Three's 3G radio equipment costs and the respective modelled costs, the scale of the differences would be [✂] times on capex and [✂] times on opex and so our view that the scale of the difference warranted further scrutiny is not dependent on the 2G data submissions of Three.

6.92 Ofcom argued that Three's evidence on radio equipment costs had changed during the consultation and appeal process and that this underlined the variability of equipment cost estimates (see paragraph 6.45*(b)* and 6.45*(c)*). Three said that this was as a result of it gaining a better understanding of Ofcom's intended use of the information (see paragraph 6.73). This resulted in higher costs being submitted and does not in our view undermine Three's Appeal.[117] Based on Three's original data (ie that available to Ofcom at the time of its decision) the differences between the modelled and actual radio equipment costs would be larger than those we are considering in this Appeal.[118] The scale of the changes in Three's evidence is small compared with the alleged error.

6.93 Ofcom argued that Three's data on micro-cells and pico-cells was not borne out by the evidence from Orange and T-Mobile (see paragraph 6.45*(d)*). Three responded that this demonstrated that its evidence was conservative (see paragraph 6.73); we accept this since it appears that taking account of the Orange and T-Mobile evidence could increase the alleged discrepancy.

6.94 Ofcom identified the difficulties of obtaining consistent information (see paragraphs 6.81 and 6.82). However, we do not think that this rebuts Three's challenge. In our view, none of these points demonstrate that the Three data is fundamentally wrong or likely to be misstated to the scale of the alleged error.

EE

6.95 EE provided evidence that the information provided by MCPs to Ofcom on radio equipment varied by a factor of up to 8.5 and that on significant items differences of over three times were found. EE said that the reasons for these differences related to the capacity of items and also installation costs (see paragraph 6.69). However (as noted above), Three considered its cost assessment to reflect accurately the capacity

[117] Three NoA, W/S Mantzos, Tables 2 & 3.
[118] We recognize that Three did not provide as much information in its original response to Ofcom as it has in this Appeal.

specifications and installation requirements assumed in the model. We found Three's claim persuasive and did not think that the interveners comments undermined this.

Summary

6.96 Ofcom and its supporting interveners have provided argument and evidence that indicates that Three's cost figures *could* be incorrect or poor estimates of the appropriate costs. However the only alternative evidence of costs that has been provided is that in Ofcom's Annex. We do not consider that either the alternative cost evidence or the queries as to the robustness of Three's evidence undermines Three's claim given the scale of differences that Three has highlighted between the bottom-up and modelled data.

Propensity for bottom-up analysis to understate costs

6.97 Three's case depends not only on its cost estimates but also on its arguments that Ofcom's upward adjustment of the equipment costs (effected by replacing the 2011 radio equipment costs by the 2007 radio equipment costs) was incorrect. The propensity for bottom-up analysis to understate costs is one reason why an upwards adjustment could be appropriate.

6.98 Ofcom argued that the aim of the 2011 Model was to estimate the efficient costs of the network as a whole and that the granular cost estimates of Three were not a sound basis for impugning the 2011 Model. It said that the bottom-up approach may result in some relevant costs being missed and that adjustments may therefore be needed at the calibration stage to avoid any serious mismatch with the MCP's aggregated asset cost data (see paragraph 6.78*(a)*). It also said that information on aggregate level costs was likely to be more robust than the more granular cost information on which Three sought to reply (see paragraph 6.33).

6.99 Vodafone argued that the model was a simplification and that there were only 80 asset classes, so to represent the whole network the unit costs of these 80 assets must be adjusted upwards (see paragraph 6.63*(a)*).

6.100 We agree that the bottom-up approach will not necessarily capture every cost and therefore might understate the cost of the total network. However, this observation does not suggest to us that it should be necessary or appropriate to scale up certain bottom-up figures several times over. If the bottom-up model is predicting such a small fraction of certain costs, it would appear to indicate a significant problem with some of the data or with the methodology.

6.101 Whilst we agree that the aggregate level cost data may be more robust (in a general sense) than one operators' detailed cost estimates, we do not think that a general tendency for the bottom-up model to understate costs is a reasonable explanation for the difference between Three's estimates and Ofcom's modelled radio equipment unit costs.

6.102 We are persuaded by Three's view (see paragraph 6.75) that the uncertainties Ofcom described in the radio equipment data are present for other assets too, and we accept Three's point that voice termination uses different proportions of different equipment, so the category to which costs are allocated may be important. Given this, we consider that the bottom-up evidence is important, and we do not agree with Ofcom's view that it is too granular to be a basis for rejecting the 2011 Model.

Weight placed on top-down analysis

6.103 We considered whether Three had shown that it was incorrect for Ofcom to adjust the radio equipment costs in the way it had in order to take account of the top-down data.

The Recommendation

6.104 Three argued that Ofcom placed too much weight on top-down data. It argued that favouring the top-down evidence exclusively was contrary to the Recommendation. Three said that given the Recommendation, Ofcom ought to have continued to ensure that the model made sense from a bottom-up perspective at all times (see paragraph 6.26).

6.105 Ofcom said that it had had utmost regard to the Recommendation, as it was required to do, and that its approach in using a top-down calibration was correct as a matter of principle and was consistent with the Recommendation (see paragraph 6.42).

6.106 Ofcom said (see paragraph 6.53) that bottom-up data would understate the costs of a network, and that relying on it too heavily was wrong. It reiterated this in its Core Submission (see paragraph 6.78*(a)*). It said that if the calibration stage was to serve any useful function, it may necessitate adjustments to the initial bottom-up inputs.

6.107 We consider the Recommendation to be relevant to our determination, although not necessarily decisive as Ofcom may properly depart from it, given sufficient justification. Having adopted an approach that it stated to be consistent with the Recommendation, and in light of the requirement that it has utmost regard to the Recommendation, if Ofcom had then purposely departed from particular aspects of that approach, we would expect Ofcom to provide reasoning to justify this decision.

6.108 Our reading of the Recommendation is that it recommends the use of a bottom-up model, but that it provides for regulators to undertake a reconciliation with the results of a top-down model, first in order to produce robust results and to avoid large discrepancies, and secondly in order to identify and improve possible shortcomings in the bottom-up model.

6.109 Ofcom described its own approach as a 'hybrid' (see paragraph 6.6). Whether Ofcom's approach departs from the Recommendation would appear to depend upon what Ofcom's process for resolving differences between the bottom-up and top-down results was, and upon what the Recommendation indicated should be done in these circumstances.

6.110 Ofcom's approach for resolving differences between the bottom-up and top-down results was its calibration process. The 2010 Model used radio equipment costs that had been prepared on the basis of bottom-up evidence, but these figures were replaced with figures from Ofcom's 2007 Model in order to improve the top-down reconciliation which had been worsened as a result of excluding handset costs from the 2011 Model (see paragraphs 6.10 and 6.13). Ofcom has not explained the reason for this change or the rationale for using the 2007 Model's figures other than that this resulted in better overall calibration.

6.111 The Recommendation was not clear as to what should be done in circumstances where there was a discrepancy between bottom-up and top-down data. Point 3 says that NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results, and may make adjustments accordingly. Recital (11)

(see paragraph 6.17) might be taken to suggest that the bottom-up model be improved—this is implied by the second sentence of the recital but not necessarily by the first. However, in our view it is not consistent with the Recommendation for the sole means of dealing with such differences to be to adjust the results of the bottom-up model in order to achieve a better fit with top-down figures.

6.112 Whilst we agree with Ofcom that if the top-down comparison was to serve any useful function, it may necessitate adjustments to the initial bottom-up inputs, it does not follow that the adjustments Ofcom made to radio equipment costs were necessitated in this case. We do not think it necessary that such adjustments should be made without examining the likely causes of discrepancies. In addition we think it possible that there could be issues with the specification or use of the top-down data. Whilst in certain cases Ofcom might have undertaken other steps, such as further checking of bottom-up evidence, none of its statements suggest that this was the process it used for radio equipment. We note Three's view that any adjustment should continue to make sense from a bottom-up perspective (see paragraph 6.26) and that the model should not be modified merely to bring the results closer (see paragraph 6.77).

6.113 We do not think that this process provides an adequate basis for Ofcom discounting bottom-up evidence on radio equipment costs, particularly given the scale of the difference between the bottom-up and top-down figures. In our view, this approach amounted—as claimed by Three—to the exclusion, for all practical purposes, of the bottom-up evidence.

Ofcom's radio equipment calibration

6.114 Ofcom said that rather than using the granular cost estimates of Three to dispute the 2011 Model, a more appropriate method was to compare the 2011 Model with the aggregated data received from MCPs for radio equipment on GBV and opex (see paragraph 6.47). Ofcom provided figures to show the modelled GBV and opex at a radio equipment cost level compared with the minimum and maximum figures provided by the operators.

GBV

6.115 Ofcom provided a figure showing the modelled GBV at a radio equipment level (see paragraphs 6.48 and 6.49, and Figure 6.2). Ofcom said that if the 2011 Model were used with either the asset cost assumptions proposed by Mr Hunt or the radio equipment MEA trends from the 2010 Model, then the modelled GBV would trend downwards from 2008 to 2009, which it said was at odds with the trend of the MCP radio equipment GBV data.

6.116 Three in its Core Submission (see paragraph 6.76) said that GBV and NBV values could not be inferred from its evidence, which related to unit costs only in 2009 and beyond.[119]

6.117 We think that only very limited conclusions relating to Three's claim can be derived from Figure 6.2. The fact that GBV is within the min-max bounds does not mean that the unit cost used going forward is correct. The trend shown in the radio equipment GBV figure (Figure 6.2) is towards the upper end of the min-max bound and whilst

[119] We note that Ofcom said that Mr Mantzos in Table 4 of his witness statement quantified the effect of the alleged error on LRIC and that he explicitly used the unit costs from 2010 Model as well as the radio equipment estimates of Mr Hunt. Ofcom therefore considered that Mr Mantzos' view was factually incorrect because he was willing to use the unit costs in the 2010 Model in other instances. (Ofcom letter to CC of 23 November 2011, Table 2.)

increasing in each period (which is consistent with the min and max bounds) does not reflect either the shape of the upper bound GBV curve (which is stepped), or the gradient of the lower bound curve (which flattens in 2009).

6.118 We are not persuaded that the evidence of a modelled trend line can demonstrate that Three's evidence as to equipment costs for 2009 is wrong or unsuitable because of calibration issues. The disparity that Ofcom identified could equally arise from errors in other points on the line (earlier costs) or from a misassessment of the underlying trend.

6.119 Ofcom also argued that GBV had a memory which meant that calibration even in a single year included information on past periods (see paragraph 6.54*(a)*(ii)). We would agree that the GBV in a single year reflects the cumulative spend to date on assets in use. However, GBV correspondence (between the modelled GBV and MCPs' reported GBVs) of itself does not demonstrate a correct model. This is because GBV is a combination of asset count and asset costs; Ofcom may have a good estimate of GBV in a given year, but have incorrect values for asset count or asset cost in the years making up that cumulative total—this is exactly Three's point.[120] We therefore do not agree with Ofcom that having a GBV in 2009 that fits within the min-max bounds verifies the modelling and underlying assumptions.

Opex

6.120 With regard to radio equipment opex (see paragraph 6.51 and Figure 6.3), Ofcom said that the model was at the 'top end' of what might be expected and 'tracked the trend of expenditure well'. However, the modelled radio equipment opex is above albeit it close to, the upper bound in 2006 to 2008 and clearly exceeds it in 2009. The trend shown by the actual[121] radio equipment data is a decline from 2008. Ofcom was unable to say whether the decline was a structural shift or a one-off (see paragraph 6.61), but the implication is that Ofcom has assumed that it is a one-off as the model does not reflect this decline.

6.121 Ofcom modelled a trend line using its interpretation of Three's claim. It argued that its own modelled trend line was reasonable while that based on its interpretation of Mr Hunt's data produced a step change that suggested that it was unsuitable (see paragraph 6.51). Ofcom suggested that the modelled line based on the 2010 Model assumptions had similar characteristics to its own, although we note that it appears to be better positioned within Ofcom's min-max bounds.

6.122 In our view, the most that Ofcom's figure could show is that the results of its calibration of opex costs are not significantly worse than those arrived at from the 2010 Model data. However, this applies only at the calibration level and does not address Three's claims as to the level of opex costs.

6.123 Thus, in our view, Ofcom's arguments based on its radio equipment GBV and opex charts do not adequately address Three's challenge.

Other calibration points—network level

6.124 Three did not challenge the use of top-down calibration in principle; however, it said that the calibration exercise and flaws in it provided further evidence that the radio

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[120] Ofcom and EE highlighted that the modelled asset counts closely matched the operator average.(Ofcom response to Provisional Decision, Appendix 1, and EE response to Provisional Decision, paragraph 150).
[121] [✂]and [✂] data.

equipment costs in the 2011 Model were wrong (see paragraph 6.25). Three challenged the use of a four-year calibration period and said that the model did not calibrate well over a longer period. It suggested that costs were understated between 2002 and 2005 (P2) and that as a result the model matched GBV in 2006 to 2009 by overstating unit costs in that period. Three's challenge was based on the network level calibrations (GBV, NBV and opex) as opposed to the radio equipment level calibrations Ofcom used in its Defence.

6.125 Ofcom's rationale (see paragraph 6.54*(b)*) for using a four-year calibration period was that no one complained during the consultation and that it was 'towards the upper end' of the calibration periods used in previous reviews.

6.126 Ofcom argued that calibration over a longer period would risk being disproportionate (see paragraph 6.54*(a)*). It said that GBV had a memory—as explained above (see paragraph 6.119), it is not clear how this helps with a potential inter-temporal issue. Whilst the total cost allocated in the period to 2009 might be right, because the unit costs in 2009 are important for forecasting there is difficulty with relying on GBV in total (unless the GBV trend matches very well) as it tells us little about the reliability of the unit cost assumptions in a given year.

6.127 We accept that calibrating over a longer period of time would add to the complexity of the calibration process, but with such a disparity between bottom-up and top-down data it may be appropriate to extend the calibration period. The length of time to be calibrated must be balanced against the evidence coming from the model. If the bottom-up and top-down data were closely aligned, there would be less need to calibrate over a longer period.

6.128 Ofcom suggested that the timing of 3G roll-outs was a possible cause for the P2 GBV discrepancy (modelled and actual) (see paragraph 6.54*(a)*(i)). This may be the case but we have not found it necessary to examine this closely. Three said that the radio equipment issue may be an inter-temporal (ie unit costs being too low in P2 and too high in P3) issue (see paragraph 6.25). Both Ofcom's and Three's suggested explanations for this discrepancy are possible but in our view neither has been demonstrated.

6.129 We agree with Ofcom that there may be difficulties in comparing modelled and actual NBV, as companies follow different depreciation policies etc (see paragraph 6.56). We think it is therefore reasonable to place less weight on the NBV comparison than the GBV comparison. However, we do not consider that the information resulting from the NBV model/actual comparison should be considered to be worthless given that it is part of Ofcom's process. Mr Mantzos compared the network GBV and NBV calibrations to show that there was a possible error with unit costs in recent years. Mr Mantzos used this to suggest that Ofcom should have looked more closely at the radio equipment costs in the model.

6.130 As for the capex calibrations (GBV and NBV), Three has not appealed the opex calibration directly, rather Mr Mantzos used the comparison to show that there were indications that costs in recent years might be overstated. We would agree with this view, the modelled network operating costs exceeded the operator average between 2006 and 2009 (in 2009 by a significant margin).[122] Additionally, the modelled radio equipment opex (provided by Ofcom in its Defence) lies just above the min-max band in 2006 to 2008 and in 2009 clearly exceeds it. As opex calibration is one factor that

[122] Three NoA, W/S Mantzos I, Figure 7.

Ofcom looked at, we would expect it to balance this against the evidence from the other calibrations in assessing the robustness of its Model.

6.131 These arguments (see paragraphs 6.124, 6.125, 6.126 and 6.128) do not in our view lead us to a clear conclusion as to whether Ofcom was right to use a four-year calibration period. Given the discrepancy between top-down and bottom-up radio equipment cost data and the comparison of actual to modelled GBV at network level (Figure 6.1) (showing a poor match for much of 2003 to 2005), as well as the issues in calibration for opex and NBV (over the four-year period that Ofcom assessed), it is possible that Ofcom should have examined this in greater detail.

Overall assessment

6.132 The evidence on equipment costs supplied by Three as part of its appeal, and that supplied to Ofcom during its consultation, indicates that the unit costs assumed for radio equipment in the 2011 Model were overstated relative to the direct evidence on costs available. We consider that Ofcom incorrectly used alternative data (ie 2007 radio equipment figures) in order to achieve a closer fit with the top-down data. Whilst we accept that regulatory judgement is required to come to a decision on the costs to be used in the model, we consider that in this case, given the scale of the differences in the evidence, the alleged error does not fall within the margin of Ofcom's regulatory discretion.

6.133 We recognize that Ofcom has to balance the merits of using bottom-up data with ensuring that its model captures network costs as a whole. Using bottom-up data alone, costs may be omitted as the model is a simplified representation of reality (ie it models only 80 asset classes). However, the bottom-up analysis is crucial as it informs the allocation to asset class and of current unit costs and thereby enables future costs to be predicted. The top-down data used by Ofcom—whilst comprehensive (in terms of the network)—does not allocate data to specific asset types and does not provide a clear indication of current unit costs. We therefore see a role for both bottom-up and top-down analysis.

6.134 Ofcom has relied on the radio equipment GBV being within its min-max bounds. However, this fact, on its own, does not demonstrate that the unit cost assumptions in a given year are appropriate, as the GBV trend line in the model does not track the shape of the trend line in the operator data. Moreover the min-max bounds are wide and we consider them to be only a guide as to reasonability.

6.135 We consider that Three's evidence relating to the GBV, NBV and opex reconciliations collectively cast doubt on the unit costs used by Ofcom. We consider this evidence to be supportive of Three's position.

6.136 We consider that Three's arguments and evidence relating to equipment costs demonstrates that Ofcom should not have relied upon the figures it had used. Our assessment, on the balance of probabilities, is that the 2011 Model overstated the contested radio equipment costs.

6.137 The issue arose because the bottom-up data and the top-down analysis led to substantially different results. We think that Ofcom should have investigated this discrepancy further given the importance of the bottom-up analysis. Instead it has effectively given primacy to the top-down analysis.

6.138 Ofcom provided reasons why Three's evidence might not be accurate, but given the scale of the difference between Ofcom's modelled number and the operator data (from Three and other operators) we do not think that Ofcom's modelled figures for

the appealed items of radio equipment are reasonable. We do not think that the fact that Ofcom's radio equipment costs from the 2007 Model appeared to provide a better reconciliation (at an overall network level) with the top-down analysis was sufficient reason for discarding the 2011 bottom-up data. We therefore consider that Ofcom erred in relying on the radio equipment figures that it used.

Determination

6.139 For the above reasons, we find that Ofcom erred in relying on a costs model that overstated certain costs associated with certain radio equipment specifically with the items described in Ofcom's publicly-available cost model as:

(a) 2G cell site equipment;

(b) 2G TRXs;

(c) 2G BSCs;

(d) 3G cell site equipment; and

(e) 3G RNCs.

Section 7: Reference Question 7

Having regard to the fulfilment by the Tribunal of its duties under section 195 of the Communications Act 2003 and in the event that the Competition Commission determines that the answer to any of the above questions is yes, the Competition Commission is to include in its determinations:

(i) clear and precise guidance as to how any such error found should be corrected; and

(ii) insofar as is reasonably practicable, a determination as to any consequential adjustments to the charge controls.

Introduction

7.1 In the foregoing sections, we have determined that Ofcom has erred in relation to the matters alleged in Reference Questions 3, 4 and 6.

7.2 We are therefore required to include in our determination:

(a) clear and precise guidance as to how those errors should be corrected;[1] and

(b) in so far as reasonably practicable, a determination as to any consequential adjustments to the level of the price controls.

7.3 Accordingly, we address those questions below, adopting the following structure for this part of our determination:

(a) For each of the errors which we have identified, we first set out guidance as to how the errors should be corrected, thereby addressing Reference Question 7(i)—see paragraphs 7.5 to 7.351 below.

(b) We then consider how the price control should be adjusted, addressing Reference Question 7(ii).

7.4 We have been mindful in our assessment of potential remedies and in our conclusions in relation to this reference question that in the setting of remedies to the errors identified we must have regard to the provisions in sections 47 and 88 of the Act.

Reference Question 7(i)

7.5 In this section, for each of the questions in respect of which we have determined that Ofcom had erred in turn, we have sought to provide clear and precise guidance as to how that error should be corrected.

7.6 In relation to each error, we first set out the initial proposals relating to the remedies for that error which we put to the parties in two letters following our provisional determination (our Remedies Letter (1) and Remedies Letter (2)).[2]

7.7 We then summarize the salient points from each party's submissions in respect of the remedies for that error. This includes points from the party's pleadings, its written

[1] Reference Question 7(i).
[2] CC letters of 14 December 2011 and 6 January 2012.

submissions following our provisional determination and further written submissions provided to us at our request subsequently, and those oral submissions made to us during the plenary hearing held to discuss the questions of remedies following our provisional determination (the Remedies Hearing).

7.8 Finally, we set out our own assessment of the appropriate guidance in relation to that error.

General questions in our Remedies Letter applicable to each error identified

7.9 The following principles, proposals and questions set out in our Remedies Letter (1) were of general application to all the instances of error we have identified in this determination. Accordingly, we consider them in the respective assessments of each of those errors in the sections which follow:

(a) We asked whether our provisional findings necessitated adjustments to the price control and if they did, whether we could and should determine such adjustments or whether the adjustment was better remitted to Ofcom.

(b) We also asked what materiality threshold should apply and, in particular, asked for submissions as to the level of materiality that should apply (i) to individual adjustments and (ii) at an aggregate level.

(c) We indicated that we considered the timeliness of implementation to be an important factor in assessing the suitability of any remedy.

(d) We further indicated that we would particularly welcome submissions that had been agreed among the parties. Where agreement on remedies was not possible, we asked that parties nonetheless seek to agree on the appropriate methodology to adopt in determining a remedy. However, we were mindful at all times that it remained our duty to determine the Reference Questions for ourselves.

Interim adjustments

7.10 In response to our Remedies Letters the parties made some submissions regarding the potential for interim remedies in the event that we were to remit all/part of Reference Question 7 to Ofcom.

7.11 Ofcom told us that it would generally prefer to avoid successive modifications to SMP conditions where possible, particularly in a relatively short period of time, in order to avoid disruption to the market and to consumers.[3]

7.12 Three said that if there were to be a remittal of Reference Question 6 this should not be allowed to delay the implementation of a remedy on Reference Question 4.[4] However, it said that any analysis and adjustments to deal with Reference Questions 3 and 6 should be dealt with at the same time and not separately, in view of the clear potential for each process to inform the other.[5]

7.13 Vodafone said that if a remittal was necessary then it would have no objection to the adoption of a so-called first-stage set of adjustments to deal with those that can be resolved at the CC stage, but it would not support that if it resulted in a see-sawing of

[3] Remedies hearing transcript, p14, lines 1–4.
[4] Three remedies submission, §65.
[5] Three remedies submission, §66.

prices down and up again. It said that, for example, it would be acceptable to have a first-round set of adjustments that would be a downward set of adjustments with a view to having a later further downward adjustment if, for example, Reference Question 6 had to be left to be resolved, but it would not be acceptable to have a downward adjustment and then later an upward adjustment if Reference Question 3 were left to be resolved. Vodafone said this was a common-sense consideration, but in principle it did not have an objection to a first-stage adjustment followed by a second-stage adjustment.[6]

7.14 Telefónica said that its view on interim measures depended on the time period that was envisaged, but in principle it agreed with Ofcom that it was preferable, if possible, to avoid a series of sequential adjustments to the price controls, for the sake of avoiding disruption to the industry.[7]

7.15 BT said that if remittal were required on Reference Question 6, then it agreed with Vodafone that an interim remedy on Reference Questions 3 and 4 could, and should, be imposed given the delay that would be cause by any remittal. It considered that such an interim measure would be amply justified.[8]

7.16 EE said that in principal it had no objection to an interim remedy as long as what was being implemented on an interim basis was coherent, ie that it was recalibrated.[9]

Provisional adjustments

7.17 Additionally, Three raised the possibility of a provisional adjustment if remitting Reference Question 6 such that it included a conservative figure in respect of Reference Question 6 as an interim solution.[10]

7.18 Ofcom considered such an approach to not be an 'ideal arrangement', it said that if there was clarity with regard to the final direction it could see this as a practical way forward but as there were different views regarding the direction this resolution may go, then it would be possible that there could be conflicting changes in the short and long term.[11]

7.19 Vodafone considered that a provisional adjustment was not an attractive idea. It said that to the extent that there was controversy over the appropriate adjustment there would equally be controversy as to what would be a safeguard or conservative interim adjustment and agreeing that would distract from the job of agreeing the final position. Vodafone would not want to see a sort of half-way house adjustment that provisionally or partially addressed Reference Question 6.[12]

7.20 EE endorsed Vodafone's comments regarding provisional adjustments—it said that it would not support a sort of half-way house adjustment.[13]

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[6] Remedies hearing transcript, p17, lines 8–20.
[7] Remedies hearing transcript, p36, lines 20–25.
[8] Remedies hearing transcript, p42, lines 11–17.
[9] Remedies hearing transcript, p60, lines 1–8.
[10] Remedies hearing transcript, p51, lines 1–4.
[11] Remedies hearing transcript, p54, lines 3–14.
[12] Remedies hearing transcript, p57, lines 19–25, and p58, lines 1 & 2.
[13] Remedies hearing transcript, p60, lines 9–11.

Correcting for the errors in Reference Question 3

Our initial proposals

7.21 In our determination of Reference Question 3, we concluded that Ofcom had erred in relation to the 2G/3G MSC cost driver, the weekend/weekday data split and the historic datacard market share (the Reference Question 3 errors).

7.22 In our Remedies Letter (1) we requested the parties' submissions as to whether proper interpretation of the pleadings in relation to the errors identified under reference question 3 could result in an effect on the calculation of LRIC. We stated that notwithstanding any views on appropriateness, we considered it necessary to address issues of calculation since the appropriateness issue might not have been resolved rapidly.

7.23 We therefore asked Ofcom to submit a proposal (and revised calculations of LRIC) as to how to correct the Reference Question 3 errors and whether for any of the Reference Question 3 errors a consequential adjustment to its top-down calibration was necessary and if so, to provide suggestions for how the relevant recalibration could be performed on which the other parties could comment.[14]

7.24 We also asked the parties whether adjusting the Reference Question 3 errors could result in a reduction of LRIC.[15]

7.25 The parties were invited to comment on whether the appropriate basis for the calculation of remedies included evidence which had become available since the Statement.[16]

7.26 In our Remedies Letter (2) we asked the parties to set out their position in regard to the 2G/3G MSC cost driver error, given Ofcom's correction of 15 October 2011.[17]

7.27 We also asked the parties to comment on the revised model inputs, as proposed by Ofcom in its letter of 5 January 2011,[18] to correct the remaining Reference Question 3 errors (before any adjustment for calibration) and the need for recalibration of the model and how this should be performed.[19]

Submissions from the parties

Summary of Ofcom's submission

Introduction

7.28 Table 7.1 below sets out Ofcom's calculation of LRIC for the period of 2009/10 to 2013/14 in the original charge control, Ofcom's adjusted charge control as of 25 October 2011 (which effectively corrected the 2G/3G MSC cost driver error) and Ofcom's proposed adjustments to LRIC for the historic datacard market share error and the error related to the weekday/weekend split of data traffic (the 'remaining Reference Question 3 errors'). Ofcom made the calculations for the remaining

[14] CC letter to the parties on remedies, 14 December 2011, Appendix 3, paragraphs 5–8 & 10.
[15] CC letter to the parties on remedies, 14 December 2011, Appendix 3, paragraph 2.
[16] CC letter to the parties on remedies, 14 December 2011, Appendix 3, paragraph 10.
[17] CC letter to the parties on remedies, 6 January 2011, paragraph 1.
[18] Ofcom sent very similar proposals to the other parties on 3 January 2011, which informed the other parties' responses to our Remedies letter 1.
[19] CC letter to the parties on remedies, 6 January 2011, paragraphs 2 & 3.

Reference Question 3 errors using the adjusted charge control model from 25 October 2011, which included the effect of the 2G/3G MSC cost driver error adjustment. Ofcom also provided a proposal for recalibration.

