Three response to Ofcom Wholesale mobile voice call termination Market Review Consultation.

Non-confidential

23 June 2010

Three.co.uk

Executive Summary.

1 Ofcom's mobile termination rate (MTR) consultation[1] is fundamentally important to the communications industry. MTRs are the single biggest constraint on retail pricing in the UK mobile voice market. Set at the right level, they will drive competition, innovation and investment – to the large benefit of consumers and the economy. Set at the wrong level, and communications users will be much worse off.

2 Therefore Ofcom is right to propose reducing MTRs to pure LRIC[2] – not just because it follows the European Commission (EC) Recommendation[3] – but because it will transform competition for the better.

3 Three[4] strongly supports with Ofcom's proposal to reduce MTRs to pure LRIC – because we believe that it will benefit all consumers, though lower prices and greater innovation and investment.

4 Three nevertheless disagrees with Ofcom's proposal that a four-year glide path is needed to minimise industry and consumer disruption. On the contrary, a glidepath will only delay benefits to consumers. At most, Ofcom should reduce MTRs to pure LRIC by 31 December 2012, in line with the EC Recommendation.

5 Three also disagrees with Ofcom's estimate of pure the LRIC of mobile termination, which Three calculates at 0.25p/min, not 0.5p/min.

Ofcom's current LRIC+ approach to setting MTRs distorts competition and is unnecessary.

6 All customer tariffs must take into account the likely cost to a mobile network operator (MNO) of serving a customer. For MNOs, the largest variable cost of serving a customer is the cost of outbound calls to other networks ("off-net" calls).

7 Under the current MTR system, this cost is set at a level that exceeds the underlying cost of terminating a call by over ten times. This creates a strong disincentive for MNOs to compete on price, as reducing prices only drives greater MTR costs, with little if any compensating MTR revenues.

1 Ofcom Wholesale mobile voice call termination Market Review, Consultation, April 2010.
2 Long-run incremental cost.
3 European Commission Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2009).
4 Hutchison 3G UK Ltd.

8 Moreover, the current system imposes a disproportionate cost on new entrants and smaller MNOs. This is because the cost of outbound calls for smaller MNOs is magnified by the larger proportion of smaller MNOs' off-net calls. This is an inevitable consequence of smaller MNOs' smaller market share, nothing else, as a greater proportion of its subscribers' calls are always likely to be terminated off-net than for a larger MNO.

9 Overall, the current MTR system is a barrier to competition and innovation and is not necessary for any other reason. Reducing MTRs to pure LRIC addresses this problem at a stroke. If MTRs are limited to the level of costs caused, as Ofcom now proposes, then all MNOs will face the same cost-reflective level of costs for outbound calls – rather than an artificially-inflated and varying level of costs – and all MNOs will be able to compete on this same basis. It will greatly increase competition between larger MNOs and with smaller MNOs and potential new entrants.

10 It is for these reasons that Three supports Ofcom's proposal, subject to the proviso that Ofcom could and should reduce MTRs faster and further.

Reducing MTRs to pure LRIC will transform competition in the mobile voice market.

11 Three has looked hard at its own retail prices to see what could be viable as MTRs fall (taking into account that Three will also lose MTR revenue from both fixed and other mobile operators). Three's conclusion is that lower MTRs enables very much better deals for customers. Bearing in mind that tariffs are always costed on the basis of expected customer lifetime, Three has decided to launch new tariffs from this July that will be competitive and sustainable in a pure LRIC world. Three's new pay monthly tariff – "The One Plan" – will offer all the calls, texts and data that most consumers are every likely to need from just ✂ (confidential) a month. The equivalent to this now typically costs over twice this amount a month from other MNOs. Of course, Three would need to revisit its tariffs if Ofcom did not adopt pure LRIC as the basis for setting MTRs from next April.

12 Falling prices and rising innovation and investment mimics what has already happened in the mobile broadband market, where there is no equivalent of MTRs. Without such barriers to competition, prices have dropped by 97% in less than three years (from £50/GB a month to £1.50/GB a month).

Three believes that current prices for mobile broadband are sustainable and consistent with independent observers' estimates of the costs of providing mobile broadband. Moreover, mobile broadband is where all MNOs – and new entrants – are now intensifying their investment.

13 Falling prices should come as no surprise. Proof that lower MTRs will mean lower prices can be seen by what has happened as MTRs have fallen historically, in the UK, and also elsewhere in the world. The proof that prices will fall can also, tellingly, be found in the corporate statements of those MNOs who have benefited from high MTRs and who oppose any reduction. They say, to regulators, that lower MTRs will mean higher prices, but they warn their investors, that what it will really mean is lower revenues and lower profits.

14 All consumers will benefit. The scaremongering from other MNOs about rising prices for the most vulnerable is without basis. First, why do the same MNOs that can serve low-income consumers in developing countries at much lower prices than in the UK, say that they would need to increase prices for low-income consumers here? And second, why would MNOs increase prices to those consumers who are most likely to leave if the prices were increased? It defies normal commercial logic. If they did raise prices, then other providers would welcome those customers, not least Three.

Reducing MTRs to pure LRIC will also increase competition between fixed and mobile operators.

15 The problem of above-cost MTRs also impacts competition between fixed and mobile operators. Fixed termination rates are already much lower than MTRs. This leads to the perverse situation where the costs of calls from fixed operators are often more expensive than the same calls from mobile operators.

16 Reducing MTRs to pure LRIC will redress this imbalance, by reducing the costs of outgoing calls for both fixed and mobile operators. This will increase competition between fixed and mobile operators, promoting lower prices and greater innovation and investment.

Reducing MTRs to pure LRIC will encourage investment and innovation.

17 Large MNOs are concerned that Ofcom's proposals will cut their revenues, and this will mean lower profits and less investment which would be incompatible with Ofcom's statutory duties. We disagree with this logic.

18 Lower profits does not mean less investment. On the contrary, lower profits means that MNOs will need to invest more to generate new revenues. Greater price competition normally means that firms need to differentiate more effectively on non-price factors – e.g. network quality, product innovation or customer service. In particular, operators will now have stronger incentives to win new customers and retain existing customers to get the most out of the investments they have already made.

19 Indeed, it is not low MTRs that undermine investment, but high MTRs. The distortion of competition caused by high MTRs discourages investment – it discourages new entrants from entering and smaller players from growing, and thereby discourages established players from needing to invest or innovate. Setting MTRs at pure LRIC will promote investment by exposing the market to a completely new level of competition.

20 Furthermore, some MNOs appear to misunderstand Ofcom's obligations to promote investment. Ofcom is required only to "take into account" the investment made by the operator and "allow them a reasonable rate of return on adequate capital employed taking into account the risks involved". Ofcom is not obliged to guarantee full recovery of all investments plus a fair rate of return whatever the circumstances. Ofcom has broad discretion to set its policies and the nature and extent of recovery of investments made by operators is one factor among many that Ofcom must take into account.

21 In any event, setting MTRs at pure LRIC will allow full recovery of investments efficiently incurred in providing termination services, as pure LRIC expressly includes recovery of fixed costs and a rate of return. Excluding fixed and common costs from pure LRIC does not preclude recovery of these costs through other more efficient means, for example, through fixed charges and effective price discrimination strategies.

Ofcom is right to change its approach from LRIC+ to pure LRIC.

22 Other MNOs have argued that Ofcom is not entitled to change its current LRIC+ approach to setting MTRs and, in any event, that Ofcom's current LRIC+ approach is the best way for Ofcom to meet its statutory objectives.

23 This argument has little merit. Ofcom is entirely entitled to change its approach if a new approach is found to be a better way of achieving its objectives, especially if there have been changes in market circumstances.

24 Moreover, changing Ofcom's approach from setting MTRs at LRIC+ to pure LRIC will considerably assist Ofcom in meeting its primary duties of:
- promoting competition in relevant markets;
- encouraging investment and innovation in relevant markets;
- considering the needs of people with disabilities, of the elderly and of those on low incomes; and
- contributing to the development of the European internal market.

There are no reasons for departing from the EC Recommendation.

25 In the absence of any compelling reasons not to, Ofcom should adopt the EC Recommendation, as it:
- is the right approach;
- is already being adopted widely by other EU Member States; and
- will secure EU-wide harmonisation.

26 There is certainly nothing about the UK mobile market that gives a reason to depart from the EC Recommendation. On the contrary, features of the UK mobile market provide particularly strong reasons for adopting the EC Recommendation, not departing from it.

27 Specifically, the UK mobile voice market has a much higher-than-average market share asymmetry between smaller and larger MNOs, mainly resulting from the recent UK merger of Orange and T-Mobile. The EC Recommendation specifically highlights market share asymmetry as a factor that greatly aggravates the problems of high MTRs and, therefore, a specific reason to reduce MTRs quickly to pure LRIC.

There is no need for a four year glidepath.

28 Ofcom argues that a four-year glidepath is needed to minimise industry and consumer disruption resulting from falling MTRs. In reality, a glidepath will only delay benefits to consumers. Any disruption to industry has been foreshadowed by the EC and Ofcom for some considerable time now and falling MTRs have been widely anticipated and built into business plans. Any disruption to consumers will only be beneficial, namely lower prices and new products and services.

29 Ofcom should therefore reduce MTRs to pure LRIC from 1 April 2011 or by 31 December 2012 at the latest, in line with the EC Recommendation.

Pure LRIC of voice termination is 0.25p/min not 0.5p/min.

30 Ofcom estimates, on the basis of a bottom-up model of a "hypothetically efficient operator", that the pure LRIC of mobile voice termination is 0.5p/min. Three has reviewed Ofcom's model in detail and found that the pure LRIC of mobile voice termination is closer to 0.25p/min, half the level estimated by Ofcom.

Three's consultation response.

31 Three's response to Ofcom's MTR consultation therefore explains:

Section 1. – why reducing MTRs to pure LRIC will transform competition in the mobile voice market;

Section 2. – why reducing MTRs to pure LRIC will encourage investment and innovation;

Section 3. – why moving from LRIC+ to pure LRIC is the right approach;

Section 4. – why there are no reasons for departing from the EC Recommendation;

Section 5. – why pure LRIC of mobile voice termination is 0.25p/min; and

Section 6. – Three's response to Ofcom's specific questions.

32 Three's response also includes additional Annexes on:

Annex A. – summary of Annex conclusions;

Annex B. – the impact of pure LRIC v. LRIC+ on competition;

Annex C. – the distributional impact of reducing MTRs to pure LRIC;

Annex D. – spectrum valuation;

Annex E. – international mobile voice market comparisons;

Annex F. – the cost of capital; and

Annex G. – the impact of pure LRIC on investment in the mobile broadband market.

Contents.

1. Reducing MTRs to pure LRIC will transform competition in the mobile voice market.

33 Reducing MTRs to pure LRIC will transform competition in the mobile voice market, bringing substantial gains to consumers.

34 MNOs can only compete on a level playing field if each MNO, large or small, faces an average termination cost per call equal to the underlying costs of termination that is essentially the same regardless of the proportion of calls terminated off-net or on-net. This will be the case if MTRs are set at pure LRIC as that reflects the underlying costs of termination and should be similar to the costs caused for termination of on-net calls.

35 Experience in the UK and overseas shows that falling MTRs lead to falling retail prices. Reducing MTRs to pure LRIC will not only continue this trend, but, for the first time, will lead to a situation of unrestricted and undistorted competition between MNOs.

36 This section therefore explains:
- how MTRs greater than pure LRIC limit competition;
- how high MTRs have limited competition in the UK mobile voice market;
- how falling MTRs have improved competition;
- how lower MTRs will enable Three to be much more competitive;
- why voice MTRs are irrelevant to competition and investment in the mobile broadband market; and
- why a glide-path will only delay benefits to consumers.

1.1. MTRs greater than pure LRIC limit competition.

37 MTRs affect competition because they are a cost that must be taken into account in assessing the viability of all mobile voice retail pricing propositions. Indeed, MTRs represent the largest variable cost item to be taken into account.

(i) MTRs above LRIC reduce incentives to compete for all MNOs.

38 According to Ofcom's latest figures, UK customers made on average 33 minutes a month of off-net calls per connection and 42 minutes a month of on-net calls[5]. At current average MTRs of 5p a minute (payable for off-net calls) and pure LRIC termination costs estimated by Ofcom to be

5 Ofcom Communications Market Report 2009, Figure 4.71.

0.5p a minute, this means an average cost of all outbound calls (on-net and off-net) for a typical large operator of 2.5p a minute on average[6].

39 Hence, on average, MTRs inflate the cost of outbound calls by five times, from 0.5p/min to 2.5p/min. This means that no operator would have an incentive to set outbound call prices below 2.5p/min without losing money on average for every call. MTRs therefore create a disincentive to compete on price below the weighted-average termination cost of on-net and off-net calls.

40 In comparison, smaller MNOs experience a much greater proportion of off-net calls than larger MNOs (in the case of Three, approximately twice as many calls are off-net). This simply reflects market share and the fact that more of the potential recipients of our customers' calls are on other networks[7]. On the basis of Three's experience, the average cost of all outbound calls for a smaller operator is therefore 4.5p a minute on average[8].

41 This illustrates that smaller MNOs face a higher variable cost of outbound calls than larger MNOs, which limits smaller MNOs' ability to price competitively, despite no underlying cost differences between smaller and larger MNOs.

42 Hence, while MTRs limit competition between larger MNOs – by limiting retail price flexibility and setting an effective floor on retail prices – MTRs distort competition between small and large MNOs even further, by limiting the price flexibility of smaller MNOs even moreby an even greater amount, creating an even higher floor on the pricing that they can profitably offer.

43 According to Ofcom data, the current average price of UK mobile metered call prices is 2.7p a minute[9], which unsurprisingly, is greater the average retail price floor of 2.5p/min estimated above. Hence, for larger operators, this average level of pricing represents an average outgoing call margin of 0.2p a minute, whereas for smaller operators, this level of average pricing means an average loss of 1.8p a minute on every call.

6 Namely, 5p a minute for off-net calls x 33 minutes plus 0.5p a minute for on-net calls x 42 minutes, divided by 75 minutes in total = 2.5p a minute on average. This assumes that the (pure LRIC) cost of on-net calls to an operator is approximately the same as the estimated pure LRIC of off-net calls.

7 The smaller the operator, the higher the proportion of off-net calls. In the extreme, for a new entrant, almost 100% of calls would be initially off-net; whereas, for a single monopoly network, 100% of calls would be on-net.

8 Namely, 5p a minute for off-net calls x 66 minutes plus 0.5p a minute for on-net calls x 9 minutes, divided by 75 minutes in total = 4.5p a minute on average.

9 Equal to £3.27 average per month per connection metered voice call charges divided by 122.8 average call minutes per month per connection (source: Ofcom Communications Market Report, Figures 4.57 and 4.71).

44 This confirms how MTRs are setting an artificial floor on voice call charges and making it difficult for smaller MNOs to compete and bring prices down further. Whereas larger operators could reduce average prices slightly and still make a positive margin, smaller operators could not reduce prices without making even greater losses on every call. Hence, high MTRs limit the pricing flexibility of all MNOs, but particularly smaller MNOs.

45 So Ofcom's data show that, even at current market prices, smaller MNOs are unable to price at competitive levels without making a loss on every call. In contrast, if MTRs were set at Ofcom's estimated pure LRIC of 0.5p a minute, then all operators would have an equal incentive to compete call charges towards this level – and this would set a proper floor on voice call charges, namely cost.

(ii) Inbound MTR revenue does not change this problem.

46 MTRs limit competition, because if an MNO reduces it prices this will increase its outbound call volumes, with little if any increase in its inbound call volume. Hence, competing on price causes an outbound traffic imbalance, likely to result in a net MTR cost[10]. So, even if all MNOs had no traffic imbalances, high MTRs would still be a problem, because of the disincentive they create to compete on price.

47 In general, there are many causes of traffic imbalances, particularly, differences in customer and product mix, and the effect of the number portability system[11]. However, these other factors tend to change slowly over time. In contrast, price competition can have an immediate impact on net call traffic flows[12].

48 The effect on inbound MTR revenue is no different for smaller MNOs. While smaller MNOs receive a relatively greater proportion of MTR revenue for incoming calls, reflecting their larger share of off-net calls, this does not change smaller MNOs' pricing incentives. This is because cutting prices drives more outbound calls, but not more inbound calls[13].

10 Depending on the extent of asymmetry of termination rates if any.
11 For example, postpay customer generate net outbound traffic and prepay customers generate net inbound traffic. Absence of effective number portability generates net outbound traffic, as many customers in the UK switch without porting their number (to get better tariffs), but this results in such customers making lots of calls but not receiving many, at least for the initial period after switching.
12 While price competition also leads to new customers, which itself will increase inbound MTR revenue, the effect of this is always much less than the impact on outbound traffic from existing customers.
13 In other words, MTRs impose a high marginal cost with no offsetting marginal income. An operator's pricing primarily drives the volume of outbound calls. Conversely, but unsurprisingly, other operators' pricing drives the volumes of inbound calls. Hence, everything else being equal, the ratio of outbound to inbound calls is a function of an operator's relative competitiveness in the market.

49 Experience from all MNOs shows that the more that an MNO cuts prices – to be competitive and help win new customers – the more this drives an imbalance between outbound and inbound calls. Whenever an operator launches a new offer or price promotion, this quickly leads to an observed reduction in that operator's "reciprocation rate" (the ratio of inbound to outbound calls).

50 This was particularly Three's experience when Three first entered the UK mobile market. In order to be competitive and win new customers, Three offered market-beating pricing. While this helped win market share, the main effect of this was a large imbalance of outbound to inbound calls, which imposed an unsustainable cost on Three of continuing with such pricing[14]. See evidence below.

51 In the face of high MTRs, there are no pricing options available to smaller MNOs that will allow them to be sustainably competitive with larger MNOs, for example:

- if MNOs charge all outbound calls (on-net and off-net) at the same retail price – then smaller operators will simply face a higher average cost per call;
- if MNOs charge different on-net and off-net prices – then smaller operators' customers will be worse off everything else being equal;
- if MNOs charge a fixed monthly price for a bundle of all calls (on-net and off-net) – then smaller MNOs will face a higher total cost of offering this bundle; or
- if MNOs charge a fixed monthly price for a bundle of off-net calls (with on-net calls free) – then smaller MNOs' customers will just need to spend more to get the same benefits.

52 All of these tariff structures are currently present in some form in the UK mobile voice market[15]. This illustrates that smaller operators will always need to offer lower prices or larger call bundles just to be competitive with the market.

53 Therefore, while greater MTR revenue partly offsets the greater MTR cost facing smaller MNOs, it does not change the underlying problem that high MTRs limit pricing flexibility, especially for smaller MNOs. This weakens price competition between all MNOs and particularly weakens smaller MNOs' ability to price competitively and with this gain market share[16].

14 Especially as Three's inbound MTR started falling in 2007 following Ofcom's decision to regulate Three's MTR.
15 They are also all examples of economic network effects, namely, a large network operator has an advantage of subscribers being able to call a larger proportion of recipients on-net rather than off-net.
16 This just creates a vicious circle for smaller operators and other new entrants facing high MTRs – the more competitive that they are (relative to the market) the most costly this strategy becomes.

54 Annex B. below explains the further the impact of LRIC+ versus pure LRIC MTRs and market share asymmetry on competition in mobile voice.

(iii) Three's experience in the mobile voice market illustrates how high MTRs limit competition.

55 The theoretical explanation above of how MTRs higher than pure LRIC limit competition is borne out by Three's experience in the UK mobile voice market, in particular that:

1. Three has always had to offer better tariffs than the other MNOs, just to remain competitive; and
2. Three's attempts to win significant share of the mobile voice market imposed an unsustainable financial cost.

56 While a new entrant into a mature mobile voice market inevitably faces a range of barriers to winning new customers, for Three, high MTRs have created in all likelihood by far the largest barrier to gaining new customers compared to any other factor[17].

57 When Three first launched services in the UK in 2003, it faced a market where the two original entrants (O2 and Vodafone) had been present for almost 20 years and the two later entrants (Orange and T-Mobile) had been present for almost 10 years. For the reasons above, this meant that Three had to offer significantly better tariffs, and/or other service features, than the existing operators to have any chance of winning new customers.

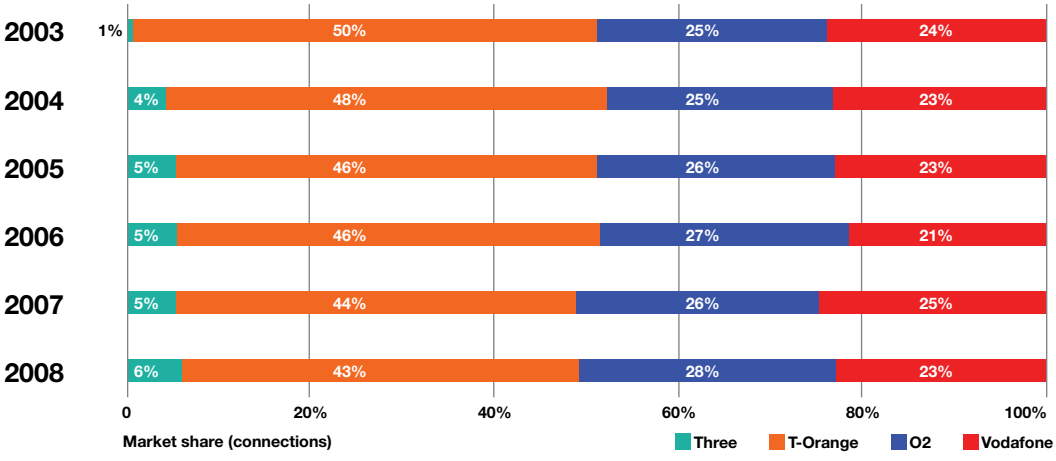
58 This price strategy was initially successful for Three in terms of winning market share. It also, however, increased outbound call volumes much more than inbound volumes. This ultimately became financially unsustainable, forcing Three to raise its prices to a level where it could no longer compete effectively for new market share[18].

59 The figure below illustrates this, showing how Three made initial large gains in its share of the UK mobile voice market, growing from 0% to 5% market share in its first two years. After that, Three has gained only small increments of market share in the subsequent five years.

17 Other factors include the need quickly to build a comparable level of mobile network coverage, the need to build a new brand, the existing high level of consumer penetration of mobile voice services and the associated switching costs of attracting customers from other MNOs.

18 The cost of winning mature mobile voice market share in the face of high MTRs – in the hope of ultimately becoming profitable – is highly likely to be prohibitive, and is more likely to force new entrants to exit the market at some stage either through consolidation or through ceasing business altogether, as has happened in a number of countries.

Figure 1: UK mobile voice market shares.



Source: Ofcom Communications Market Report 2009; Three

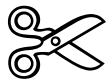
60 The figure below demonstrates this situation, showing Three's mobile-to-mobile (M2M) off-net minutes per user since launch in 2003, which shows that:

- Three's incoming M2M off-net minutes have grown steadily, reflecting growing use by Three customers as a main handset[19], growing share of prepay customers[20] and general market growth in call volumes[21], reaching a current level where off-net incoming call volumes, of 90-100 minutes a month for Three, considerably exceeding market average off-net call volumes, of 33 minutes a month, reflecting Three's continuing small mobile voice market share;
- in contrast, Three's outgoing M2M off-net minutes have always far exceeded its incoming minutes, chiefly as a result of Three's competitive pricing strategy (and also due to other factors) – , but that Three has nevertheless acted to bring down progressively brought its outgoing minutes down (chiefly through becoming relatively less competitive) in order to manage its net MTR cost.

61 In evidence for Three's competitiveness, Three has consistently had a large proportion of the most competitive offers in the mobile voice market, as confirmed by independent price surveys[22].

19 In the early years, customers often used Three as a secondary handset for outgoing calls only, reflecting the low pricing of Three's outgoing calls and difficulties for customers in porting mobile numbers from one MNO to another.
20 Prepay attracts much more incoming calls than average. Three was initially limited in the prepay market due to the original high cost of 3G handsets. This handset cost premium has now come down significantly, allowing Three to grow its prepay market share.
21 Total mobile call volumes per user have increased dramatically over the same period.
22 See Annex B, Table 5 for UK mobile voice pricing comparison.

Figure 2: Three mobile-to-mobile off-net traffic.



Minutes per user a month

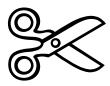
Incoming M2M minutes

Outgoing M2M minutes

Source: Three (confidential)

62 The figure below illustrates that Three has had a consistently greater percentage of off-net calls than the other MNOs.

Figure 3: Proportion of off-net calls



Vodafone

O2

T-Mobile

Orange

Three

Source: Ofcom, Three (confidential)

63 Three's evidence illustrates the cost of growing market share that high MTRs impose on a new entrant or any other smaller operator. As Three's evidence shows, this cost forced Three to raise its prices – in order to improve its traffic imbalance position – but at the cost of no longer winning further market share[23].

64 Furthermore, high MTRs have specifically precluded Three from competing in certain segments of the mobile voice market, especially high-end postpay.

65 High MTRs limit smaller operators' ability to compete in the high-end postpay mobile voice segment because of the high net outbound traffic associated with these tariffs. "High-end" postpay currently means a fixed access charge of £35 a month or more. Such tariffs include large bundles of inclusive off-net minutes. Accordingly, customers that choose these tariffs tend to make large volumes of outbound calls without a compensating volume of inbound calls.

66 To illustrate this, the average outbound call volume for all UK postpay subscribers was 234 minutes a month, compared to average outbound call volume for all subscribers of 123 minutes a month and average outbound call volume for all prepay subscribers of 56 minutes a month[24].

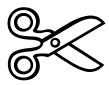
67 The figure below shows Three's average outgoing and incoming voice traffic across the range of our postpay tariffs, which illustrates that reciprocation (the ratio of incoming to outgoing minutes) tends to fall rapidly with tariff value[25].

23 Three also previously benefited from higher incoming than outgoing MTRs, which partly offset the outgoing traffic imbalance. Since 2007, this "asymmetry" of MTRs has fallen (following Ofcom's 2007 MTR price review), adding further incentive for Three to increase its prices to help reduce the net traffic outflow. Since 2007, Three has improved its mobile-to-mobile "reciprocation" rate (the ratio of incoming to outgoing traffic) from 70% to 90%.

24 Source: Ofcom Communications Market Report 2009, Figures 4.71 and 4.72. Of the average 123 minutes a month outbound calls, 75 minutes a month were other mobiles. The others minutes were to fixed lines, international calls, etc.

25 Actual monthly pricing depends on chosen phone.

Figure 4: Average outgoing and incoming voice traffic on Three postpay tariffs.



Incoming M2M minutes Outgoing M2M minutes

Source: Three (confidential)

68 The low level of reciprocation associated with high-end postpay tariffs (and high level of off-net traffic experienced by smaller operators) thereby creates a competitive disadvantage for smaller operators in this segment. Accordingly, this is why Three has necessarily had to focus on the sub-£35 a month postpay market, making it difficult for Three to offer high-end postpay smartphones, such as Apple iPhone or Blackberry[26].

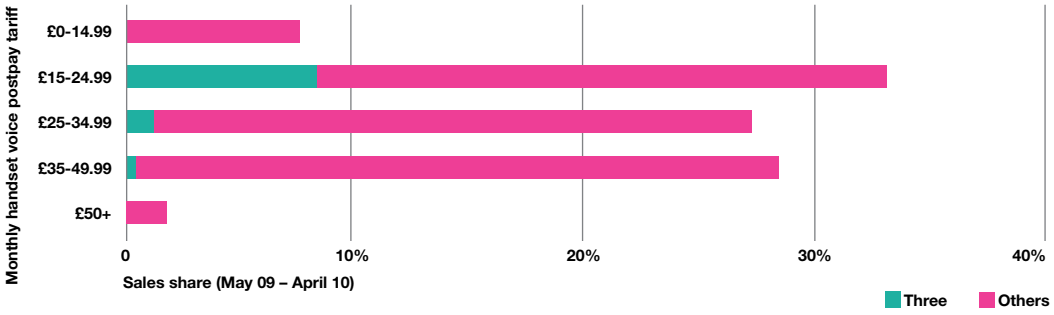
69 Conversely, as a 3G-only operator, the additional cost of 3G handsets[27] has also limited Three's ability to compete in the low-end postpay and prepay segments. Overall, this has meant that Three has had to focus on mid-market tariff segments (£15-£35 a month)[28], as illustrated by the figure below, which shows Three's current sales by monthly tariff compared to the market.

26 This is an added challenge for Three, as Three's natural strength in 3G relative to the other MNOs should mean that Three is better placed to offer high-end smartphones. High MTRs have nevertheless limited Three's ability to compete in this part of the mobile voice market.

27 While the cost of all handsets has fallen, there is a persistent premium in the cost of a 3G handset compared to a 2G handset.

28 The £15-£35 a month postpay segment currently represents 61% of the postpay market by connections (and significantly less by revenue) – source: GfK.

Figure 5: Three v other postpay sales by tariff.



Source: GfK

70 Despite these challenges, regulators have recognised strongly that Three is essential to maintaining effective competition in the UK mobile market, for example:

- "[Three] is an important driving force for competition on the UK mobile market. [Three] is a leader in pricing and service innovations (e.g. mobile broadband, […] mobile VoIP services);
- [Three] is considered […to be] an important competitive force in the UK market and to be the most innovative MNO in the market. It has played a key role in driving innovation, particularly in the data segment, and lower prices for consumers. The important role of [Three] on the UK market has also been acknowledged and confirmed by Ofcom;
- The possible disappearance of [Three] or the degradation of its competitive position could consequently have a serious impact on the UK retail mobile communication market"[29];
- "The OFT is concerned that the loss of [Three] as a source of competitive pressure could have a very significant adverse impact on competition in mobile telephony and mobile broadband services in the UK as it would in effect represent a '5 to 3' transaction in a market characterised by very substantial barriers to entry and growth; and
- "Despite the small market share of [Three] it is widely regarded as a maverick in the UK market and the potential for its removal […] would cause significant concern."[30]

29 Orange/T-Mobile merger decision, European Commission, March 2010.
30 Orange/T-Mobile merger referral request, Office of Fair Trading, Feb 2010.

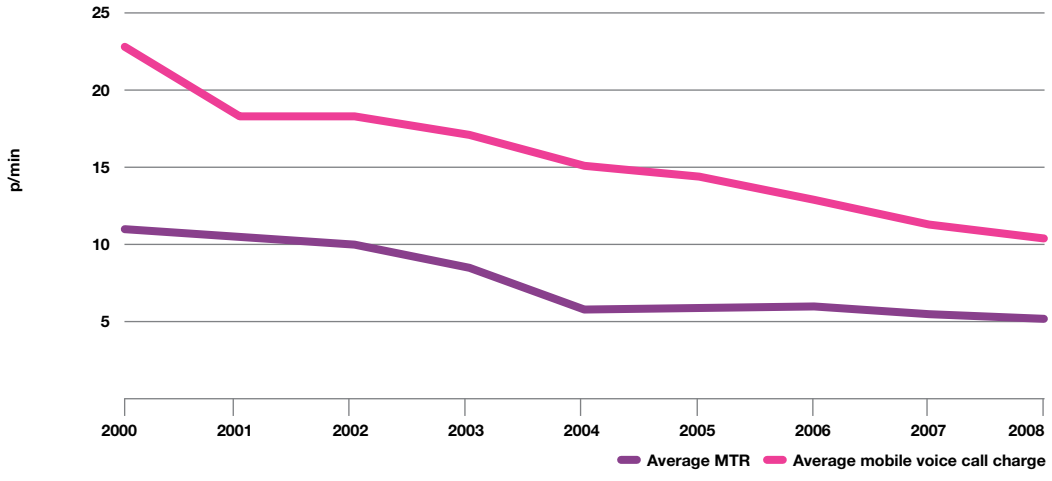
71 Three has also consistently had a large proportion of the most competitive offers in the mobile voice market, as confirmed by independent price surveys[31].

1.2. Falling MTRs have led to increased competition.

72 Historic falling MTRs have led to increasing competition and, in particular, falling prices. MTRs have been falling for several years across a wide range of countries, especially in the EU, chiefly due to regulation.[32] While other factors are also likely to have driven falling retail prices, it can be readily inferred that falling MTRs have been a major contributing factor, not least from the statements made by larger MNOs to investors.

73 The figure below illustrates the relationship between average mobile voice call charges and average MTRs in the UK.

Figure 6: Average mobile voice call charges and MTRs.

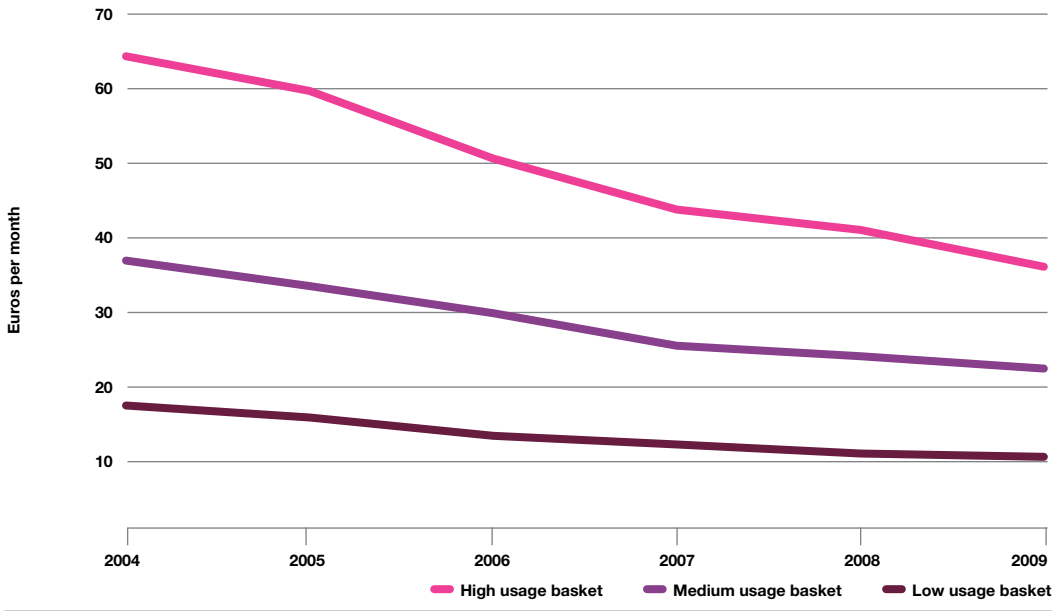


Source: Ofcom[33]; Three

74 The two figures below illustrate a similar pattern of falling MTRs and falling prices across the EU.

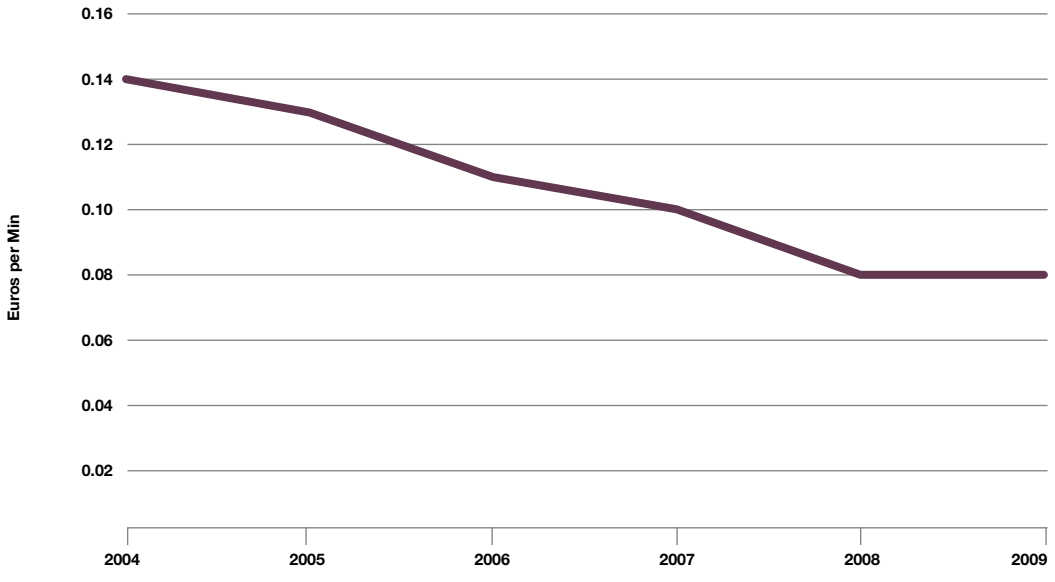
31 See Annex B, Table 5 for UK mobile voice pricing comparison.
32 While time series data provide valuable insights from other countries, international cross-section comparisons are intrinsically difficult and yield conflicting results. See Annex E for discussion of international comparison studies.
33 MTR Consultation, Ofcom Communications Market Reports.

Figure 7: Average monthly retail price of EU mobile services.



Source: European Commission[34]

Figure 8: Average EU MTRs.



Source: European Regulators Group; Three calculations[35]

34 Progress Report on the Single European Electronic Communications Market (15th report).
35 Note: Based upon figures for sixteen western European countries between 2004 and 2009.