TABLE 7.1 **LRIC outputs after Reference Question 3 changes**

ppm, 2008/09 prices

	2009/10	*2010/11*	*2011/12*	*2012/13*	*2013/14*	*2014/15*
2011 Cost Model	0.88	0.89	0.78	0.75	0.72	0.69
2G/3G MSC (Ofcom adj charge control)	0.92	0.93	0.82	0.78	0.75	0.72
Datacard market share (together with 2G/3G MSC)	0.93	0.89	0.84	0.80	0.77	0.74
Data proportion in the weekend (together with 2G/3G MSC)	0.91	0.92	0.80	0.77	0.73	0.70
All three RQ3 errors without recalibration	0.92	0.88	0.76	0.77	0.73	0.70
All three RQ3 errors with recalibration	0.94	0.90	0.79	0.76	0.77	0.74

Source: 2011 Cost model, paragraph Ofcom remedies skeleton, Appendix 4, Figure 9.

7.29 Ofcom's view was that Vodafone had not explicitly pleaded the Reference Question 3 errors in the LRIC calculation, but that Vodafone nevertheless intended these alleged errors to be taken into account in calculating a revised pure LRIC estimate.[20]

7.30 Ofcom did not consider that there was a significant difference between relevant evidence which was before us during the appeal and the evidence which was before Ofcom pursuant to section 135 information requests at the time of the Statement that would inform the correction of the Reference Question 3 errors.[21]

7.31 Ofcom stated that it did not consider that the datacard market share and weekend/ weekday data split errors were material errors.[22]

7.32 Ofcom said it saw no reason for a remittal of any reference question, as it believed there to be a straightforward, pragmatic and timely way of remedying each of the errors we had identified.[23]

2G/3G MSC cost driver

7.33 Ofcom said that no adjustment was necessary for the 2G/3G MSC cost driver error as this error was already adjusted for by Ofcom on 25 October 2011 when it modified the price control subject to the appeal.[24]

7.34 Ofcom said that the 2G/3G MSC cost driver error that it corrected was distinct from the error alleged by Vodafone in relation to the same asset. Ofcom therefore considered when it modified the charge control on 25 October 2011 that it was not within the CC's jurisdiction to correct this computational error, as it did not fall within the scope of any Reference Question in these appeals.[25]

[20] Ofcom remedies skeleton, §17.
[21] Ofcom remedies skeleton, §37.
[22] Ofcom remedies skeleton, §§13–15.
[23] Ofcom remedies hearing transcript, p12.
[24] Ofcom remedies skeleton, §§8, 10 & 12.
[25] Ofcom remedies skeleton, §11.

Weekend/weekday data split

7.35 Ofcom suggested using a 28 per cent share for data at the weekend (and 72 per cent during the week) as this reflected Vodafone's and EE's estimates of this split.[26]

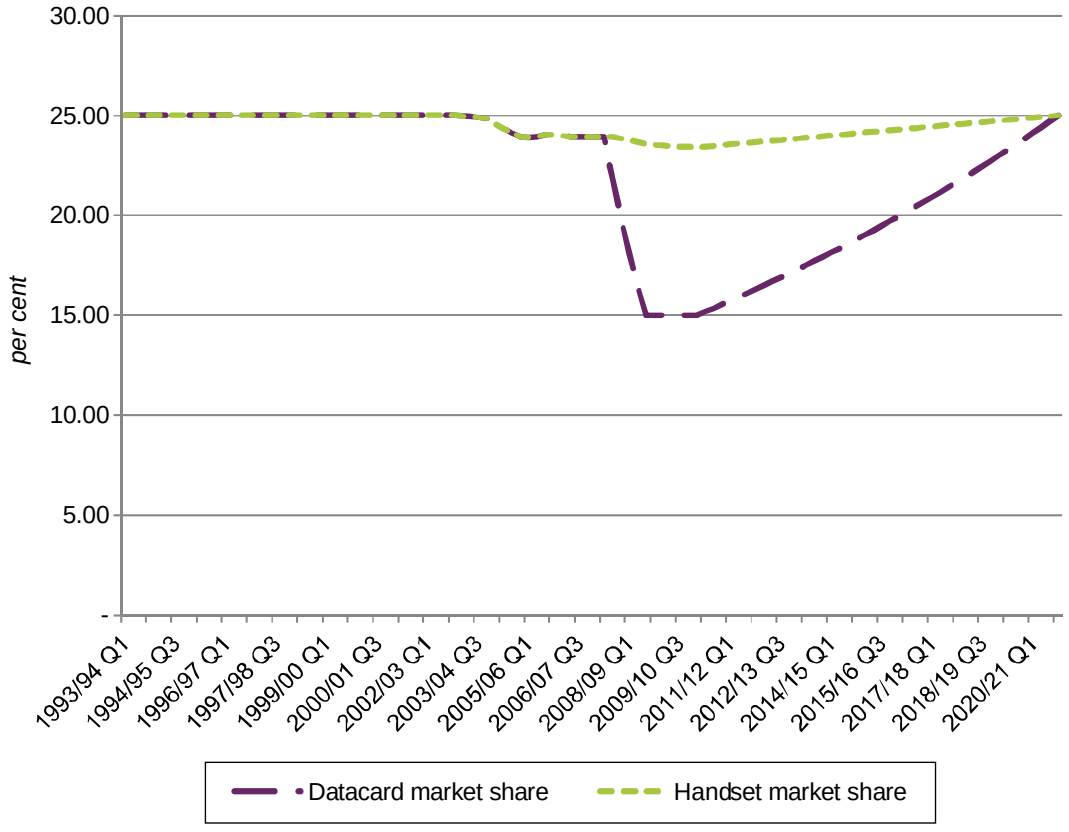
Historic datacard market shares

7.36 Ofcom did not consider that adjustments to the market share for handsets were necessary in order to remedy the historic datacard market share error.[27] Ofcom suggested that only the datacard market share should be adjusted.

7.37 Ofcom proposed to set the datacard market share at the same level as the handset market share until 2007/08 Q3 (ie the earliest date from which Ofcom had section 135 data showing H3G's datacard market share). From this point onwards, the 2G/3G operator datacard market share gradually decreased to 15 per cent by 2008/09 Q3 in Ofcom's proposal. The datacard market share was then held constant at 15 per cent until 2010/11 Q1 (the last quarter for which Ofcom had section 135 data), and gradually increased thereafter to reach 25 per cent in 2020/21.[28] See also Figure 7.1 below.

FIGURE 7.1

Ofcom's proposed datacard and handset market share



Source: Ofcom.

[26] Ofcom remedies skeleton, §§20 & 21.
[27] Ofcom remedies skeleton, §24.
[28] Ofcom remedies skeleton, §23.

Recalibration for Reference Question 3 errors

7.38 Ofcom in its email from 6 January 2012 stated that the model outputs of the 2011 Model and the revised model of 25 October 2011 were the same for calibration purposes.[29] We consider therefore, that Ofcom's comments below referred to the remaining Reference Question 3 errors only.

7.39 Ofcom considered that after the Reference Question 3 adjustments in its model, the financial metrics (in particular GBV and opex), remained reasonably well calibrated to the average 2G/3G MCP data. However, in terms of asset counts, the 3G cell site numbers dimensioned by the adjusted model were a little low compared with the average of the actual MCP data (in particular around 2008 to 2009) and diverged further from the MCP forecasts over time, although these asset counts were still within the min-max bounds of the actual MCP data.[30]

7.40 Ofcom therefore suggested the following calibration adjustments:[31]

(a) a 1 per cent reduction in 3G cell radii in all geotypes for all years in order to bring the modelled 3G cell site numbers into better calibration with the actual 3G cell site numbers; and

(b) a 5 per cent reduction in 3G cell equipment utilization for all years, again in order to bring the modelled 3G cell site numbers into better calibration with the actual 3G cell site numbers.

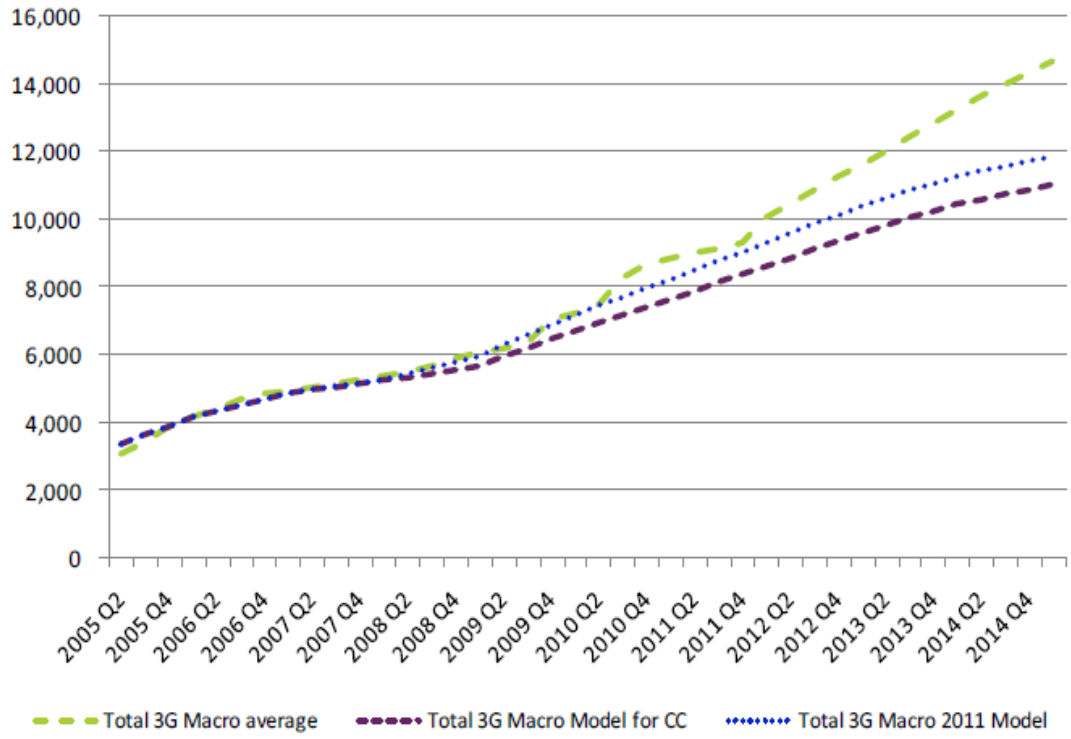
7.41 Ofcom said that the difference between recalibrating (in line with Ofcom's proposal set out above) and not recalibrating was an increase in pure LRIC of 0.04ppm in 2014/15 (ie approximately 6 per cent of the pure LRIC). While Ofcom considered that modest recalibration improved the adjusted model (and that on balance a small degree of recalibration would be beneficial[32]), Ofcom did not consider this to be imperative and Ofcom did not consider that the adjusted model outputs would be flawed if no recalibration was performed in remedying the Reference Question 3 errors.[33]

7.42 Ofcom, in a separate letter, on 6 January 2012 provided the following figures on the overall calibration of the Model after the Reference Question 3 calibration adjustments.

[29] Email from Ofcom to CC, 6 January 2011.
[30] Ofcom remedies skeleton, §26.
[31] Ofcom remedies skeleton, §27.
[32] Ofcom remedies hearing transcript, p8.
[33] Ofcom remedies skeleton, §31.

FIGURE 7.2

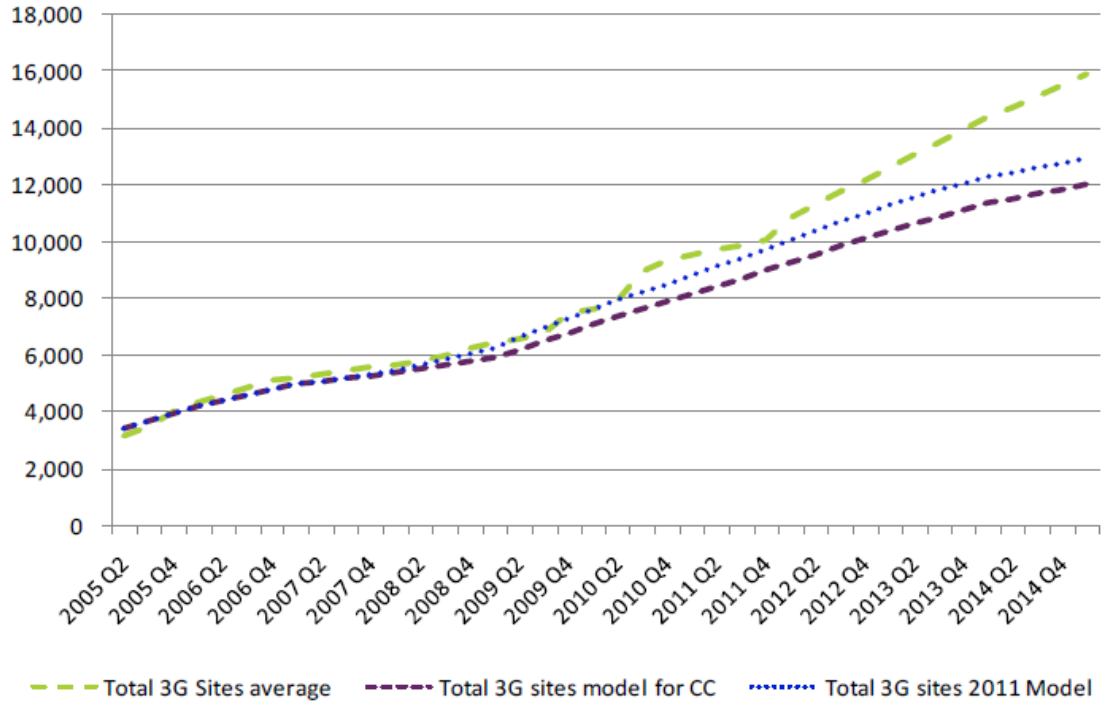
Macro cell site counts after Reference Question 3 changes and recalibration [minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.3

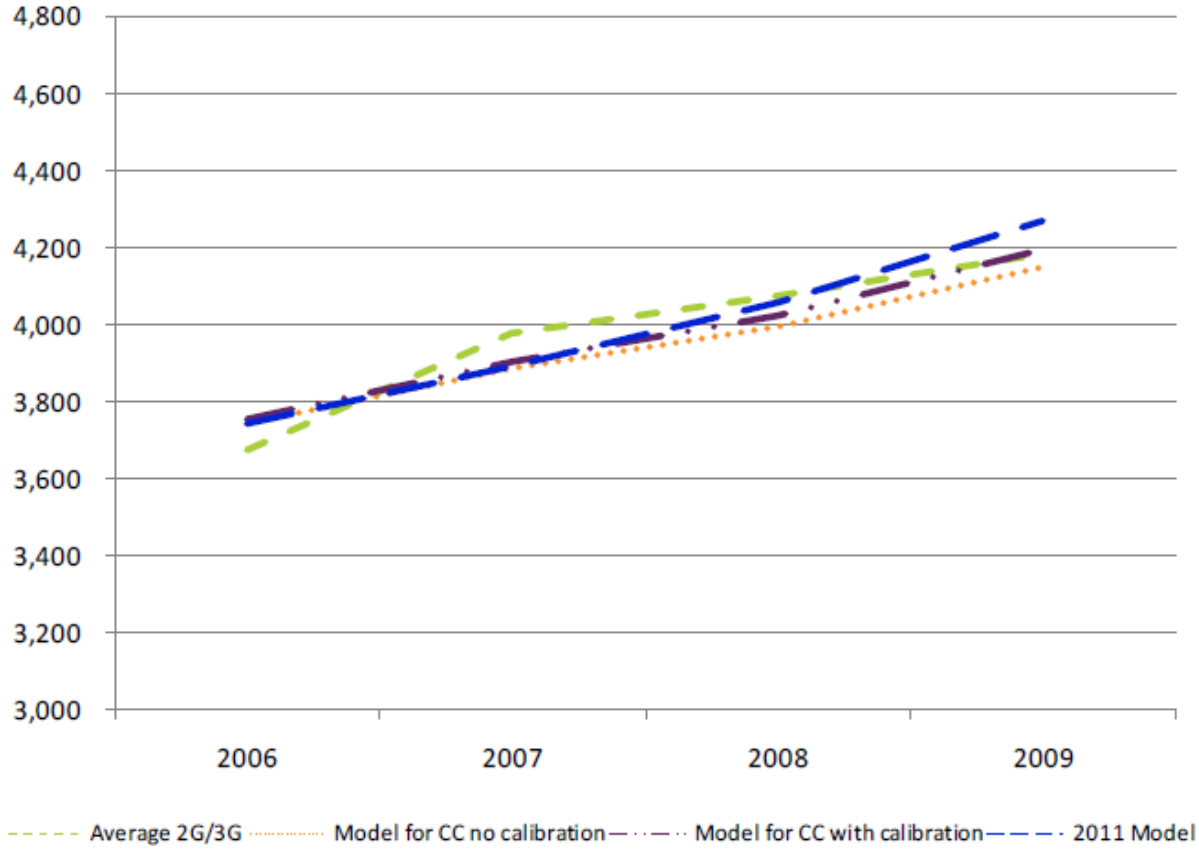
Total cell site counts after Reference Question 3 changes and recalibration [minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.4

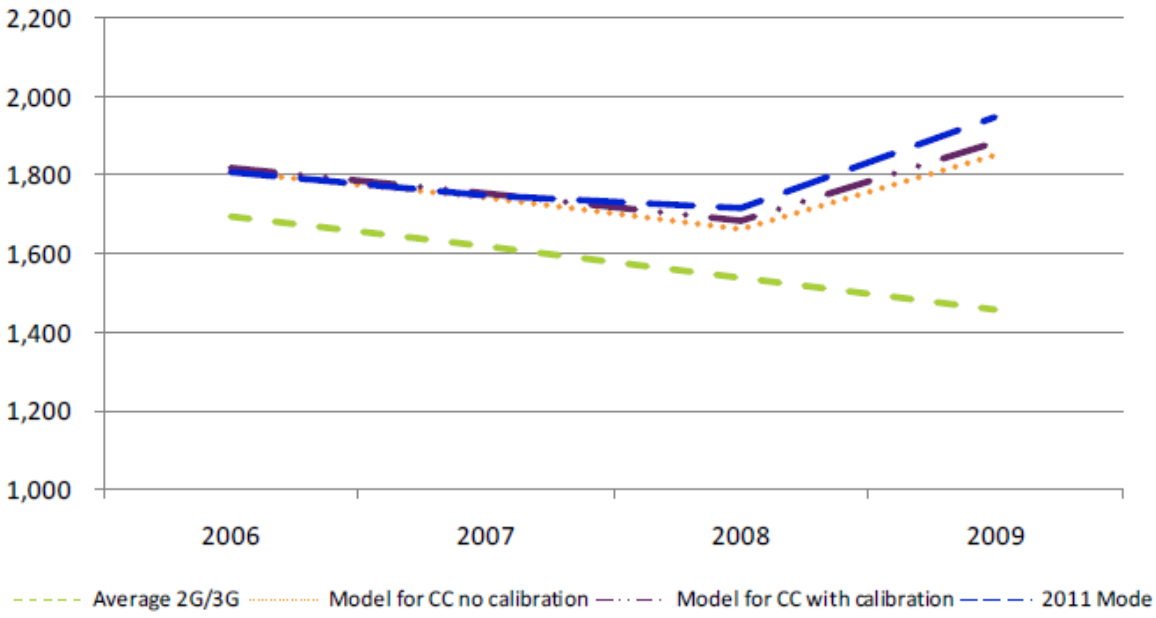
GBV after Reference Question 3 changes—recalibrated and unrecalibrated (£m) [minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.5

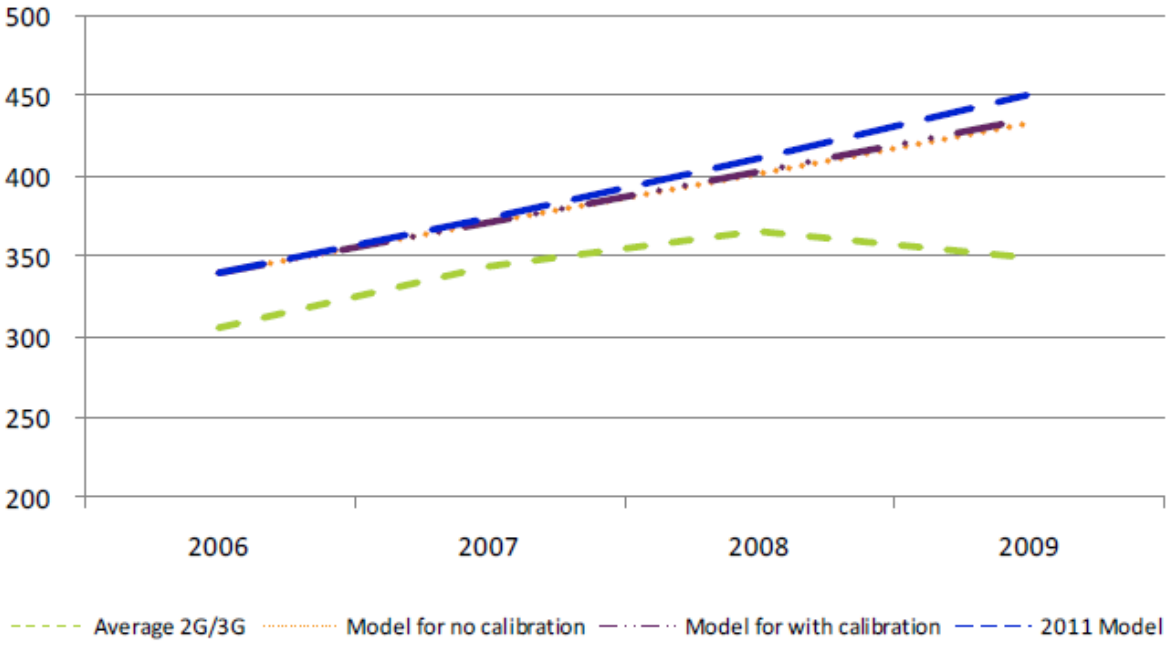
NBV after Reference Question 3 changes—recalibrated and unrecalibrated (£m) [minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.6

Opex after Reference Question 3 charges—recalibrated and unrecalibrated (£m) [minimum/maximum lines have been removed]



Source: Ofcom.

7.43 Ofcom, in response to Vodafone's suggestion that only the utilization parameters be adjusted, said that it was not suggesting that 3G cell radii be decreased because there was a decrease in data traffic over the 3G network. Ofcom said that its limited adjustment to both 3G cell radii and 3G cell equipment utilization was motivated by the desire to make the smallest changes necessary to align the modelled asset counts with the 2G/3G operator average.[34]

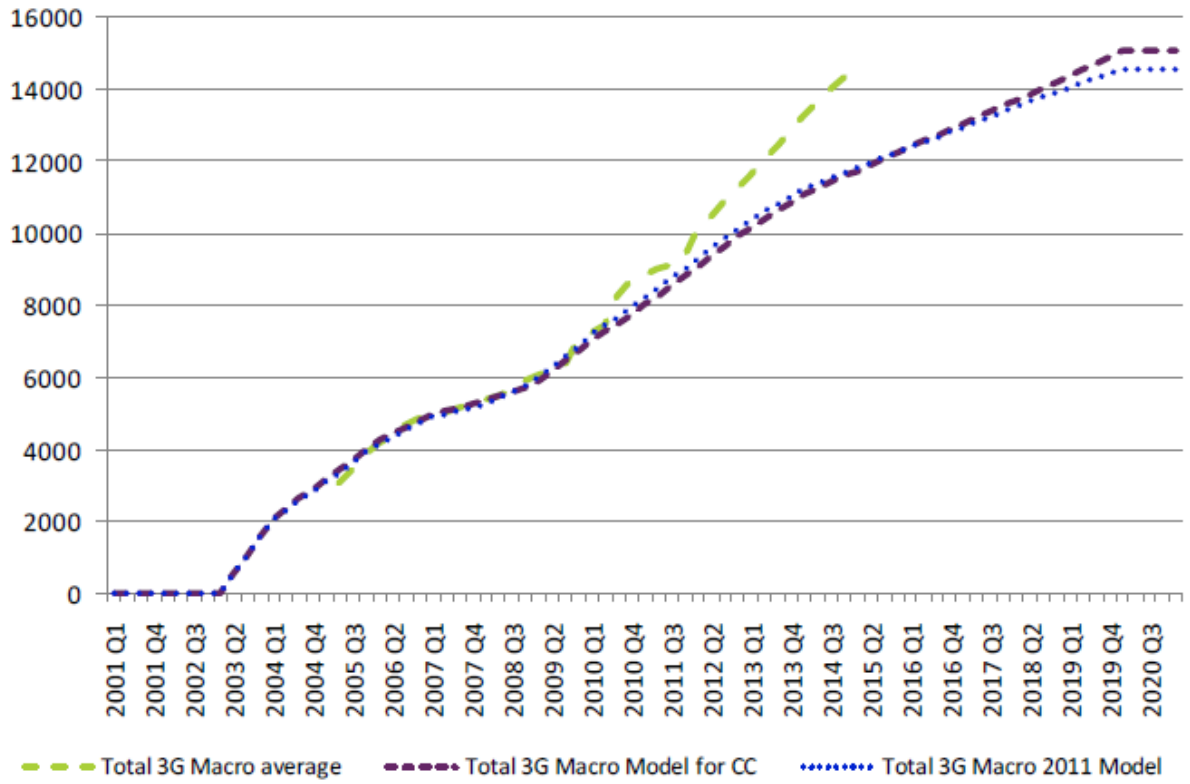
7.44 Ofcom said that, if we decided that recalibration was required in consequence of any Reference Question 3 adjustments, then a more reasonable approach was to make small adjustments to the two main network parameters driving cell site numbers (ie both 3G cell radii and 3G cell equipment utilization), than to make large adjustments to just one.[35]

7.45 Ofcom also noted that a 10 per cent utilization adjustment would be a significant adjustment and double Ofcom's proposal of a 5 per cent adjustment.[36]

7.46 Upon our request Ofcom provided the following graphs in relation to the impact of its proposed recalibration in respect of 3G cell site counts, GBV and opex over the entire modelling period.[37]

FIGURE 7.7

3G cell site counts[38]
[minimum/maximum lines have been removed]

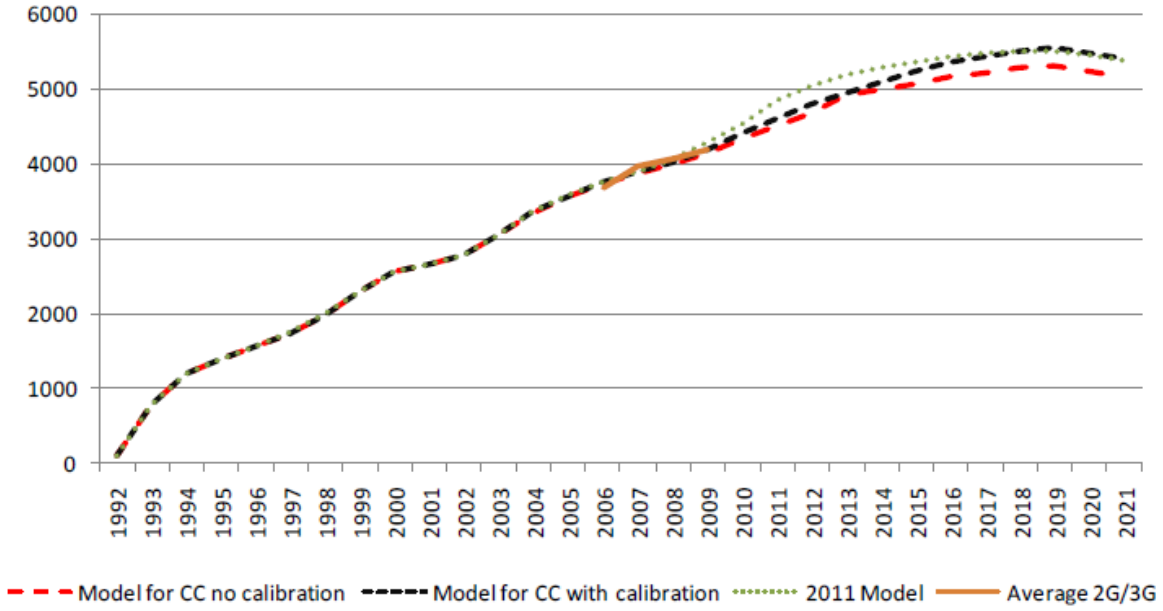


Source: Ofcom.