75 All the large UK MNOs' parent companies recognise that falling MTRs have led to – and will continue to lead to – falling prices, revenues and profitability (i.e. that a "waterbed" effect does not exist or, at the least, is far from complete). Without exception, the four largest telecoms operators in Europe – which are the parent companies of the now three large UK MNOs – blame falling MTRs for falling revenues, in most cases, over and above any other factor, for example:

- "Mobile termination rate cuts accounted for 3.3 percentage points of the year-on-year revenue decline in the quarter. […] UK voice ARPU in 2009 decreased 8.7% year-on-year in local currency to 15.5 euros (-10.5% in the fourth quarter), mainly due to mobile termination rate cuts." (Telefónica)[36]
- "Regulations could require us to reduce […] termination rates in mobile […]. Such regulations and regulatory actions could place significant competitive and pricing pressure on our operations." (Telefónica)[37]
- "Industry regulators continue to impose lower mobile termination rates […] The combination of competition and regulatory pressures have contributed to a 17% per annum decline in the average price per minute across our global network over the last three years. […] UK service revenue declined by 4.7% with lower voice revenue primarily due to a mobile termination rate reduction effective from July 2009." (Vodafone)[38]
- "Margins are expected to be impacted by negative factors such as […] the expectation of further termination rate cuts by regulators." (Vodafone)[39]
- "The effect of termination rate cuts actually impacts margin adversely." (Vodafone)[40]
- "I think we are bracing ourselves for a decline in MTRs over the long term. They will clearly go down. The whole industry will basically reset in the direction of having very low MTRs, with potentially cross-net becoming the norm. […] So, can I think of MTRs going into the 3 euro cent range and then going below and then potentially going to a more bill and keep type of model over the long term, yes." (Vodafone)[41]
- "In a period where there is globalisation of the economy, and when the Regulator considered to cut the termination rate, there is a

36 Telefonica Annual Report 2009.
37 Telefonica Form 20-F 2009.
38 Vodafone Group Plc Annual Report 2010.
39 Vodafone Group Plc Annual Report 2010.
40 Andy Halford (Chief Financial Officer, Vodafone), Preliminary Results – Analyst and Investor Conference Call (for the year ended 31 March 2010), 18 May 2010.
41 Vittorio Colao (Chief Executive, Vodafone), Preliminary Results – Analyst and Investor Conference Call (for the year ended 31 March 2010), 18 May 2010.

kind of impossibility, to compensate for the regulation effect with revenues which are not growing anymore." (France Telecom)[42]

- "The reduction in termination rates […] impacted the revenues of all market players. […] The European Commission's Recommendation on the Regulatory Treatment of […] Mobile Termination Rates adopted in May 2009 will continue to put pressure on national regulatory authorities to further reduce termination rates in Germany and at our foreign subsidiaries. The continuation of this policy is expected to result in mobile communications revenue losses." (Deutsche Telekom)[43]
- "Mobile call termination charges are also subject to regulatory measures in countries with mobile telecommunications operations that can have a negative effect on revenues. […] If the European Commission were to further reduce termination rates, it may have an adverse effect on the profitability of our mobile-telecommunications operations in Europe." (Deutsche Telekom)[44]

76 Investment analysts also share the same view that MTRs have led to falling prices and this should be expected to continue, for example:

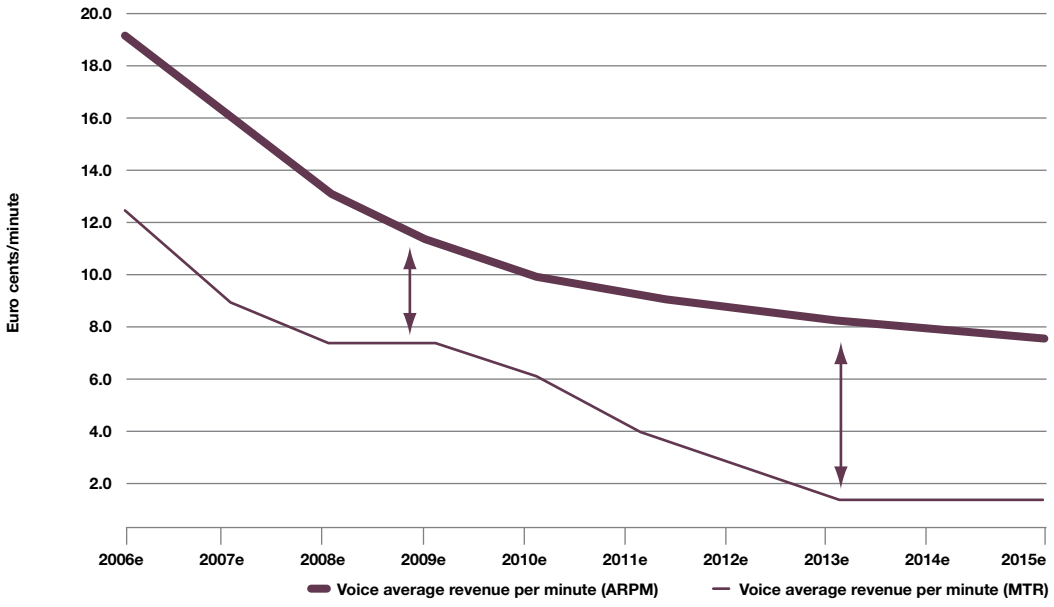
- "Why [do] MTRs matter? A fall in MTRs towards zero would: a) remove the regulatory rents enjoyed by Vodafone thanks to its high market share (which helps creating a significant club effect due to heavily discounted on-net traffic), b) aggravate the pricing environment (as small operators are no longer restrained by the presence of high MTR levels)." (Société Générale)[45];
- "We remain nervous of four-player markets which typically have at least one sub-scale operator. Subscale operators will jostle for market share and can potentially be disruptive, especially as the termination rate floor disappears over the medium-term. […] The regulatory pressure on termination rates in Europe is unrelenting, lowering the floor for off-net pricing. […] Tougher-than-expected regulatory pressure on mobile termination rates (MTRs) in Belgium, the UK and the Netherlands in recent weeks have raised the concern of further pricing pressure in these markets at the retail level. These decisions will also put more pressure on laggard regulators to catch up with the moves down to the EC recommended range for MTRs (€1.5-3c by end 2012)." (Nomura)[46]

42 Didier Lombard, France Telecom CEO and Chairman, Analysts Conference – Presentation of Annual Results 2009 – 25 February 2010.
43 Deutsche Telekom Annual Report 2009.
44 Deutsche Telekom Form 20-F 2009.
45 Societe Generale Cross Asset Research (2010), 'Vodafone – Separating hype from reality – Mobile Regulation: from bad to worse?', April 1.
46 Nomura, European Telecom Services, Vodafone note (14 May 2010).

– "While one might expect the mobile operators to increase their retail pricing to combat the termination rate hit, this is a rare response in practice, and more likely the mobile industry will take most of the revenue and EBITDA hit on the nose. Furthermore, it does increase the chance of a price war in the medium term, as an aggressive pricing strategy becomes more viable." (Enders Analysis)[47]

77 The figure below shows how analysts expect retail prices to continue to fall as MTRs reduce.

Figure 9: Expected relationship between average mobile revenue and MTRs.



Source: Morgan Stanley[48]

1.3. Lower MTRs enable smaller MNOs, including Three, to be much more competitive.

78 As indicated above, there is much evidence that prices can be expected to fall as a result of reduced MTRs. Three recognises, though, that actions are more compelling than words.

47 Enders Analysis (2010), 'UK mobile termination rates: terminated', April 6.
48 Morgan Stanley Research Europe, "Aggressive MTR Cuts Might Put Pressure on Retail Tariffs", 1 February 2010.

79 Three has looked hard at its own retail prices to see what would be viable if MTRs fall as Ofcom proposes (taking into account that Three will also lose MTR revenue from both fixed and other mobile operators). Three's conclusion is that lower MTRs does enable us to offer much better deals to customers. Bearing in mind that tariffs are always costed on the basis of the expected customer lifetime, Three has decided to go ahead this July with new tariffs that will competitive and viable in a pure LRIC world. Three's new tariff – "The One Plan" – will offer all the calls, texts and data that most people are every likely to need for just ✂ (confidential) per month. The equivalent to this typically now costs over twice this amount a month from other MNOs. ✂ (confidential) currently buys considerably less than Three will offer[49]. The One Plan will also be accompanied by a range of other new tariffs offering better value at all price points.

80 Of course, Three would need to revisit its tariffs if Ofcom did not adopt pure LRIC as the basis for regulating MTRs.

81 In the past, a competitive pricing strategy has been unsustainable for a new entrant or smaller operator, as demonstrated by Three's efforts in the first two years of its existence.

82 However, if MTRs are limited to the level of costs caused, as Ofcom now broadly proposes, then all MNOs will face a similar cost per minute of outgoing calls, as the distinction between calls terminated on or off network will be substantially reduced if not eliminated. This will mean that smaller MNOs can now price much more competitively over a longer period and this is highly likely to bring all market prices down.

83 Indeed, if Ofcom's proposal is adopted, then established MNOs will no longer be able to rely on the strategy of waiting for the competitive prices of smaller or "maverick" operators to become unsustainable. Instead, they will need to respond to the challenge posed by The One Plan, and similar tariffs, head-on, leading to increased competition on both prices and innovative services to the overall benefit of UK consumers and the economy.

84 The One Plan is now a sustainable pricing strategy mainly because it will allow Three to gain market share without the high cost imposed by a large increase in outbound call traffic.

49 At most ✂ minutes (confidential) (and sometimes much less depending on choice of handset) which for many people is much less than they are often likely to need.

85 Overall, Three's pricing initiative will lead to a huge increase in value-for-money in the UK mobile voice market and large overall reduction in voice pricing for all customers. Setting MTRs at pure LRIC will not simply result in a restructuring of tariffs – of lower call charges and higher fixed charges – as Ofcom and other MNOs suggest. It will result in a large overall reduction in voice prices as competition increases. In particular, all customer groups will benefit from a move to setting MTRs at pure LRIC, not just high users.

86 As Ofcom has identified, price discrimination will mean that even if there were a rebalancing of prices between call charges and fixed charges, this would not happen uniformly across all customer segments. In general, if fixed charges did rise on average, they would rise least, if at all, for the most elastic customers. See Annex C. for further analysis of the distributional impact.

87 As Ofcom has also identified, those who will benefit least will be consumers who do not take advantage of lower call charges to increase their usage. There is no particular connection between such inelastic customers and those who are most vulnerable; hence, there is no reason why vulnerable groups will be worse off than others. Accordingly, there is no reason why Ofcom or any legislator should need to consider a "social tariff" as a result of setting MTRs at pure LRIC[50].

88 While other UK MNOs are claiming that reductions in MTRs are likely to mean that "mobile operators will be forced to increase the cost of owning a phone in order to recoup money lost through the lower termination rates" and "low-income families will start paying more to use their phones"[51], this is highly unlikely to happen, as competition will prevent it.

89 All the main UK MNOs' parent companies recognise that falling MTRs have led to – and will continue to lead to – falling prices, revenues and profitability (see Section 1.2 above), namely they will not be able force an increase in the cost of owning a phone to recoup the money lost through lower MTRs.

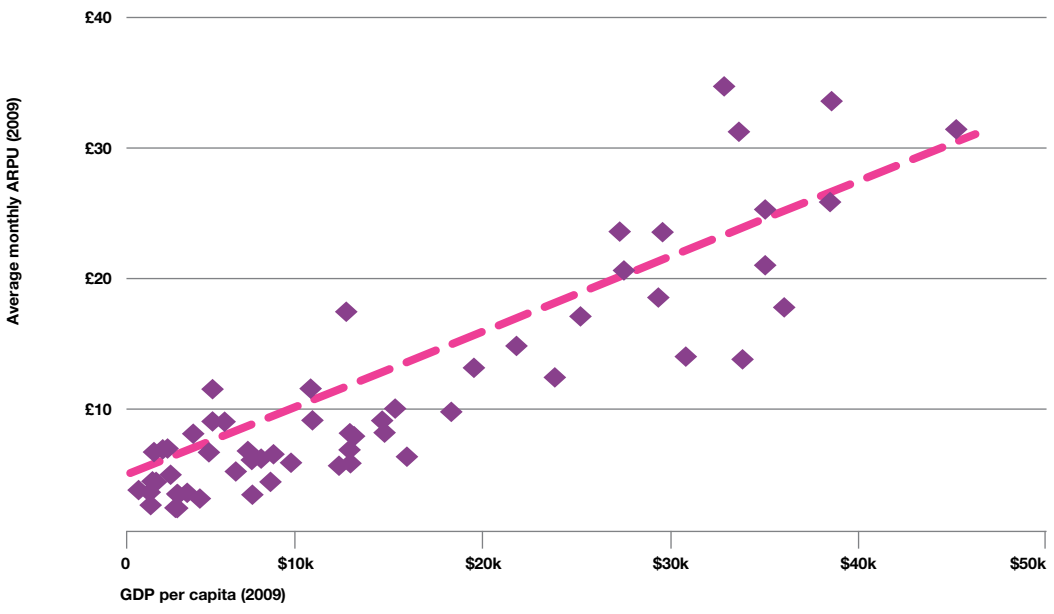
90 Evidence that there is large scope for reduction in UK mobile voice pricing can be seen from pricing of mobile voice in emerging market countries and from the pricing of mobile broadband.

50 Three would support implementation of a regulated social tariff if in the unlikely event that this turned out to be needed.
51 "Vodafone slams plan for lower connection charges", The Telegraph, 12 June 2010.

91 Emerging markets provide specific evidence of the ability to serve low-income mobile customers profitably. The figure below shows the strong relationship between average revenue per mobile phone user (ARPU) and GDP per capita and large a difference in mobile pricing between rich countries and poor countries, despite the same underlying costs and technology[52], with typical ARPU of:

- £2-£9 a month in Africa, China, Eastern Europe, India and South-East Asia;
- £7-£17 in Latin America and the Middle East; and
- £17-£35 a month in Japan, North America and Western Europe.

Figure 10: Relationship between average country ARPU and GDP per capita.



Source: IMF World Economic Outlook database, GSMA Wireless Intelligence

92 This demonstrates the sustainability of serving low-income households at much lower prices, as confirmed by recent statements by Vodafone:

> "[…] during the year we have improved our revenue mix, reducing our reliance on what I would call 'mature European mobile voice', and increasing revenue from [...] lower-priced emerging market voice."[53]

93 Therefore, there should be no doubt that all customer groups will benefit considerably as a result of Ofcom's proposal.

52 Moreover, growth of mobile phones in emerging markets has significantly contributed to falling mobile network equipment and consumer handset costs worldwide, which has helped grow mobile markets further in developed markets.
53 Vittorio Colao (Chief Executive, Vodafone), Preliminary Results – Analyst and Investor Conference Call (for the year ended 31 March 2010), 18 May 2010.

94 See Annex C. for further analysis of the distributional impact of reducing MTRs to pure LRIC.

1.4. Reducing MTRs to pure LRIC will increase competition between fixed and mobile operators.

95 While Three has chiefly focused in its response on the impact of reducing MTRs to pure LRIC on the mobile voice telecoms market, such a reduction will also have a large impact on the fixed voice telecoms market.

96 First, the problem of high MTRs are equally applicable to competition between fixed and mobile operators. Namely, MTRs significantly above cost limit competition by limiting pricing flexibility, putting an artificial floor on retail pricing.

97 In the case of fixed operators, high MTRs put a lower limit on the pricing of fixed-to-mobile calls. This results in excessive pricing for fixed telecoms users wishing to call mobile users. Consequently, it limits the ability of fixed telecoms operators to compete with mobile telecoms operators.

98 Second, unlike MTRs, fixed termination rates are already much closer to cost. This benefits mobile operators compared to fixed operators. It also distorts competition between fixed and mobile operators by making it much more costly to call a mobile line than to call a fixed line compared to the underlying cost differences.

99 This can lead to the perverse situation where the costs of calls from fixed operators are often more expensive than from mobile operators for the same calls, despite the lower costs of fixed telecoms. Removing this distortion would allow fixed operators to become much more competitive, creating added competition with the mobile voice market, to the extent that consumers view fixed and mobile as substitutes.

100 Overall, reducing MTRs to pure LRIC will increase the competiveness of both the mobile and fixed voice telecoms markets, by reducing the costs of outgoing calls for both.

101 It may also promote the convergence of fixed and mobile telecoms, by removing unnecessary barriers to competition and convergence.

1.5. MTRs are irrelevant to competition and investment in the mobile broadband market.

102 Experience of the mobile broadband market shows that:

- where there are no MTRs or other large barriers to competition, competition has taken off, with MNOs investing heavily in new capacity, new technology, new products and services, while prices have been falling rapidly; and
- smaller MNOs – which do not rely heavily on voice MTRs, if at all – have been particularly active in leading mobile broadband investment, competition and customer take-up.

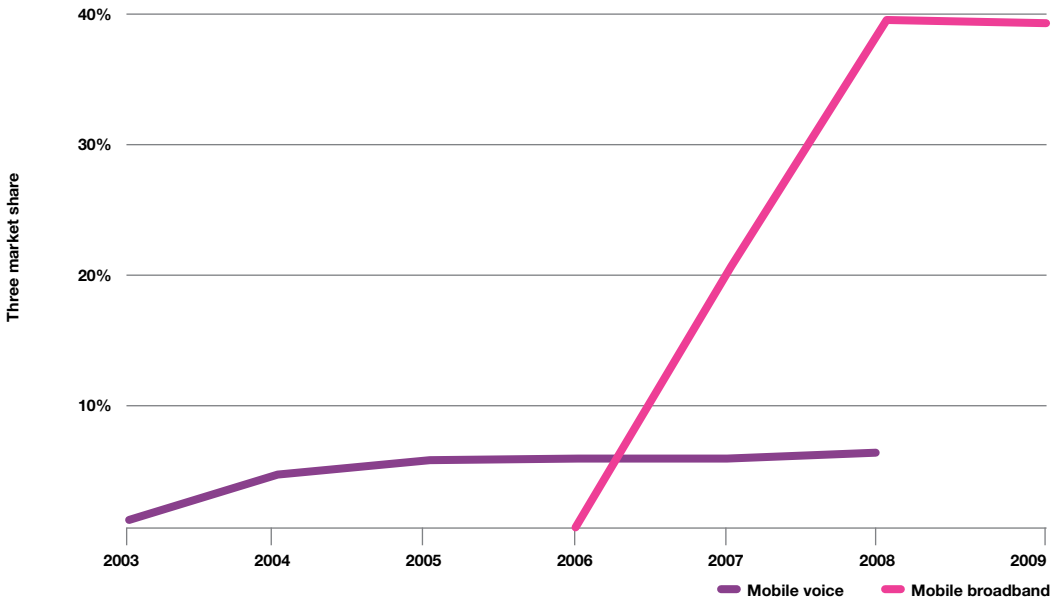
103 Indeed, the Three Group – which comprises smaller MNOs in a range of countries – has had much greater success in mobile broadband than in mobile voice, particularly in the UK, as:

- in the UK mobile broadband market, Three itself has transformed mobile broadband from an overpriced niche business-product to a great value-for-money mass market consumer product, with Three leading the market with a share of 40% in just over two years; whereas
- in the UK mobile voice market, Three's growth has been slow, with Three gaining only 6% of mobile phone connections[54] in over seven years.

104 The figure below shows Three's market shares in mobile voice and mobile broadband since Three's launch of mobile voice in 2003 and mobile broadband in 2007.

54 Source: Ofcom Communications Market report 2009, Figure 4.42 (2008).

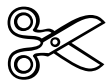
Figure 11: Three market share of mobile voice and mobile broadband.



Source: Enders Analysis, Ofcom

105 Three has competed both on quality and price as illustrated by the figure and table below, which show Three's 3G network size compared to other UK MNOs and shows the evolution in mobile broadband pricing since Three's launch of consumer mobile broadband in September 2007.

Figure 12: Three and other MNO average 3G sites.



Three Other operators (average)

Source: Ofcom[55]; Three (confidential)

Table 1: UK postpay mobile broadband pricing.

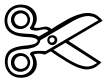
Best value monthly package per GB	Three	Vodafone	T-Mobile	Orange	O2
September 2007	£5	£8	£10	£53	£53
June 2008	£3	£5	£5	£5	£7
May 2010	£1.50	£5	£5	£2.50	£5

Source: Pure Pricing

106 This evidence shows that Three's pricing has forced the market as a whole to cut prices with the result that all consumers have benefited. As the figure below shows, Three has been so successful that other MNOs have had to respond to avoid being left behind.

54 Source: Ofcom Communications Market report 2009, Figure 4.42 (2008).

Figure 13: UK monthly mobile broadband sales.

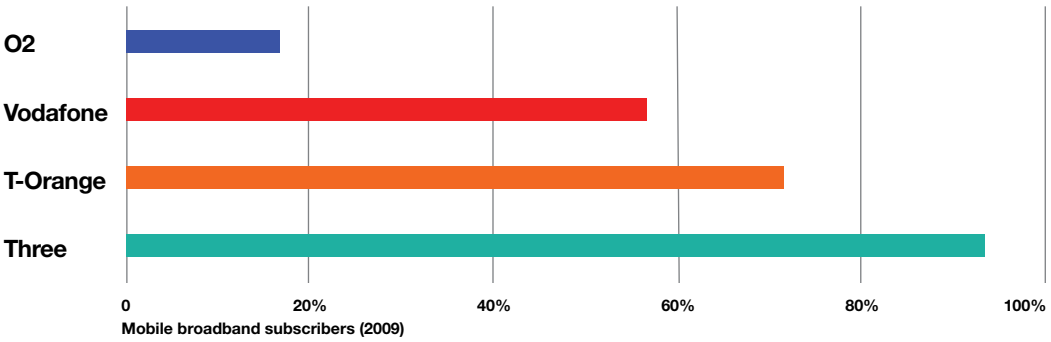


Three Other operators

Source: GfK; Three (confidential)

107 Moreover, unlike mobile voice, where MTRs impede growth, Three's market leading growth strategy in mobile broadband has been sustainable. Three has been able to continue to lead the market and therefore sustain competitive pressure despite the efforts of others to respond, as illustrated by current market shares below.

Figure 14: UK mobile broadband market shares

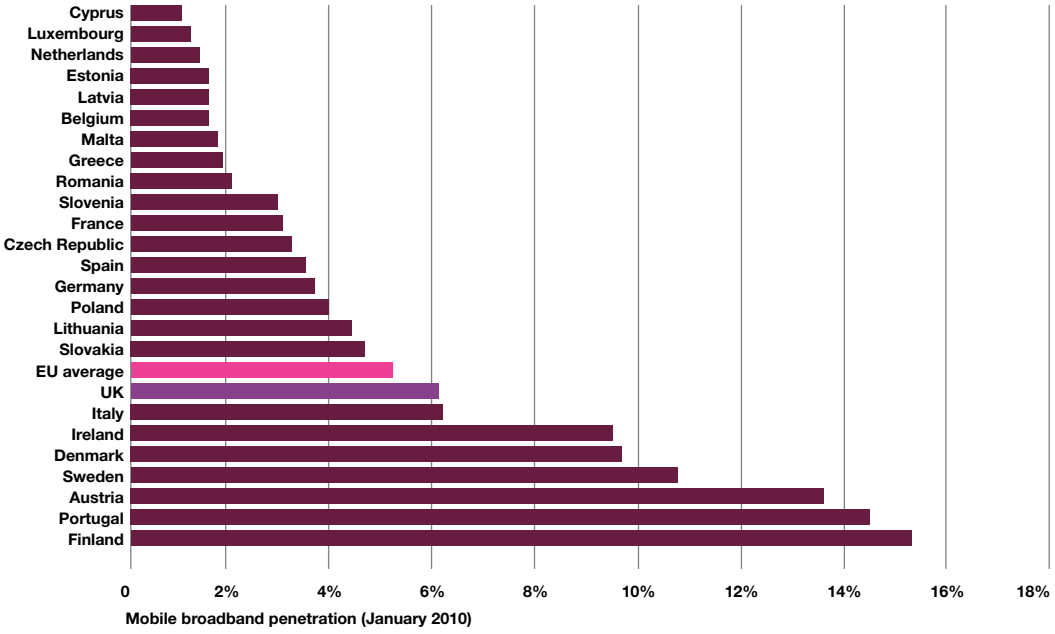


Source: Enders Analysis

108 The Three Group has had a similar experience in all the countries in which it operates[56]. Moreover, the countries in which the Three Group operates lead in the penetration of mobile broadband (with the exception of just Portugal and Finland), which the figure below shows.

109 In 2009, mobile broadband penetration doubled across Europe, from 3% to 6%, and now represents almost 20% of all broadband internet connections across the EU[57]. Three suggests that this strongly demonstrates the benefits available to consumers in a market where competition is effective.

Figure 15: Mobile broadband penetration across EU countries.



Source: European Commission[58]

55 Wholesale mobile voice call termination market review, Supporting Annexes, Figure 23.
56 In Europe, the Three Group operates in Austria, Denmark, Ireland, Italy, Sweden and the UK.
57 Source: European Commission, 15th Progress Report on Single European Electronic Communications Market (2010), Figure 22. Moreover, according to Ofcom, 12% of UK households had a mobile broadband connection at Q1 2009 (Communications Market Report 2009, page 8).
58 15th Progress Report on Single European Electronic Communications Market (2010), Figure 2.

110 Other MNOs have nevertheless argued that cutting MTRs will hinder investment in mobile broadband. However, this concern is misplaced and assumes that voice MTRs are needed to cross-subsidise investment in mobile broadband.

111 There is no evidence to suggest that this is the case. On the contrary, independent sources confirm that the current market pricing of mobile broadband is cost-reflective, and therefore indicates a sustainable and highly competitive market[59], for example:

- Ofcom's own LRIC model indicates that pure LRIC for mobile broadband of £1-£2/GB a month[60];
- Barclays Capital estimates that the cost of additional mobile broadband capacity is €2-€5/GB a month[61];
- Enders Analysis estimates that the cost of additional mobile broadband capacity is £0.3-£3/GB a month[62]; and
- Ericsson and Nokia Siemens Networks estimate total opex and capex of €1.5-5/GB a month.[63]

112 In any event, the mobile broadband market is already starting to see re-pricing in response to market pressures, for example, US operators AT&T and Verizon, and also some UK operators are withdrawing unlimited mobile broadband tariffs.

113 The absence of any cross-subsidy (or the need for it) is evident from the fact that investment in mobile broadband is often growing fastest in markets with low voice MTRs, such as the US[64], and often by operators that are not even present in the voice market, for example, Clearwire and Harbinger Capital in the US[65].

114 Similarly, various potential new entrants are showing interest in future UK spectrum auctions. New entry solely in mobile broadband would not be feasible if market prices reflected cross-subsidy. Indeed, the fact that it would foreclose the mobile broadband market to suppliers without a large share in the mobile voice market is itself a strong reason why voice MTRs should not be allowed to cross-subsidise mobile broadband pricing.

59 Subject to the timely and competitive availability of new mobile spectrum.
60 Pure LRIC is a relevant benchmark because, like pure LRIC of voice termination, pure LRIC of data will include recovery of the fixed and investment costs of providing adding additional data capacity.
61 "Net neutrality", Financial Times, 4 May 2010.
62 "UK telecoms: Spectrum and capacity issues", Enders Analysis, May 2010.
63 "Don't worry – Mobile broadband is profitable", Ericsson, EBR #2 2009; "Mobile broadband with HSPA and LTE – capacity and cost aspects", Nkia Siemens Networks, 2010.
64 At the end 2009, the US had much greater committed deployment than the EU. See "Mobile Communication Developments in the OECD area", OECD, June 2010.
65 These operators intend to focus either exclusively on the mobile broadband market or to lease mobile broadband capacity to retail mobile communications providers. See "Next mobile bandwidth wave gains momentum", Financial Times, 4 May 2010.

115 Far from needing support from mobile voice revenues, mobile broadband is growing rapidly as a replacement for declining mobile voice revenues:
- mobile voice revenue declined by 2% in 2009 across Europe (75% of mobile services revenue);
- mobile broadband revenue grew by 9% in 2009 across Europe (25% of mobile services revenue); and
- overall mobile services revenue grew by 1% in 2009[66].

116 Other telecoms groups also recognise this shift of revenue and investment away from "mature" mobile voice to "fast growing" mobile broadband, for example:
- "[…] five key achievements of the year: […] during the year we have improved our revenue mix, reducing our reliance on what I would call 'mature European mobile voice', and increasing revenue from consumer and business data services […] in the last quarter the data growth in the UK was 32.8%, again the highest in Europe so pretty good." (Vodafone)[67]; and
- "The investment in Europe is basically held at previous levels. We are very, very focused upon building out our data networks. Given the prodigious cash flow from the rest of the business, we have absolutely continued to focus on that." (Vodafone)[68].

117 Annex G. provides further analysis on the impact of pure LRIC MTRs on the mobile broadband market and the costing of mobile broadband services.

118 Some MCPs have highlighted that Directive 2002/21/EC (the "Framework Directive") and Directive 2002/19/EC (the "Access Directive") require MTRs be set to allow full recovery of investments and to promote new investment.

119 Three agrees with this. This is because setting MTRs at pure LRIC does allow full recovery of investments, as it includes recovery of the fixed costs and return on investment of providing termination services. It promotes investment through its promotion of competition. Effective competition is always the most effective driver of innovation and investment.

120 Furthermore, while Article 13(2) of the Access Directive refers to promotion of investment as an end in itself, Article 8(2) of the Framework Directive emphasises promotion of competition, with encouragement of

66 European Commission, 15th Progress Report on Single European Electronic Communications Market (2010), Table 1.
67 Vittorio Colao (Chief Executive, Vodafone), Preliminary Results – Analyst and Investor Conference Call (for the year ended 31 March 2010), 18 May 2010.
68 Andy Halford (Chief Financial Officer, Vodafone), Preliminary Results – Analyst and Investor Conference Call (for the year ended 31 March 2010), 18 May 2010.

"efficient investment" only to the extent that it promotes competition. Settings MTRs at pure LRIC is therefore consistent with both the Access Directive and Framework Directive.

1.6. A glide-path will only delay benefits to consumers.

121 Ofcom argues that a four-year glide-path is necessary to limit industry and consumer disruption.[69]

122 Three strongly disagrees with this. Three believes that there is no reason for any glidepath, as it will only delay benefits to consumers, because:

- the likely effect of Ofcom's proposal on consumers will be lower prices and greater innovation, which will only benefit customers; and
- the likely effect of Ofcom's proposals on the mobile telecoms industry has been long anticipated and has already been long planned for.

123 At a maximum, the glidepath should be 21 months, following the EC Recommendation, which recommends that MTRs should be reduced to pure LRIC by 31 December 2012 at the latest.

124 First, the chief benefit of Ofcom's proposals will be greater competition in the UK mobile voice market, by removing the barrier to competition that MTRs above pure LRIC creates. Three believes that these will benefit all customer categories – prepay and postpay, low users and high users. Hence, the slower the glidepath, the slower that competition will benefit consumers.

125 Ofcom argues that, due to the recent emergence of longer mobile contract lengths, MTRs falling "too quickly" would lead to inefficient rebalancing of pricing between different customer segments that could be harmful.[70] Three disagrees with this, as it assumes the existence of a "waterbed" effect – namely, that reductions in some prices will lead to increases in other prices. The existence of a waterbed effect in the mobile telecoms industry is already widely discredited, as:

- the conditions for a waterbed to hold – namely, free entry and exit – do not apply to the mobile telecoms industry at all[71];

69 Ofcom (2010), 'Wholesale mobile voice call termination Market Review. Volume 2 – Main consultation.', April 1st, para 9.20.
70 Ofcom (2010), 'Wholesale mobile voice call termination Market Review. Volume 2 – Main consultation.', April 1st, para 9.20.
71 "The argument sometimes advanced by firms of 'if you take revenues from somewhere we must make it up somewhere else' is not valid unless firms have fixed and common costs and compete under conditions of free entry and exit." A. Schiff, "The 'Waterbed' effect and Price Regulation", Review of Network economics, Vol. 7, Issue 3, September 2008.

- all the major MNOs themselves accept that falling MTRs have led to falling revenues and that they have not been able to make this up by increasing prices elsewhere (see quotes above);
- investment analysts and other industry observers hold exactly the same view (see quotes above);
- empirical studies are inconclusive as to the existence of a waterbed effect in the mobile telecoms industry[72]; and
- reducing MTRs to pure LRIC will be expected to have a strong impact on rising competition and falling prices.

126 The main impact of longer consumer contracts will be a delay in the benefits to consumers of lower MTRs.[73] In any event, Three estimates that, if MNOs started at April 2010 (when Ofcom published its MTR proposal), then MNOs should be able to vary 90% of customers' contracts before April 2011 (when Ofcom's decision comes into effect)[74]. Three is already changing its pricing in anticipation of MTRs falling rapidly (see Section 1.3 above), so there is no reason why other MNOs cannot start changing their pricing now. Hence, any impact of long customer contracts, if any, should not be material.

127 Second, Ofcom's proposal has been long anticipated. It will be almost three years between the European Commission first proposing pure LRIC MTRs and Ofcom's proposal coming into effect[75]. Ofcom's proposal was widely expected by industry analysts and the UK MNOs have also been planning for large MTRs reductions for some time.

128 Ofcom is right that the changing method of evaluating the efficient costs of MTRs is significant. However, Three estimates that the direct financial impact of reducing MTRs from current levels to pure LRIC is fairly modest, at £440m for the industry, which represents just 2% of industry revenue or 10% of earnings before interest tax and depreciation (EBITDA).[76] Furthermore, the effect of Ofcom changing its method for settings MTRs, from LRIC+ to pure LRIC represents only a quarter of this reduction (with the remainder occurring even if Ofcom continued to use LRIC+, based on current estimates of the value for LRIC+).

72 For example, Genakos, C. and Valletti, T. (2009) "Testing the 'waterbed effect in mobile telephony", Journal of the European Economic Association. Andersson, K. and Hansen, B., (2007), "Network Competition: Empirical Evidence on Mobile Termination Charges and Profitability".
73 The proportion of 24-month contract sales has risen rapidly in the last 12 months, from 19% to 56% of postpay sales at April 2010 (source: GfK).
74 This is based on the current distribution of consumer contract lengths in the market.
75 The European Commission first set out its views on MTR reform in June 2008 ("Lower charges, greater consistency, more competition: Commission consults on bringing down mobile phone tariffs in Europe") and Ofcom has been actively considering a move to pure LRIC since May 2009 ("Wholesale mobile voice call termination. Preliminary consultation on future regulation").
76 The direct loss to the mobile telecoms industry is the reduction to fixed-to-mobile termination revenue.

129 Moreover, it is not clear why in Ofcom's proposal, if MNOs can accommodate a 1.5p-1.8p MTR reduction in the first year, then operators need a further three years to accommodate the remaining 2.0p reduction.

130 The indirect financial impact of falling MTRs – due to greater competition – will be determined by the market. In any event, it will be slowed to the extent that operators have long consumer contracts, as consumers will not be able to switch without penalty until their contracts have expired.

131 Third, an immediate reduction of MTRs to pure LRIC in April 2011 would not be out of line with regulatory precedent, as for example:

- in Ofcom's 2004 MTR price review, Ofcom concluded that a one-off reduction of MTRs without the application of a glide-path would not cause excessive disruption to the industry or consumers[77] – furthermore, the absolute reductions in Ofcom's current MTR proposal is much lower than in previous MTR price reviews;
- in Ofcom's 2008 leased line price review, Ofcom concluded that "In cases where prices at the start of the control are materially out of line with costs there may be an argument for making one off adjustments to these charges (to bring them more in line with the underlying costs of provision)"[78];
- in Ofcom's 2004 review of the cost recovery mechanism for BT's product management, policy and planning (PPP) charge[79], Ofcom proposed a 75% one-off initial charge reduction;
- in Oftel's 1997 review of BT's interconnection charges, Oftel made a large downward reduction in BT's charges to reflect a move from annually determined historic cost accounting (HCA) based charges to new LRIC based charges (the so-called 1997 "LRIC drop")[80] – Oftel wanted to make "a clean break from the old regime by implementing the LRIC adjustment, to allow the industry to benefit without delay from the better economic signals that LRIC based charges will provide"[81] concluding that an immediate drop was appropriate because it had been foreshadowed for some time and would not result in any windfall loss to BT; and
- in Ofgem's 1995 and 2000 electricity distribution price review, Ofgem proposed large initial price reductions "on the basis that

77 Ofcom (2004), 'Wholesale mobile voice call termination. Statement.' , June 1st, Para. 6.82.
78 Ofcom (2008), 'Leased Lines Charge Control', December, para. 1.20.
79 July 2004 PPP Statement "Review of BT's product management, policy and planning (PPP) charge" http://www.ofcom.org.uk/consult/condocs/rev_bt_pm/statement/statement.pdf.
80 1997 Network Charge Control Statement, at http://www.ofcom.org.uk/static/archive/oftel/publications/1995_98/pricing/nccjul97.htm.
81 Ibid at para 3.7.

customers would prefer a larger immediate price cut and that companies preferred a financial profile that did not deteriorate throughout the period"[82].

132 Last, Ofcom's primary duties are to benefit consumers and promote competition, not necessarily to limit industry or consumer disruption. In any event, Three considers that there will be little if any adverse industry or consumer disruption caused by reducing MTRs to pure LRIC from April 2011.

82 Ofgem (1999), 'Reviews of Public Electricity Suppliers 1998 to 2000. Distribution Price Control Review. Final Proposal', December, para. 6.4.

2. Reducing MTRs to pure LRIC will encourage investment and innovation.

133 Large MNOs are concerned that Ofcom's proposals will cut their revenues. They suggest that lower revenues and lower profits will mean less investment and that this would be incompatible with Ofcom's statutory duties. Three disagrees.