[34] Ofcom's remedies response, 17 January 2012, p2.
[35] Ofcom's remedies response, 17 January 2012, p2.
[36] Ofcom's remedies response, 17 January 2012, p2.
[37] Letter from Ofcom in response to Reference Question 3, 27 January 2012.
[38] Letter from Ofcom in response to Reference Question 3, 30 January 2012.

FIGURE 7.8

GBV after Reference Question 3 changes—recalibrated and unrecalibrated (£m)[39] [minimum/maximum lines have been removed]

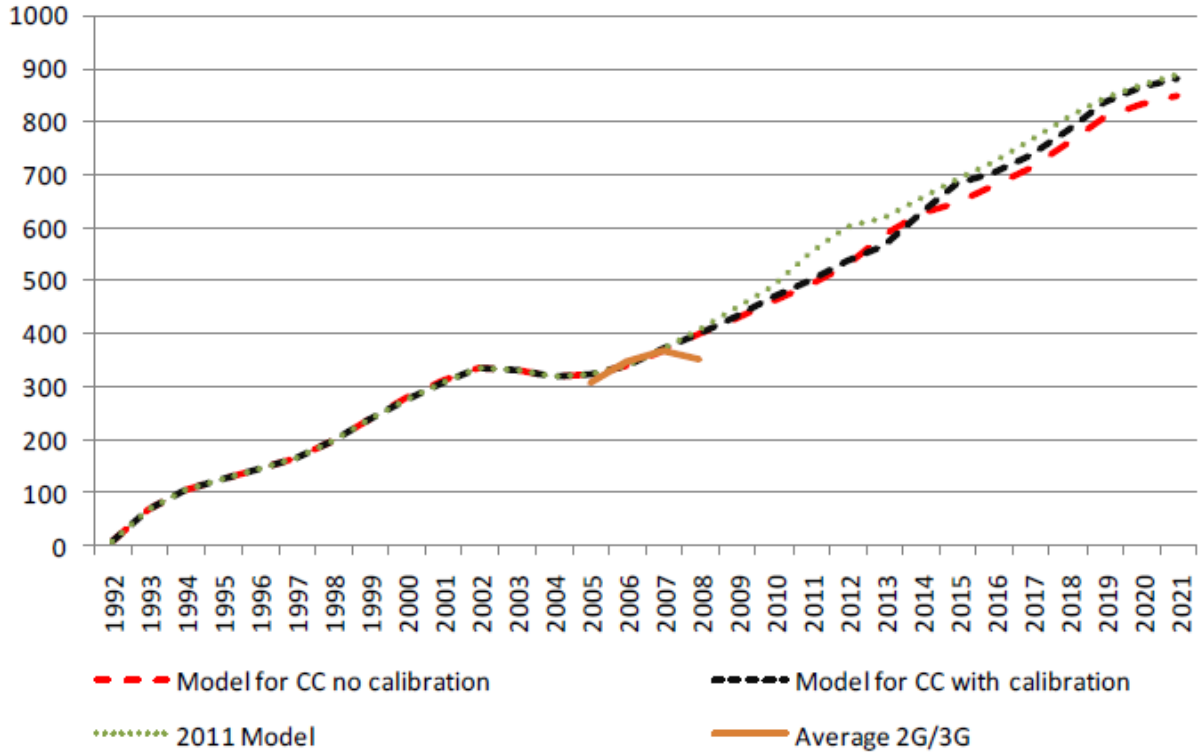


Source: Ofcom.

[39] Letter from Ofcom in response to Reference Question 3, 27 January 2012.

FIGURE 7.9

Opex after Reference Question 3 changes—recalibrated and unrecalibrated (£m)[40] [minimum/maximum lines have been removed]



Source: Ofcom.

Recalibration of Reference Question 3 errors together with Reference Question 6 error

7.47 Ofcom considered that no further recalibration (apart from the recalibration to correct the Reference Question 3 errors) should be performed as a consequence of the Reference Question 6 adjustment.[41]

Summary of Vodafone's submission

Introduction

7.48 Vodafone said that all the Reference Question 3 errors were properly pleaded and material.[42]

7.49 Vodafone said that as the adjustments in Reference Question 3 after recalibration were positive, it did not need to comment on its position if they were negative.[43]

[40] Letter from Ofcom in response to Reference Question 3, 27 January 2012.
[41] Ofcom remedies skeleton, §§57–60.
[42] Vodafone remedies response, 17 January 2012, §§A1.3 & A1.4.
[43] Vodafone remedies hearing transcript, p18, row 5ff.

Correction of the Reference Question 3 errors (before calibration)

7.50 Vodafone agreed that Ofcom had dealt fully and adequately with the correction in respect of the 2G/3G MSC cost driver error and said that no recalibration was necessary in relation to this error.[44]

7.51 Vodafone said it considered that Ofcom's proposed adjustments for the remaining Reference Question 3 errors (before recalibration) were broadly satisfactory and accepted Ofcom's proposed adjustments.[45]

7.52 Vodafone also considered that a consequential adjustment to the handset market share was strictly speaking necessary as a result of correcting the datacard market share, but considered that the impact of this would be small.[46]

Recalibration for Reference Question 3 errors

7.53 Vodafone said that recalibration was necessary (except for the 2G/3G MSC cost driver error[47]) and that the particular focus should be on the quantity of 3G equipment being dimensioned by the model.[48]

7.54 Vodafone said that Ofcom's proposed recalibration was not appropriate.[49]

7.55 Vodafone said that the consequence of correcting the remaining Reference Question 3 errors was to reduce the total modelled traffic volume of the hypothetical 2G/3G operator in the busy hour. This in turn led to a smaller modelled network build and a lower modelled total network capital and operating cost expenditure.[50]

7.56 Vodafone said that because correcting the remaining Reference Question 3 errors led to a reduction in traffic in the model, an adjustment was required to reduce the effective (rather than the absolute) traffic-carrying capacity of equipment, so that the volume of equipment built reverted back to that in the March 2011 model.[51] Vodafone said that, in effect therefore, this must be a utilization adjustment.[52]

7.57 Vodafone did not agree with Ofcom's proposed adjustment to cell radii because it implied that a reduction to the peak levels of traffic reduced the area coverage ability of 3G equipment.[53] This was incorrect as there was no technical reason to suggest that a reduction in peak 3G traffic volume reduced the area coverage of 3G technology (and if anything area coverage would increase following a reduction in traffic due to the effect of cell breathing).[54]

7.58 Vodafone said that rather than making an adjustment to cell radii, Ofcom should have made a larger utilization adjustment (to a level of 70 per cent).[55]

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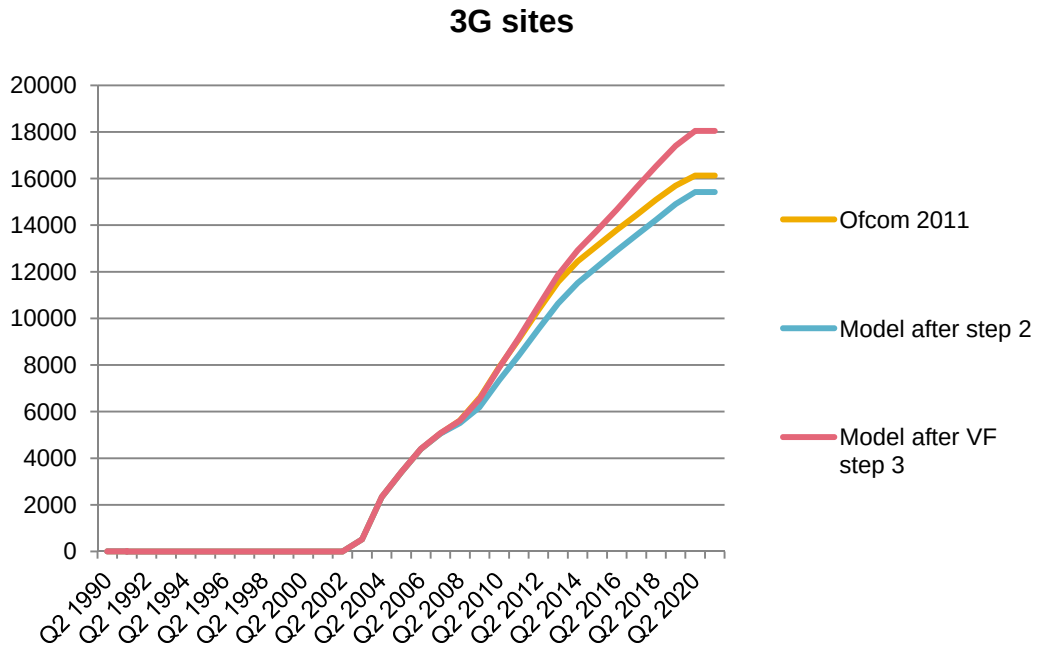
[44] Vodafone remedies hearing transcript, p17, rows 24 & 25. Vodafone remedies response, 17 January 2012, §A1.11.
[45] Vodafone remedies hearing transcript, p18, rows 1ff & 20ff. Vodafone remedies response, 17 January 2012, §§A1.14 & A1.15.
[46] Vodafone remedies response, 17 January 2012, §A1.16.
[47] Vodafone remedies hearing transcript, p18, row 14ff.
[48] Vodafone remedies skeleton, §14.
[49] Vodafone remedies hearing transcript, p18, row 4ff, and p19, row 24ff. Vodafone remedies response, 17 January 2012, §A1.18.
[50] Vodafone remedies response, 17 January 2012, §§A1.17 & A1.14.
[51] Vodafone remedies response, 17 January 2012, §§A1.18 & A1.19.
[52] Vodafone remedies response, 17 January 2012, §A1.19.
[53] Vodafone remedies response, 17 January 2012, §A1.20.
[54] Vodafone remedies response, 17 January 2012, §A1.21.
[55] Vodafone remedies response, 17 January 2012, §A1.22.

7.59 Vodafone said that its proposed adjustment led to a better alignment of 3G cell site counts to the 2011 Model and the actual operator average than Ofcom's proposal.[56]

7.60 Vodafone also said that its calibration proposal was closer aligned with Ofcom's operator forecasts for the period 2011 to 2014 as set out in Ofcom's remedy skeleton.[57]

7.61 Upon our request Vodafone provided the following graphs in relation to the impact of its proposed recalibration in respect of 3G cell site counts and GBV and opex.[58]

FIGURE 7.10

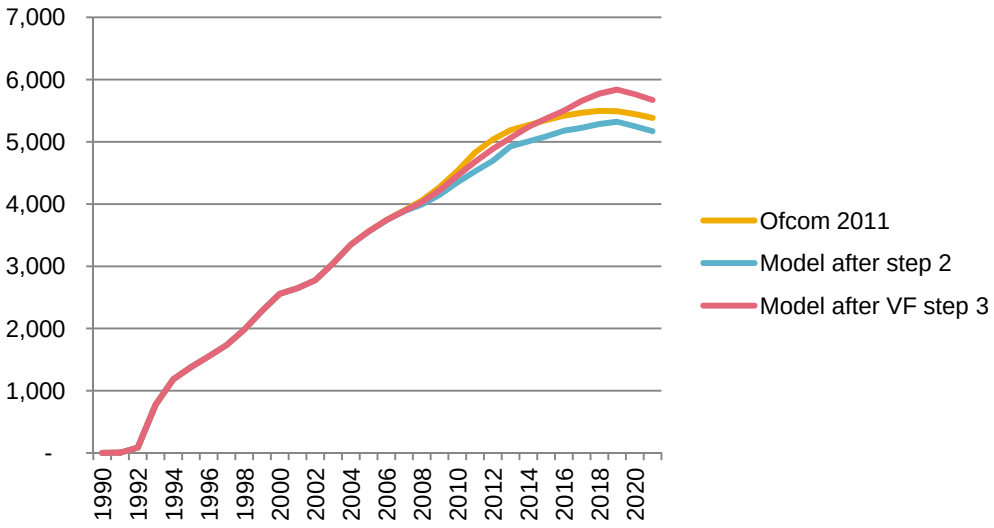


Source: Vodafone.

[56] Vodafone remedies response, 17 January 2012, §A1.22 & Table 3G cell site counts.
[57] Vodafone remedies response, 17 January 2012, §A1.23.
[58] Letter from Vodafone in response to Reference Question 3, 26 January 2012.

FIGURE 7.11

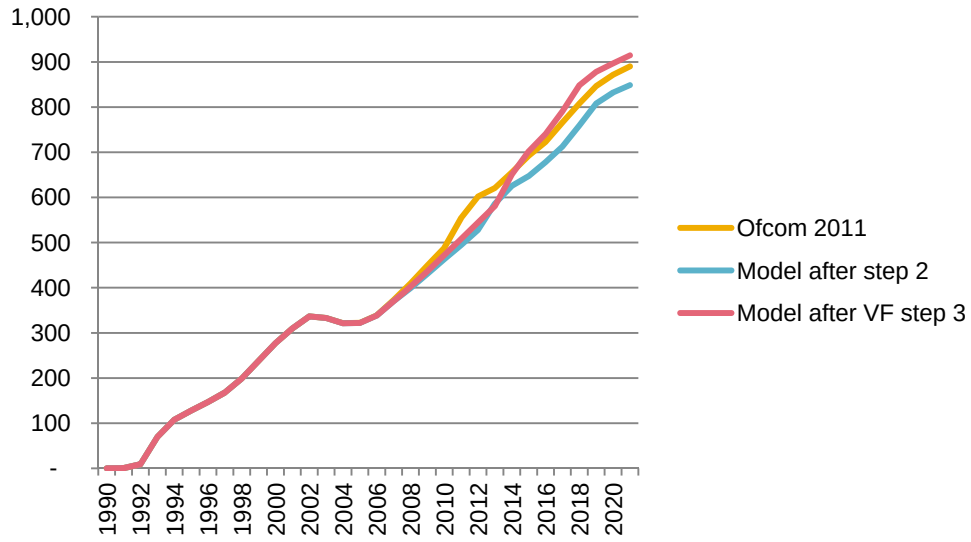
GBV



Source: Vodafone.

FIGURE 7.12

Opex



Source: Vodafone.

Recalibration of Reference Question 3 errors together with Reference Question 6 error

7.62 Vodafone did not consider that the correction of the Reference Question 3 errors (including recalibration) was related to the correction of the Reference Question 6 error and considered that both issues did not need to be resolved simultaneously. This was because the Reference Question 3 errors were related to changes in

network equipment dimensioning and the Reference Question 6 error was related to unit cost data.[59]

Vodafone comments on Ofcom's proposal from 17 January 2012

7.63 Vodafone considered that Ofcom, in its proposal on Reference Question 3 should not make any changes to its modelling without considering their impact on LRIC. Vodafone said that Ofcom's approach to assume that as long as it set parameters that resulted in a full service level calibration the LRIC result would naturally follow, was not properly reasoned and not in line with the Recommendation.[60]

7.64 Vodafone said that Ofcom's proposal led to an adjustment in the balance between coverage and capacity in Ofcom's model, but that Ofcom did not examine the implication of this for the calculation of LRIC and that Ofcom did not have due regard for the purpose of the model which was to correctly identify the LRIC costs of the MCT service.

7.65 Vodafone said that correcting the remaining Reference Question 3 errors (before recalibration) reduced the volume of equipment as a result of reductions in traffic and its recalibration proposal restored the dimensioned equipment through reducing the traffic handling utilization of equipment. This, it said, did the least harm to the structure of the model.[61]

Summary of EE's submission

Introduction

7.66 EE considered that a correction of the Reference Question 3 errors should result in a change to the LRIC calculation as this was sufficiently pleaded by Vodafone.[62]

7.67 EE said that the Reference Question 3 errors were material and should be corrected.[63] EE said that not making the Reference Question 3 corrections would result in mobile customers paying an additional £19 million in retail charges, and a loss to operators of around £5 million each. Those impacts were far in excess of the administrative costs involved in making the corrections.[64]

7.68 EE contested our conclusions set out in our provisional determination that Ofcom had not erred in relation to the various errors EE alleged in their challenge. They therefore included in their remedies proposal adjustments in relation to these alleged errors despite the fact that we had not identified these matters in our Remedies Letter (1).[65,66]

[59] Vodafone remedies response, 17 January 2012, §A1.25.
[60] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p5.
[61] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, pp5 & 6.
[62] EE remedies skeleton, §§3–5.
[63] EE remedies skeleton, §§2a, 7–10.
[64] EE remedies hearing transcript, p30, row 3ff.
[65] EE remedies submission, 17 January 2012, §§162, 166 & 181.
[66] As we have not determined that Ofcom erred in the context of Reference Question 2 we do not include these adjustments in our remedies below.

Correction of the Reference Question 3 errors (before calibration)

7.69 EE said it agreed with Ofcom that the 2G/3G MSC cost driver error had already been corrected and accepted Ofcom's proposed remedy (of 5 January 2012) in respect of this error.[67]

7.70 EE also agreed with Ofcom's proposal of 5 January 2012 on the correction of the historic datacard market share error.[68]

7.71 However, EE suggested a different adjustment to correct the error in the weekend/ weekday data traffic split:[69]

(a) EE accepted that operator data supported Ofcom's proposed assumption (in its 5 January 2012 letter) of 28 per cent for the share of data traffic during the week-end for 2010/11 and earlier years.

(b) However, EE submitted a longer time series of data for T-Mobile from 6 September 2010 to 12 December 2011 (EE noted that Orange did not keep equivalent data for more than a few months). EE said that T-Mobile's data showed that the proportion of data traffic on the weekend was declining at a statistically significant rate of [✂] per cent per year. EE said that extrapolating this to 2020/21 might suggest that the proportion of weekend data would fall as low as [✂] per cent. However, EE believed that it would not be reasonable to simply extrapolate the current trend indefinitely into the future as there was always likely to be a significant share of data traffic on the weekend albeit not as high as currently. Accordingly, EE proposed that a reasonable assumption informed by T-Mobile's data would be to assume that the share of data on the weekend was 28 per cent in 2010/11 and would fall to 20 per cent (ie Ofcom's original assumption) by 2020/21.[70]

(c) EE said that its revised assumption led to a calculation of LRIC (in 2014/15) after the Reference Question 3 error corrections (before calibration) of 0.7233ppm vs Ofcom's estimate of 0.7000ppm.[71]

Recalibration for Reference Question 3 errors

7.72 EE said that it would be important to recalibrate the Model after these corrections were made.[72]

7.73 EE said that it had some concerns that, by changing cell radii, there was a danger that Ofcom would affect the balance of coverage and capacity costs which in turn would inappropriately impact on LRIC given the subtractive approach to its calcu-lation.[73]

7.74 EE said that Ofcom's proposed adjustment to the cell radius made almost no difference to modelled asset counts (it only increased the macrocell count by around 1 per cent and made no difference to the number of micro and pico cells) and thus lacked any objective basis to be part of a remedy that tried to ensure that asset

[67] EE remedies hearing transcript, p30, row 9ff. EE remedies submission, 17 January 2012, §162.
[68] EE remedies hearing transcript, p30, row 9ff. EE remedies submission, 17 January 2012, §162.
[69] EE remedies hearing transcript, p30, row 9ff. EE remedies submission, 17 January 2012, §164.
[70] EE remedies submission, 17 January 2012, §165.
[71] EE remedies submission, 17 January 2012, §165 & Table 2.
[72] EE remedies skeleton, §§2a, 7–10.
[73] Letter from EE, 9 January 2012, in response to our remedies hearing note of 6 January 2012.

counts were appropriately calibrated. Given that achieving calibration was Ofcom's only stated reason for the change, EE believed that adjusting cell radii was un-justified.[74]

7.75 EE said that Ofcom's proposed remedy only reduced the difference between modelled asset counts and average operator asset counts from –7 per cent and –19 to –3 per cent and –10 per cent for 3G macrocells and 3G micro- and picocells respectively.[75]

7.76 EE proposed that the utilization for the four 3G cell site equipment categories should instead be set to 70 per cent. This proposal halved the discrepancy between the model and top-down average asset count information for 3G macrocells and 3G micro and pico cells compared with Ofcom's proposed adjustment.[76]

7.77 EE said that while even finer calibration could be sought, further adjustments were not likely to be proportionate given that calibration between many assets types was already inexact.[77]

7.78 EE said that the effect of its proposed calibration of asset counts was to increase the estimate LRIC to 0.7871ppm (compared with Ofcom's proposal of 0.74ppm).[78]

7.79 Upon our request EE also provided graphs in relation to the impact of its proposed recalibration in respect of 3G cell site counts and GBV and opex.[79] However, given that Vodafone's and EE's adjustment for calibration appeared to be identical, we do not show these graphs here.

Summary of Telefónica's submission

7.80 Telefónica said that the Reference Question 3 errors were properly pleaded by Vodafone and were material errors.[80] Telefónica said that correcting the Reference Question 3 errors would make a difference that would amount to a sum of [✂] for Telefónica alone over the unexpired period of the charge control.[81]

7.81 Telefónica made no other comments.[82]

Summary of BT's submissions

7.82 BT considered that the Reference Question 3 errors were not material. Nonetheless, in the interests of drawing the appeal to a speedy conclusion, BT was prepared to accept that these errors be remedied as suggested in Ofcom's proposal.[83] BT later said that it agreed with Ofcom on Reference Question 3.[84]

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[74] EE remedies submission, 17 January 2012, §168.
[75] EE remedies submission, 17 January 2012, §169.
[76] EE remedies submission, 17 January 2012, §169.
[77] EE remedies submission, 17 January 2012, §169.
[78] EE remedies submission, 17 January 2012, §170 & Table 4.
[79] Letter from EE in response to Reference Question 3, 27 January 2012 (corrected version).
[80] Telefónica remedies hearing transcript, p35, row 6ff.
[81] Telefónica remedies hearing transcript, p35, row 12ff.
[82] Telefónica remedies skeleton, §2.
[83] BT remedies skeleton, §12. BT submission on remedies, 17 January 2012, §§8 & 9.
[84] BT remedies hearing transcript, p37, row 5ff.

7.83 BT was of the view that the Reference Question 3 errors should be remedied regardless of whether or not any identified error led to lower MTRs.[85]

Summary of Three's submissions

Introduction

7.84 Three was of the view that the weekday/weekend data split and the historic datacard market share errors were not properly pleaded by Vodafone. Therefore it is not appropriate for the CC to provide any remedy in respect of these findings. Alternatively, to the extent that these matters are raised indirectly in Vodafone's Notice of Appeal, the relevant part of that pleading invited the CC to investigate alternatives only if Ofcom's LRIC model was found not to be "fit for purpose".[86]

7.85 Three said that Ofcom's correction of the 2G/3G MSC cost driver error was correct and there was no need for any consequential recalibration in relation to that error.[87]

7.86 Three considered that the impact of correcting the weekday/weekend data split and the historic datacard market share errors was negligible and did not justify any adjustment to LRIC.[88] However, Three said that in order to avoid further prejudicial delay in implementing the decision Three was prepared to agree to the remedies proposed by Ofcom on 3 January 2012 in their entirety.[89]

7.87 Three said that if the weekday/weekend data split and the historic datacard market share errors were corrected then this included the scope for us to reduce LRIC.[90]

7.88 Three said we should determine the adjustment for the weekday/weekend data split and the historic datacard market share errors ourselves.[91]

7.89 Three said that if we decided that recalibration was necessary we should conduct the recalibration ourselves or, if it was not reasonably practicable, the recalibration should be remitted to Ofcom.[92]

Correction of the Reference Question 3 errors (before calibration)

7.90 Three agreed with Ofcom's proposal for the correction (before calibration) of the remaining Reference Question 3 errors.[93]

7.91 Three said that we should ignore EE's proposal on the weekend/weekday data split. This was because:[94]

(a) EE was providing new evidence which should be treated as inadmissible.[95]

(b) The evidence was not reliable because EE was extrapolating for nine years from data obtained from only part of its business over a relatively short period of

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[85] BT remedies skeleton, §16.
[86] Three remedies skeleton, §§2(1) & 16–18 and Three remedies response, 17 January 2012, §§2(1) & 16–21.
[87] Three remedies hearing transcript, p43, row 6ff.
[88] Three remedies skeleton, §§2(2) & 25 and Three remedies response, 17 January 2012, §§2(2) & 27–30.
[89] Three remedies skeleton, §48 and Three remedies response 17 January 2012, §§2(6) & 67.
[90] Three remedies skeleton, §§20–24 and Three remedies response, 17 January 2012, §§22–25.
[91] Three remedies skeleton, §27.
[92] Three remedies skeleton, §2(2) and Three remedies response, 17 January 2012, §§2(2) & 32.
[93] Three remedies hearing transcript, p44, row 6ff.
[94] Letter from Three, 18 January 2012, §4.
[95] Letter from Three, 18 January 2012, §4(a).

14 months;[96] Three also noted that this part of EE's business accounted for less than 20 per cent of the data market.[97]

(c) There was no justification for EE's suggested figures (which were between Ofcom's proposal and the evidence provided by EE).[98]

Recalibration for Reference Question 3 errors

7.92 Three agreed with Ofcom's recalibration proposal of the remaining Reference Question 3 errors and considered that the proposal appeared broadly reasonable.[99]

7.93 In response to Vodafone's suggested recalibration, Three said:

(a) Ofcom's recalibration did not, as Vodafone suggested, imply that a change in traffic affected coverage.[100] Rather, the Reference Question 3 errors would have caused a misalignment between predicted and actual asset counts and Ofcom tried to correct this with adjustments to network dimensioning assumptions.[101] Vodafone, in its proposal wrongly assumed that that all Ofcom's network dimensioning assumptions resulting from the original calibration of the 2011 Model were correct apart from utilization assumptions.[102]

(b) The correct approach to recalibration was to judge the reasonableness of the network dimensioning assumptions in the corrected model on their own merits, ie how well they predicted asset counts over time in the corrected model. No inferences could be drawn from a comparison of the assumptions in the corrected model with the assumptions in the 2011 model. For example, it did not follow that by adjusting cell radii Ofcom was implying, as Vodafone claimed, that lower levels of peak traffic lead to lower cell radii; rather, it could more logically be interpreted as implying that Ofcom now believed that its attempt to make the calibration work in the 2011 Model misled it into overstating cell radii.[103]

Recalibration of Reference Question 3 errors together with the Reference Question 6 error

7.94 Three was of the view that any analysis and adjustments to deal with Reference Question 3 and Reference Question 6 (or as a minimum the recalibration[104]) should be dealt with at the same time and not separately, in view of the clear potential for each process to inform the other.[105]

Assessment

Correction of the Reference Question 3 errors (before calibration)

7.95 We set out in paragraph 1.73 that we do not believe that the pleadings provide sufficient basis for the correction of the error findings in the context of Reference

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[96] Letter from Three, 18 January 2012, §4(b).
[97] Letter from Three, 18 January 2012, §4(b).
[98] Letter from Three, 18 January 2012, §4(b).
[99] Three remedies hearing transcript, p45, row 14ff.
[100] Three remedies response, 17 January 2012, §31(1).
[101] Three remedies response, 17 January 2012, §31(1).
[102] Three remedies response, 17 January 2012, §31(2).
[103] Three remedies response, 17 January 2012, §31(3).
[104] Three remedies skeleton, §51.
[105] Three remedies skeleton, §47, and Three remedies response, 17 January 2012, §§2(2), 33 & 70.

Question 3 in the LRIC model. We believe that the question of appropriate remedies should arise from the errors identified and we note that we did not uphold the allegations of error in relation to the calculation of LRIC under Reference Question 2. However, we have included in our determination of Reference Question 7 our views as to how the errors we have found to the inputs to the LRIC+ model would be corrected and the consequential adjustments that would be necessary to the LRIC model and the charge control itself, were the Tribunal to disagree with the position we have taken.

7.96 All the parties were in agreement that the 2G/3G MSC cost driver error was corrected in full in Ofcom's revised decision of 25 October 2011.

7.97 In respect of the weekend/weekday data share the parties generally agreed that Ofcom's proposal in its letter of 5 January 2012 for a 28 per cent share of data traffic at the weekend was acceptable. Whilst EE disagreed with Ofcom's proposal we do not consider that it would be proportionate to further refine Ofcom's estimate given the relatively small impact on LRIC of correcting this error.

7.98 We also note that EE's proposal was based on data in the relatively short time horizon of slightly more than one year. We do not consider that such a short time horizon provides sufficient evidence that the share of data traffic at the weekend is declining on a steady trend in the longer term. We also consider that we would need to gather similar data from other operators to assess whether T-Mobile's trend is company or industry specific. We do not consider that it would be proportionate to undertake such an assessment, considering the relatively small impact correcting the weekend/weekday data split has on the calculation of LRIC.