2.1. Ofcom's duty is to promote efficient investment.

134 Some MNOs have argued that Directive 2002/21/EC (the "Framework Directive") and Directive 2002/19/EC (the "Access Directive") require MTRs be set to allow full recovery of investments and to promote new investment.

135 However, Article 13(1) of the Access Directive provides only that the national regulatory authority (NRA) must "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".

136 This is not an obligation to ensure a full recovery of investments made in all circumstances. The Access Directive provides a broad discretion to the NRA to decide the nature and extent of the recovery of investments by operators, tempered by such other policy considerations as the NRA is permitted to apply.

137 In this regard it is significant that Article 8(2) of the Framework Directive refers to the objective of encouraging "efficient investment" only to the extent that it promotes competition.

2.2. Low MTRs promote efficient investment.

138 Ofcom's proposal specifically allows the recovery of all fixed and variable costs which are incremental to the provision of the wholesale call termination service (including a reasonable rate of return on capital employed, taking into account the risks involved), and this would thereby facilitate efficient cost recovery.

139 In any event, the purpose of voice MTRs is not to cross-subsidise other products and services (such as mobile broadband), as this would only distort competition in other markets, for example, by foreclosing the mobile broadband market to suppliers without a large share in the mobile voice market.

140 Furthermore, there is no evidence that efficient cost recovery for other products and services needs to rely on cross-subsidy from voice MTRs. As discussed in Section 1. above, mobile broadband is still able to achieve efficient cost recovery in its own right despite rapidly falling retail prices.

141 Finally, setting MTRs at pure LRIC will promote investment through the promotion of competition. Effective competition is ultimately the most effective driver of innovation and investment.

2.3. Preserving high MTRs will not promote efficient investment.

142 Even if the 2G/3G MNOs were correct that moving from LRIC+ to pure LRIC will reduce their overall revenues, and potentially their investment incentives, then such incentives must be legitimate if Ofcom is to take them into account.

143 Three recognises that cutting MTRs will lead, at least in the short term, to reduced revenues for the MNOs, including for Three.

144 However, if high MTRs have created investment incentives for the 2G/3G MNOs then they have done so only by securing a lucrative revenue stream not subject to competitive pressures and by restricting retail competition by new or smaller operators. These incentives were, however, illegitimate as they ran counter to the overriding objective of promoting competition. The obligation to encourage investment is explicitly required to be read in that context: Article 8(2) of the Framework Directive. As such, these investment incentives cannot properly be relied on as justifying the continuation of LRIC+ as the basis for setting MTRs.

3. Ofcom is right to move from LRIC+ to pure LRIC.

145 The 2G/3G MNOs have argued that Ofcom is not entitled to change its current LRIC+ approach to setting MTRs and, in any event, that Ofcom's current LRIC+ approach is the best way for Ofcom to meet its statutory objectives.

146 Three strongly disagrees with these arguments.

3.1. Ofcom is entitled to change its approach.

147 Ofcom is entitled (and required) as a matter of public law to take a fresh view of the appropriate costs methodology for the next charge control period for setting MTRs. It is in no way bound by its previous assessment, contrary to the suggestions of the 2G/3G MNOs.

148 Ofcom's past policies of setting MTRs (based on LRIC+) do not as a matter of law create any legitimate expectation that Ofcom should set MTRs on the same basis in future. Moreover, the Competition Commission's (CC's) determination[83], which relied in part on Ofcom's previous approach for setting MTRs, does not oblige or even encourage Ofcom to set MTRs on the same basis in future.

149 Therefore, as to the question of legitimate expectation that Ofcom would continue with its past policies in using a LRIC+ approach for setting MTRs:

- Ofcom has a duty not to fetter its discretion and to make decisions based on the public interest, and is entitled to change its approach where it decides that a change is in the public interest;
- Ofcom has not created, as a matter of law, any legitimate expectation that it would maintain its approach in favour of LRIC+ in this MTR review; and
- even if (in the unlikely event) it was found that there was a legitimate expectation that Ofcom would follow its previous policies, the rights held to arise would most likely be procedural – namely, the courts would require Ofcom to consult those affected by its decision-making before diverting from past practice – as opposed to substantive, namely, requiring Ofcom to maintain its LRIC+ methodology. Ofcom has already held a thorough consultation process satisfying any procedural requirements.

83 CC Determination in Three v Ofcom (case 1083/3/3/07) and BT v Ofcom (case 1085/3/3/07), 16 January 2009 (the "CC's Determination").

150 As to the CC's Determination:

- the CC was not deciding the matter *de novo*. It was acting in an appellate capacity and took as its starting point the Ofcom decision[84]. The CC also recognised that it was not a second-tier regulator and that the policy and regulatory judgements involved in choosing the relevant pricing methodology were primarily a matter for Ofcom alone;
- the CC merely considered whether Ofcom had erred in relation to specific questions referred by the Competition Appeal Tribunal (CAT) – the CC did not make an assessment of whether the LRIC+ methodology was more appropriate than any other approach and was expressly limited from doing so;
- the CAT limited the arguments that could be considered by the CC in the appeal and ruled inadmissible much material of a type that subsequently proved persuasive before the European Commission. In thus limiting the scope of the appeal, the CAT specifically stated that nothing in its ruling "should be taken as any indication of the views of the Tribunal on the merits of the points that [Three] makes"[85]. The CC made similar comments in its determination and specifically noted, but offered no view on the parallel discussions continuing at the European level; and
- in any event, the CC's Determination was limited to the facts and arguments in the particular case. Determinations of the CC do not have any formal precedent value. Accordingly, the CCs Determination does not oblige Ofcom to continue using LRIC+ in subsequent charge control periods.

3.2. Pure LRIC achieves Ofcom's objectives better than LRIC+.

151 In taking a fresh view of the competing forms of costs methodology, and particularly in view of the potential for change in the market environment, Ofcom's current conclusion is that pure LRIC achieves its policy objectives more effectively than LRIC+.

152 Ofcom's objectives are derived from the Communications Act 2003 ("CA 2003") and the EU regime which CA 2003 implements.

84 Ofcom Statement on Mobile Call Termination, 27 March 2007.
85 Three v Ofcom [2008] CAT 10 (the admissibility ruling) para. 11.

153 Under s3(1) of the CA 2003 Ofcom must, in carrying out its functions, further the interests of citizens and consumers, where appropriate by promoting competition. Under s3(4), Ofcom is required to have regard to a range of other considerations, including:

1. the desirability of promoting competition in relevant markets;
2. the desirability of encouraging investment and innovation in relevant markets; and
3. the needs of persons with disabilities, of the elderly and of those on low incomes.

154 Ofcom must also have regard to the interests of consumers in respect of choice, price, quality of service and value for money (s3(5)).

155 Under s4 of the CA 2003, Ofcom is required to act in accordance with the six European Community requirements for regulation. These include:

1. promoting competition in the provision of electronic communications networks and services, associated facilities and the supply of directories; and
2. contributing to the development of the European internal market.

156 The tests for imposition of price controls also reflect similar requirements. Under s88(1)(b), Ofcom is only permitted to set a price control where it appears to it that the setting of the price control is appropriate for the purposes of promoting efficiency, promoting sustainable competition and conferring the greatest benefit on end-users of public electronic communications services.

157 Ofcom notes that it has in the past found LRIC+ to be appropriate but finds that this methodology may no longer be appropriate because of the changing market environment, among other things. Three maintains that pure LRIC has been more appropriate than LRIC+ for some time, but that the case for LRIC is now even stronger in view of the changing market environment to which Ofcom refers.

158 In particular, Three agrees with Ofcom that technology is changing rapidly and developing more quickly than during the previous charge control period and that higher MTRs (resulting from the LRIC+ approach) are likely to create obstacles to innovation. Among other things, this is because, high MTRs especially discourage new entrants, who are the most likely to bring new innovation to the relevant markets.

159 As is set out in Section 1.1. above, in a market with high MTRs, a new entrant must overcome the double obstacles that:

- MNOs with high market shares benefit from large network effects that directly increase the cost to new entrants of outbound calls relative to incumbents; and
- although the obvious way for a new entrant to grow market share is to be more competitive, doing so causes an outward traffic imbalance that will tend to make the cost of growing market share prohibitively high.

160 As Ofcom finds, the distortion caused by high MTRs becomes more serious as more players enter or seek to enter the market. Three agrees with Ofcom that circumstances have changed materially since the last charge control, especially with the emerging availability of spectrum through the Digital Dividend and other new spectrum availability. This makes new entry more likely than before and aggravates the negative effects of continuing to use LRIC+ for setting MTRs.

161 As noted in Section 1., Ofcom's proposal carefully considers the impact on vulnerable groups and those on low income. Ofcom's finds that none of these groups should be adversely affected, which Three agrees with. Moreover, Three believes that low income users will particularly benefit from Ofcom's proposal, as a result of increasing competition. See also Annex C. on the likely distributional impacts of Ofcom's proposal.

162 As set out in Sections 1. and 2., Ofcom's proposal will strongly promote investment and innovation.

163 Ofcom's approach also follows the EC Recommendation, which among other things, is a harmonising measure, and thereby contributes to promotion of the European internal market.

164 Therefore, Three believes that Ofcom's proposal to set MTRs at pure LRIC achieves each of Ofcom's statutory objectives much better than LRIC+.

4. No reasons for departing from the EC Recommendation.

165 Ofcom concludes that there are no reasons for departing from the EC Recommendation that MTRs should be no greater than pure LRIC. Three firmly agrees with this conclusion.

166 In particular, Ofcom should follow the EC Recommendation unless there are compelling reasons for not doing so.

167 Accordingly, this section explains why:
- the EC Recommendation promotes competition and investment;
- there are no general reasons for departing from the EC Recommendation; and
- there are no UK-specific reasons for departing from the EC Recommendation.

4.1. The EC Recommendation promotes competition and investment.

168 Three strongly supports the EC Recommendation, in particular its findings that:
- an incremental cost approach which allocates only efficiently incurred costs that would not be sustained if the service included in the increment was no longer produced (i.e. avoidable costs) promotes efficient production and consumption and minimises potential competitive distortions;
- the further termination rates move away from incremental cost, the greater the competitive distortions between fixed and mobile markets and/or between operators with asymmetric market shares and traffic flows;
- a LRIC approach allows 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 wholesale call termination service and would thereby facilitate efficient cost recovery;
- call termination is a service which generates benefits to both calling and called parties, but for the purposes of setting wholesale termination charges, all of the avoidable costs of providing the wholesale call termination service should be recovered via the wholesale charge;
- termination markets represent a situation of two-way access where both interconnecting operators are presumed to benefit from the arrangement but, as these operators are also in competition with

each other for subscribers, termination rates can have important strategic and competitive implications;
- in markets where operators have asymmetric market shares, this can result in significant net payments from smaller to larger competitors;
- high termination rates tend to lead to high retail prices for originating calls and correspondingly lower usage rates, thus decreasing consumer welfare;
- the lack of harmonisation in the application of cost-accounting principles to termination markets to-date demonstrates a need for a common approach which will provide greater legal certainty and the right incentives for potential investors, and reduce the regulatory burden on existing operators that are currently active in several EU Member States; and
- a period of transition until 31 December 2012 should be considered long enough to allow NRAs to put the cost model in place and for operators to adapt their business plans accordingly while, on the other hand, recognising the pressing need to ensure that consumers derive maximum benefits in terms of efficient cost-based termination rates.[86]

169 These findings confirm that setting MTRs at pure LRIC will promote competition and investment, and moreover, that any MTR greater than pure LRIC limits and distorts competition. They are also consistent with Three's analysis and evidence on the effect of setting MTRs at pure LRIC in Sections 1. and 2. above and Annex B.

4.2. No general reasons for departing from the EC Recommendation.

170 Three considers that there are no general reasons for Ofcom departing from the EC Recommendation, as:
- adopting the EC Recommendation follows directly from Ofcom's duties to further the interests of consumers and citizens and promote competition;
- the EC Recommendation is entirely compatible with other relevant EC recommendations and law; and
- the EC Recommendation is being widely adopted by other EU Member States.

86 EC Recommendation, para. 3-4, 13, 15, 21.

171 First, Ofcom's MTR proposal is entirely consistent with Ofcom's general duties, as discussed in Section 3.2 above.

172 In following the EC Recommendation, Ofcom will therefore have discharged all of its general and specific duties contained in the CA 2003. In contrast, adopting LRIC+ would not satisfy Ofcom's duties as it would not promote the interests of consumers or citizens.

173 Second, the EC Recommendation (and Ofcom's proposal) is the best way of reflecting what would happen in a hypothetical competitive market, as:

- setting MTRs at pure LRIC promotes fair and undistorted competition between MNOs; and
- setting MTRs at LRIC+ (or any level above pure LRIC) will always have the effect of limiting, distorting or restricting competition between MNOs.

174 Third, the EC Recommendation (and Ofcom's proposal) does not preclude efficient investment recovery for the reasons set out in Sections 1. and 2. above.

175 Fourth, contrary to what T-Mobile alleged in its response to Ofcom's last MTR consultation, the EC Recommendation (and Ofcom's proposal) are not in any way inconsistent with the EC's Recommendation on Accounting Separation and Cost Accounting Systems. The Recommendations have different purposes and do not cover many, if any, of the same issues.

176 Fifth, proposals to adopt the EC Recommendation have already been made by NRAs in a number of EU Member States, in particular, the proposal to reduce MTRs to pure LRIC by 31 December 2012 at the latest. We are not aware of any Member States that have proposed not to adopt pure LRIC. As far as we are aware, the UK is the only Member State proposing to extend the glidepath beyond 31 December 2012.

177 Many other countries have charge controls that expire before 31 December 2012 and many regulators have confirmed their intention to review future regulation of MTRs during 2010-12 in preparation for new charge controls beyond 2013.

178 The table below summarises the current position in larger EU Member States.

Table 2: Response to EC Recommendation across Member States

Country	Response to EC Recommendation
Austria	Current MTRs expire 31 December 2012. No new proposed MTRs yet.
Belgium	Proposed glidepath to LRIC MTRs by 31 December 2012.
Czech Republic	Proposed glidepath to LRIC MTRs by 31 December 2011.
France	Proposed LRIC MTRs from 1 January 2011.
Germany	Current MTRs expire 30 November 2010. No new proposed MTRs yet.
Hungary	No new proposed MTRs yet.
Italy	Proposed LRIC MTRs from 1 July 2012.
Netherlands	Proposed glidepath to LRIC MTRs by 1 September 2012.
Spain	Intending to develop LRIC approach by 31 December 2012.
Sweden	No new proposed MTRs yet.
UK	Current MTRs expire 31 March 2011. Proposed glidepath to LRIC MTRs 31 by March 2015.

Source: National Regulatory Authorities

179 We note the Commission's recent comment that:

> "Many NRAs (e.g. Belgium, France, Poland, Austria, Spain, Portugal) have indicated that they intend to develop efficient operator cost models and intend to comply with the Commission Recommendation. As a general comment the Commission reiterated its view that the termination rates should be set at the levels reflecting forward-looking costs of an efficient operator."[87]

180 We also note the Commission's renewed emphasis on the need to reduce MTRs to pure LRIC at the earliest possible date.

181 Among other things, the EC Recommendation is a harmonising measure intended to address different regulatory treatment of MTRs across EU Member States. There has, up to now, been a considerable divergence in treatment and this itself distorts competition across national boundaries and prevents the operation of the European internal market.

87 European Commission, 15th Progress Report on Single European Electronic Communications Market (2010), page 52.

182 Furthermore, Europe is not alone in proposing much lower MTRs. Various telecoms regulators outside the EU have recently proposed reducing MTRs to cost, following findings that high MTRs harm competition and consumers, including:

- Israel's Ministry of Communications' proposal in May 2010 to cut MTRs from ILS0.251 (4.5p) per minute to ILS0.0414 (0.75p) per minute from 1 August 2010 and further reductions to ILS0.0257 (0.46p) per minute by 2014. The new MTRs will be based on a bottom-up LRIC approach;
- New Zealand's Commerce Commission's proposal in April 2010 that, following Vodafone's introduction of unlimited on-net prepay plans, which the Commission feared would make it difficult for new entrants to compete, MTRs should now be regulated at cost; and
- Norway's telecoms regulator proposal in March 2010 that MNOs with SMP must reduce MTRs from 0.9 kroner (€11.1cents) per minute to 0.17 kroner (€2.1 cents) by 2013.

4.3. No UK-specific reasons for departing from the EC Recommendation.

183 Three considers that there are no UK-specific reasons for Ofcom to depart from the EC Recommendation.

184 There are no features of the UK mobile telecoms market that would justify diverging from the EC Recommendation, such as differences in:

- market structure (including numbers of MNOs, levels of market concentration or asymmetries of market shares);
- customer measures (including pricing, subscriber penetration, churn, prepay/postpay take-up or mobile/fixed take-up); or
- financial measures (including profitability or capital expenditure).

185 On most measures, the UK is similar to the EU average, and therefore there is no justification on this basis for departing from the EC Recommendation. On measures where the UK diverges from the EU average – such as asymmetries of market shares – there is a particularly strong case for adopting the EC recommendation without delay.

186 Evidence on market structure shows that:

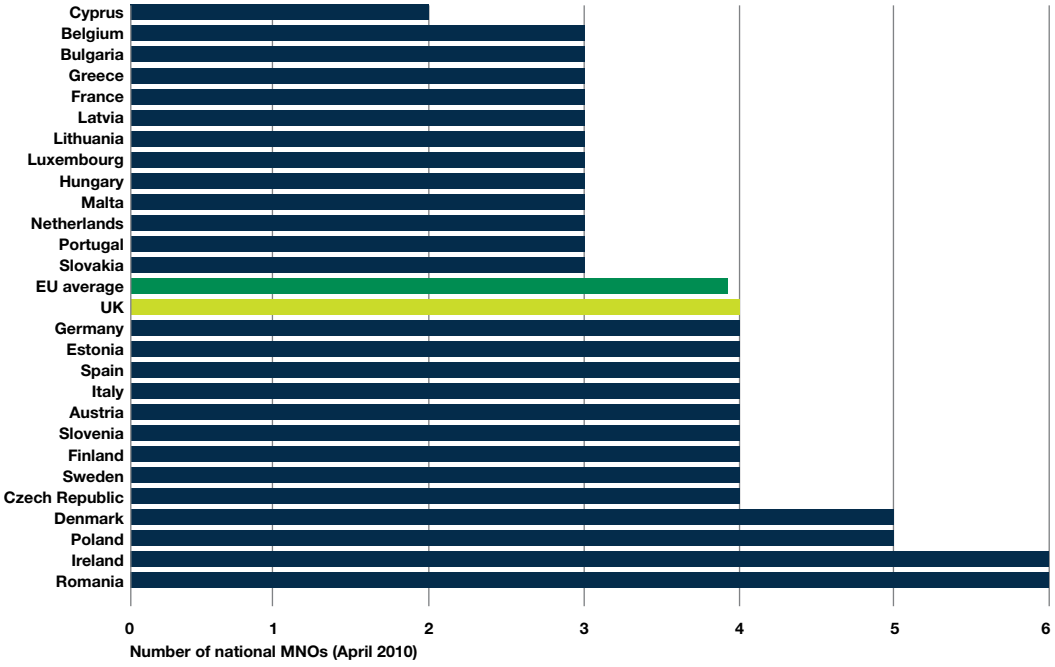
- the UK is similar to the EU average in terms of the number of national MNOs and overall market structure; but

– the UK is considerably higher than average in terms of asymmetry of market shares, which mainly results from the recent merger of Orange and T-Mobile in the UK.

187 See the following three figures.

188 High market share asymmetry is an especially strong reason for adopting the EC Recommendation, because, as the EC Recommendation highlights, the further MTRs move away from incremental cost, the greater the competitive distortions between operators with asymmetric market shares. As also demonstrated in Section 1. above, MTRs above pure LRIC particularly limit smaller operators from competing on an equal basis with larger operators, thereby distorting and restricting competition.[88]

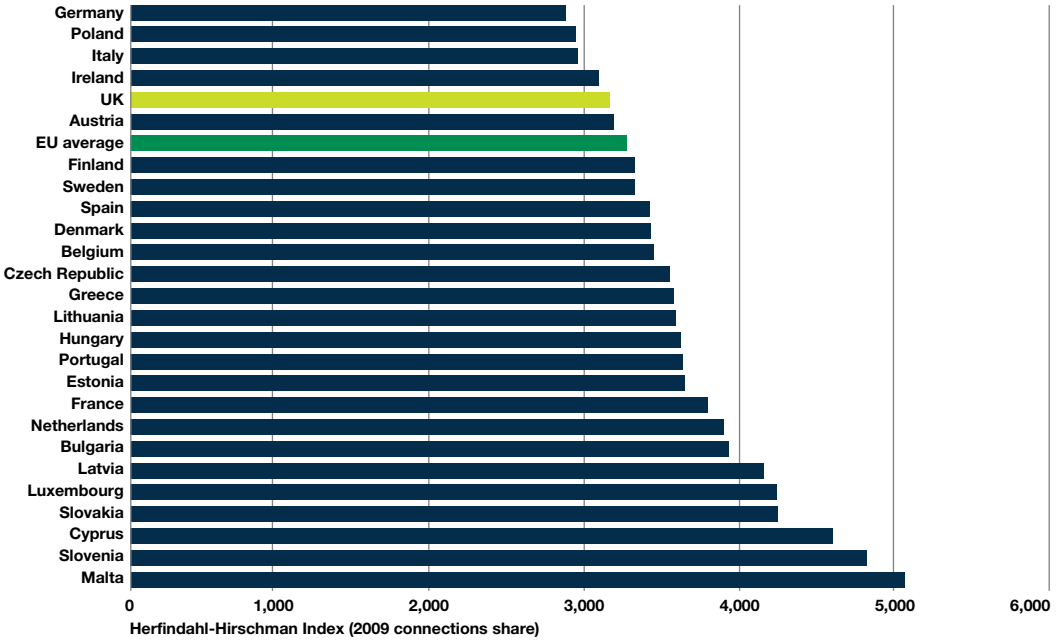
Figure 16: EU numbers of MNOs.



Source: European Commission[89]

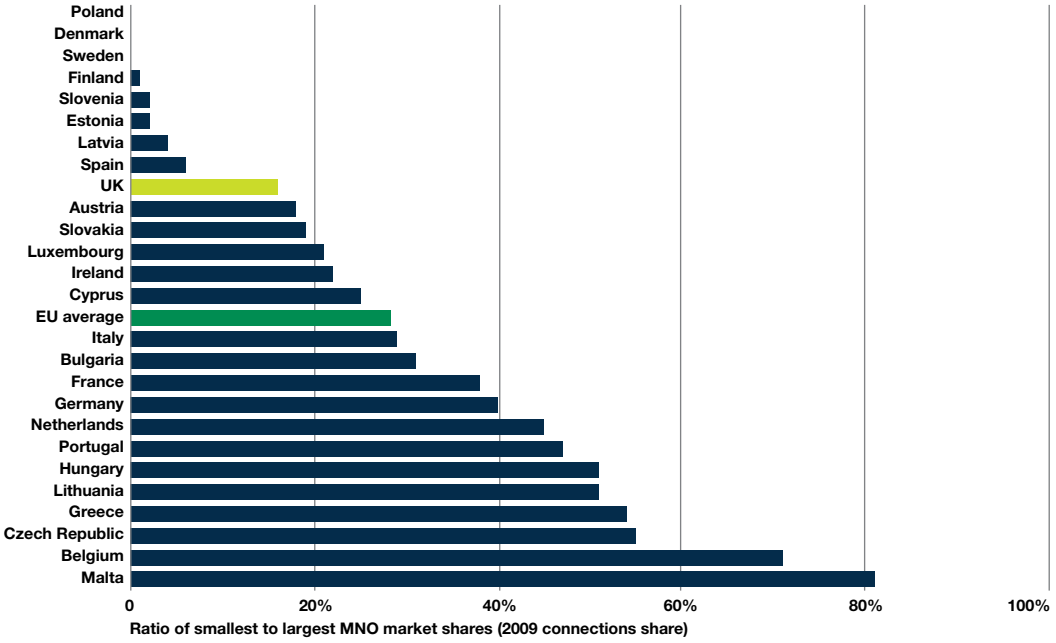
88 MTRs above pure LRIC would still limit competition even if there were no differences in market shares of operators, as MTRs above pure LRIC raise the cost for all operators of winning market share and therefore of competing intensely.
89 15th Progress Report on the Single European Electronic Communications Market (2010).

Figure 17: EU MNO market structure.



Source: GSMA Wireless Intelligence[90]

Figure 18: EU MNO market share asymmetry.



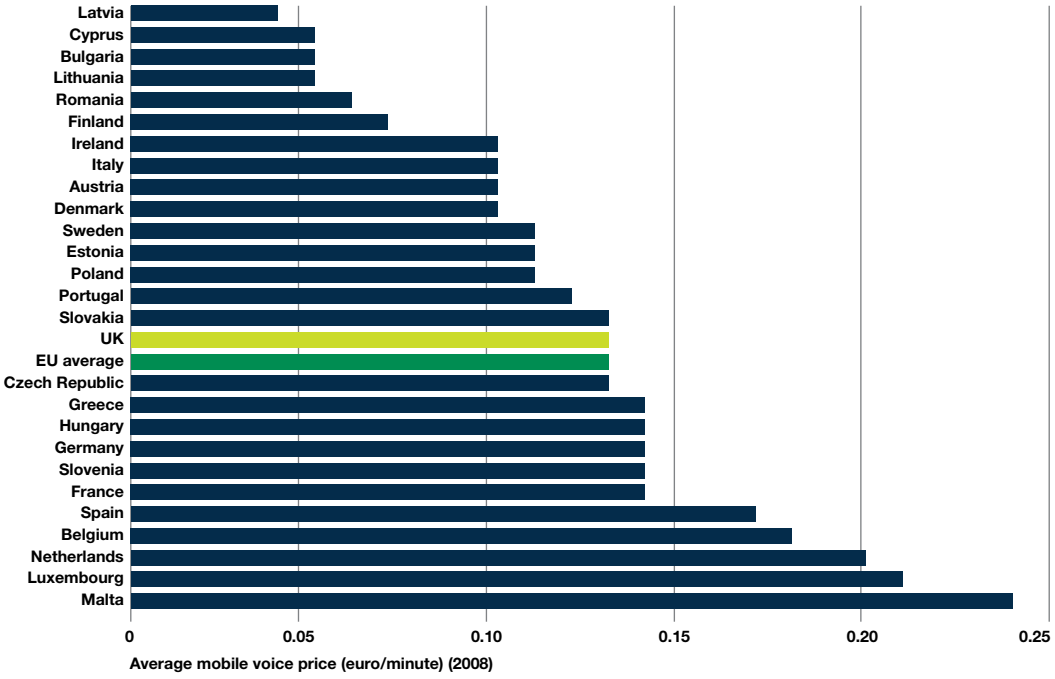
Source: GSMA Wireless Intelligence[91]

90 HHI, 2009 Q4 connections share.
91 2009 Q4 connections share.

189 Evidence on customer measures shows that:

- the UK is almost identical to the EU average on mobile price per minute;
- UK mobile penetration is similar to the EU average; and
- the UK is only slightly higher than the EU average on proportion of prepay/ postpay subscribers.

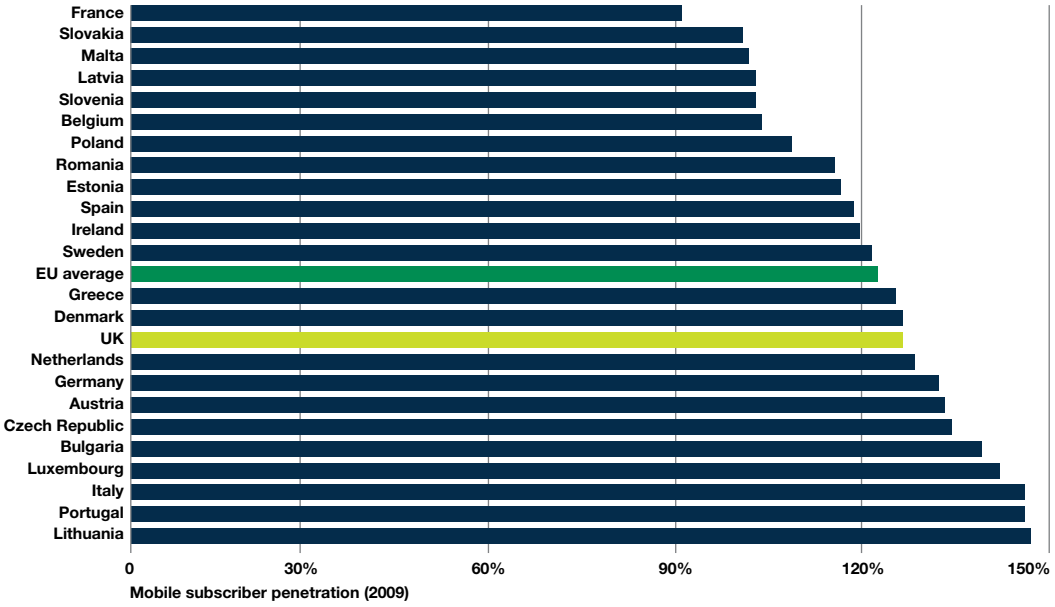
Figure 19: EU mobile price per minute.



Source: European Commission[92]

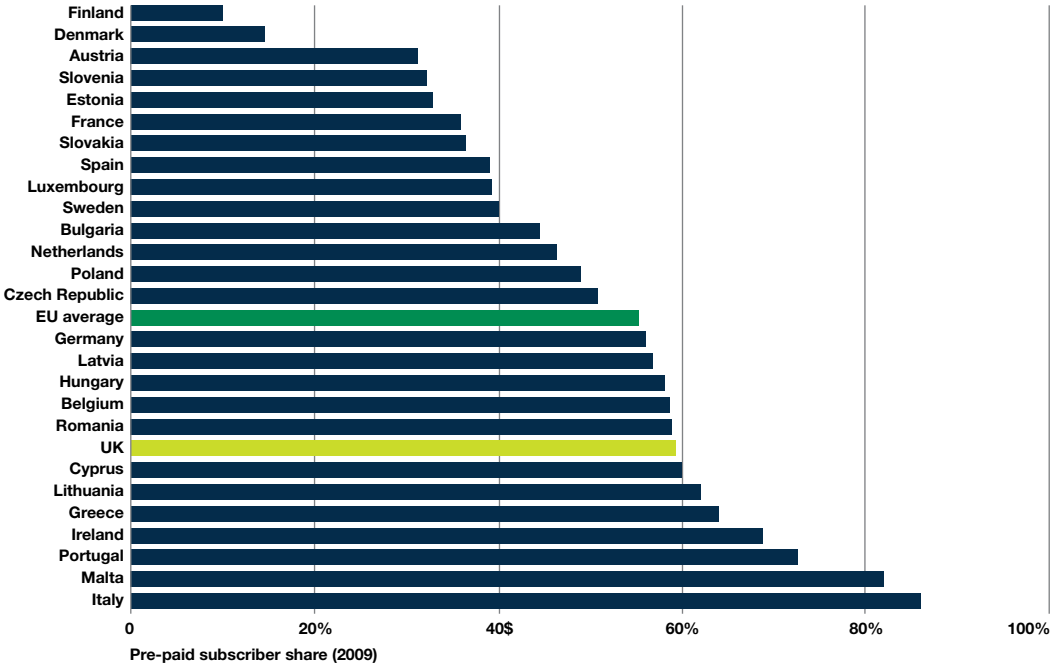
92 15th Progress Report on the Single European Electronic Communications Market (2010).

Figure 20: EU mobile subscriber penetration.



Source: European Commission[93]

Figure 21: EU mobile pre-paid subscriber share.



Source: European Commission[94]

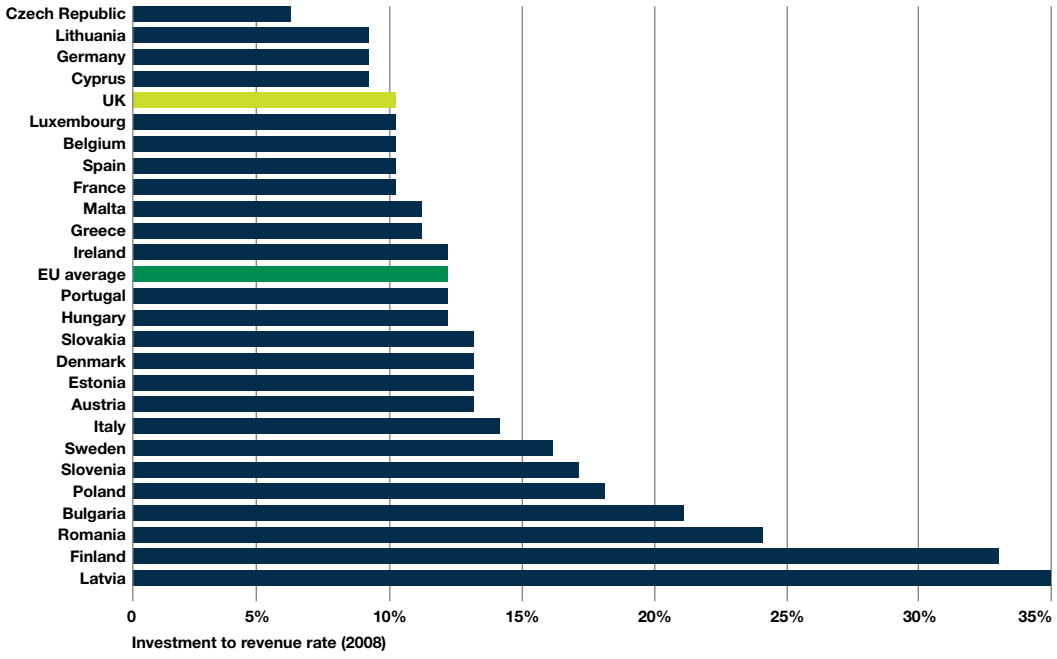
93 15th Progress Report on the Single European Electronic Communications Market (2010).
94 15th Progress Report on the Single European Electronic Communications Market (2010).

190 Evidence on financial measures shows that:

- UK MNO investment (as a proportion of revenue) is lower than the EU average; and
- UK MNO profit margins are lower than the EU average.

191 However, neither of these measures is relevant to any of the findings underlying the EC Recommendation. MTRs above pure LRIC are a problem regardless of industry investment levels or profitability. In general, the effect of lower MTRs should be expected to reduce profitability and boost investment, as described in Sections 1. and 2. above. Three notes, for example, that the national regulator in the Netherlands – the country with the lowest reported MNO profit margins in the EU – is proposing for MTRs to fall to pure LRIC by 1 September 2012, one of the sharpest MTR reductions of any EU country.

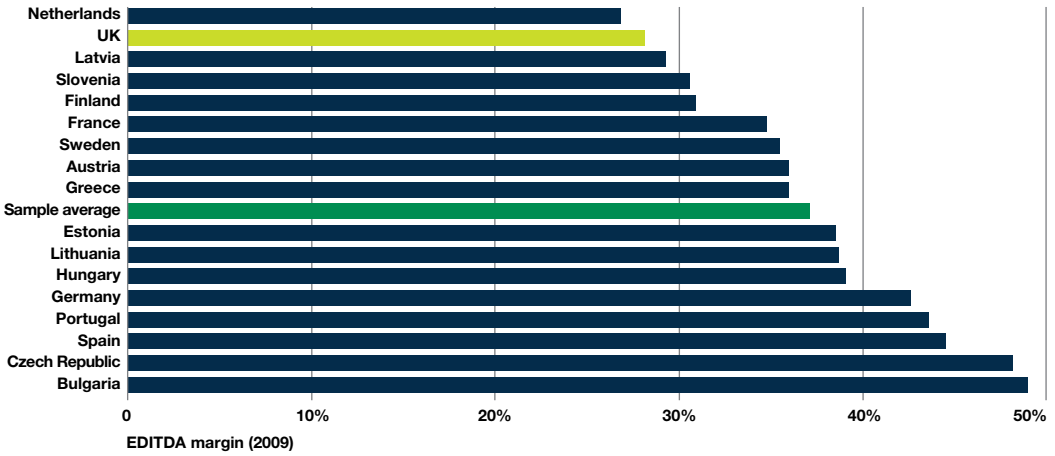
Figure 22: EU MNO investment to revenue rate.



Source: European Commission[95]

95 15th Progress Report on the Single European Electronic Communications Market (2010).

Figure 23: EU MNO profit margins.



Source: GSMA Wireless Intelligence

5. Mobile termination pure LRIC is closer to 0.25p/min.

192 Ofcom proposes that using pure LRIC to set the charge control will lead to MTRs falling from 4.3p/min in 2010/11 to 0.5p/min by 2014/15 (in 2008/09 prices) – and that the major factors behind this decline are:
- large increases in data volumes, reducing the proportion of costs attributable to voice;
- decline in the cost of network equipment, as 3G technology becomes more established; and
- removal of common costs as a result of moving to a pure LRIC approach.

193 Three agrees that these factors drive the proposed reduction in MTRs.

194 Three nevertheless calculates that Ofcom's model over-estimates pure LRIC by approximately 100%, due to a combination of factors, namely:
1. Ofcom's model missing out weekend mobile voice traffic – correcting for this reduces Ofcom's pure LRIC estimate by 0.13p/min;
2. Ofcom's model not sufficiently reflecting the move to 3G technology in the UK – adjusting for this reduces Ofcom's pure LRIC estimate by a further 0.08p/min;
3. Ofcom's model overstating the terminal value of costs in the model's economic depreciation calculations – correcting for this reduces Ofcom's pure LRIC estimate by a further 0.04p/min; and
4. Ofcom's model understating the number of sites required for 3G coverage – adjusting for this reduces Ofcom's pure LRIC estimate by 0.01p/min.