7.99 All parties agreed that Ofcom's proposal in its letter from 5 January 2012 for a revised modelling assumption for the historic datacard market share (see paragraphs 7.36 and 7.37) was acceptable.

7.100 We therefore find that the remaining Reference Question 3 errors (before calibration) should be corrected as set out in Ofcom's proposal of 5 January 2011.

Recalibration for Reference Question 3 errors

7.101 As set out in paragraph 7.38, we do not consider that recalibration is necessary as a consequence of correcting the 2G/3G MSC error.

7.102 We set out below our assessment of the need for recalibration for the remaining Reference Question 3 errors.

7.103 We consider that the remaining Reference Question 3 errors both warrant recalibration in principle. This is because both errors impact on the dimensioning of the network of the efficient hypothetical operator in Ofcom's model.

7.104 When assessing the remedies proposals we were guided by our principle that we should set our remedies so that Ofcom's original decision remains unaffected, as far as possible, where Ofcom has not been found to have erred.[106] We therefore considered that recalibration of the remaining Reference Question 3 errors should result in an overall calibration of the asset count and accounting measures broadly similar to Ofcom's decision.

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[106] CC13 Price control appeals under section 193 of the Communications Act 2003: Competition Commission Guidelines April 2011

7.105 In its statement Ofcom used counts of different types of network equipment (eg cell sites, MSCs) ('asset counts') and accounting costs based on data from management accounts (accounting data) for calibration of the 2011 Model.[107]

7.106 Ofcom performed the asset count calibration using a wide range of assets, but focused in particular on the number of cell sites:

(a) total 2G sites;[108]

(b) total 3G sites;[109] and

(c) total macro sites[110] and total sites (macro, micro, pico).[111]

7.107 Ofcom performed accounting data calibration using:[112]

(a) GBV;

(b) NBV; and

(c) operating costs.

7.108 When assessing the recalibration proposals we put most of our emphasis on total 3G cell site counts, GBV and opex. This was because 3G cell site counts capture all 3G cells and because we consider that Ofcom placed more weight on GBV than NBV in its decision.

7.109 Ofcom's recalibration proposal results in 3G cell site counts that are very close to the 3G cell site counts in Ofcom's statement, in both the calibration period (2005 to 2010) and also over the total modelling period, whilst all accounting measures are similar to the statement, and in some cases slightly closer to the average operator data during the calibration period (2006 to 2009), and close to Ofcom's decision over the entire modelling period.

7.110 Requiring further analysis of the potentially large number of alternative options to recalibrate has the potential to delay significantly the implementation of the remedy. Furthermore, it is not clear that such further analysis would provide a meaningfully different answer. We also note that recalibration requires an element of regulatory judgment and we believe it is appropriate to defer to Ofcom's judgment in relation to this aspect of their proposal. We note Vodafone's and EE's concern that the nature of the error did not allow for a recalibration of cell radii, but we note EE's comments that the cell radii adjustment had only a relatively small impact on recalibration of cell sites and as such are of the view that it would likely be disproportionate to undertake further analysis of this point..

7.111 We therefore consider that Ofcom's suggested recalibration provides an appropriate way to perform the recalibration.

7.112 However, we note that Vodafone and EE provided alternative proposals for recalibration. We therefore considered whether EE's and Vodafone's proposals provided a better way to recalibrate than Ofcom's proposal.

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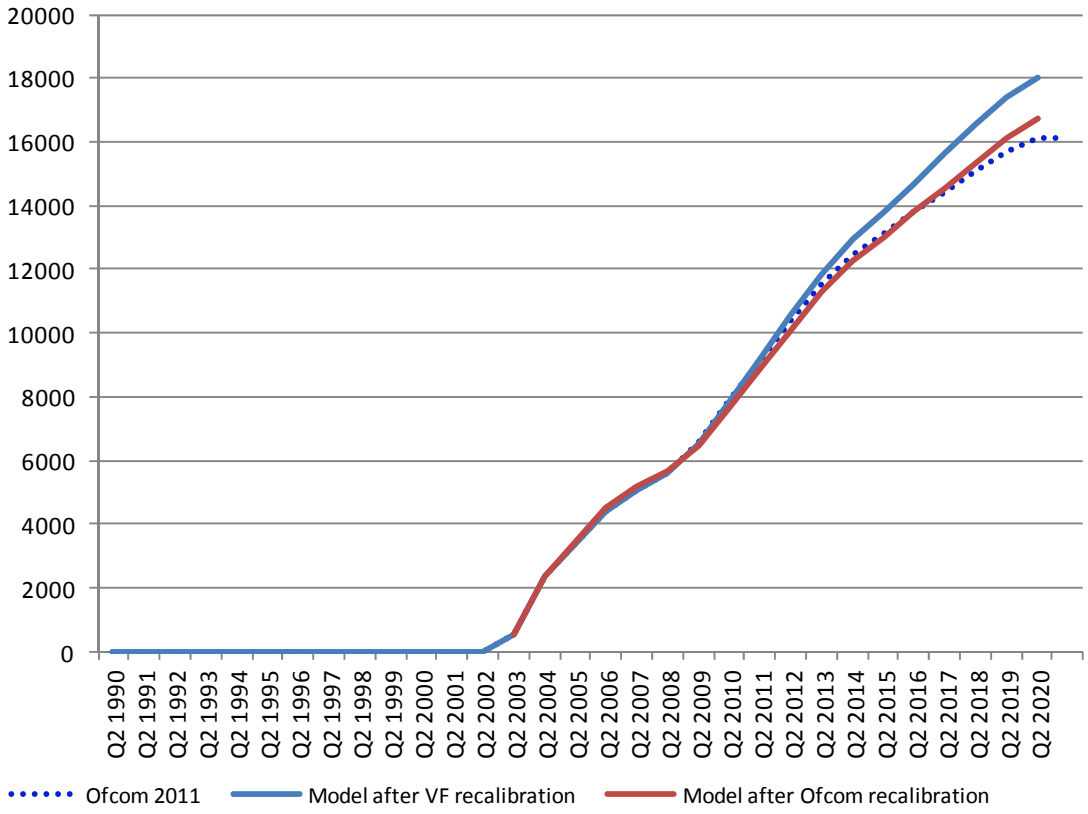
[107] Ofcom decision, §A7.5.
[108] Ofcom decision, Figure A7.2.
[109] Ofcom decision, Figure A7.3.
[110] Ofcom decision, Figure A7.4.
[111] Ofcom decision, Figure A7.5.
[112] Ofcom decision, §A7.32.

7.113 We note that EE's and Vodafone's proposal for recalibration appeared to be identical (ie both suggested to reduce the 3G cell equipment utilization parameter to 70 per cent).

7.114 We do not consider that Vodafone's and EE's proposal was superior to Ofcom's. We note that Vodafone stated that its proposal provided a better alignment with operator data and the 2011 Model for the calibration period than Ofcom's proposal. However, Vodafone's and EE's proposal leads to higher 3G cell site counts, GBV and opex towards the end of the explicit modelling period (2021) than Ofcom assumed in the 2011 model. We note that Ofcom's recalibration proposal aligns 3G cell site counts more closely to the 2011 Model for than Vodafone's and EE's proposal when looking at the entire modelling period. See Figure 7.13 below.

FIGURE 7.13

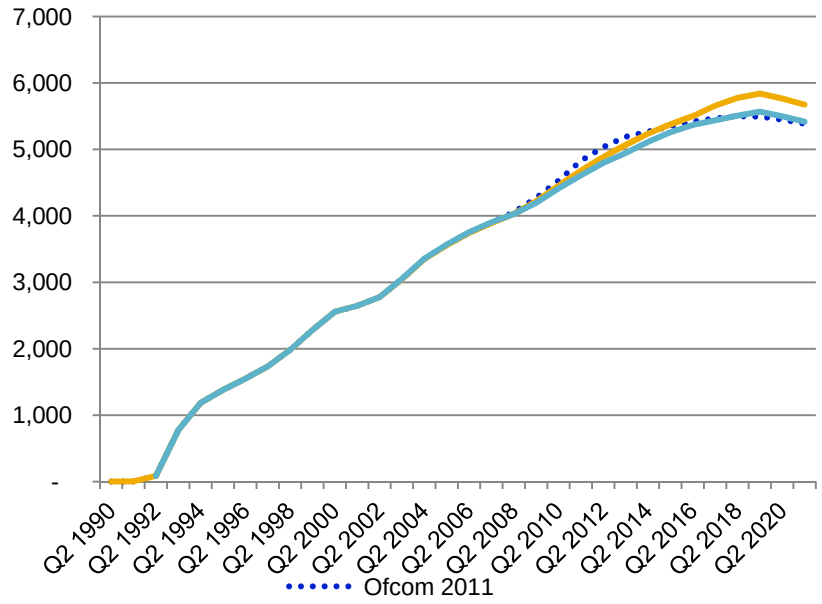
3G cell site count recalibration and 2011 model



Source: CC.

FIGURE 7.14

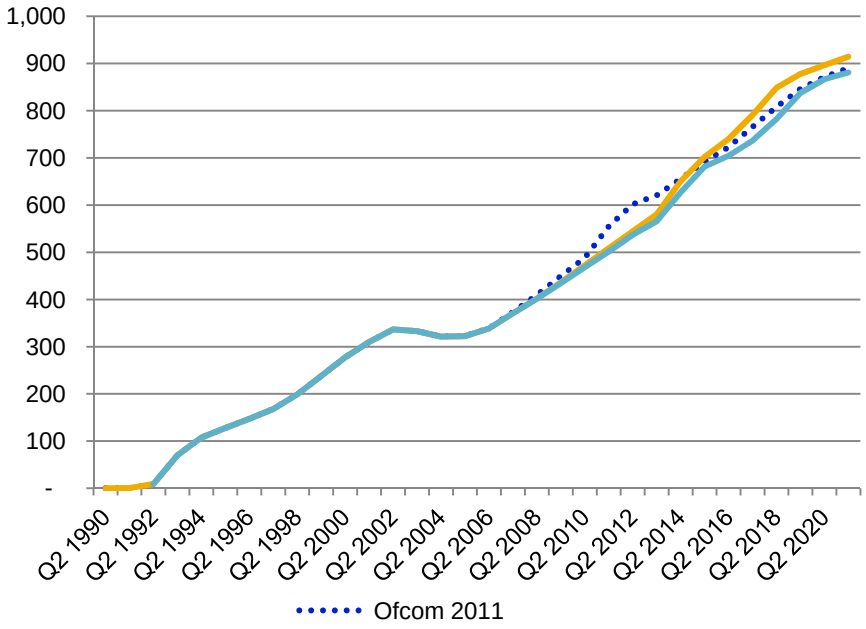
GBV recalibration and 2011 model



Source: CC.

FIGURE 7.15

Opex recalibration and 2011 model



Source: CC.

7.115 Considering that Vodafone's and EE's proposals were much less closely aligned with Ofcom's 2011 Model for cell site counts and GBV in the later modelling period than Ofcom's proposal we do not find that Vodafone or EE have provided a superior alternative to Ofcom's proposal for recalibration.

7.116 Accordingly, we find that recalibration for the remaining Reference Question 3 errors should be performed as set out by Ofcom in its letter of 5 January 2012. We find Ofcom's proposal to be an appropriate remedy.

Correcting for the errors in Reference Question 4

Our initial proposals

7.117 In our determination of Reference Question 4, we concluded that Ofcom had erred in deciding to adopt a four-year transition period over which mobile termination rates would be reduced to the level of the LRIC cost standard, rather than over a three-year period.

7.118 In our Remedies Letter (1), we asked whether there were any principled or practical reasons why this error should not be directly corrected by moving on to a glide path that moves from the charge control at the end of the previous charge control (ie the level at 31 March 2011) to reach the level of LRIC for 2013/14 on 1 April 2013, with a constant percentage reduction of the charge in each 12-month period, and adjusting to match the LRIC for 2014/15 on 1 April 2014 (since Ofcom's model estimates a different value of LRIC for each year).[113]

Submissions from the parties

Summary of Ofcom's submission

7.119 Ofcom said that our proposal was the most straightforward means of correcting the error.[114] Ofcom also suggested that any adjustment to the charge control should pre-serve the methodology and approach to calculation as adopted in Ofcom's original decision.[115,116]

7.120 Ofcom calculated a possible glide path starting from the level of MTRs at 31 March 2011 with a constant percentage reduction in each year, reaching LRIC on 1 April 2013.[117]

Summary of EE's submission

7.121 EE said that the impact of reducing MTRs in three cuts rather than four, and the appropriateness of the glide path which resulted (or alternatively whether a glide path should be imposed which delayed these cuts), were empirical matters that needed further investigation. It argued that the CC should either consider these matters or remit to Ofcom for it to do so.[118] It also argued that we had not taken into account the effects of errors in other reference questions.[119]

7.122 EE said that any reduction in MTRs beyond those in Ofcom's decision:[120]

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[113] CC letter to the parties on remedies, 14 December 2011.
[114] Ofcom remedies hearing transcript, p9.
[115] Ofcom's letter of 3 January 2012, p4.
[116] We take this to mean the same methodology for deriving controlling percentages and calculating nominal figures, and the same approach to rounding, as described at footnote 2 of Ofcom's letter of 3 January 2012. We note that no party has suggested that we should change these aspects of the methodology and we do not intend to do so.
[117] See 'Step 5' of Ofcom's letter of 3 January 2012.
[118] EE Submission on the provisional determination and remedies, §107.
[119] EE Submission on the provisional determination and remedies, §93.
[120] EE Submission on the provisional determination and remedies, §94 and EE remedies skeleton §§16—25.

(a) was likely to harm consumers, including vulnerable customers, in circumstances where neither the CC nor Ofcom had properly analysed this issue;

(b) was not consistent with the statutory duties of the CC and Ofcom to take into account the need to allow MCPs to make a reasonable return on investments that had already been made; and

(c) would result in MTR reductions that were so large as to be without relevant regulatory precedent (in percentage terms, which EE calculated as being around 50 per cent per year under the suggested glide path in Ofcom's letter, and even more in real terms).

7.123 EE also submitted that the glide path should take account of the current economic climate and the fact that a three-year glide path would mean that a significant proportion of current contract customers would still be in their minimum contract term at the time of the cut to pure LRIC levels on 1 April 2013 (since this would be within 14 months of the final determination), and that in addition it takes several months for MCPs to plan, design and implement price increases (including pre-pay price increases).[121]

7.124 EE said that if the CC decided to proceed with a three-year glide path, then the need to allow an appropriate period for retail prices to be adjusted suggested that such reductions should be delayed to some extent and should be calculated from the current level of charges (not retrospectively calculated from the start of the current charge control period). [122]

7.125 On the subject of the amount of warning MCPs had had as to the prospect of lower MTRs, EE said that the period from the issuing of our Provisional Determination did not contribute because the contents of it could not be shared with its commercial department or otherwise used to set prices.[123]

Summary of Vodafone's submission

7.126 Vodafone submitted that it would be preferable to maintain a longer than three-year glide path, to avoid an excessively steep series of reductions in years 1, 2 and 3 of the charge control period. It supported EE's case on this issue.[124]

7.127 In response to Ofcom's letter, Vodafone said that there should not simply be a mechanistic adoption of a new glide path such as Ofcom has set out.[125]

7.128 On the subject of notice periods, Vodafone said that it would be 'normal' for Ofcom to decide what the appropriate notice period should be. Vodafone noted that if the new charge level were to be introduced without notice, BT (and by extension other MCPs and FCPs) would not be able immediately to pass on new rates to customers and hence the benefits of lower MTRs would, in the very short term, flow to operators rather than consumers.[126]

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[121] EE Submission on the provisional determination and remedies, §§102 and 105.
[122] EE Submission on the provisional determination and remedies, §108.
[123] EE Submission on the provisional determination and remedies, §105.
[124] Vodafone response to the CC's provisional determination of the price control questions, §A1.8.
[125] Vodafone remedies hearing transcript, p22.
[126] Vodafone remedies hearing transcript, p57.

Summary of Telefónica's submission

7.129 Telefónica agreed with EE that we had not considered the steepness of the potential decrease, which was the cumulative effect of the three-year glide path and the other errors in the provisional determination.[127]

7.130 Telefónica said that the most proportionate approach would be to maintain the four-year glide path for a transitional period of time (eg one year), while adjusting the relevant MTRs to take account of any reductions implied by the CC's answers to Reference Questions 3 and 6. In the alternative, Telefónica said that it would support an approach that mitigated the steepness of the further reductions by the adoption of a constant ppm glide path reduction, either for a three-year period starting from 1 April 2011 that took as its starting point the cap applicable at the end of the previous charge control regime (ie 31 March 2011); or a two-year period commencing 1 April 2012 that took as its starting point the current charge.[128]

7.131 On notice periods, Telefónica said that it would be necessary for Ofcom to give sufficient notice of the introduction of the new charge control to allow the parties, in turn, to give the periods of notice required under their contracts with third party network operators for changes to their charges. In the case of MCPs' contracts with BT, this period is 56 days, although BT has explicitly said that it would waive this,[129] and in other cases is 30 days.[130]

Summary of BT's submissions

7.132 BT said that there were no principled or practical reasons why the glide path error should not be directly corrected as in our initial proposal.[131]

7.133 BT responded to EE's arguments. It said that the starting point was that Ofcom was right to prefer LRIC-based MTRs, taking into account the effects on efficiency, competition and vulnerable customers, and that none of the MNOs had put forward any convincing evidence that they or their customers would be unduly strained by a three-year glide path. BT said that comparing the glide path in the Statement with the glide path now proposed by Ofcom, the difference in MTRs was small.[132]

7.134 As to contract periods, BT said that EE's argument suggested that a long transition period would be necessary no matter what the outcome of the appeal. However, in practice the existence of a small proportion of customers with long terms remaining on their contracts did not justify delaying the realization of the benefits of LRIC MTRs; especially since post-pay customers as a whole had generally balanced call ratios.[133]

7.135 BT also said that EE had long had notice of the possibility that the CC would find in favour of BT's appeal and could have planned accordingly.[134]

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[127] Telefónica response to the provisional determination, §7.1.
[128] Telefónica response to the provisional determination, §7.2.
[129] BT written submissions on remedies, §27.
[130] Telefónica remedies hearing transcript, pp35 & 36.
[131] BT written submissions on remedies, §10.
[132] BT written submissions on remedies, §§12—25.
[133] BT written submissions on remedies, §§26—30.
[134] BT written submissions on remedies, §25.iv.3.

Summary of Three's submissions

7.136 Three adopted BT's position. It said that in the alternative, there was merit in the solution proposed by Ofcom.[135]

7.137 Three said that EE's arguments about the effects on consumers were the same as those it had made, and we had addressed, in our provisional determination, and that EE had ignored our findings on past investments. It said that the unprecedented reductions EE claimed were not large in absolute terms and that we had said, correctly, that the absolute size should be the main focus.[136]

7.138 It added that EE had been aware of the possibility of a shorter glide path and lower unit costs since BT and Three filed their appeals on 15 May 2011, which would be almost a year before the MTRs had to be changed if the change was made to take effect from the start of the next charge control year. Three argued that EE would also have had the benefit of over four months since being forewarned of a likely change in our provisional determination.[137]

7.139 Three said that the concept of equal percentage reductions in each charge control year appeared in Ofcom's proposed new glide path as it did in the Decision. Three said that this was consistent with the approach previously adopted by the CC of maintaining the same approach as adopted in the decision under appeal unless the particular element had itself been appealed.[138]

Assessment

7.140 As our starting point, we note that Ofcom's approach to the glide path—using a constant proportional reduction in each year—is one that it has often used and appears a reasonable principle. None of the parties appealed against Ofcom's glide path on the grounds that it was too steep (ie the reduction in MTRs was too large) in the first or second years.

7.141 As noted above, our proposed remedy in our provisional determination was that MTRs should move on to the glide path that Ofcom would have set in the original Statement had it not erred in the ways we have set out in this Determination (and having corrected for the error that Ofcom itself identified[139]). For illustration Table 7.2 below shows the glide path implied by that proposal, taking into account the remedy we have found for the error identified in Reference Question 6.[140] We also show what the glide path would look like if a remedy were included for the errors found in Reference Question 3, which would affect the estimated level of LRIC in each year. Both of these proposed remedies involve setting MTRs at the respective estimates of LRIC in both 2013/14 and 2014/15.

[135] Three's submission on remedies, §36.
[136] Three's submission on remedies, §47.
[137] Three's submission on remedies, §44.
[138] Three's submission on remedies, §46.
[139] We note that Ofcom has changed the charge control on 25 October 2011 and we adopt, for pragmatic reasons, this revised charge control as the basis for any changes to the charge control, even though we do not consider that the 2G/3G MSC cost driver error was pleaded by Vodafone in relation to the calculation of LRIC.
[140] This glide path has been calculated for illustrative purposes. We would expect that Ofcom would produce a similar glide path but it is possible that slight differences in methodology (eg rounding issues) could lead to minor differences.

TABLE 7.2 **Glide paths**

ppm, 2008/09 prices, 2dps

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
Current glide path	4.18	2.69	1.74	1.12	0.72
Proposed remedy (incl RQ6 error)	4.18	2.27	1.23	0.67	0.65
Proposed remedy (incl RQ3 & RQ6 errors)	4.18	2.29	1.25	0.69	0.67

Source: Ofcom, emails to CC of 9 December 2011 and 8 February 2012; CC calculations.

7.142 As a practical matter, we assume that the remedy would come into force at a date close to 1 April 2012, which is the start of the second year of this charge control, and our analysis reflects this. Hence our main focus is on the years 2012/13 and 2013/14, years in which different glide paths would produce different MTRs.

Setting a glide path without further investigation

7.143 We reject EE's argument that the consequences of adopting a different glide path have not been properly considered, in terms of either effects on consumers or effects on operators' returns on investment. Ofcom's decision found, and our appraisal of it in Reference Question 1 upheld, that setting MTRs at LRIC is desirable. It follows from this that any reduction of MTRs to a level at or above LRIC, during the glide path period, is also desirable (subject to any negative consequences of too rapid an adjustment, as we discussed in Reference Question 5). Even though the resulting level of LRIC is slightly lower than Ofcom envisaged, As a result of remedies to Reference Question 6, the reasoning and evidence used in Ofcom's decision, and examined by us in this Determination, indicate that setting MTRs at a revised LRIC is still likely to be desirable. As illustrated in Table 7.2 above, the difference is small (around 0.07ppm in 2014/15).

7.144 We also reject EE's argument that the glide path should take into account the 'unprecedented' changes in MTRs. We note that the details of EE's argument were premised on the estimates produced by Ofcom for its proposed correction of errors in Reference Question 3 and Reference Question 6. These estimates of LRIC are much lower than those that apply under the remedies we have found for those questions, and hence the actual changes would be smaller than those EE referred to. However, even on the figures as argued by EE, we note that the changes are large in percentage terms but not in absolute terms. For example, it is smaller than the change in the first year of the charge control. We would be more concerned about the percentage change if MCT were the only service supplied by MCPs, or if it constituted a larger proportion of their revenues. But we noted in our consideration of Reference Question 4 that the impact of the changes in MTRs over the entire glide path was small relative to MCPs' revenues and profits, and that remains the case. For the same reason, we do not consider that any further evaluation of the effects on MCPs' ability to recoup their investments is necessary. We have seen no evidence that the 'current economic climate' should affect these conclusions.

7.145 We also note that we would expect any possible harm caused by changes in MTRs to be more likely to arise if those changes are unexpected or implemented at short notice. The parties would have been anticipating that MTRs would fall each year under the glide path in Ofcom's Statement, and should have anticipated at least the possibility of further falls as a result of these appeals. Therefore, the main impact on MCPs of the changes in MTRs under our proposed remedy is the incremental change from Ofcom's glide path to our glide path, rather than the whole change in MTRs at the start of each year or the charge control. So, for example, although the reduction in MTRs from the current (2011/12) level when our remedy takes effect

(assuming it takes effect after 31 March 2012) will be 1.46ppm (in 2008/09 prices), MCPs should have been anticipating a reduction of 0.96ppm under the existing glide path. The incremental reduction arising from our proposed remedy (including the remedy for Reference Question 6) is only 0.50ppm (which is 17 per cent of 2011/12 rates).

7.146 For these reasons, we reject EE's arguments that further investigation is necessary before setting a new glide path.

Length of the glide path

7.147 We considered EE's argument that we should allow a further two years for MTRs to reach the level of LRIC (ie effectively have a four-year glide path). We decided that there was no good justification for doing so, for two reasons.

7.148 First, the size of the additional reduction in MTRs, beyond that prescribed by Ofcom's Statement, is relatively small.

7.149 Secondly, EE has argued that a significant proportion of current post-pay customers will be in contract when MTRs reach LRIC on 1 April 2013. This is true, but we expect that the proportion of customers affected will be small (given that the timing of our determination means that there is still 14 months' notice until MCTs reach the level of LRIC and given that post-pay contracts vary in length from 12 to 24 months, and can be even shorter in the case of SIM-only contracts). Also, by 1 April 2013 there should be no residential mobile customers within their minimum contract period who started their contracts prior to the publication of Ofcom's Statement; so we would expect that operators' pricing plans for new customers (before taking into account the possible outcomes of this appeal process) would have been prepared on the assumption that MTRs are set at the level in Ofcom's Statement.

7.150 MCPs have had ample time to anticipate the possibility of further reductions of MTRs as a result of this appeal process and could have included this contingency in their forward planning. Further, we have found that post-pay customers have, on average, a roughly balanced calling profile so the aggregate effect on their profitability, if any, will be small. Finally, the difference between our proposed level of MTRs and the level under the glide path in Ofcom's Statement is small in 2012/13 (0.50ppm in 2008/09 prices, or 12 per cent of MTRs at the end of the previous charge control) and even smaller in 2013/14. It therefore seems unlikely that the imposition of our proposed glide path will result in any material harm to consumers and all the evidence suggests that the effects on MCPs' revenues and profits will be small. We consider that the benefits of lower MTRs should not be delayed unnecessarily and we do not find sufficient reasons for a delay.

Shape of the glide path

7.151 Having decided that MTRs should reach the level of pure LRIC by 1 April 2013, and since we are approaching the end of the 2011/12 year, the main impact of our choice of glide path will be on the level of MTRs for the year April 2012 to March 2013. Among the issues we considered are:

(a) whether we should move directly to the glide path that Ofcom would have set in place from April 2011 had it not erred, or calculate a new glide path (effectively a two-year path) based on the current level of MTRs; and

(b) whether the glide path should take the form of a constant percentage reduction in each year, or a constant ppm reduction in each year (ie a straight line).

7.152 Our aim is to set a glide path that remedies the errors in Ofcom's decision, and does so in a way that balances the desirability of lowering the MTR sooner with the impact of this change on the MCPs. As we explain below, we did not find that there were overwhelming arguments for any particular glide path. We have therefore tried to select a glide path that remedied the error is proportionate and is consistent with the approach of Ofcom's original glide path.

7.153 Our starting point is that moving to the glide path that Ofcom would have set had it not erred, as proposed in our provisional determination, clearly remedies the errors and, as Ofcom argued, is the most straightforward means of doing so. We then considered whether doing so is proportionate and whether any other possible glide path was obviously superior, taking into account the benefits of reaching LRIC as quickly as possible set against any relevant costs of doing so.

7.154 We compared our proposed glide path with the current glide path implemented by Ofcom[141] and with other possible glide paths. We first note that the differences between them are relatively small in the year 2012/13, and even smaller in subsequent years. Our proposed glide path is only 0.50ppm lower than the current glide path for 2012/13, of which 0.41ppm is due to the shorter glide path and 0.09ppm is due to the remedy in Reference Question 6.[142]

7.155 We considered whether we should instead start a new two-year glide path starting from the current 2011/12 level of MTRs (with two equal percentage reductions to reach LRIC in 2013/14). We thought there might be a case for doing so if the change in MTRs from the current level to the level at the start of the remedy would be large. If this had been the case, it might have been necessary to trade off the desirable objective of setting MTRs closer to LRIC in 2012/13 against the undesirable consequence of greater disruption to MCPs' pricing (and any other effects on consumers) from a larger-than-expected reduction in MTRs at short notice. In any case, MTRs in 2012/13 would be only 0.11ppm higher under such a glide path than under our proposed glide path. Since the differences are small, there would be no significant advantage from adopting a two-year glide path to be set against the (admittedly small) disadvantage that it is slightly further from LRIC.

7.156 Our proposed remedy also has the benefit of simplicity: the principle behind it is clear, and would remain so at any point in the charge control. A glide path that restarts from the current charge level would lead to different results if it were set in, say, March rather than May because the 'current' level would have changed.

7.157 We also considered whether a straight-line glide path would be more appropriate. Again, this would involve a balancing of the objective of setting MTRs closer to LRIC against undesirable consequences. A straight-line glide path starting from the current (2011/12) level of MTRs would give an outcome close to the current glide path in 2012/13 (1.68ppm), and then reach LRIC in 2013/14. We think that arguments could be made in favour of or against this (with regard to balancing objectives), but we do not believe that the advantages could be shown to outweigh the disadvantage of higher MTRs. We note that any view that a straight-line glide path would be more appropriate would also have applied to Ofcom's original decision, and none of the

[141] Modified to correct the error that Ofcom itself identified (see footnote to paragraph 7.141).
[142] We note that should the Tribunal decide to implement a remedy for the errors found under Reference Question, the differences would become even smaller.

MCPs appealed against that aspect of the decision. In the absence of compelling reasons to do otherwise, we maintain the principle used by Ofcom.

7.158 Therefore we find that our proposed glide path is reasonable and, especially given the small difference between that and both Ofcom's glide path in its decision and other possible glide paths, there is no convincing case that any alternative glide path would be superior.

Conclusion

7.159 We have, for the reasons above, decided to proceed with our proposed remedy: that MTRs should move on to the three-year glide path that Ofcom would have set in the original Statement had it not erred in the ways we have set out in this Determination (and having corrected for the error that Ofcom itself identified[143]). We consider this to be a reasonable general principle in the absence of good reasons to depart from it. It is also consistent with Ofcom's reasoning in the Statement.

Correcting for the errors in Reference Question 6

Our finding and approach to remedies

7.160 We found that Ofcom erred in relying on a model that overstated certain costs associated with certain radio equipment. Our finding turned on Ofcom's approach which uplifted the costs of certain radio equipment assets by multiple times the unit costs evidenced by the section 135 operator data without adequate justification. We considered that Ofcom should have more thoroughly investigated the differences between the bottom-up and top-down data.

7.161 We sought to identify a satisfactory remedy that could be implemented without remittal. Since we thought that such a remedy would be unlikely to fully address the issues we had found, given our concerns about the quality of the underlying data (see paragraph 7.262), we also considered the option of remitting the issue to Ofcom.

7.162 We therefore considered:

(a) an adjustment option; and

(b) remittal to Ofcom.

7.163 In our remedies letter of 14 December 2011 we asked Ofcom to put forward a proposal as to how the provisionally identified errors might be remedied. Ofcom responded to this request with a revised version of the 2011 Model on 5 January 2012; [144] we refer to this as Ofcom's initial proposal. The parties provided skeleton arguments on remedies (Skeleton Arguments) taking account of this in advance of the remedies hearing. The possible remedy options were discussed at the remedies hearing and in light of this we requested that Ofcom consider whether it could improve its initial proposal to reflect some of the concerns raised. Parties submitted their formal responses on 17 January 2012. At that point Ofcom put forward a variant

[143] We note that Ofcom has changed the charge control on 25 October 2011 and we adopt, for pragmatic reasons, this revised charge control as the basis for any changes to the charge control, even though we do not consider that the 2G/3G MSC cost driver error was pleaded by Vodafone in relation to the calculation of LRIC.
[144] Ofcom initially wrote to us on 3 January 2012, a revised version of the 2011 Model was issued on 5 January 2012 (5 January Model).

to its initial proposal (we refer to this as the 17 January Variant) and EE, Vodafone and Three presented their own suggestions.

7.164 We set out Ofcom's initial proposal and the parties' formal responses of 17 January 2012 below, in our discussion of the adjustment remedy option. We have not found it necessary to detail all of the discussions and correspondence that took place in between receiving the Skeleton Arguments and the formal responses. Instead we set out the thrust of the parties' positions as relevant to our determination. We set out comments from the remedies hearing and subsequent correspondence only where necessary.

The adjustment remedy option

7.165 We have structured this section as follows:

(a) first, we set out the parties' submissions on an adjustment remedy (paragraphs 7.166 to 7.226);

(b) second, we set out our analysis of the parties' submissions on an adjustment remedy and our view of the key issues (paragraphs 7.227 to 7.273);

(c) third, in light of our conclusions we requested that Ofcom run its model with some amended inputs to inform a possible adjustment remedy option that we might adopt; we invited comment on this (paragraphs 7.274 to 7.308); and

(d) fourth, we set out our conclusions on an adjustment remedy (paragraphs 7.348 to 7.349).

Ofcom's proposals

Initial proposal—5 January Model

7.166 Ofcom said that it would propose revising the MEA price trends of the relevant asset classes between 2005/06 and 2008/09 inclusive, using its regulatory judgement as to the appropriate price trends, but placing heavy weight on the original cost data submitted to Ofcom by the MCPs during the market review process as a result of the section 135 information requests.[145]

7.167 Ofcom's model that supported this proposal was referred to as the '5 January Model'. The MCT LRIC in 2014/15 on this basis would be 0.53ppm.

7.168 Ofcom said that the 5 January Model unit cost values for each piece of radio equipment were typically within the min-max range of the bottom-up section 135 data (ie the range between the minimum and maximum cost submitted by the operators to Ofcom).[146]

- *Capex*

7.169 For capex, Ofcom proposed the following adjustments.[147]

[145] Ofcom letter, 3 January 2012.
[146] Ofcom letter, 17 January 2012, Annex, p1.
[147] Ofcom's model accompanying the 5 January 2012 proposal.

TABLE 7.3 **Adjustments to capex cost trends (2011 Model values in brackets)**

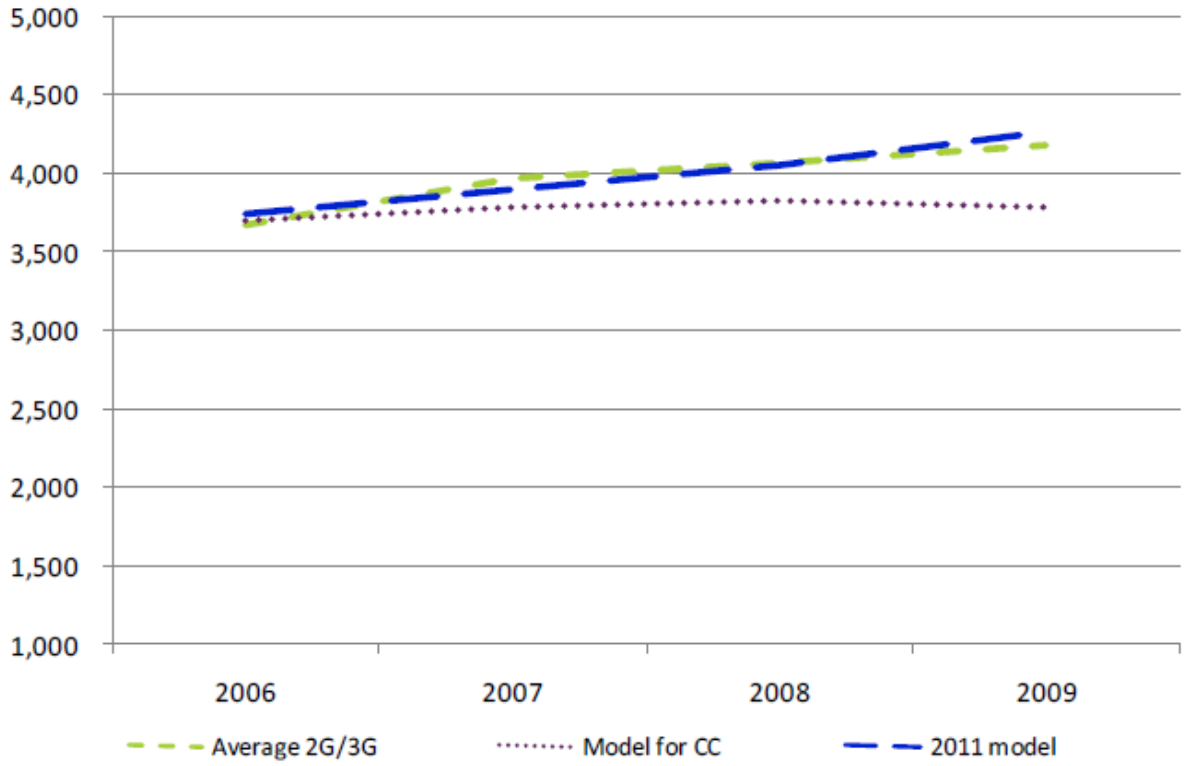
	2005/06	*2006/07*	*2007/08*	*2008/09*
Macro BTS and Node Bs	–25% (–5%)	–20% (–5%)	–20% (–5%)	–15% (–5%)
Micro BTS and TRX	–25% (–5%)	–20% (–5%)	–20% (–5%)	–15% (–5%)
BSC	–40% (–4%)	–40% (–4%)	–40% (–4%)	–40% (–4%)
RNC	–35% (–5%)	–35% (–5%)	–40% (–5%)	–40% (–5%)

Source: CC based on Ofcom's data of 5 January and Ofcom's email from 8 February 2012.

7.170 Ofcom provided the following calibration chart for GBV, which reflected this adjustment.[148]

FIGURE 7.16

GBV calibration after Reference Question 6 changes (£m) [minimum/maximum lines have been removed]



Source: Ofcom.

7.171 In its Skeleton Argument Ofcom said that whilst it might be desirable to improve the GBV calibration by reference to the MCP average it was not clear that increasing the cost of other non-radio equipment assets was likely to be satisfactory. It noted that radio equipment costs were around three-quarters of total network costs and that offsetting a large decline in radio equipment unit costs would require a more than proportionate increase in other network costs. It said that these adjustments would go beyond minimal changes and that changes would create scope for further disagreement between the parties. As the modelled GBV was within the min-max range of MCP data it did not see that it was necessary to recalibrate.[149]

[148] Ofcom's supplementary figures for 5 January 2012 proposal (received in letter from 6 January 2012).
[149] Ofcom skeleton argument, §53.

7.172 Ofcom said it had considered whether it was appropriate to look back over a longer period and adjust the equipment costs in 'P2' (ie 2002 to 2005) (see Section 6, paragraph 6.25*(b)*) in order to improve calibration, but considered this to be inappropriate as:

(a) equipment unit costs in P2 in the 2011 Model were determined in significant part based on bottom-up data obtained from the MCPs in previous market reviews, as well as the calibration exercise then undertaken;

(b) in so far as unit costs in models for historic periods were shaped by bottom-up data, it was undesirable to retrospectively adjust these unit costs;

(c) it said that it had in mind our provisional determination which noted the need not to discard bottom-up data without sufficient justification;

(d) the radio equipment costs derived from the previous market review and the results of the 2007 calibration were not appealed; and

(e) the CC had provisionally concluded that the parties' view on the alleged P2 discrepancy were 'speculative'.[150]

7.173 It said that a quick analysis of the effect that such a P2 adjustment would have showed that it would not materially alter the LRIC value in 2014/15 (0.52ppm) but that it would have a detrimental impact on GBV calibration. It said that as well as being undesirable as a matter of principle, a P2 adjustment would not be proportionate given the lack of impact on the charge control.[151]

- *Opex*

7.174 For opex, Ofcom proposed the following adjustments.[152]

TABLE 7.4 **Adjustments to opex cost trends (2011 Model values in brackets)**

	2005/06	*2006/07*	*2007/08*	*2008/09*
2G macro BTS and Node Bs	–25% (–3%)	–20% (–3%)	–20% (–3%)	–15% (–3%)
3G macro BTS and Node Bs	–25% (–15%)	–20% (–8%)	–20% (–4%)	–15% (–2%)
Micro BTS and TRX	–25% (–3%)	–20% (–3%)	–20% (–3%)	–15% (–3%)
BSC	–40% (–4%)	–40% (–4%)	–35% (–4%)	–35% (–4%)
RNC	–40% (–15%)	–40% (–8%)	–40% (–4%)	–40% (–2%)

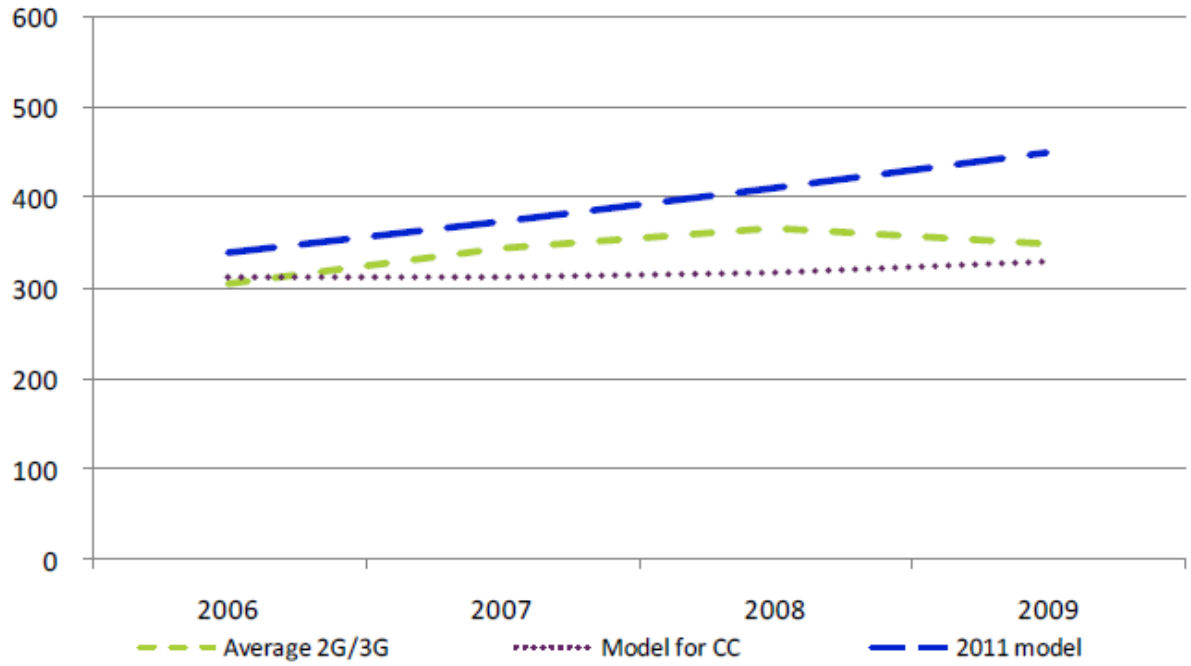
Source: CC based on Ofcom's data of 5 January.

7.175 Ofcom provided the following calibration chart for opex, which reflected this adjustment.[153]

[150] Ofcom skeleton argument, §54.
[151] Ofcom skeleton argument, §56.
[152] Ofcom's model accompanying the 5 January 2012 proposal.
[153] Ofcom's supplementary figures for 5 January 2012 proposal (received in letter from 6 January 2012).

FIGURE 7.17

Opex after Reference Question 6 changes (£m)
[minimum/maximum lines have been removed]



Source: Ofcom.

- *Recalibration*

7.176 Ofcom did not propose to recalibrate the model after the adjustments to radio equipment costs were made. This left the modelled GBV below the 2G/3G operator average in 2006 to 2009 (2006 about the same) see Figure 7.15, the modelled NBV above the 2G/3G operator average in 2006 to 2009 and the modelled opex just above the 2G/3G operator average in 2006 and below the 2G/3G operator average in 2007 to 2009 (see Figure 7.17).[154]

17 January Variant Model

7.177 Following, the remedies hearing in its response to the provisional determination dated 17 January 2012 Ofcom provided a variant of its earlier proposal. This was designed to address some of the parties' concerns about the modelled GBV and opex being below the 2G/3G operator average (see paragraph 7.188).

- *Capex*

7.178 Ofcom investigated whether the bottom-up data would support alternative financial parameter values, as an alternative means of improving GBV calibration. It found that this could be achieved by adding two years to the asset lives of each of the radio equipment assets and that this would result in the asset life typically lying within the min-max range of the section 135 data (with one exception, in relation to which only one operator provided section 135 data on a comparable basis). The effect of this

[154] Ofcom letter, 3 January 2012, Appendix 2.

adjustment would be to increase the modelled GBV so that the difference between the 2G/3G operator average GBV and modelled GBV was 6 per cent in the final year. However, this improvement in GBV came at the expense of the NBV calibration, where NBV was pushed to the top of the min-max range. Ofcom said that it did not believe this undermined the overall calibration.

7.179 The overall effect of this asset life adjustment (when taken together with all of the other adjustments proposed by Ofcom in its Skeleton Argument) was to reduce the LRIC in 2014/15 from 0.53ppm (in its initial proposal) to 0.52ppm.[155]

- *Opex*

7.180 Ofcom said that it considered that the 5 January Model was adequately calibrated, but if we considered that the opex calibration should be improved, then this could be achieved by reducing the rate of decline in RAN equipment opex.[156]

7.181 For opex, Ofcom proposed the following adjustments in its 17 January Variant Model.[157]

TABLE 7.5 **Adjustments to opex cost (5 January 2012 values in brackets)**

	2005/06	*2006/07*	*2007/08*	*2008/09*
2G macro BTS and Node Bs	–15% (–25%)	–15% (–20%)	–15% (–20%)	–10% (–15%)
3G macro BTS and Node Bs	–15% (–25%)	–15% (–20%)	–15% (–20%)	–10% (–15%)
Micro BTS and TRX	–15% (–25%)	–15% (–20%)	–15% (–20%)	–10% (–15%)
BSC	–40% (–40%)	–40% (–40%)	–35% (–35%)	–35% (–35%)
RNC	–40% (–40%)	–40% (–40%)	–40% (–40%)	–40% (–40%)

Source: Ofcom.

7.182 Ofcom said that it made an adjustment to opex price trends in its 17 January Variant Model to more closely align opex with the operator averages.[158]

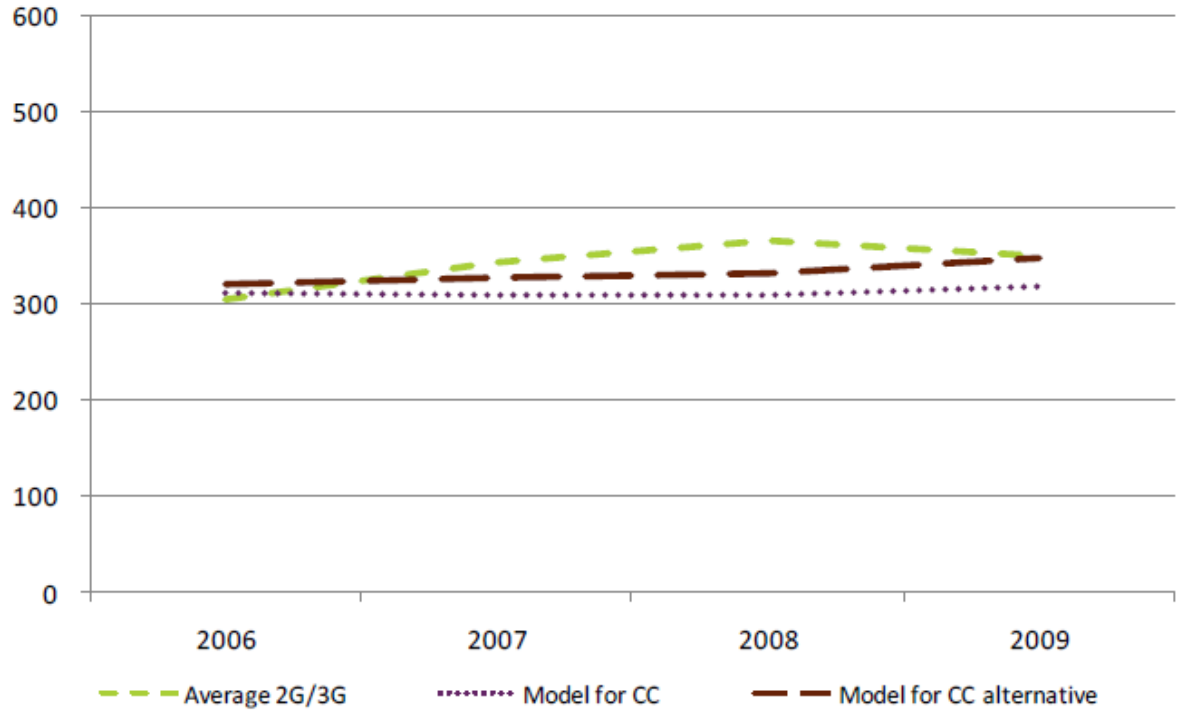
7.183 Ofcom said that in its 17 January Variant Model, it had reduced the rate of decline in radio equipment opex. It noted this might involve departing from the original section 135 data min-max range (Ofcom noted that in many cases only a single operator provided the relevant opex data in response to the section 135 requests[159]), but would still typically be consistent with the bottom-up evidence provided by Three during the appeal process, [✂].

7.184 Ofcom said that the modelling resulting from the 17 January Variant Model would result in opex differing from the 2G/3G operator average by only 1 per cent in 2009 year.[160] See Figure 7.18 below.[161]

[155] Ofcom letter, 17 January 2012, Annex, p5.
[156] Ofcom letter, 17 January 2012, Annex, p5.
[157] Ofcom's model accompanying the 17 January 2012 proposal.
[158] Ofcom letter, 17 January 2012, p2.
[159] Ofcom letter, 17 January 2012, p2.
[160] Ofcom letter, 17 January 2012, Annex, p7.
[161] Ofcom letter, 17 January 2012, Annex, Figure 3.

FIGURE 7.18

Opex with Reference Question 3 changes (including recalibration) and Reference Question 6 changes (£m nominal)[162] [minimum/maximum lines have been removed]



Source: Ofcom.

7.185 Ofcom said that if this was implemented together with all of the adjustments proposed in Ofcom's Skeleton Argument the result of the variation in radio equipment opex from 2005/06 to 2008/09 was to increase the LRIC of MCT from 0.53ppm (in Ofcom's initial proposal), to 0.55ppm, when implemented without the asset life adjustment and to 0.54ppm when implemented with the asset life adjustment.[163]

EE's submission

EE's view of Ofcom's initial proposal—5 January Model

7.186 EE said that it was prepared to accept Ofcom's proposed revised equipment prices (ie those of 5 January Model) as a pragmatic starting point for developing a remedy.[164]

7.187 It said that Ofcom's proposal would underestimate average operator GBV by 11 to 12 per cent (depending on which other adjustments were made) and that Ofcom's proposal was poorly calibrated to the change in GBV over time with significant

[162] Ofcom letter, 17 January 2012, Annex, Figure 3.
[163] Ofcom letter, 17 January 2012, Annex, pp7 & 8.
[164] EE submission on the provisional determination and Remedies, §171.

divergence in the last year of calibration, ie 2008/09. EE said that Ofcom's proposals did not match the slope of operating costs over the calibration period.[165]

7.188 EE said that Ofcom's proposed remedy would produce a GBV that was significantly below the average GBV of the operators and would result in termination rates that assumed a (low) level of costs that was impractical for operators to achieve in practice.[166] It said that setting charges that failed to recover efficient costs was inconsistent with section 88(2) of the Communications Act and Article 13(1) of the Access Directive which required regulators to allow a reasonable rate of return on adequate capital employed. It also said that the model appeared to provide a GBV in 2009 that was 10 per cent or more below the average GBV of operators and that in the CC's 2003 Determination, the CC considered that a difference of 7 per cent warranted an adjustment.[167]

7.189 EE was concerned that the assumed level of 2G equipment prices was low relative to actual operator data.[168]

EE's proposal

- *Capex*

7.190 EE said that all equipment prices in the 5 January Model, except for 3G radio equipment prices, should be increased by 8 per cent in each year of the calibration period (2005/06 to 2008/09). It said that this meant the 3G radio equipment prices which the CC identified as being in error were retained at the level assumed in Ofcom's new proposals and that other equipment prices were increased by a relatively modest amount (ie not by the multiples of the bottom-up data that was a concern to the CC) over Ofcom's proposals which assumed price decreases of up to 40 per cent for particular assets.

7.191 EE considered that the fact that more of the weight of the adjustment was put on 2G relative to 3G assets was consistent with its view that Ofcom's proposed 2G prices were very low relative to the overall operator data.[169]

- *Opex*

7.192 EE said that its proposed adjustments (see Table 7.6 below) to annual changes in operating expenses achieved a much closer calibration than Ofcom's actual proposals while still being reasonably consistent with that bottom-up evidence. It said that larger initial falls in the initial year of the calibration period helped bring the model into line with the data (effectively adjusting for price reductions in earlier years being understated).[170]

7.193 EE provided the following suggestion for opex unit cost trends.[171]

[165] EE submission on the provisional determination and Remedies, §172.
[166] EE skeleton argument, §2(c).
[167] Ofcom skeleton argument, §29.
[168] EE Submission on the provisional determination and remedies, §173.
[169] EE Submission on the provisional determination and remedies, §174.
[170] EE submission on the provisional determination and remedies, §175.
[171] EE submission on the provisional determination and remedies, Table 5.

TABLE 7.6 **EE's proposed opex unit cost trends**

per cent

	2005/06	*2006/07*	*2007/08*	*2008/09*
2G macro BTS and Node Bs	–30	–3	–3	–3
3G macro BTS and Node Bs	–40	–3	–3	–3
Micro BTS and TRX	–30	–3	–3	–3
BSC	–40	–40	–35	–35
RNC	–40	–40	–40	–40

Source: EE Submission on the provisional determination and remedies, §Table 5.

- *Overall effect*

7.194 EE's proposals resulted in a MTR in 2014/15 of 0.67ppm to 0.69ppm (depending on which other adjustments were made in conjunction).[172]

7.195 EE said that if we were minded to maintain the cost relativities of Ofcom's 5 January Model we could increase all costs by 6 per cent for each year and would get MTR in 2014/15 of 0.67ppm–0.69ppm (depending on which other adjustments were made in conjunction).[173]

EE's view of Ofcom's 17 January Variant Model

7.196 EE said that Ofcom's original asset lives were based on data on asset lives from all operators (and for most assets, asset life data was provided by at least four operators), whereas price data for many assets was only provided by one or two operators. It said that to remedy a large shortfall in costs, it was appropriate to adjust assumptions about asset prices rather than asset lives given the greater confidence that can be placed on estimates of the latter.[174]

7.197 EE also said that whilst Ofcom had suggested that its adjustments to asset lives were reasonable based on the range of operator data, there were a number of problems with Ofcom's argument:[175]

(a) First, Ofcom's reported range appears not to have taken into account Orange's data on 3G asset lives (ie Orange's data is generally below Ofcom's purported minimum).

(b) Second, Ofcom's new proposed asset lives cannot be said to be representative of the overall operator data:

(i) Ofcom's reliance on a range gives undue weight to data from Three which appears unreliable as H3G has put forward asset lives on 3G assets that are [✂] those of the highest data of the other operators. This is particularly surprising as Three shares the same 3G network as T-Mobile and the relevant equipment is jointly procured.

(ii) Ofcom's new proposed asset lives are not representative of the data provided by the other four operators. For example, for many assets, three operators

[172] EE submission on the provisional determination and remedies, §177.
[173] EE submission on the provisional determination and remedies, §180.
[174] EE letter of 19 January responding to Three's letter of 18 January, §17.
[175] EE letter of 19 January responding to Three's letter of 18 January, §18.

provided asset lives of eight years or less, but Ofcom's new proposal would adopt an asset life of ten years.