195 These issues aside, Three strongly agrees with Ofcom's overall approach to modelling pure LRIC and with most of the significant data inputs and assumptions underlying Ofcom's estimate[96].

196 In contrast, Three considers that Ofcom's LRIC+ modelling approach contains a large number of methodological and data problems – and consequently that Ofcom's LRIC+ estimate is highly unreliable.

197 This section therefore explains:
- how Ofcom's model misses out weekend traffic and the effect of correcting for this;
- why Ofcom's model does not sufficiently reflect the move to 3G technology in the UK and the effect of adjusting for this;

96 Including, for example, Ofcom's assumed effective voice capacity per 3G sector and carrier. As noted below, Ofcom's model contains certain other assumptions which Three is in less agreement about. However, these appear to have limited impact on the estimate of pure LRIC.

- how Ofcom's model overstates the terminal value of costs and the effect of correcting for this;
- why Ofcom's model understates the number of sites required for 3G coverage and the effect of adjusting for this;
- why Ofcom's pure LRIC modelling approach is reliable and that there are no other material issues with Ofcom's pure LRIC estimate; and
- why Ofcom's LRIC+ modelling approach contains a large number of issues and therefore that Ofcom's LRIC+ estimate is not reliable.

5.1. Ofcom's model misses out weekend traffic.

198 Ofcom's model only takes into account mobile traffic on weekdays, but not weekends (or public holidays).

199 This is important because total network costs are driven by traffic in the "busy hour", which is derived by:

- dividing total forecast annual minutes by the number of "busy days" in a year to estimate demand during a busy day; and
- then, multiplying busy day demand by the fraction of busy day demand falling in the busy hour.

200 As total network costs are driven by demand in the busy hour, the greater the number of busy days, the lower the total network-cost and the lower the estimated LRIC.

201 In Ofcom's 2007 mobile charge control model, Ofcom assumed 250 busy days a year, namely, total weekdays less public holidays. However, this assumption ignores that a large volume of traffic is carried on weekends and public holidays – and therefore overstates busy day traffic and total network costs.

202 In contrast, Ofcom's 2009 direct routing cost benefit analysis adjusted busy day traffic to reflect the estimated proportion of traffic falling at weekends[97].

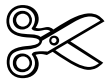
203 Three believes, as did Ofcom in its direct routing analysis, that it is unrealistic and unnecessary to ignore weekend traffic, and therefore Ofcom should update its current mobile charge control model to reflect a

97 Routing calls to ported telephone numbers, Ofcom, 3 August 2009. Weekend traffic was reflected in the bottom up calculation of transmission costs. The final cost benefit analysis model issued on 7 May 2010 used a top down calculation only based on information received from operators so no weekend traffic assumption was necessary.

similar adjustment[98]. One simple way of achieving this would be to replace the 250 busy days with a grossed up "weekday equivalent" figure.

204 The approach in Ofcom's direct routing model estimated that 19.2%, or nearly a fifth, of total voice traffic falls on weekends. That would generate a weekday equivalent figure of (5*52) / (100% – 19.2%) = 322 busy days[99]. Three's own experience is that the proportion of voice traffic falling on weekends is ✂ (confidential), higher than Ofcom's direct routing assumption[100]. This would generate a weekday equivalent figure of ✂ busy days (confidential). The figure below compares Ofcom's and Three's weekend traffic evidence.

Figure 24: Weekend mobile voice traffic estimates.



Ofcom Three

Source: Ofcom; Three (confidential)

205 Three has re-run Ofcom's model to assess the impact of this and estimates that reflecting Ofcom's estimate of weekend traffic, would result in pure LRIC falling by 0.13p from 0.51p to 0.38p.[101]

5.2. Ofcom's model does not sufficiently reflect move to 3G technology.

206 Three considers that Ofcom's model insufficiently reflects the establishment of 3G technology and its impact on a combined 2G/3G operator, in particular, because:

- Ofcom's model assumes that an inefficiently high proportion of 3G traffic is deliberately routed onto 2G networks;
- Ofcom's model assumes an inefficiently low 2G-to-3G handset migration rate; and

98 Three argued for a similar adjustment in its 30 April 2010 submission to Ofcom on Donor Conveyance charges.
99 Three has used 5*52 = 260 as the numerator in this calculation in order to retain consistency with the denominator, which represents the proportion of calls falling on weekdays including public holidays. If the figure for the proportion of calls falling on public holidays were known, then the numerator could be reduced to 250, as in Ofcom's MCT model, and the denominator reduced to indicate the proportion of calls falling on weekdays excluding public holidays. Both approaches would generate the same figure of 322 for "weekday equivalent" busy days.
100 Based on usage data from February to April 2010.
101 Three estimates that LRIC+ would fall by 0.10p, from 1.54p to 1.44p.

– Ofcom's model does not reflect the large difference in traffic capacity between 2G and 3G cell sites.

207 First, Ofcom's model assumes that the hypothetical 2G/3G operator deliberately routes 40% of 3G-capable traffic (that is, traffic from a 3G handset that is within 3G coverage) onto its 2G network:

> "It is our understanding that even though a subscriber may use a 3G-capable handset, a significant proportion of that user's voice traffic is still routed via the 2G network. This situation could be caused by a lack of 3G coverage in the area concerned, the operator choosing to route voice traffic over the 2G network, or the user disabling the 3G functionality of their handset. To allow for this possibility in our model, we assume that 40% of all voice traffic originated and terminated by a 3G handset user is routed over the 2G network."[102]

208 It is clear in Ofcom's model that the 40% routing assumption is over and above 2G roaming due to lack of 3G coverage. Moreover, Ofcom's model assumes that the 40% routing assumption remains constant at 40% indefinitely into the future.

209 Three recognises that 2G/3G operators currently route a proportion of 3G traffic onto 2G networks in this way, and that some level of this is cost efficient in the short term, reflecting existing sunk 2G costs.

210 However, what Three questions is that it is efficient for the level of 2G routing to remain constant indefinitely into the future. Indeed, Ofcom's model demonstrates that, in the long-run, the incremental cost of terminating voice traffic is lower on 3G than 2G. It cannot therefore be efficient to continue routing the same proportion of 3G traffic onto 2G networks over the medium to long term. This would involve a conscious decision by operators to replace old 2G capacity with new 2G capacity when its life expires, in order to continue handling routed 3G traffic, when upgrading to 3G capacity would be demonstrably less costly.[103]

211 Therefore, whatever the efficient level of routing is now, Three would expect to see an efficient operator reducing that level of routing progressively, in order to minimise total future costs. In this case, calibrating future modelling assumptions against current operator

102 Paragraph A8.42, Ofcom consultation.

103 One possible explanation is the planned path to LTE ("4G") networks in a liberalised spectrum environment, where it may turn out to be more efficient for 2G/3G operators to upgrade 2G equipment direct to LTE rather than 3G equipment. However, as Ofcom's model explicitly excludes LTE and spectrum liberalisation, this rationale is not available to the hypothetical 2G/3G operator which the model is intended to reflect.

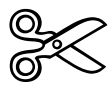
behaviour – or unexplained plans about future behaviour – is not appropriate, as there is a clear reason why 2G/3G operators should be expected to reduce 2G routing in future, absent further explanation.

212 As the current commercial rationale for deliberate routing is cost-minimisation, it should follow that future routing assumptions should also minimise costs. Accordingly, if Ofcom's routing assumption is clearly suboptimal in minimising costs, it is unreasonable. It is not a strategy an efficient operator would adopt.

213 On this basis, Three believes Ofcom's current assumption of a permanent 40% level of deliberate routing is unreasonable. As a simple illustration, Three notes that Ofcom's model predicts that if deliberate 2G routing were to end altogether in 2010/11, this would generate a £380m present value saving under Ofcom's existing 2G to 3G migration assumption[104].

214 Second, Ofcom's model assumes a rate of subscriber migration from 2G handsets to 3G handsets that is much slower than that assumed in its 2007 model. For example, the 2007 model assumed that by Q4 2014/15, 94% of subscribers would have migrated to 3G, whereas the current model assumes that only 69% would have migrated by the same date. The figure below illustrates Ofcom's 2G to 3G handset migration assumptions.

Figure 25: Weekend mobile voice traffic estimates.



Ofcom 2007 Ofcom 2010

Source: Ofcom; Three (confidential)

104 As at 2010/11.

215 While 2G to 3G handset migration has been slower than predicted in 2007, the rate of handset migration is largely under the control of operators. On the basis of Ofcom's model, an efficient operator, which Ofcom's model is intended to reflect, should accelerate migration – by additionally subsidising 3G handsets – if the incremental benefits of 3G migration exceed the incremental handset subsidy costs. These incremental benefits should include both the network cost savings of 3G plus additional revenue opportunities made possible by 3G.

216 Three notes that Ofcom's model itself predicts that a move from Ofcom's existing handset migration assumption to the faster "medium migration" assumption in the model would generate a £170m present value network cost saving. Like 2G routing, Three therefore questions the reasonableness of Ofcom's handset migration assumption, absent further justification.

217 Ofcom suggests that, as operators currently have no plans to switch off their 2G networks, this supports Ofcom's slower 2G to 3G handset migration assumption[105]. Three disagrees with this justification, as even if UK subscribers were to migrate rapidly to 3G handsets, 2G/3G operators would probably still keep lower-capacity 2G networks running to provide cost effective coverage in remote rural areas[106] and for 2G international roaming coverage.

218 Third, Ofcom's model uses "routing factors" to determine both the efficient level of network elements and associated unit costs. The same set of routing factors is normally used for both of these steps, reflecting the principle of cost causality.

219 In the case of cell sites, the efficient number of network elements is a product of coverage and cell deployment assumptions. The model uses the "all radio traffic" set of routing factors to generate unit costs. This set of routing factors reflects the relative demand that different services place on radio equipment.

220 However, the "all radio traffic" set of routing factors does not take into account that 2G traffic and 3G traffic place greatly different demands on the required number of cell sites – and therefore it overstates the cost of 3G services and understates the cost of 2G services.

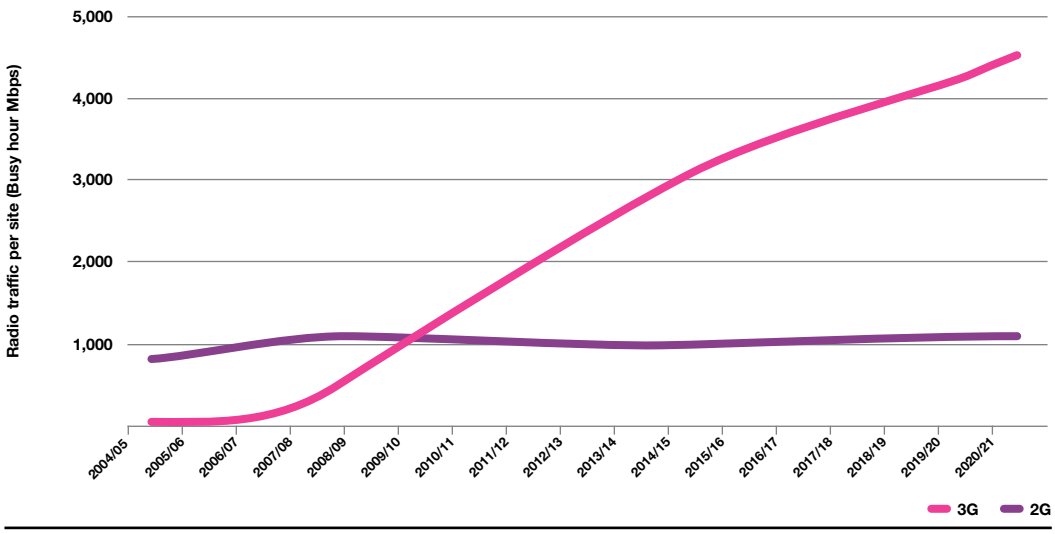
105 Paragraph A8.40, Ofcom consultation.
106 Under the model's assumption of fixed spectrum mapping.

221 Specifically, typical cell site capacity is far higher for 3G radio traffic than for 2G traffic. This can be seen by comparing Ofcom's model's estimate of the number of 2G and 3G cell sites required on a stand-alone basis:

- total 2G radio traffic output reaches a peak of 9.9m units[107] in 2008/09, supported by a total of 9,223 macro sites – an average of 1,074 units per site; and
- in contrast, total 3G radio traffic output reaches a peak of 38.2m units in 2020/21, supported by a total of 8,529 macro sites – an average of 4,483 units per site, over four times the 2G level.

222 The figure below illustrates these.

Figure 26: Radio traffic per standalone 2G and 3G macro site.



Source: Ofcom MTR model

223 We have tested this issue by re-running the model to reflect a 3G only operator with the same pattern of 3G coverage and 3G demand as a 2G/3G operator. This generates a pure LRIC for 3G call termination of 0.34p, lower than the 0.41p generated for 3G call termination in Ofcom's own model for a 2G/3G operator. Namely, Ofcom's model is suggesting that the impact of 3G traffic sharing in parts of the network with 2G traffic is to increase rather than reduce 3G costs. This is clearly incorrect and only arises because 3G costs are overstated given the radio traffic routing factors, in the 2G/3G model.

107 Busy hour Mbps.

224 We have also taken the economic depreciation calculation for microcell site operating expenditure, as an example, and re-run it assuming that the 2G and 3G networks are run on a stand-alone basis. Not only are 3G costs lower on a stand alone basis, confirming the previous result, but from 2012/13 onwards the weighted average of 2G and 3G costs are also lower on a stand alone basis.

225 There are a number of possible solutions to this problem. One approach would be to model all 2G and 3G elements separately and then reflect site sharing between 2G and 3G networks through the level of unit costs, as the model currently does for inter-operator site sharing. Alternatively, one can simply adjust the "all radio traffic" set of routing factors, so that each 3G output unit is a quarter of each 2G output unit[108].

226 Three estimates that the overall impact of Ofcom's model not fully reflecting the move to 3G technology is a reduction in pure LRIC by a further 0.08p to 0.30p.[109]

5.3. Ofcom's model overstates the terminal value of costs.

227 In Ofcom's model, the economic depreciation calculation includes an explicit forecast of costs and charges to 2039/40, followed by "terminal values" to capture subsequent years. Since the model does not explicitly model network element deployment beyond 2039/40, the economic depreciation calculation adopts a simplifying assumption that the present value of capex and opex costs beyond 2039/40 are equal to the present value of long run charges[110] beyond 2039/40[111].

228 Three has identified an arithmetical error in the implementation of this simplifying assumption. The present value of costs generally – and the present value of the terminal value of costs specifically – should be calculated using actual year-by-year discount rates[112]. However, when the model calculates the present value of the terminal value of long run charges, it uses the long run terminal discount rate in each year, not

108 Three acknowledges that this would also impact on cost allocation for backhaul. However, given the cost/volume relationship of per site backhaul costs (i.e. the fact that total backhaul costs are driven by the number of sites as well as total traffic levels), Three believes that a similar routing factor argument also applies in the case of backhaul.

109 This is based on a simple assumption of ending deliberate roaming in 2010/11. An optimised profile for deliberate roaming would be even more efficient and cause a further fall in LRIC. It is also based on Ofcom's "medium migration" assumption for 2G to 3G migration. Three estimates that the equivalent impact on LRIC+ would be further reduction by 0.48p to 0.96p.

110 That is, charges assuming 2039/40 levels of output and cost.

111 Namely, in the capex section of each economic depreciation sheet in "4-Economic", the value of cell BC37 is set equal to the value of cell BC49, and in the opex section, the value of cell BC139 is set equal to the value of cell BC148.

112 Rows 37 and 139 in each economic depreciation sheet should reflect the actual discount rate in each year, i.e. row 15 in the Linked Inputs sheet in "4-Economic".

actual year by year discount rates[113]. That method is appropriate for calculating the long run charge. However, if that same figure is to be used to estimate the present value of the terminal value of costs, an adjustment needs to be made to reflect that the present value should be calculated using actual discount rates, not the long run terminal discount rate[114]. The model does not make this adjustment.

229 Therefore, the model overstates the present value of costs to be recovered through charges because it uses the incorrect discount rate to estimate the terminal value of costs (and therefore also overstates future charges)[115].

230 Three has re-run Ofcom's model to assess the impact of correcting the terminal value as suggested above and estimates that this would reduce pure LRIC by further 0.04p to 0.26p[116].

5.4. Ofcom's model understates the number of sites required for 3G coverage.

231 Ofcom's model assumes values for 3G cell site radii that allow the hypothetical 2G/3G operator to achieve 3G population coverage of 92.4% with 6,764 cell sites. Three's practical experience of deploying a 3G network suggests that this level of population coverage would require significantly more sites than Ofcom suggests.

232 As part of its rollout obligation, Three has performed extensive monitoring of the population coverage achieved by its network over the last seven years. The most recent population coverage recorded by Three in this monitoring was ✂% (confidential) at February 2009, at which time Three had ✂ (confidential) macro cell sites, all but a handful of which were deployed for coverage rather than traffic capacity purposes.

113 BC49 and BC148 in each economic depreciation sheet are discounted to 1990 by the terminal discount rate in every year between 1990 and 2039/40.

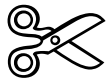
114 Specifically, BC49 and BC148 should both be scaled down by a factor equal to ((1+terminal discount rate)^50)/[(1+actual discount rate year 1)*(1+actual discount rate year 2)*.....*(1 + actual discount rate year 50)]. Note that the denominator is already calculated in row 19 of the Linked Inputs sheet.

115 Rows 116 to 121 in each economic depreciation sheet. The presence of this error perhaps explains the addition in the 2010 economic depreciation calculations of an additional step entitled "correction for under recover due to flat or increasing pricing", which is not explained in Ofcom's consultation document. And it is not clear why it should be necessary in a properly functioning set of calculations. It would appear that it is only needed because under flat or increasing pricing the terminal value error is not hidden by the input cost profile calculations and manifests itself as a failure to recover costs. When the terminal value is amended as suggested above, this issue disappears, and the additional correction then becomes unnecessary.

116 Three estimates that the corresponding reduction to LRIC+ would be by an additional 0.08p to 0.88p.

233 In Three's view, the ✂% (confidential) coverage would require at minimum ✂ (confidential) cell sites[117]. The figure below illustrates these data.

Figure 27: 3G cell sites needed to provide UK population coverage.