7.198 We note that Ofcom responded to this on 20 January 2012, it apologized for not including Orange's data and said that this affected ten of the 3G radio equipment assets. Ofcom had said that two years could be added to the radio equipment asset lives without taking them above the min-max range (save for one exception). It said that inclusion of the Orange data did not affect this observation.[176]

7.199 EE said that Ofcom's 17 January Variant Model did not achieve a close calibration to operators' average GBV and further assumed asset lives that were not representative of overall operator data.[177]

Vodafone's submissions

Vodafone's view of Ofcom's initial proposal—5 January Model

7.200 Vodafone said that the general approach adopted by Ofcom, in terms of applying unit cost changes to a subset of cost categories over four years, appeared to be a reasonable method. However, Vodafone had a number of concerns about the inputs:

(a) the resulting series of total cost information from the model showed expenses and gross assets growing significantly more slowly than the reported costs of operators, based on the average operator input, over the relevant period;

(b) the expense and investment unit cost inputs for 2009/10 had the costs of 2G equipment significantly lower than that of equivalent 3G equipment, even though the bottom-up cost information did not support this assumption.[178]

7.201 Vodafone considered that the alignment of the model with the top-down information was so poor that Ofcom's proposals were not an acceptable remedy.[179]

Vodafone's proposal

7.202 Vodafone said that it:

(a) had taken into account the broad level of unit costs for 3G radio equipment and BSCs/RNCs used by Ofcom for 2009/10 which Vodafone presumed took account of the bottom-up information available to Ofcom;

(b) had increased the costs of 2G radio equipment in 2009/10 to a level such that the relativity between the cost of 2G equipment and 3G equipment was consistent with the bottom-up information available; and

(c) had set the annual percentage price changes in order to attempt to produce better alignment between the results of the model and the average top-down information presented by Ofcom in the 2011 Statement.[180]

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[176] Ofcom email to CC dated 20 January 2012.
[177] EE's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[178] Vodafone response to the CC's provisional determination of the price control questions, §A1.34.
[179] Vodafone response to the CC's provisional determination of the price control questions, §A1.37.
[180] Vodafone response to the CC's provisional determination of the price control questions, §A1.43.

- *Capex*

7.203 Vodafone also adjusted the MEA Unit investment costs as follows.[181]

TABLE 7.7 **MEA Unit Investments (per cent change in real terms—applied in following year)**

per cent

	2005/06	*2006/07*	*2007/08*	*2008/09*
2G (incl TRX)	–5	–5	–5	–5
3G (excl Carriers)	–5	–5	–30	–30
BSC	–40	–40	–40	–40
RNC	–35	–35	–40	–40

Source: Vodafone response to the CC's provisional determination of the price control questions, §A1.47.

- *Opex*

7.204 For opex, Vodafone kept the same assumptions as Ofcom for BSC and RNC, but made adjustments to 2G macro BTS and Node Bs, 3G macro BTS and Node Bs and micro BTS and TRX. These adjustments were the same as those proposed by EE (paragraph 7.192) and are set out in Table 7.8 below.[182]

TABLE 7.8 **MEA Unit Expenses (per cent change in real terms—applied in following year)**

per cent

	2005/06	*2006/07*	*2007/08*	*2008/09*
2G macro BTS and Node Bs	–30	–3	–3	–3
3G macro BTS and Node Bs	–40	–3	–3	–3
micro BTS and TRX	–30	–3	–3	–3
BSC	–40	–40	–35	–35
RNC	–40	–40	–40	–40

Source: Vodafone response to the CC's provisional determination of the price control questions, §A1.44.

7.205 Vodafone said that its adjustments resulted in a LRIC output in 2014/15 of 0.64ppm (including changes to Reference Question 3).[183]

Vodafone's view of Ofcom's 17 January Variant Model

- *Capex*

7.206 Vodafone said that Ofcom did not have sufficient unambiguous evidence to suggest that an extension to RAN asset lives was warranted. Vodafone said that the assumption of network sharing in Ofcom's model suggested a reduction, rather than an increase in the asset life assumptions (as network sharing created an asset replacement opportunity).[184]

7.207 Vodafone also pointed out that Ofcom had responded to our determination that unit costs were incorrect with a recalibration of another variable.[185]

[181] Vodafone response to the CC's provisional determination of the price control questions, §A1.47.
[182] Vodafone response to the CC's provisional determination of the price control questions, §A1.44.
[183] Vodafone response to the CC's provisional determination of the price control questions, §A1.50.
[184] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p3.
[185] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p3.

7.208 Vodafone also considered Ofcom's recalibration of asset lives improved the calibration proposal from 5 January 2012 only slightly and the GBV was still well below the actual operator averages and also was still on the wrong trajectory.[186] Vodafone considered its own recalibration proposal provided a better slope and better absolute levels of GBV.[187]

- *Opex*

7.209 Vodafone considered that Ofcom's opex recalibration proposal was very similar to its own opex recalibration proposal in terms of the impact on LRIC and said that there was very little to choose between these two alternatives.[188]

Telefónica's submissions

7.210 Telefónica said that it concurred with Vodafone in relation to the remedies issues (save for a single point made in relation to the glide path, ie the Reference Question 4 remedy).[189]

BT's submissions

7.211 BT said that it accepted the changes set out by Ofcom in its initial proposal (ie 5 January Model) would be a fair, reasonable and pragmatic remedy to the error provisionally found by the CC.[190] BT did not comment on Ofcom's 17 January Variant model.

Three's submissions

Three's proposal

7.212 Three argued that its own evidence as to the effect of the overstatement was the best available. It said that it was unlikely that better evidence would emerge if it had not already been produced in the extensive consultation and appeal process.[191]

7.213 Three said that top-down information was applied to check for errors in the bottom-up model and to avoid 'large discrepancies' in the costs and cost allocation between real and hypothetical operators. It said that there was no question of matching the bottom-up and top-down figures.[192]

7.214 Three said that recalibration was not necessary, it said that for opex there was no reason why re-calibration should do anything to undermine its view that a correction of the opex unit costs would reduce the 2014/15 LRIC. For capex whilst it said that in principle recalibration would be ideal it considered that it might result in some offsetting effect to the reduction in LRIC if non-radio costs were increased however it considered that the available evidence suggested this was unlikely. Three referred to its view that pre-2009 unit costs were understated (see Section 6, paragraph 6.25*(c)*).[193] Three noted in particular that Ofcom's initial proposal suggested that

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[186] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p3 & 4.
[187] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p4.
[188] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p5.
[189] Telefónica response to the provisional determination, §1.2.
[190] BT written submissions on remedies, §31.
[191] Three's submission on remedies, §2(4).
[192] Three's submission on remedies, §55.
[193] Three's Skeleton Argument §§39-41.

recalibration of the model would not show that the impact on 2014/15 LRIC of the decrease in 2009 radio unit costs was offset by increases in non-radio costs.[194] It said that there was no evidential basis for the assumption that there was likely to be an offsetting effect as a result of recalibration. It said that it was highly unlikely that on a remittal to Ofcom evidence might emerge which could support such an offsetting effect.[195]

Three's view of Ofcom's initial proposal

7.215 Three said that in order to avoid further prejudicial delay in implementing the Decision it was prepared to agree to the remedies proposed by Ofcom in their entirety.[196]

7.216 It said that Ofcom's approach remained highly advantageous for EE, Vodafone and Telefónica: in Ofcom's most recent analysis the relevant unit costs were treated as more than double Three's unchallenged figures. Three maintained that the unit costs used in the model should be lower than those proposed by Ofcom and said it would argue as much if Ofcom's complete package of proposed remedies was not to be adopted.[197]

7.217 Three accepted, however, that Ofcom's initial proposal resulted in unit costs that were more appropriate than those currently in the model and a calibration exercise that was more successful than in the 2011 Model.[198]

7.218 It said that Ofcom's initial proposal struck an appropriate balance between the objective of securing the best solution and the need for expedition. Three submitted that the benefits that may be obtained by further recalibration and analysis were substantially outweighed by the prejudice caused by further delay in implementing the Decision. As noted above, Ofcom's proposed solution was clearly better than the status quo and should be given effect even if only as an interim solution pending further investigation by Ofcom.[199]

Three's view of Ofcom's 17 January Variant Model

7.219 Three was content to accept either Ofcom's 5 January Model or the 17 January Variant Model.[200]

Other comments on the parties' proposals

7.220 We received some correspondence from EE and Three concerning each other's submissions to us. We set out the key points from this correspondence below.

Three's other comments

7.221 Three wrote to the CC responding to EE's remedies submission.[201] It said that the fundamental premise for EE's objections to Ofcom's proposed remedial solution of

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[194] Three's submission on remedies, §57.
[195] Three's submission on remedies, §62.
[196] Three's submission on remedies, §67.
[197] Three's submission on remedies, §68.
[198] Three's submission on remedies, §68.
[199] Three's submission on remedies, §69.
[200] Three's letter of 18 January 2012, final paragraph.
[201] Three's letter of 18 January 2012.

5 January 2012 was that the assumed level of 2G equipment prices was low relative to actual operator data. Three said that the Annex to Ofcom's remedies submission of 17 January 2012 demonstrated that EE's fundamental premise was wrong. Three noted that for seven out of nine 2G capex categories, the 5 January Model input figures were within the min-max bounds and mostly near the upper end of the range, For the other two 2G categories and all the 2G opex categories, Ofcom's figures were above the maximum figures provided in the operators section 135 responses. Three therefore considered that there was no justification for further increasing 2G radio equipment unit costs.[202]

7.222 In addition, Three said that EE's approach of applying an across the board uplift to all equipment unit costs (or all apart from 3G radio equipment unit costs) was flawed. It said that this approach assumed that top-down data must take precedence and that it flew in the face of evidence available on radio equipment unit costs by increasing unit costs when all the evidence showed costs were too high already, or at least, at the upper bound of what was reasonable and it said that no bottom-up evidence had been provided to suggest that other equipment unit costs were understated. Three also objected to the NBV calibration in EE's proposal, as it said the predicted NBV was heading in the opposite direction of actual NBV at the end of the period for which there was data.[203]

7.223 In terms of Vodafone's proposal, Three made similar points to those it raised on EE's. In addition, it said that Vodafone's adjustments to the rate of change in unit costs resulted in some inexplicable and unusual patterns whereby unit costs changed very differently over the four-year period, with large adjustments in some years and small adjustments in others. It considered that Vodafone's solution did not achieve significantly better calibration—the reason asserted for putting it forward. It said that in matching GBV Vodafone's was only slightly better than Ofcom's 5 January Model over four years and nowhere near as good as Ofcom's 17 January Variant Model.[204]

EE's other comments

7.224 EE responded to Three's view that Ofcom's proposed 2G equipment prices in 5 January Model should not be considered low relative to actual operator data.

7.225 EE explained that it understood that Ofcom's range for 2G capex was derived from the actual data of only [✂] and in some cases only from [✂]. Further, T-Mobile's data for some equipment related only to hardware costs. In these circumstances, the [✂] data was likely to be the most reliable. Ofcom's proposed new 2G prices were below the [✂] data in the majority of cases (five out of nine) and in some other cases where the proposed prices were above the [✂] data they were below [✂] data.[205]

7.226 In response to Three's criticism of EE's uplift to all assets, EE said that its proposed approach was a pragmatic solution to achieving a reasonable alignment between bottom-up and top-down data in a way that retained sight of both approaches.[206] EE noted that Ofcom's proposed prices assumed reductions in key assets of up to 40 per cent a year for four years in succession taking those asset prices down to as low as one-eighth of their original levels. It said Ofcom's proposed price paths could not be considered to be a realistic description of the actual path of equipment prices and that EE's proposal would assume a more realistic path. Further, EE's proposal

[202] Three's letter of 18 January 2012, §§6 & 7.
[203] Three's letter of 18 January 2012, §8.
[204] Three's letter of 18 January 2012, §9.
[205] EE response to Three's letter of 18 January 2012.
[206] EE's letter of 19 January responding to Three's letter of 18 January, §15.

also achieved appropriate 2009 prices recognizing that there was a need for some upward adjustment to avoid a large shortfall between the modelled costs and actual costs.[207]

Our view of the parties' proposals

7.227 As set out in paragraph 7.160, we found that Ofcom erred in relying on a model that overstated certain costs associated with certain radio equipment, in particular that Ofcom uplifted the costs of certain radio equipment assets by multiple times the unit costs evidenced by the section 135 operator data without adequate justification. We also considered that Ofcom should have more thoroughly investigated the differences between the bottom-up and top-down data.

7.228 In an ideal world a proper reconciliation between the bottom-up and top-down data would be carried out and this reconciliation would involve a reassessment of the data or the methodology underlying Ofcom's decision. However this exercise is likely to present several practical challenges and we therefore considered that a pragmatic approach may be appropriate. We stressed to the parties that we would consider the timeliness of implementation to be an important factor in assessing the suitability of any remedy.

7.229 Whilst we have found that Ofcom should have more thoroughly investigated the differences between the bottom-up and top-down data, we consider that doing this as part of the remedies process would necessitate remittal to Ofcom. We consider this option below in paragraphs 7.309 to 7.347.

7.230 Having received the submissions from the parties, we identified a number of important issues:

(a) One of the main problems was the degree of difference between the top-down and bottom-up figures. We did not consider that it would be possible for us to establish the cause of these differences.

(b) There was an important divergence between parties as to the weight that should be placed upon achieving a close match to the modelled average GBV and the role of this in enabling cost recovery. We noted that the bottom-up data appeared to be less complete and less reliable than the top-down data. By way of example, some of the bottom-up data that Ofcom had appeared to have only been supplied by one or two parties. We were mindful of the Recommendation, but considered that in the given circumstances greater weight might need to be placed on the top-down data than on the aggregated bottom-up data.

(c) Ofcom's calibration process involved testing various adjustments to bottom-up data in order to seek a good fit with predicted GBV, NBV and opex. We did not consider that we could carry out such an extensive exercise in a similar way to Ofcom because repeated iterations would be impractical and because we are not as familiar with the model as Ofcom. We considered that it would be preferable for us to identify a consistent set of adjustments and a slightly simplified calibration.

(d) We did not want to make adjustments that were more wide ranging than necessary. This is in line with our Guidelines (see also paragraph 7.357).[208] However,

[207] EE's letter of 19 January responding to Three's letter of 18 January, §16.

we recognized that if, say, we were to correct the radio equipment costs appealed by Three and to maintain the predicted GBV, then we would need to make adjustments to other unit costs.

(e) The remedy could require us to take into account considerations that had not been previously raised. For example, Vodafone and EE argued the relative costs of 2G/3G were not reflective of section 135 data.

7.231 We consider the parties' proposals below.

Ofcom's initial proposal—5 January Model

7.232 In our view the key benefits of this approach are that it is confined to fixing the identified error (or at least aspects of it), it places more weight on the bottom-up data than before; and it is informed by Ofcom's regulatory judgement and experience.

7.233 Our concerns with Ofcom's proposal are that it results in a cost model that appears to use an arbitrary combination of bottom-up and top-down data. In Ofcom's proposal unit equipment costs are largely based on the s135 data (without recalibration - see paragraph 7.259), which leaves GBV around 10 per cent below the operator average in 2009 (and below where it was in the 2011 Model) (see Figure 7.16 above). At the same time, asset counts remain calibrated by reference to top-down data.

Ofcom—17 January Variant Model

Capex

7.234 In comparison with Ofcom's initial proposal, this approach produced a modelled GBV that is closer to the 2G/3G operator average. However, it achieved this by adjusting asset lives and these were not appealed (although we note that the asset lives remain largely within the min-max tolerance bands that Ofcom advocates).

7.235 In our view, adjustment of asset lives was not appropriate without further detailed consideration and it would not be practical for us to do this. (However, we thought it might be appropriate for Ofcom to do this on a remittal or a new decision.)

Opex

7.236 Ofcom's 17 January Variant Model calibrated more closely with operator opex data than Ofcom's initial proposal. This was achieved in some cases at the expense of the min-max bounds in the section 135 data. However, when taking into account Three's data provided in Three's appeal, these figures did not look unreasonable.

Vodafone's remedy

7.237 Vodafone's remedy started with Ofcom's revised cost assumptions (ie those in Ofcom's 5 January Model) and then addressed Vodafone's concerns about the relative costs of 2G and 3G equipment by uplifting the 2G costs to the relative 3G cost where applicable. It then applied an adjusted price trend to the radio equipment.

7.238 The benefits of this approach were that it has a clear position on the role of bottom-up and top-down evidence (top-down gives total; bottom-up gives structure). The

[208] CC13 Price control appeals under section 193 of the Communications Act 2003: Competition Commission Guidelines April 2011

downsides are that it is not clear to us that changes should be restricted to assets chosen by Vodafone; and the adjustments made to prices have an element of arbitrariness in that there is no objective rationale for the adjustments offered by Vodafone except that the result is that GBV is better calibrated than in Ofcom's proposal.

7.239 We were concerned that Vodafone's proposal adjusted only radio costs, albeit more evenly than in the 2011 Model, as none of the evidence suggested to us that any adjustment should be confined to radio equipment costs.

EE's remedy

7.240 EE's remedy started with Ofcom's revised cost assumptions. EE addressed its concerns about the relative costs of 2G and 3G equipment by applying an uplift to all costs except 3G radio equipment. It also made adjustments to the opex price trends.

7.241 Like Vodafone's proposal, EE's proposal has a clear position on the role of bottom-up and top-down evidence (top-down gives total; bottom-up gives structure). However, it is not clear that changes should be restricted to assets chosen by EE (we do not agree that 3G radio equipment should be singled out); and the adjustments made to prices have an element of arbitrariness in that there is no objective rationale for the adjustments offered by EE except that the result is that GBV is better calibrated than in Ofcom's proposal. However, in contrast to Vodafone's remedy proposal, we prefer the wider application of the uplifts (ie across almost all assets) in EE's suggestion.

Three's remedy

7.242 Three's proposal was to use its own evidence to provide the unit costs of those assets it had appealed. We do not agree with Three that the unit cost data used should be based solely on its own evidence. We consider that all operators' bottom-up data should be considered.

7.243 As with Ofcom's 5 January Model, Three's proposal would leave modelled GBV below operator averages as it does not re-calibrate the data (see paragraph 7.233).

Our view of the key issues

7.244 We considered whether the submissions received revealed a preferred approach.

Opex

7.245 The opex approach in Ofcom's 17 January Variant Model appears to have addressed EE's and Vodafone's earlier criticism of Ofcom's initial proposal (ie that operating costs were below operator actual costs).

7.246 We note that:

(a) Three agreed with both of Ofcom's proposals (the 5 January Model and 17 January Variant Model) for opex (albeit in the context of adopting Ofcom's remedy in full).

(b) Vodafone indicated that it did not consider there to be a material difference in the effect on LRIC between its proposed remedy for opex and Ofcom's 17 January Variant Model for opex.

(c) EE and BT did not comment on Ofcom's 17 January Variant Model for opex.

(d) Vodafone's and EE's proposal for the opex remedy appear to be the same.

7.247 We therefore considered that Ofcom's 17 January Variant Model provided a remedy for opex that was largely agreeable to the parties.[209] Whilst we requested several alternative remedies in the additional model runs (see below), the results of these were not substantially different to Ofcom's proposal and we do not consider that these provide a clearly superior solution.

7.248 We therefore consider that the remedy for opex should be performed as suggested by Ofcom in the 17 January Variant Model.

Capex

7.249 None of the proposals in relation to a recalibration of capex received unanimous support from the parties.

7.250 Whilst the parties' proposals and responses in relation to the appropriate remedy for capex indicated a broad agreement on the initial unit cost adjustments (as set out in Ofcom's 5 January Model), they revealed disagreement on the need for recalibration after making these initial unit cost adjustments.

7.251 We set out below first our views on the initial unit cost data adjustment and secondly our views on recalibration.

The initial capex unit cost adjustment

7.252 The parties appeared to agree that, in order to remedy Reference Question 6, as a starting point, the cost of certain equipment should be reduced initially in line with Ofcom's proposal from 5 January 2012.

7.253 However, EE and Vodafone disagreed with Ofcom's proposal of a reduction in unit costs for certain 2G equipment to levels below the equivalent 3G equipment unit costs on the basis that this was contrary to the bottom-up evidence before us and Ofcom.

7.254 Whilst we recognize that in the main the 2G equipment costs, as stated by Three, are within the min-max bands of the section 135 data (see paragraph 7.221), we also note EE's explanation that relatively few operators had provided data on 2G equipment and that those who had, had shown that relative to equivalent 3G equipment the costs should be the same as for 3G equipment, or possibly above 3G equipment in the case of T-Mobile). We consider that this is consistent with the evidence reviewed in Section 6, paragraph 6.88.

7.255 We considered whether this structure should be reflected in the model and whether adjustments to 2G equipment unit cost should be as set out in Ofcom's proposal from 5 January 2012, but limited to ensure that 2G equipment costs were not below those of the equivalent 3G equipment (if this is evidenced in the section 135 request data).

7.256 Ofcom told us that effecting such a request was not straightforward. It said that it would be necessary to decide which particular 2G and 3G assets should be considered equivalent (taking into account the fact that the model uses different compon-

[209] Although we recognized that any agreement was qualified as several parties maintained alternative principled positions.

ent configurations to build a 2G or 3G cell and that various different releases of 3G equipment are modelled, and given the differences in capacity between 2G and 3G assets). It said that it was also necessary to decide over what time period 2G costs should be equalized to 3G costs (and that this point was somewhat linked to the capacity point (ie that 2G/3G assets have different capacities), as capacity and costs change over time).[210]

7.257 We accepted Ofcom's points. We believe that making further investigations would not be possible within a reasonable timeframe in the context of an appeal.[211]

7.258 We therefore accepted the unit costs in Ofcom's proposal of 5 January 2012 as the starting point for proposing an adjustment remedy for capex.

The need for recalibration

7.259 The need for recalibration represents the main difference in position between the parties. Ofcom, in its 5 January proposal (supported by BT and Three), did not consider a recalibration of its initial unit cost adjustments for capex to be necessary. EE, Telefónica and Vodafone considered that recalibration was necessary, in order to ensure that operators could recover their efficiently incurred costs. It was clear from the parties' proposals that an adjustment for capex without recalibration was likely to produce substantially lower MCT charges than an adjustment with recalibration (although the outcome would be sensitive to how the recalibration was performed).

7.260 We note that Ofcom, in its Core Submission (see Section 6, paragraph 6.79), had considered that recalibration would likely be necessary if there was any significant departure from the assumptions of the 2011 Model (as it considered the 2011 Model was well calibrated at the network level), in particular to better align the GBV with the operator average. However, on the basis of our provisional determination, it formed a different view for our remedies process (see paragraph 7.171).

7.261 The danger of proceeding without recalibration is that the bottom-up cost data may misstate the costs of the average 2G/3G operator. This is because the model is only a broad approximation of reality; for example, it does not include all the assets that operators employ in their networks. We note that there is a large variation in the cost data provided for, at least, a number of assets in the model.[212]

7.262 We consider that in this case top-down data (GBV and NBV) from operators is likely to be more robust than the individual asset data since it is based on data from a larger number of operators than the costs of the individual (around 80) assets in the model, since not all operators supplied the latter in response to section 135 requests. In some cases, individual asset costs are based on the data of only one operator. [213]

7.263 The modelled GBV after Ofcom's proposed adjustments to capex from 5 January Model is considerably below the average for the 2G/3G operator, and the gap increases towards the end of the calibration period (see Figure 7.16 above). In our view, because we consider the bottom-up data less reliable than the top-down data, if

[210] Ofcom email to CC of 8 February 2012.
[211] We note that we sent various model requests to Ofcom that included an adjustment for BSCs and RNCs in opex. However these adjustments turned out to be very small, so we did not consider it appropriate to include them. We also note that Ofcom did not consider that the bottom-up evidence indicated that opex of BSCs and RNCs should be equalized (see Ofcom response to 6 February 2012 request).
[212] See Table 1 in Ofcom Annex A to Ofcom's submissions from 17 January 2012
[213] See Table 1 in Ofcom Annex A to Ofcom's submissions from 17 January 2012.

recalibration is not undertaken the appropriate recovery of efficiently incurred costs is less likely to be achieved.

7.264 We therefore agree with EE, Telefónica and Vodafone that a recalibration of the model is required following the adjustment to the 2G and 3G equipment costs, as part of the remedy for Reference Question 6.

7.265 We recognize the concern that this may give too much weight to top-down evidence. However given our view of the relative quality of the top-down and bottom-up data this is necessary. We believe the bottom-up data does provide useful information as to the relative levels of unit costs of different assets/asset groups and should be used for this.

7.266 We consider that adjustments in the model to effect recalibration should be limited to the period of 2006-2009. This is because this is the calibration period used in Ofcom's decision. We consider that making adjustments to earlier periods would likely require remittal, for example to identify whether and for what years adjustments should be made in prior years. We consider that recalibration should be limited to unit costs. This is because Ofcom, in its original decision considered that unit costs were the appropriate way to effect recalibration. We consider that finding alternative adjustments would likely require remittal. We also consider that recalibration should be performed through a proportional adjustment to the unit costs of all assets. Although this approach entails making changes to non-radio equipment costs, which have not been appealed, we think this is a necessary consequence of correcting the error. We propose applying an uplift in a consistent manner across all asset classes to preserve the structure of the bottom-up data. We did not have any evidence before us that indicated that unit costs for particular assets should be adjusted in preference to the unit costs of any other assets and therefore considered that an adjustment across all assets was the most appropriate approach. As set out in paragraph 7.233 we consider that if there is no recalibration, parts of the model will be calibrated by reference to top-down data and other parts will not. We think it is better to change non-radio equipment costs than to reach an outcome where various parts of the model are treated differently.

7.267 We also considered the most appropriate metric for calibration. We note that in Ofcom's proposed adjustments, NBV was more closely aligned with the average 2G/3G operator level than GBV was. However, we consider it appropriate that in our remedy we should put more weight on GBV calibration, in line with our findings on Reference Question 6 (Section 6, paragraph 6.129) where we found that it was reasonable for Ofcom to place less weight on NBV than GBV calibration.

7.268 We therefore find that recalibration of the model should be carried out using GBV.

How calibration should be effected

7.269 Ofcom (in its 17 January Variant Model), EE and Vodafone provided proposals for recalibration of capex. We were not persuaded that any of the proposed recalibration proposals were necessarily the correct approach for correcting the error found in Reference Question 6 as discussed earlier (see paragraphs 7.235, 7.238 and 7.241).

7.270 We therefore considered whether it was possible to derive a way to recalibrate capex that was more coherent.

7.271 We considered that a uniform uplift to all unit costs (ie an increase to all assets' unit costs to ensure that the overall cost in the model reconciled to the GBV data available) might preserve the structure of the bottom-up asset price data but would

ensure that the overall level of cost was determined by the top-down data. This uplift would be applied across all asset classes and not just certain radio equipment as in the 2011 Model, or all equipment (except 3G radio equipment) as in EE's proposal.

7.272 We consider that such an uplift is appropriate (in this context) as we are not able to iteratively adjust the components of the model to achieve better fit (see paragraph 7.230(c)) and without an uplift the bottom-up data would not adequately reflect the operator averages (of GBV). We do not consider that, on the basis of the evidence before us, it is possible to identify a particular group of assets or a particular asset to which any adjustment of unit costs should be applied in preference. We therefore consider the unit costs of all (approximately 80) assets in the model should be adjusted.[214] We consider that this should be done for those years that Ofcom considered in particular as part of its calibration in its decision, ie the period 2006 to 2009.

7.273 We consider that, given the error we found in respect of Reference Question 6 was an overstatement of certain unit costs and was closely aligned with Ofcom's calibration of the 2011 Model and because Ofcom decided to adjust unit costs as part of its calibration at that time, the calibration of Reference Question 6 should be performed by adjusting unit costs only.

Our modelling request

7.274 Given the concerns raised above, we asked Ofcom to perform some modelling runs for us (our modelling request) in order that we might find a more suitable remedy, taking into account the points discussed above.

7.275 Overall we sent Ofcom three different modelling requests. These requests were focused on achieving an overall level of calibration so that GBV and opex (see paragraph 7.247) were either close to the operator averages or Ofcom's 2011 Model. Our requests were based on Ofcom's proposals in its 5 January Model and 17 January Variant Model and the adjustments we requested were limited to adjustments of equipment unit costs for opex and capex over Ofcom's calibration period of 2006 to 2009.

7.276 Our initial request (of 23 January 2012) looked at adjusting the opex and capex with a single percentage uplift to unit costs for all assets in Ofcom's model (except for spectrum) such that the model calibrated well for the period of 2006 to 2009 when compared with operator averages or, alternatively, the 2011 Model in 2006 to 2009.

7.277 We asked Ofcom to apply the single percentage uplift to all assets so that the percentage uplift either:

(a) varied by year across 2006 to 2009; or

(b) was the same in each year across 2006 to 2009.

7.278 In response to these proposals the parties made a number of comments, many of them in line with their remedies submissions described earlier. We set out the key points below in paragraphs 7.280 to 7.296.

[214] Except for spectrum costs. Ofcom told us that it did not include spectrum costs when it performed its calibration of the 2011 Model. We adopted the same approach to recalibration as part of our remedy for Reference Question 6.

The parties' comments on our modelling request

7.279 The parties made a number of comments that re-iterated or developed concerns that had previously been expressed and which we had taken into account in our earlier examination of key issues.

Ofcom's comments on our modelling request

7.280 Ofcom considered that the adjustments in our modelling request were inappropriate and disproportionate. This was because:[215]

(a) Our modelling request would uplift all costs in the modelled network to the level of top-down data, without any consideration being given to bottom-up cost data. It said that this was at odds with the error we had provisionally found[216] and that our provisional determination also indicated that this would depart from the Recommendation.[217]

(b) Our modelling request required uplifting the costs of all modelled assets, including costs that were not subject to the appeals. This was despite our guidance stating that we would not typically devise remedies other than those that were directly necessary to correct any errors identified.[218]

7.281 We had considered Ofcom's points earlier; see in particular paragraphs 7.230(b), 7.230(d), 7.265 and 7.266 as well as our more general discussion.

Three's comments on our modelling request

7.282 Three considered that our modelling request was not appropriate for capex.[219] This was because our modelling request:

(a) was inconsistent with the EC Recommendation and our reasoning in our provisional determination. This was because it could not be safely assumed that the top-down analysis was wholly reliable and that the only errors were found in the bottom-up data;[220]

(b) to achieve perfect calibration to the operator average GBV placed greater emphasis on top-down compared with bottom-up data.[221] Three said that achieving calibration with the 2011 Model was even less satisfactory as it would require calibration against an arbitrary top-down measure;[222]

(c) failed to take into account the poor GBV calibration in periods before 2006;[223] and

(d) would increase some equipment unit costs above the maximum levels indicated by Ofcom's section 135 requests and some equipment unit cost beyond the

[215] Ofcom's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[216] Ofcom's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[217] Ofcom's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[218] Ofcom's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[219] Three letter to CC 26 January in response to our modelling request to Ofcom, p3.
[220] Three letter to CC 26 January in response to our modelling request to Ofcom, pp1 & 2.
[221] Three letter to CC 26 January in response to our modelling request to Ofcom, p3.
[222] Three letter to CC 26 January in response to our modelling request to Ofcom, p4.
[223] Three letter to CC 26 January in response to our modelling request to Ofcom, p2.

levels in the 2011 Model. Three also said that our modelling request would change unit equipment costs for assets that were not subject to this appeal;[224]

7.283 Three considered that using a uniform uplift factor across all years would be inconsistent with Ofcom's model where unit costs did not reduce uniformly in every year.[225] It also considered that we should at least ensure that unit equipment costs did not exceed the maximum levels indicated by the bottom-up data. This was because a balance needed to be struck between bottom-up and top-down data.[226]

7.284 Three said that we should allow some tolerance for GBV levels in the model to be below the operator averages.[227] It said that calibrating exactly in every year went further than Ofcom's decision in placing weight on the top-down analysis as Ofcom's decision was within 4 per cent tolerance in every year. It said some asset life adjustment should be permitted.

7.285 Three also said that we should consider an adjustment to asset lives if an adjustment to asset lives allowed a closer match of unit costs and asset lives with bottom-up evidence.[228]

7.286 Three said that it preferred Ofcom's proposals in both its 5 January Model and 17 January Variant Model to our proposed remedy.[229]

EE's comments on our modelling request

7.287 EE considered that the CC's request in relation to opex which required a uniform uplift across assets and years, was more likely to achieve the best overall calibration to the level and trend of average opex data provided by operators. It said that to try to achieve calibration in every year for opex (by applying different uplifts in different years) would be to incorrectly attribute all of the movement in total opex to changes in unit costs and to ignore the fact that the Model does not achieve perfect calibration in asset counts. The instability in the reported operator data would also lead to significant variability in opex cost movements between years.[230]

7.288 In relation to GBV, EE said that it was important that calibration adjustments achieved a close fit to the level and slope of the operator data. EE also said that calibration over the entire modelling period (1990 to 2021) could reveal whether or not the Model calculated a reasonable path of costs, including in the years prior to and after the calibration period. EE said that further adjustments beyond those put forward in our modelling request may be required, so that our model request achieved a good or better fit to the operator data over this longer period as well as in the calibration period compared with EE's proposal of 17 January 2012.[231]

Vodafone's comments on our modelling request

7.289 Vodafone said that a unit cost uplift was warranted as Ofcom's two proposals provided an insufficiently large GBV value, indicating that Ofcom's proposals under-

[224] Three letter to CC 26 January in response to our modelling request to Ofcom, p3.
[225] Three letter to CC 26 January in response to our modelling request to Ofcom, p4.
[226] Three letter to CC 26 January in response to our modelling request to Ofcom, p3.
[227] Three letter to CC 26 January in response to our modelling request to Ofcom, p4.
[228] Three letter to CC 26 January in response to our modelling request to Ofcom, p5.
[229] Three letter to CC 26 January in response to our modelling request to Ofcom, p5.
[230] EE's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[231] EE's letter to CC 26 January in response to our modelling request to Ofcom, p1.

costed its assets (because the model was a simplification of reality and did therefore not model certain costs).[232]

7.290 Vodafone said that our modelling request was not appropriate because either it required significant fluctuations in unit prices, which overemphasized the top-down calibration at the expense of bottom-up pricing and pricing trends (in case of different adjustment factors from year to year) or (when using a single uplift factor for every year) it risked that the fit in each year would be poor and that the overall unit cost trend would be impaired.[233]

7.291 Vodafone said that top-down calibration did not need to achieve perfect calibration with operator averages, but that it was more important that the model produced cost levels that were very similar to operator actual averages and that the model followed the trends of costs that existed in the real world.[234]

7.292 Vodafone said that its proposal in response to our provisional determination achieved a reasonable fit in every year and captured the overall underlying trend of the average operator.[235]

BT's comments on our modelling request

7.293 BT objected to the recalibration method in our modelling request.[236] It said that uplifting bottom-up numbers by a certain percentage would repeat the error we found, ie it meant that we would prefer top-down to bottom-up evidence, which was contrary to the Recommendation.[237]

7.294 BT said that it was problematic to limit recalibration to the four-year period of 2006 to 2010:

(a) This was because Three's evidence indicated that the discrepancy between top-down and bottom-up numbers might be explained by poor calibration in earlier periods (and that it was not unlikely if current equipment unit costs were correct that past equipment cost may be understated).[238]

(b) This was also because we indicated in our provisional determination that limiting the calibration to a four-year period might be a problem.[239]

7.295 BT said that whilst recalibrating the model to reflect the lower 3G radio equipment costs would not be simple or speedy, this task should not be short circuited by applying simple uplift factors that lacked any substantial basis.[240]

7.296 BT said that Ofcom's proposal for remedying the Reference Question 6 error remained the best considered option and was better than using simple uplift factors. BT noted that Ofcom said that further work following remittal was unlikely to provide a meaningfully different answer from Ofcom's present proposal.[241]

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[232] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[233] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[234] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[235] Vodafone's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[236] BT's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[237] BT's letter to CC 26 January in response to our modelling request to Ofcom, p1.
[238] BT's letter to CC 26 January in response to our modelling request to Ofcom, pp1 & 2.
[239] BT's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[240] BT's letter to CC 26 January in response to our modelling request to Ofcom, p2.
[241] BT's letter to CC 26 January in response to our modelling request to Ofcom, p2.

Our view taking account of the comments received on our modelling request

7.297 We carefully considered the comments received on our adjustment proposals and reviewed the output of our modelling request.

7.298 In our view the principled points made by the parties had been taken into account when we formulated our request. These are discussed earlier; see paragraphs 7.230 and 7.244 to 7.273.

7.299 Having considered these, we were concerned that our modelling request resulted in a calibration that worked well only across the period 2006 to 2009 and so explored whether a longer calibration period was appropriate.

7.300 We also accepted that adjusting the percentage uplift in every year is not appropriate as this resulted in the price trends swinging from +75 per cent to –10 per cent, which did not look realistic. We considered that using a single uplift factor applied to capex in each year of the calibration period (2006 to 2009) was appropriate (hence our second modelling request—see paragraph 7.299).

7.301 We considered the various options for recalibration. We found that the most objectively derived data points were the modelled GBV levels in the 2011 Model (as opposed to the operator averages). We considered that an approach which calibrated well over the period to 2021 was better than an approach which only calibrated over the 2006 to 2009 period. In the 2011 Model, modelled GBV data was available over the entire modelling period (whereas operator averages were only available for part of the modelling period). We preferred this option as it largely eliminated the possibility of differing trajectories for modelled GBV in the period after the end of the calibration period and as such provided a definite reference point. We considered that calibrating only with reference to the calibration period itself posed the risk of having to choose between various different possible trajectories for GBV in the period after the calibration period (depending on how calibration was effected), even where level calibration was similar during the calibration period.

7.302 We asked Ofcom (in our 2 February 2012 request) to adjust the model run slightly such that calibration was performed against modelled GBV and opex data in the 2011 Model over the period of 2006 to 2021 (rather than against operator averages).

7.303 Having reviewed the results from the parties' proposals (which indicated that there was no major disagreement on Ofcom's 17 January Model Variant for the remedy for opex) and our first and second model request, we asked Ofcom to respond to a final modelling request (of 8 February 2012) which we subsequently describe as 'our adjustment proposal'.

Results

7.304 Our final request, which represents our adjustment proposal was:

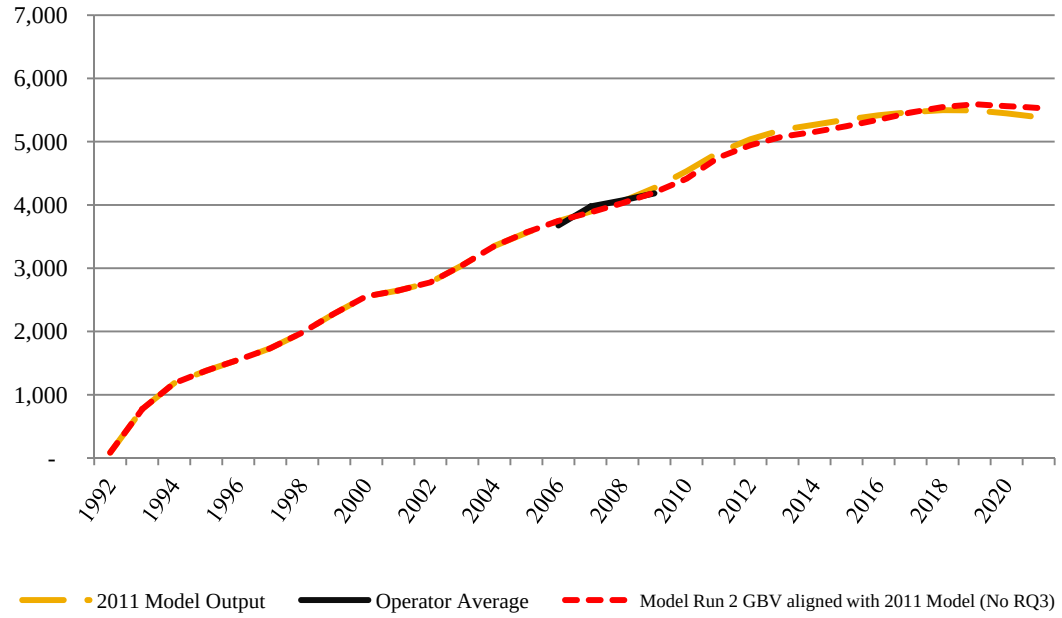
(a) for opex, this is based on Ofcom's 17 January Model Variant; and

(b) for capex, this is based on Ofcom's 5 January Model unit cost adjustments , in addition to which we asked Ofcom to adjust unit costs of all assets using a single uplift factor over the period of 2006 to 2009 so that GBV was close to the modelled GBV in the 2011 model.

7.305 This resulted in the following calibration figures.

FIGURE 7.19

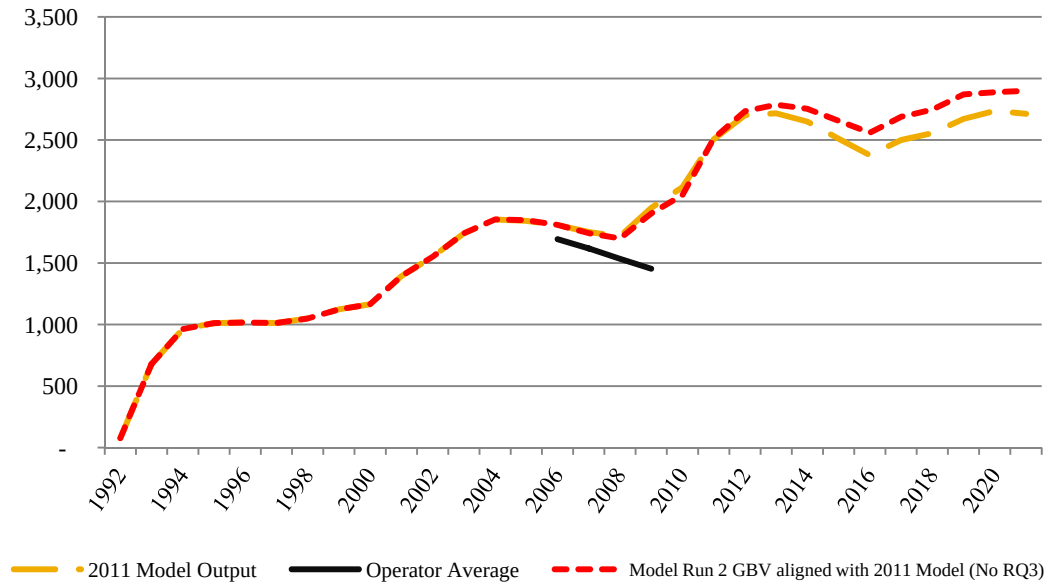
GBV calibration
[minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.20

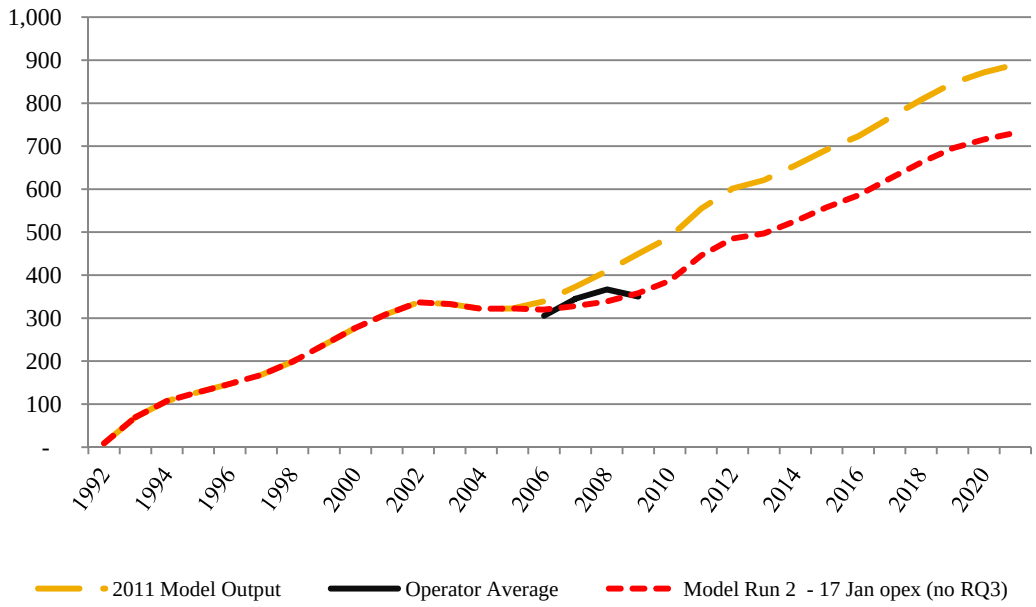
NBV calibration
[minimum/maximum lines have been removed]



Source: Ofcom.

FIGURE 7.21

Opex calibration
[minimum/maximum lines have been removed]



Source: Ofcom.

7.306 Our adjustment option provides a close GBV fit in comparison with the 2011 Model and is also relatively close to the operator average GBV (Figure 7.19). We note that NBV (Figure 7.20) is less well aligned with the operator averages, but is relatively close to the NBV in the 2011 Model. We consider that our adjustment option for opex (Figure 7.21) results in levels that are relatively close to the operator averages. We therefore consider that these graphs show a satisfactory overall level of calibration.

7.307 This resulted in the following LRICs in 2010/11 to 2014/15 if the correction for the Reference Question 3 errors is excluded.

TABLE 7.9 **LRIC for period 2010/11 to 2014/15 with Reference Question 3 errors excluded**

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
2011 Model	0.93	0.82	0.78	0.75	0.72
Proposed adjustment model	0.82	0.71	0.69	0.67	0.65

Source: Ofcom response on 8 February 2012.

7.308 This resulted in the following LRICs in 2010/11 to 2014/15 if the correction for the Reference Question 3 errors is included.

TABLE 7.10 **LRIC for period 2010/11 to 2014/15 with Reference Question 3 errors included**

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
2011 Model	0.93	0.82	0.78	0.75	0.72
Proposed adjustment model	0.80	0.68	0.66	0.69	0.67

Source: Ofcom response on 8 February 2012.

The remittal remedy option

7.309 In making our final determination we contemplated the possibility of remedy on Reference Question 6 by remittal to Ofcom. We considered that if we were to remit, the remittal should provide for a reasonable, pragmatic remedy to any error(s) identified under Reference Question 6 taking into account:

(a) the finding in our final determination on the Reference Question;

(b) the continued desirability of a timely implementation;

(c) factors that we had identified in our final determination as relevant in our discussion of remedies;

(d) any specific steps that we thought desirable or necessary; and

(e) Ofcom's regulatory judgment.

7.310 We considered that we would be looking to provide clear guidance as to what appear to us to be key issues, whilst allowing the appropriate exercise of Ofcom's judgment. In order to establish factors that may be relevant in considering the terms of any remittal, we wrote to the parties, in particular seeking views on factors that would influence the timetable of any remittal (including minimum consultation periods) and on the time required were it to be appropriate for Ofcom to make further information requests and the practicability of doing so.

7.311 We received the following responses.

The parties' comments on remittal

Ofcom's comments on remittal

7.312 At the remedies hearing, Ofcom told us that it had no reason to consider that a more extended analysis on remittal would provide an answer that was meaningfully different from its initial proposal in relation to Reference Question 6. It said that this was because:

(a) issuing further section 135 requests was unlikely to elicit better evidence than was already before the CC, as any relevant data would have been submitted to Ofcom during the market review process or to the CC during the Appeal; and

(b) a preliminary investigation of P2 adjustment proposed by Three (see Section 6, paragraph 6.29(b)) suggested that this would provide a less attractive outcome

than Ofcom's initial proposal in terms of GBV calibration and would make no material difference to the LRIC figure (see paragraph 7.173).[242]

7.313 Ofcom also said that if there were to be a remittal it was highly likely that Ofcom would be under a statutory requirement to consult both domestically and with the European Commission on its proposed decision, and these would typically be consultations for a minimum period of one month, which would run sequentially, ie the European consultation would follow the domestic consultation. Ofcom said that this may be a relevant consideration for the CC in respect of the timeliness of implementation of any approach to remedies.[243]

7.314 Ofcom considered that it was reasonably practicable for us to determine a remedy.[244] It noted that Three had agreed with Ofcom's proposal (from 5 January 2012) and that Three had suggested that we implement this proposal.[245]

7.315 Ofcom said that if we were to remit to Ofcom then we should explain fully why we considered that the approach agreed by Ofcom and Three was not appropriate, in the light of our findings in relation to Reference Question 6.[246]

7.316 Ofcom said that whilst it would have regard to guidance given to it in a remittal, Ofcom must reach its own decisions as to how to conduct any outstanding work in relation to remitted matters, which must accord with Ofcom's legal powers and statutory duties.[247]

Vodafone's comments on remittal

7.317 Vodafone said that it would be preferable for us to decide the appropriate remedy for Reference Question 6 and saw no good reason for a remittal of the Reference Question 6 error to Ofcom.[248]

7.318 Vodafone considered that a remittal to Ofcom would cause substantial delays. Vodafone also considered that if substantial work was needed to remedy the Reference Question 6 error because of the complexity of deciding on the relative weight of the bottom-up and top-down measures, because of the question whether other input costs are also erroneous and because of the question what the most appropriate calibration adjustments were, then this called into question whether Ofcom's model was fit for purpose for calculating LRIC. We should then reconsider our decision on Reference Question 6 as Reference Question 6 may be an example of 'cherry-picking' adjustments to individual input costs.[249]

7.319 Vodafone said that if Reference Question 6 was remedied with an adjustment to the input cost of relevant radio equipment, then recalibration was necessary to bring overall costs back to the relevant 'real world' level.[250]

7.320 Vodafone said that it supported the principle of converging on 100 per cent calibration (like in our modelling requests to Ofcom).[251]

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[242] Remedies hearing transcript, p12.
[243] Remedies hearing transcript, p13, lines 4–10.
[244] Ofcom letter, 6 February 2012, p1.
[245] Ofcom letter, 6 February 2012, p1.
[246] Ofcom letter, 6 February 2012, p2.
[247] Ofcom letter, 6 February 2012, p2.
[248] Vodafone letter, 6 February 2012, p2, §5.
[249] Vodafone letter, 6 February 2012, p2.
[250] Vodafone letter, 6 February 2012, §§1 & 2.

7.321 Vodafone said that if we could not decide on the appropriate recalibration ourselves, then we should give Ofcom precise guidance on how the recalibration adjustments should be made.[252] Such guidance should include:

(a) That Ofcom only use the information available at the time of the Decision, as it would be very time consuming to request updated data as it would not be appropriate to use only partially updated information, but Ofcom would need to get updated data on total GBV and total opex (for calibration) as well as network build volumes (to derive relevant unit costs). Vodafone also said that we already had unit price data for the calibration period of 2005-09 and that no new data was needed to decide the reconciliation between bottom-up and top-down data (which was the key outstanding question).[253]

(b) That calibration should be performed using a constant percentage uplift across the calibration period as this achieved a fairly good fit and did not require wildly fluctuating unit cost adjustment values.[254]

(c) Unit prices should be the only variable for recalibration as Reference Question 6 was all about unit costs.[255]

(d) We should determine whether recalibration should be performed against operator averages or the 2011 Model (or an average of the two).[256]

(e) We should determine maximum limits for the deviation from these averages.[257]

(f) We should not allow Ofcom to exercise its judgement in a manner not contemplated by the present appeal proceedings.[258]

(g) The time Ofcom should take to complete the remittal should not be prescribed.[259]

EE's comments on remittal

7.322 EE said that it would support a proposal to remit Reference Question 6 back to Ofcom for a short and focused reconsultation. EE believed that this could be done within three months.[260]

7.323 EE said that the best process for remittal was for us to set out guidance in regard to what data should be relied upon and the set of principles that a remedy under Reference Question 6 should satisfy. These could be separated into two distinct steps:[261]

(a) determination of the initial bottom-up unit cost data; and

(b) calibration adjustments to align overall costs with average operator data.

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[251] Vodafone letter, 6 February 2012, §4.
[252] Vodafone letter, 6 February 2012, §§5 & 6.
[253] Vodafone letter, 6 February 2012, §7.
[254] Vodafone letter, 6 February 2012, §8.
[255] Vodafone letter, 6 February 2012, §8.
[256] Vodafone letter, 6 February 2012, §9.
[257] Vodafone letter, 6 February 2012, §9.
[258] Vodafone letter, 6 February 2012, §10.
[259] Vodafone letter, 6 February 2012, §11.
[260] EE letter, 6 February 2012, p1.
[261] EE letter, 6 February 2012, p2.

- *Bottom-up unit cost data*

7.324 EE considered that it would be reasonable for us to instruct Ofcom to use as the initial base level of bottom-up costs Ofcom's proposed 3G radio equipment asset and opex unit costs in its 5 January Model with a further adjustment to ensure that 2G equipment costs are not lower than the price of equivalent 3G equipment (consistent with 'option (a)' in our letter to Ofcom of 23 January).[262]

7.325 EE said that a further request for asset price data may help minimize the range of data point values, but that:[263]

(a) This would likely take an additional few months to complete, as this would require a consultation on the information request itself to ensure that the correct data was being sought in a uniform way; MCPs would need to be provided a reasonable time period for data gathering, and Ofcom may need to ask further follow-up questions and would need to perform further remodelling of the data.[264]

(b) Further data could raise broader issues of the time consistency of other data leading to further demands for revision to data.[265]

7.326 EE considered that what was most relevant was that the structure of network asset prices across the model was accurate.[266]

7.327 EE also considered that what was really at issue was the need to give due weight to the top-down approach via recalibration—this did not necessitate further information requests for bottom-up cost data.[267]

- *Recalibration*

7.328 EE considered that the following principles should form part of our instructions to Ofcom for recalibration:[268]

(a) Calibration of total GBV and opex generated by the model should be closely aligned in terms of the level and slope to average data collected from operators.[269]

(b) Only equipment asset and opex unit costs should be adjusted. Asset life assumptions should not be amended as part of this process.[270] This would limit the scope and complexity of the recalibration exercise.[271]

(c) Where equipment asset and opex unit costs are amended in the calibration process, changes should be applied equally (on a proportional basis) across all asset categories to avoid changing the structure of costs obtained from bottom-up information.[272]

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[262] EE letter, 6 February 2012, p2.
[263] EE letter, 6 February 2012, p2.
[264] EE letter, 6 February 2012, p2.
[265] EE letter, 6 February 2012, p3.
[266] EE letter, 6 February 2012, p2.
[267] EE letter, 6 February 2012, p3.
[268] EE letter, 6 February 2012, p3.
[269] EE letter, 6 February 2012, p3.
[270] EE letter, 6 February 2012, p3.
[271] EE letter, 6 February 2012, p3.
[272] EE letter, 6 February 2012, p3.

(d) Adjustments to asset and opex unit costs should be made primarily over the calibration period. Changes to unit costs prior to the calibration period should only be made where it is otherwise not possible to achieve the calibration objective. Changes should not be made to the growth rate of unit costs after the calibration period.[273]

7.329 EE said that it considered that this recalibration exercise would take up in the region of two to three months, but depended on whether Ofcom was required to undertake the two consecutive one month consultations nationally and with the European Commission that it discussed at the Remedies Hearing. If we were to direct Ofcom to make further statutory information requests then the process of making these requests, responding to them and further analysing the results would add more time to the overall process.

7.330 EE said that if we only remitted the Reference Question 6 error there may not be a clear process for dealing with the impact of any remedies resulting from the other errors, especially the Reference Question 4 error. EE considered that a final view on the remedies under Reference Question 4 could not be taken without having reached a final view on the outcomes resulting from Reference Question 3 and Reference Question 6.[274]

Three's comments on remittal

7.331 Three said that it was desirable that Ofcom should implement a reasonable, pragmatic remedy and that it should do so as soon as reasonably practicable.[275]

7.332 Three said that Ofcom's decision on remittal must be consistent with such findings as we made in relation to Reference Question 6 and that it would not be sufficient for Ofcom merely to 'take into account' the finding by the CC that Ofcom erred in relation to Reference Question 6.[276]

7.333 Three said that we should, if the matter were remitted, avoid setting out detailed and specific guidance or instructions to Ofcom. This was because it would be difficult for us to form any firm views on the right approach and because it may leave Ofcom with an impossible task. A more directive approach by us on remittal also risked straying into the prohibited area identified by the Court of Appeal in *Ofcom v Floe Telecom Ltd* [2006] EWCA Civ 768.[277]

7.334 As regards the minimum time required for consultations, Three said that Ofcom could consult with the European Commission at the same time as consulting with the public on a proposed solution, in the same way as it did in imposing the original charge control.[278]

7.335 As regards the issuing of further information requests, Three said that it saw no reason why Ofcom could not issue information requests and otherwise start work on a remedy as soon as the Final Determination was issued and without waiting for the Tribunal's final order.[279]

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[273] EE letter, 6 February 2012, p3.
[274] EE letter, 6 February 2012, p4.
[275] Three letter, 6 February 2012, p1.
[276] Three letter, 6 February 2012, p1.
[277] Three letter, 6 February 2012, pp1 & 2.
[278] Three letter, 6 February 2012, p2.
[279] Three letter, 6 February 2012, p2.

BT's comments on remittal

7.336 BT said that it was critical that Ofcom had made plain at the remedies hearing that it considered it unlikely that it would able to gather additional helpful evidence even if it were to use its powers under section 135 of the Communications Act 2003 to require further information to be provided. It noted that Ofcom had explained that it had undertaken an initial analysis of Three's suggestion that the model should be calibrated over a longer period, but had decided that this was unlikely to be a fruitful approach either. Ofcom had reached the conclusion that 'overall, we have no reason to expect a more extended analysis on remittal would provide an answer that is meaningfully different to our current proposal in relation to Reference Question 6'.[280,281]

7.337 BT said that there was little point in remitting the remedy if Ofcom considered it unlikely to lead to a meaningfully different answer and that such a course would not be proportionate.[282]

7.338 BT said that if we were to remit, then we should provide the CAT with a recommended time limit within which Ofcom should exercise its judgment (which should be kept to a minimum).[283]

7.339 BT said that consultation periods should not exceed the statutory minimum period of one month, given the extensive evidence gathering and appeal process which had already been pursued in relation to the issues arising under Reference Question 6.[284]

7.340 BT said that it would be reasonable for Ofcom to limit the period for responses to any section 135 requests.[285]

7.341 BT also said that if we were to remit Reference Question 6 we should provide an interim remedy for Reference Questions 3 and 4, and additionally, in so far as it is practicable, such minimum relief as may already be anticipated to be appropriate under Reference Question 6.[286]

Our views on remittal

7.342 Most parties appeared to prefer that we determine a remedy ourselves. There was a variety of views as to both what a remittal could achieve and how long it might take.

7.343 In our view the main purpose of remittal would be to allow Ofcom to examine the sources of difference between the bottom-up data and top-down figures.

7.344 We think that there could be some problems with the top-down figures, and these might be identifiable in a reasonable period of time. However, it is difficult to be confident about this. Ofcom had told us (see paragraph 7.312) that it had carried out some investigations and that it did not expect that if it had more time it would arrive at a meaningfully different answer.

7.345 We also think that to obtain a robust result work is likely to be required to reconcile the top-down and bottom-up data. In our view, a reconciliation exercise between the

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[280] Remedies Hearing transcript, pp12 & 13.
[281] BT written submissions on remedies, §32.
[282] BT written submissions on remedies, §33.
[283] BT letter, 6 February 2012, p1.
[284] BT letter, 6 February 2012, p1.
[285] BT letter, 6 February 2012, pp1 & 2.
[286] BT letter, 6 February 2012, p2.

top-down figures and the bottom-up data currently available to Ofcom is likely to be ineffective given the quality of the bottom-up data.

7.346 Ofcom had attempted to obtain good bottom-up data. Whilst we think it likely that better could be obtained (for example, Ofcom might have obtained cost information from all operators and on a comparable basis (ie either with or without wraparound costs)), we think that this would be an extensive and time-consuming task in the context of an appeal, where the charge control period has already started.

7.347 We therefore think that remittal cannot provide an appropriate and clear solution to the errors in a timely manner. If we were to remit, we believe Ofcom would be likely to adopt a pragmatic remedy, not dissimilar to those we have considered. It might be able to improve upon those under discussion, but it is not clear that any such improvement would be likely to be significant.

Assessment of remedies options

7.348 We believe that the adjustment remedy we have considered should be adopted (see paragraph 7.304ff) since we believe that a remittal is not likely to provide a significantly better remedy and would involve more time and expenditure.

7.349 This remedy involved:

(a) for opex: was based on Ofcom's 17 January Model Variant; and

(b) for capex, was based on Ofcom's 5 January Model, in addition to which we asked Ofcom to adjust unit costs of all assets using a single uplift factor over the period of 2006 to 2009 so that GBV was close to the modelled GBV in the 2011 model. This uplift factor was 10.5 per cent per annum.

7.350 This remedy proposal was reflected in Ofcom's model run of 8 February 2012.

Determination

7.351 For the reasons given above, we determine that the errors identified in respect of Reference Questions 4 and 6 should be corrected as follows:

(a) For the Reference Question 4 error, we determine that MTRs should move to the three-year glide path which Ofcom would have adopted in its decision had it not made the relevant errors found in this Determination.

(b) For the Reference Question 6 error, we determine that Ofcom's model run of 8 February 2012 should be used for capex and opex.

7.352 We do not believe that on the basis of the pleadings the errors identified in Reference Question 3 warrant an adjustment to the LRIC model. However, should the Tribunal decide otherwise we consider that the Reference Question 3 errors, would be remedied by maintaining the adjustment for the 2G/3G MSC cost driver error as set out in Ofcom's Modification Notice of 25 October 2011 and that the correction for the remaining Reference Question 3 errors including recalibration should be as set out by Ofcom in its letter of 5 January 2012.

Reference Question 7(ii)

7.353 By way of introduction, we first provide an overview of how we approach our determination of Reference Question 7(ii). We then give our determination of Question 7(ii).

Introduction

7.354 In determining Reference Question 7(ii), we have identified what impact the adjustments in our determination of Reference Question 7(i) will have on the charge control. This includes, for example, what the revised LRIC in 2014/15 and earlier years should be and the consequences for the level of the charge control in each year, in light of the adjustments to Ofcom's Model and the adjustments to the duration of the glide path we have indentified in our determination of Reference Question 7(i).

7.355 In this section, we address the following matters:

(a) for each error identified, we consider whether any consequential adjustments to the level of the price controls are necessary;

(b) if so, we consider whether it is reasonably practicable for us to determine the appropriate adjustments; and

(c) if so, we determine consequential adjustments to the level of the price controls, having regard only to those errors for which it is necessary for us to do so.

7.356 In arriving at our determination of these questions, we are mindful that we must be content that our remedies satisfy the statutory tests, in particular those under sections 47 and 88 of the 2003 Act, and we are satisfied that the remedies do so.

7.357 When deciding on the consequential adjustments to the charge control, we were guided by the principles that we set out in our Guidelines to Price Control Appeals under the Communications Act[287]:

(a) We will try to bring the price control to where it would have been if Ofcom had not made the identified error. It may be that Ofcom would or could have made a number of different decisions at that stage. Under these circumstances we would normally seek to diverge as little as possible from the path that Ofcom actually took.[288]

(b) Remedies will normally follow an approach that is consistent with that adopted in Ofcom's original decision.[289]

(c) Any adjustments to the charge control will only apply on a forward-looking basis (ie will only apply to the unelapsed period of the charge control). This means that we do not make retrospective adjustments to the charge control.

7.358 We set out below the adjustments that should be made to the remainder of the charge control to remedy the errors we found.

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[287] CC13 Price control appeals under section 193 of the Communications Act 2003: Competition Commission Guidelines April 2011.
[288] CC 13, Annex B.
[289] CC 13, Annex B.

7.359 These adjustments are based on what is appropriate now, considering that some time in the charge control has already elapsed.

Consequential adjustments to the level of price controls—Reference Question 3

7.360 We set out in Section 2 at paragraph 2.939 that it has not been demonstrated that Ofcom should have set the charge control on a LRIC+ basis. We therefore do not consider that it is necessary to adjust the calculation of LRIC+ as a consequence of the errors in Reference Question 3.

7.361 We set out in Section 1 paragraphs 1.62 to 1.74 that we do not consider that Vodafone has pleaded the Reference Question 3 errors in relation to the calculation of LRIC. We therefore do not consider that a consequential adjustment is required to the calculation of LRIC as a consequence of the errors in Reference Question 3.

7.362 However, should the Tribunal disagree with us and consider that the Reference Question 3 errors were properly pleaded in relation to the calculation of LRIC, we provide the consequential adjustment below.

7.363 We believe that:

(a) the 2G/3G MSC cost driver error was corrected in full in Ofcom's revised decision of 25 October 2011 (paragraph 7.95);

(b) the remaining Reference Question 3 errors (before calibration) should be corrected as set out in Ofcom's proposal of 5 January 2011 (see paragraph 7.100); and

(c) recalibration for the remaining Reference Question 3 errors should be performed as set out by Ofcom in its letter of 5 January 2012 (in paragraph 7.116).

7.364 We consider that the consequential adjustments to Reference Question 6 need to be made at the same time as any consequential adjustments to the Reference Question 3 errors.

Consequential adjustments to the level of price controls—Reference Question 4

7.365 As set out in Section 5, paragraph 5.1, Ofcom applies a glide path to adjust MTRs from their level in the last year of the previous price control to the level of LRIC determined in the current price control.

7.366 We set out in paragraph 7.159 that the length of the glide path should be three years (rather than the four years in Ofcom's Decision) and that the glide path should start from the level of MTRs at the end of the previous charge control, ie that in force on 31 March 2011. The level of LRIC used in calculating this glide path should be adjusted to correct for other relevant errors before the glide path is calculated.

7.367 In practice, this glide path involves moving from the previous (2010/11) level of MTRs to the revised level of LRIC at 1 April 2013 by means of three reductions of equal percentage size, on the first of April of each year. The measure of LRIC used in the calculation of the revised glide path should be the level calculated for the year 2013/14, taking into account Ofcom's Modification notice and after correcting the error in Reference Question 6 that we have identified and, should the Tribunal deem it appropriate, the errors in Reference Question 3 that we have identified.

7.368 We set out in Tables 7.11 and 7.12 below the levels of LRIC that result from adjusting the error in Reference Question 6, and also from adjusting both the error in Reference Question 6 and the errors in Reference Question 3. These levels of LRIC form the basis for the calculation of the revised glide path.

7.369 We offer the following guidance on detailed points:

(a) MTRs will continue on their current glide path until the corrected glide path is implemented. If it is not implemented by 1 April 2012, MTRs will be reduced to the level currently envisaged by Ofcom for that date.

(b) MTRs for the year starting on 1 April 2013 will be the LRIC for the year 2013/14; and a further reduction to MTRs will take place on 1 April 2014 to the level of LRIC for the year 2014/15.

(c) We have not specified a start date or notice period; we recommend that Ofcom sets an appropriate notice period, subject to moving to the corrected glide path without undue delay. We consider that Ofcom is best placed to decide the appropriate notice period.

7.370 We expect Ofcom to perform the necessary calculations to establish the nominal maximum prices for the remainder of the charge control in accordance with the methodology and approach to calculation adopted in Ofcom's original decision.

Consequential adjustments to the level of price controls—Reference Question 6

7.371 We have already determined that:

(a) the adjustment for opex should be as set out in Ofcom's 17 January Variant Model (see paragraph 7.349*(a)*);

(b) the adjustment for capex should be as set out in Ofcom's 5 January proposal (see paragraph 7.349*(b)*); and

(c) the adjustments to capex should be recalibrated so that GBV is close to the level of GBV in the 2011 Model over the model period of 2006 to 2021 (see paragraph 7.349*(b)*).

7.372 As set out in paragraph 7.307, Ofcom provided a revised calculation for LRIC that corrected these errors in the manner set out in paragraph 7.371. This resulted in LRIC values (to 2 decimal places) as set out in Table 7.11. (To the extent that there are technical issues with the calculation – including issues such as rounding – Ofcom should provide final LRIC values adopting its normal approach in accordance with our instructions above).

TABLE 7.11 **LRIC after Reference Question 6 changes**

ppm, 2008/09 prices

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
LRIC after RQ6 error correction	0.82	0.71	0.69	0.67	0.65

Source: Ofcom—model run of 8 February 2012.

7.373 The calculation above is provided without a simultaneous correction of the Reference Question 3 errors as we did not find that Vodafone has properly pleaded the Reference Question 3 errors in relation to the calculation of LRIC.

7.374 Should the Tribunal find that Vodafone has properly pleaded the Reference Question 3 errors in respect of calculating LRIC, we believe the correction of the Reference Question 3 errors is interrelated with the correction of the Reference Question 6 errors.

7.375 We consider that it will be necessary to correct the Reference Question 3 errors and the Reference Question 6 error simultaneously as the recalibration adjustments for capex for Reference Question 3 impacts on the recalibration of capex in Reference Question 6.

7.376 As set out in paragraph 7.306, Ofcom provided a revised calculation for LRIC that corrected the Reference Question 3 and Reference Question 6 errors together. This resulted in LRIC values (to 2 decimal places) as set out in Table 7.12. (To the extent that there are technical issues with the calculation – including issues such as rounding – Ofcom should provide final LRIC values adopting its normal approach in accordance with our instructions above).

TABLE 7.12 **LRIC after Reference Question 6 and Reference Question 3 changes**

ppm, 2008/09 prices

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
LRIC after RQ6 & RQ3 error correction	0.80	0.68	0.66	0.69	0.67

Source: Ofcom model run 8 February 2012.

Reference from the Competition Appeal Tribunal to the Competition Commission

IN THE COMPETITION APPEAL TRIBUNAL

Case Numbers: 1180/3/3/11
1181/3/3/11
1182/3/3/11
1183/3/3/11

BETWEEN:

BRITISH TELECOMMUNICATIONS PLC
EVERYTHING EVERYWHERE LIMITED
HUTCHISON 3G UK LIMITED
VODAFONE LIMITED

Appellants/Interveners

-v-

OFFICE OF COMMUNICATIONS

Respondent

– and –

TELEFÓNICA UK LIMITED

Intervener

REFERENCE OF SPECIFIED PRICE CONTROL MATTERS

TO THE COMPETITION COMMISSION

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1. Having regard to:

   (A) the Statement entitled "Wholesale mobile voice call termination" dated 15 March 2011, issued by the Office of Communications ("Ofcom") ("the Decision");

   (B) the charge control imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision;

   (C) the Notices of Appeal dated 16 May 2011 lodged by British Telecommunications plc ("BT"), Hutchison 3G UK Limited ("Three"), Everything Everywhere Limited ("EE") and Vodafone Limited ("Vodafone") against the Decision;

   (D) the order of the Tribunal dated 13 June 2011, providing a timetable for any amendments to the Notices of Appeal, Ofcom's Defence, and Statements of

Intervention to be lodged in respect of the appeals, and providing for consolidation of the appeals;

the Tribunal, pursuant to Rule 3(5) of the 2004 Rules and section 193 of the Communications Act 2003, hereby refers to the Competition Commission for its determination the specified price control questions arising in these appeals.

2. By this reference the Tribunal orders the Competition Commission to determine the following questions:

Question 1

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in adopting the pure LRIC cost standard, rather than the LRIC+ cost standard, as the basis for the charge controls (for the reasons set out in paragraphs 41 to 154 of EE's Notice of Appeal (Ground 1), and paragraphs 20(A), 31 to 57 and 63 to 74 of Vodafone's Notice of Appeal).

Question 2

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in determining the level of the charge control based on pure LRIC (for the reasons set out in paragraphs 155 to 237 of EE's Notice of Appeal (Ground 2), and paragraphs 20B and 75 to 82 of Vodafone's Notice of Appeal).

Question 3

Whether Ofcom erred in determining the level of mobile termination charges that would reflect the adoption of the LRICi+ cost standard (for the reasons set out in paragraphs 238 to 240 of EE's Notice of Appeal (Ground 3), and paragraphs 20A and paragraphs 58 to 62 of Vodafone's Notice of Appeal).

Question 4

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in deciding to adopt a four-year transition period over which mobile termination rates would be reduced to the level of the pure LRIC cost standard, rather than over a three-year period (for the reasons set out at paragraphs 4.1 to 4.17 and 6.1 of BT's Notice of Appeal).

Question 5

Whether the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in failing to make a one-off adjustment to the rate at the start of the control to current levels calculated in accordance with the LRIC+ cost standard (for the reasons set out at paragraphs 5.1 to 6.1 of BT's Notice of Appeal).

Question 6

Whether (for the reasons set out at pargraphs 5.1 to 5.19 of Three's Notice of Appeal) the charge controls imposed by paragraph 1.11.2 of, and Condition M3 in

Schedule 2 to, Annex 1 of the Decision have been set at levels which are inappropriate because Ofcom erred in relying on a costs model that overstated certain costs associated with certain radio equipment, specifically one or more of the items encompassed within the following descriptions in Ofcom's publicly-available costs model:

(a) 2G cell site equipment;

(b) 2G TRXs;

(c) 2G BSCs;

(d) 3G cell site equipment; and

(e) 3G RNCs.

Question 7

Having regard to the fulfilment by the Tribunal of its duties under section 195 of the Communications Act 2003 and in the event that the Competition Commission determines that the answer to any of the above questions is yes, the Competition Commission is to include in its determination:

(i) clear and precise guidance as to how any such error found should be corrected; and

(ii) insofar as is reasonably practicable, a determination as to any consequential adjustments to the charge controls.

3. The Competition Commission is directed to determine the issues contained in this reference on or before 9 February 2012. The Competition Commission shall notify the parties to these appeals of its determination at the same time as it notifies the Tribunal pursuant to section 193(3) of the Communications Act 2003.

4. There be liberty to apply.

Marcus Smith QC
Chairman of the Competition Appeal Tribunal

Made: 30 June 2011
Drawn: 30 June 2011

Glossary

2003 Act	Communications Act 2003.
2004 Rules	Competition Appeal Tribunal (Amendment and Communications Act Appeals) Rules 2004 (SI 2004 No 2068).
2007 Model	The cost model used by **Ofcom** as the basis for its 2007 decision entitled: *Wholesale mobile voice call termination*, published on 27 March 2007.
2010 Model	The cost model used by **Ofcom** as the basis for its 2010 consultation: *Wholesale mobile voice call termination*, published on 1 April 2010.
2011 Model	The cost model used by **Ofcom** as the basis for the Decision.
2G	Second generation of mobile telephony systems, including the GSM technology standard.
3G	Third generation of mobile telephony systems, including the UMTS technology standard.
All services network	The all services network is the network of a hypothetical efficient operator that provides all services including **MCT** services.
Asset cost	The capital and operating costs of the deployed network assets.
Asset count	The number and type of network assets a hypothetical efficient network needs to deploy to meet the demand that is forecast for it.
Asset life/asset lives	The average useful economic life of any asset.
Area coverage	Area coverage is the percentage of the geographic area of the UK that has mobile phone reception.
Backhaul equipment	Equipment which links site equipment to site controller equipment, and site controller equipment to the core network.
Backhaul link	The physical link between the Node B at the site/mast and the **RNC** at the data centre.
Base station	Network element which connects to the **RNC**.
Base station controller or BSC, and RNC	An item of equipment which provides the link between the radio network and the core network—in **2G** networks this is referred to as Base Station Controller (BSC); in **3G** networks base station controllers are referred to as **RNC**s**.**
Base station equipment	Any equipment installed at the site/mast apart from antennas and backhaul.
BT	British Telecommunications Plc.
Busy hour/network	The traffic carried by the mobile network in the busiest hour of the

busy hour	day. **Ofcom** uses traffic in the **busy hour** to dimension the all services and ex **MCT** services network.
Capex	Capital expenditure.
CAPM	Capital Asset pricing Model.
CC	Competition Commission.
Cell sites	Effectively the mobile phone masts, modelled as assets 2, 8, 10, 74 and 87 in **Ofcom**'s 2011 cost model.
Cell site equipment	Any equipment installed at the site/mast excluding backhaul.
Charge control	A control which sets the maximum price that communication providers can charge for a particular product or service. Most charge controls are imposed for a defined period.
CLV	Customer lifetime value.
Core network	Part of the mobile network connecting the radio access network to other fixed and mobile networks and to the World Wide Web; it is essentially the equipment that routes calls from mast to mast and to fixed line operators (but excludes the radio access network).
Cost driver	Cost drivers are used to calculate the number of assets that are required to meet demanded capacity and coverage.
Coverage network	**Vodafone** defined a coverage network (or minimum coverage network) as the network required to enable a single call to be made or received anywhere within the overall coverage area, but did not embody additional capacity to carry higher levels of traffic.
CP	Communications provider. A generic term used to describe all market participants in the leased lines market, ie **OCP**s and **BT**.
CSH	Customer-sited handover. This is a **PoH** where the interconnection between an **OCP**'s network and **BT**'s network occurs at the **OCP**'s premises.
datacards	Datacards provide access mobile broadband for example for computers or laptops.
Defence	**Ofcom**'s Defence document dated 19 August 2011.
Dimensioning parameters	See **network build parameters**.
DLRIC	Distributed long-run incremental cost. This is estimated by defining a broader increment of a product group, and then adding to the **LRIC** of an individual product within that product group a share of the intra-group common costs.
Dongle	See **datacards**.
DPCN	Digital private circuit network. An older form of TI network used to handle lower bandwidth **PPC**s available in increments of 64 kbit/s

	from 64 kbit/s to 1024 kbit/s. Used generically to refer to all PPCs having a bandwidth of less than 2 Mbit/s. These are also known as 'sub 2 Mbit/s' services or just '64 kbit/s' or 'n x 64 kbit/s' services.
EBITDA	Earnings Before Interest, Taxation, Depreciation and Amortisation.
ED/original ED	Economic depreciation. ED matches the cost of equipment to its actual and forecast usage over the long term in **Ofcom**'s 2011 cost model.
EE	Everything Everywhere Limited.
EPMU	Equi-proportionate mark-up.
Erlang uplift/Erlang adjustment	An adjustment to reflect that voice traffic requires a certain amount of spare capacity in the network (ie the need to maintain sufficient channels to provide a high probability of successful call set-up).
ERP	Equity risk premium.
Ex MCT network	The ex **MCT** network is the network of a hypothetical efficient operator that provides all services excluding **MCT** services (which is deducted from the all services network to calculate the **LRIC** of **MCT** services using the subtractive approach).
FCP	Fixed communications provider.
Framework Directive	Directive 2002/21/EC on the common regulatory framework for electronic communications networks and services.
FRG	Finance and Regulation Group (within the **CC**).
FTM calls	Calls made from a fixed line to a mobile phone.
FTR	Fixed termination rate.
FTSE	Financial Times Stock Exchange.
GB	Gigabyte.
GBV	Gross book value.
Geotype	**Ofcom** said that geotypes are a means of classifying different geographical segments of the UK according to the likely density of traffic and building clutter that is experienced in those segments. The **geotype** definitions used in the 2011 cost model were defined on the basis of population density (as a proxy for variations in traffic density and building clutter). The 2011 cost model included a total of nine geotypes (paragraph A6.103 **Ofcom** decision).
GFC	Global financial crisis.
H3G	Hutchison 3G UK Limited.
High speed packet access or HSPA	A **3G** mobile telephony protocol which provides faster upload and download data speeds.

HLR	Home location register.
Hot spots	Localised areas of high traffic demand.
HSPA/HSPDA	High Speed Packet Access.
HSPA+	HSPA+ refers to later versions of HSPA technology that increase the efficiency of data delivery.
Leased line	A permanently connected communications link between two premises dedicated to the customer's exclusive use, providing dedicated transmission capacity between customer sites, which can be used to carry voice, data and video traffic.
Local end	The dedicated link that connects the third party customer premises and **BT**'s local exchange. This can be provided using either copper or fibre pairs depending on the distance and speed required by the customer.
LRIC/pure LRIC	Long-run incremental cost—the additional cost caused in the long run by the provision of a defined increment of output, assuming that some level of output is already produced.
LRIC+	Long run incremental costs plus a share of common costs.
LSE	Local Serving Exchange. This is the building where a third party customer is connected to the wider **BT** (or **OCP**) network.
LTE/LTE-Advanced	Long Term Evolution–Technology standard which forms part of the development of 4G mobile systems that started with **2G** and **3G** networks.
Macrocell	A base station with a large coverage radius.
MB	Megabyte.
Mbps	Megabit per second.
MCE	Mean capital employed.
MCP	Mobile communications provider (and a reference to the four national **MCP**s is a reference to those **MCP**s which operate a fully-deployed national mobile network, including both a radio access network and elements of core network: **EE**, **O_2**, **Three** and **Vodafone**).
MCT	Mobile call termination—the service provided by a **MCP** to allow an originating communications provider to connect a caller with the intended mobile call recipient on that **MCP**'s network.
MEA	Modern equivalent asset—the value of an asset, whatever its age, adjusted to reflect differences in operating capability between that asset and its modern equivalent.
Microcell	A base station with a smaller area of coverage than a macrocell, typically used to fill gaps in coverage or provide additional capacity

	in high traffic areas.
MNO	Mobile network operator.
MSC	Mobile Switching Centre, also known as the “Exchange”. Part of the core network responsible for routing calls and short message service (SMS) messages, also known as ‘texts’ within the network itself. It also performs a function known as “mobility management”, which ensures that the information held by the network is communicated appropriately within the network, so that calls are able to continue as the caller moves around and their call is picked up by different cell sites.
MTF calls	Calls made from a mobile phone to a fixed line.
MTM calls	Calls made from one mobile phone to another.
MTR	Mobile termination rate—the wholesale charge levied by **MCP**s for **MCT**.
MVNO	Mobile virtual network operator. An **MNO** that does not operate its own network but has a network sharing arrangement with one of the four **MCP**s.
NBV	Net book value.
Network build parameters	The mathematical formulas that define which and how many assets are needed to build the all services and ex **MCT** services network in **Ofcom**’s 2011 cost model.
Network busy hour	See **busy hour**.
Network dimensioning assumptions	The assumptions that **Ofcom** makes regarding the architecture of a hypothetical efficient network and the capacity of each network asset type.
NMS	Network management system—a system managing of the complexity of the mobile network.
NoA	Notice of Appeal.
Not-spot	Areas with no mobile network coverage.
NPV	Net present value.
NRA	National Regulatory Authority.
O_2	A subsidiary of **Telefónica**.
OCP	Other communications provider. A generic term used to refer to **CP**s other than **BT**.
Ofcom	Office of Communications.

OPTA	The Dutch Telecoms regulator.
Original ED	See **ED**.
Population coverage	population coverage is the percentage of the UK population having access to mobile phone services
ppm	Pence per minute.
Pure LRIC	Pure long-run incremental cost.
QoS	Quality of service.
Radio access network (RAN)	Radio access network. The part of a mobile network which transfers signals between the core network and the user equipment (eg handsets) over the air-interface; it is essentially the equipment that connects the handset to the mobile phone mast.
Radio equipment	All assets identified as **cell site equipment** in **Ofcom**'s model including macrocell, microcell and picocell equipment (including additional **2G** TRXs and additional **3G** sectors and carriers) and all site controller equipment including **2G Base Station Controllers** and **3G RNC** (together with associated peripheral equipment including ports and **2G** Packet Control Units). In **Ofcom**'s model, **radio equipment** consists of cell site equipment (assets 3, 5, 7, 9, 11 and 31 for **2G** and 42, 43, 44, 48, 49, 50, 51, 52, 53, 76, 77, 78, 79 for **3G**) and **2G** TRX (asset 12-14) and **3G** site upgrade (assets 45-47) in **Ofcom**'s 2011 Model.
Release 99	First release of the 3GPP standard—the **3G** standard used for handling data before the advent of **HSPA**.
RFR	Risk free rate.
RNC	Radio Network Controller. Hardware which coordinates a cluster of macrocells by receiving user traffic (voice calls and/or data) via backhaul from each of hundreds of macrocells with which it interfaces.
ROCE	Return on capital employed.
Routing factor	Routing factors allocate the cost of each asset in **Ofcom**'s 2011 cost model to the individual services (eg call origination or call termination).
s135 notices	Notices issues by **Ofcom** under section 135 of the **2003 Act** requiring the provision of specified information.
SAC	Stand-alone cost: the cost which would be incurred by an efficient provider of a product as a single product company. In a multi-product firm, the **SAC** of a product group is a sum of the **LRIC** of that product group and all of the costs which are common to that product and the other products produced by the firm.
Service routing	The **routing factors** multiplied by the **busy hour** traffic volumes.

factor	
Sectors	The number of antennas per carrier at a site.
Site	See **cell site**.
Site sharing	Agreement between operators to use the same site/mast but not share radio equipment.
SMP	Significant market power.
SoI	Statement of Intervention.
Telefónica	Telefónica UK Limited.
Three	Hutchison 3G UK Limited.
TMNEs	Tariff mediated network externalities.
Top down calibration	The comparison of the asset count and asset cost predictions of the bottom up evidence against historical operational and accounting data from **MCP**s.
Transit network	A network through which a call passes, but which is neither the originating network nor the terminating network for that call.
Tribunal	Competition Appeal Tribunal.
TRX	A transceiver for adding 2G capacity according to the transcript of the technical session.
UMTS	Universal mobile telecommunications system—3G mobile technology standardised by 3GPP.
VMNO	Virtual mobile network operator.
Vodafone	Vodafone Limited.
WACC	Weighted average cost of capital.
WCDMA	Wideband Code Division Multiple Access, a mobile data protocol
WiMAX/WiMAX 2	Worldwide Interoperability for Microwave Access—type of wireless technology based on the IEEE 802.16 standard.