Three ◆ Ofcom

Source: Ofcom; Three (confidential)

234 Three estimates that the effect of this adjustment is a further reduction in pure LRIC by 0.01p to 0.25p.[118]

5.5. Ofcom's overall pure LRIC modelling approach is reliable.

235 Other than the above issues, Three believes that Ofcom's pure LRIC estimate is reliable, as:

- Ofcom's pure LRIC approach directly follows the EC Recommendation and established economic principles for estimating pure LRIC;
- the majority of the key data inputs to the model are consistent with public sources and Three's business experience; and
- while some of Ofcom's other data inputs are not necessarily consistent with Three's experience or external evidence, none of these would have a material impact on Ofcom's pure LRIC estimate.[119]

236 In particular, Ofcom's proposed approach directly follows the EC Recommendation, in that it:

117 Based on extrapolation of previous gains in coverage. Increasing the required number of cell sites to ✂ (confidential) would reduce the model's assumed 3G site cell radii by ✂% (confidential).
118 Three estimates that corresponding reduction in LRIC+ would be by an additional 0.03p to 0.85p.
119 In the case of the cost of capital, we agree both with Ofcom's estimate and with Ofcom's finding that LRIC is not greatly sensitive to the cost of capital. See Annex E for Three's analysis of the cost of capital.

1. sets termination rates based on the costs incurred by an efficient operator;
2. evaluates efficient costs based on current cost and uses a bottom-up modelling approach using long-run incremental costs (LRIC) as the relevant cost methodology;
3. compares 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;
4. models costs based on efficient technologies available in the timeframe considered by the model[120];
5. defines "incremental costs" as those costs that can be avoided if a specific increment is no longer provided (also known as avoidable costs);
6. builds a LRIC model, within which the relevant increment should be defined as the wholesale voice call termination service provided to third parties;
7. applies an economic depreciation approach for determining asset depreciation;
8. takes into account the need to promote efficient entry for defining the appropriate efficient scale of the modelled operators;
9. justifies any determination of efficient cost levels which deviates from the EC's recommended principles by objective cost differences which are outside the control of the operators concerned; and
10. allows a transitional period for new mobile entrants not exceeding four years after market entry.

237 Ofcom's proposal nevertheless does not follow the EC's Recommendation 11. that national regulatory authorities (NRAs) should ensure that termination rates are implemented at a cost-efficient, symmetric level by 31 December 2012. Three strongly disagrees with Ofcom's proposal to disregard this recommendation. See Section 1 above on why a glidepath will only delay benefits to consumers and Section on why there are no reasons to depart from the EC Recommendation.

238 As Three has argued in past submissions[121], Three believes that Ofcom's 2007 model was a reliable model for estimating MTRs – and all that, in principle, was required for Ofcom to estimate pure LRIC (as defined in the EC Recommendation) was to run the 2007 model first including, then excluding, third party mobile voice termination. In essence, this is what Ofcom's current model does.

120 As at 2010, although we recognise that the model excludes some future technologies, including Long-Term Evolution (LTE), spectrum liberalisation and femtocells, among others.
121 Annex 2, Three MTR consultation response, July 2009.

239 Three is aware that some commentators have expressed doubts as to whether Ofcom's current model is capable of estimating pure LRIC. However, the only specific objections that Three is aware relate not to the design of Ofcom's model, but to the reasonableness of various input assumptions.

240 Three agrees that some input assumptions may benefit from refinement, of which we have suggested some. We nevertheless note that, in most cases where is uncertainty of input assumptions, Ofcom's pure LRIC estimate is relatively insensitive to these. The same cannot be said of Ofcom's LRIC+ estimate – see further below – and in Three's view, this makes Ofcom's estimate of pure LRIC considerably more reliable than LRIC+.

5.6. Ofcom's LRIC+ modelling approach is not reliable.

241 In contrast to Ofcom's pure LRIC estimate, Three has substantial concerns over the reliability of Ofcom's LRIC+ estimate.

242 These concerns all relate to the observation that LRIC+ is highly sensitive to a number of significant input assumptions which, in Three's view, lack evidence. The most important of these include:
- spectrum valuation;
- future levels of voice and data demand; and
- hypothetical efficient market shares and network sharing arrangements.

243 Three (and others) have expressed similar concerns in past MTR reviews.

244 At the last MTR review, the CC made considerable effort to address the issue of spectrum valuation, but could only find a temporary solution. Three believes that the problems with Ofcom's current approach to spectrum valuation are so significant that they make Ofcom's current estimate of LRIC+ wholly unreliable, chiefly:
- the violation of cost causation and cost recovery principles and the inclusion of a windfall gain as a result of the administered incentive pricing (AIP) uplift;
- the inflation of costs arising from the inconsistency between reflecting spectrum liberalisation in the consideration of spectrum value[122] – so increasing the cost of spectrum – while not reflecting spectrum liberalisation in the modelling of future network

122 Ofcom Consultation, A19.19, A9.59.

deployment (for example, use of 900MHz/1800MHz for 3G), thereby not capturing the counterbalancing reduction in network costs; and

- the overly simplistic approach to assessing the evidence from other spectrum awards, which ignores the many other explanatory variables influencing auction proceeds[123] in which Ofcom does not distinguish between bids for, and the value of, spectrum holdings that can act as barriers to entry in specific markets, and marginal additions to existing spectrum holdings in others.

245 Further technical problems with Ofcom's estimate include[124]:

- Ofcom's treatment of 3G spectrum in the economic depreciation calculation[125];
- Ofcom's calculation of the 1,181% AIP uplift for 2G spectrum[126]; and
- the path of unit costs suggested for 2G spectrum by the economic depreciation calculations.[127]

246 See Annex D for further views on the treatment of spectrum. In comparison, Three agrees with Ofcom that spectrum valuation is irrelevant for the purpose of estimating pure LRIC[128].

247 At past MTR reviews, Ofcom accepted that future levels of demand per subscriber are highly uncertain, describing inputs such as demand forecasts as "essentially arbitrary" at the CC following the last review. Ofcom continues to acknowledge this uncertainty in the current review through its sensitivity analysis. In particular, future levels of data demand are highly uncertain and voice demand can itself be expected to increase significantly in response to lower MTRs, especially if Ofcom adopts a pure LRIC approach , due to falling voice call pricing. As Ofcom's

123 As explored through expert evidence during the appeal of the last price control decision, but dismissed as immaterial at A9.48 without any justification.

124 Three has re-run Ofcom's model to correct for these concerns and estimates that this would cause LRIC+ to fall by 0.20p, from 1.54p to 1.34p.

125 Ofcom appears to be assuming an indefinite life for its 3G spectrum valuation, as the model does not allow for spectrum to be renewed within the model's planning horizon. On that basis, there is no need for a terminal value in the calculation of the present value of costs in the economic depreciation calculation. However, the economic depreciation calculation has not been revised to reflect this, and as a result the model overstates present value of spectrum costs.

126 It appears from rows 343 to 365 of "Unit expenses" in "3-Cost" that the figure of 1,181% has been chosen as the input necessary to generate a 2004/05 present value of £1.752bn, which Three assumes is Ofcom's estimate of the spectrum value uplifted for gestation. However, assuming that this equates to a capital sum for an indefinite life, as with 3G spectrum, the present value calculation should include the terminal value for AIP beyond the explicit modelling period. The exclusion of this terminal value leads to an overstatement of the required uplift. Three estimates that once this is corrected for, the uplift falls to 1,049%.

127 Ofcom's approach to 2G spectrum results in a very unusual pattern of input costs over time for 2G spectrum, which when combined with the pattern of utilisation leads to some anomalous figures in the early years of the model. Specifically, the economic depreciation calculations suggest negative charges for the 16 years from 1993/94 to 2008/09, even though traffic is using spectrum which the operator is paying for during that period. Three believes that this results from the interaction between the way in which the calculations spread the cost of initial low utilisation over the whole of the network lifetime, but (in this case) take benefits of initial lower input prices in the initial years alone. As a result, on an annual basis in the initial years, the latter more than outweigh the former and cause unit charges to turn negative. This does not make any economic sense and suggests that the low utilisation adjustment to the long run charge (step 2 out of the 3 step economic depreciation calculation) should be moderated, at a minimum to prevent charges turning negative in this way.

128 Footnote 100, Ofcom consultation.

sensitivity analysis shows, in contrast to LRIC+, pure LRIC is relatively insensitive to significant changes in these future demand assumptions.

248 Lastly, Ofcom's current model assumes a 25% market share for a hypothetical efficient operator, combined with some degree of inter-operator site sharing. These assumptions are nevertheless highly uncertain: there could be further market consolidation in the UK and there could greater cost pressure for further site sharing. Again, whereas pure LRIC is relatively insensitive to these assumptions, LRIC+ is highly sensitive to market share and site-sharing.

249 Given the powerful economic and legal reasons for Ofcom to set MTRs based on pure LRIC – combined with these considerable practical difficulties of estimating LRIC+ reliably – Three sees no reason why Ofcom needs to estimate LRIC+ in its final MTR decision.

6. Three's responses to Ofcom's specific questions.

250 In summary, Three strongly welcomes Ofcom's proposal to reduce MTRs to pure LRIC, but disagrees with Ofcom's findings that:

1. there is no single argument or set of economic arguments to strongly support using pure LRIC rather than LRIC+ for setting MTRs;
2. a four-year glide path is needed to minimise industry and consumer disruption resulting from falling MTRs; and
3. pure LRIC is 0.5p/min.

251 Three agrees with Ofcom's other findings that:

- capping MTRs based on some measure of cost will lead to better outcomes for consumers than alternative approaches, such as removing all rules on call termination;
- pure LRIC MTR charges will be considerably lower than LRIC+ MTR charges;
- the distributional impacts, if any, of pure LRIC as compared to LRIC+ on consumers are not a basis for not adopting pure LRIC;
- Ofcom ought to adopt the EC Recommendation that MTRs should be no greater than pure LRIC;
- the overall outcome of adopting pure LRIC will be positive and the risk of harm to consumers overall or on specific groups of vulnerable customers, is low;
- the market will be easily capable of adapting to Ofcom's proposed changes; and
- the move to pure LRIC will promote competition, reduce call prices, promote the development of innovative tariff packages and promote the growth of converged fixed and mobile services.

252 Three therefore agrees with Ofcom's proposals to:

- regulate directly the termination charges of the four mobile communication providers (MCPs) that operate fully-deployed national mobile networks;
- use pure LRIC to set the MTR charge control;
- define as separate markets each market for all calls to a given UK mobile number range for which a communications provider can determine the termination rate and designate each undertaking that has been allocated one or more of these number ranges as having significant market power (SMP) with respect to the market for terminating calls to that range;
- require other MCPs to provide call termination on fair and reasonable terms; and
- limit the frequency and size of changes MCPs can make to their MTRs.

253 We outline our responses to Ofcom's specific questions below.

6.1. Market definition.

Question 3.1: *Do you agree with our views on whether and when new MCPs should form separate markets?*

254 Yes. Three agrees that calls to a given number range for which an MCP can determine the termination rate should be defined as separate markets.

255 Three notes that under EU competition law, Ofcom is not bound by its previous market definition findings and is required to make a fresh analysis in each new case. Indeed, under the EU Regulatory Framework, Ofcom is required to keep the relevant markets under review and carry out an analysis before making any new market power determination.

Are there any factors we have not considered which should inform this view?

256 We are not aware of any.

Question 3.2: *Are there any other types of providers we should also consider?*

257 We are not aware of any.

Question 3.3: *Do you agree with our views on the specific call types that should be included in the market?*

258 Yes.

Are there any factors we have not considered which should inform this view, resulting in call types other than those identified being either included or excluded from the market?

259 We are not aware of any.

Question 3.4: *Do you agree with our view of that the geographic market for each of our proposed markets should be the area of the UK within which the MCP provides and can set a charge for mobile voice call termination services?*

260 Yes.

6.2. SMP assessment.

Question 4.1: *Do you agree with our view?*

261 Yes.

262 Three believes that Ofcom's proposed approach – that all MCPs that have been allocated one or more number ranges for which they can determine the termination rate, have SMP with respect to the market for terminating calls to that range – would reflect the Court of Appeal judgment in *Three v Office of Communications*[129]. This judgment would make it difficult for any MCP to make a successful challenge to a finding of SMP. In particular, the findings of the judgment are such that it would be difficult for an MCP to demonstrate that any other entity has sufficient countervailing buyer power to counteract the effects of monopoly power in termination, no matter how large the purchaser and how small the terminating operator.

Or are there other developments, not considered elsewhere in this consultation document, for potentially removing the underlying causes of SMP?

263 SMP might only change if there were another effective way of terminating calls to subscribers outside the control of the subscriber's MCP. It is possible in the future that Voice over Internet Protocol (VoIP) could facilitate this, provided that:

- a sufficient proportion of mobile subscribers have handsets that can accept VoIP calls;
- a sufficient proportion of mobile subscribers also subscribe to VoIP providers;
- VoIP provides similar call quality to normal voice calls; and
- there is no opportunity for MCPs to block VoIP calls on handsets.

129 [2009] EWCA Civ 683.

264 Up until recently, VoIP has not provided an effective way to terminate calls to subscribers outside the control of the subscriber's MCP, due to combination of the above factors not currently applying.

265 However, Skype, the largest consumer VoIP provider has recently launched an iPhone "app" that works on 3G (previous versions were WiFi only) and can be downloaded and used independently of the subscriber's MCP. We understand that Skype intends to extend this app to other smartphones in the near future. This is therefore the first time that a customer can make a VoIP call from one MCP to another, but outside of the MCP's control. Skype are currently offering this service for free although they are seeking to introduce pricing options[130].

266 At the moment this is a new development. It nevertheless could potentially remove the underlying causes of SMP. A recent OECD report reached a similar conclusion:

> "A few mobile operators have recently moved towards permitting their customers to use voice over IP (VoIP) services, provided by third parties, on their networks. They say this attracts and assists them to retain customers, thus growing overall revenue. This trend, most evident in markets that have a higher degree of competition, will continue with [next generation mobile] which will be all-IP networks, suitable for packet-based traffic. Such developments, as a result of increasing competition, have benefits for all stakeholders as they decrease the need to consider regulatory remedies when certain issues arise."[131]

Question 4.2: ***Do stakeholders have any comments on the analysis set out in this section?***

267 Three agrees with Ofcom's analysis.

Question 4.3: ***Are there any other providers with SMP that we have not identified?***

268 We are not aware of any.

130 See www.skype.com.
131 "Mobile Communication Developments in the OECD Area", OECD, June 2010.

Question 4.4: ***Do stakeholders agree with our proposed SMP assessment for the period until 2014/15?***

269 Yes.

6.3. Issues arising from SMP findings.

Question 5.1: ***Do stakeholders agree with the identified harm to consumers of excessive termination rates in the period 2011 to 2015?***

270 Yes. Three nevertheless considers that Ofcom considerably understates the harm to consumers. Please see Section 1. above for Three's evidence and analysis on this.

Question 5.2: ***Do stakeholders consider there to be any other forms of relevant consumer harm that we have not identified?***

271 Yes. Three considers that Ofcom has considerably understated the harm to competition caused by excessive termination rates. Please see Section 1. above for Three's evidence and analysis on this.

6.4. Choice of remedy.

Question 7.1: ***Do stakeholders agree with Ofcom's view regarding the need for transparency in MCT charges?***

272 Yes. Three agrees that MCT charges should be transparent.

Question 7.2: ***Do stakeholders agree with our preliminary view on application of a condition requiring network access to be provided on F&R terms?***

273 Yes.

Question 7.3: ***what are your views on the need for an ex ante undue-discrimination condition for the period of the next review?***

274 It is needed and appropriate.

Question 7.4: ***Do stakeholders believe that there are any circumstances or situations where the UK differs from other EU markets to the extent that would support a departure from following the EC Recommendation?***

275 No. The main situation in which the UK differs from other EU markets – namely, much greater than average asymmetries of MNO market shares than the EU average – implies that the EC Recommendation should apply even more strongly in the UK, as the combination of this situation and current MTRs in excess of pure LRIC results in a particularly high distortion of competition. Please see Section 4. above for Three's evidence and analysis on this.

Question 7.5: ***do you agree with Ofcom's proposals for its preferred set of remedies for the provision of MCT services?***

276 No. Ofcom should reduce termination rates to pure LRIC from 1 April 2011 or by 31 December 2012 at the latest. Three estimates that pure LRIC for MCT services is 0.25p/min. Please see Sections 1.6. and 5. above for Three's evidence and analysis on these points.

6.5. Nature and design of the charge control.

Question 9.1: ***Do you agree that a four-year period for the SMP remedies is appropriate?***

277 Three considers that MTRs should be reduced to pure LRIC from April 2011, or by 31 December 2012 at the latest, in accordance with the EC Recommendation. Please see Section 1.6. above for Three's evidence and analysis on this.

278 Three does not have a strong view on the overall period for the SMP remedies.

Question 9.2: ***Do you agree with our proposed modelling approach, as discussed in this section, the supporting annexes and the actual model? If not, please discuss the specific proposals you disagree with.***

279 Yes, we agree with the proposed modelling approach, with the exception of Ofcom's assumptions concerning:

– missing out weekend mobile voice traffic;

- not sufficiently reflecting move to 3G in the UK
- overstating the terminal value of capex and opex costs; and;
- understating the number of sites required for 3G coverage.

280 Three estimates that, once Ofcom's model is adjusted for the above, pure LRIC is approximately 0.25p/min. See Section 5 above for Three's evidence and analysis.

***Question 9.3:** What is your view of the harm caused by flip-flopping? Please provide evidence to support your response.*

281 Three believes that MTR management (also known as "flip-flopping") formerly offered benefits in encouraging more efficient use of networks. However, these benefits are rapidly diminishing. Three also accepts that there have been a number of complaints to Ofcom about flip-flopping, especially from fixed telecoms operators.

282 In particular, Three calculates that the benefits to MNOs of MTR management will fall as MTRs fall and that reducing MTRs to pure LRIC will almost fully eliminate any benefit from MTR management MNOs might have previously had.

283 Furthermore, setting differential MTRs no longer achieves the objective of sending price signals to encourage more efficient use of networks, primarily because investment in mobile networks is now driven by data rather than voice traffic. Differentiating between peak, off-peak and weekend retail pricing is also becoming increasingly anachronistic, with flat rate pricing and bundled tariffs becoming the norm. This trend is likely to continue, especially with lower MTRs. Therefore the ability to efficiently configure the voice part of mobile networks through wholesale pricing has all but disappeared.

284 Three therefore agrees that Ofcom should limit the changes MCPs can make to their MTRs, effectively ending the practice of MTR management. In particular, Three believes that it would be appropriate to remove the option of flip-flopping altogether by setting a single constant flat MTR across daytime, evening and weekend for each year of the price control (Ofcom's Option 4). This will also create significant compliance and monitoring benefits.

132 As the Ofcom's Consultation describes at 9.114.

Question 9.4: *Do you agree with our preferred option for resolving the issue of flip-flopping – i.e. charge changes restricted to the first day of each quarter and a 20% cap on individual time of day rate increases?*

285 No. Three does not agree with Ofcom's preferred option (Option 2) for resolving the issue of flip-flopping.

If not, why not? Which is your preferred option and why? You may want to include discussion of the following in your response:
- *the specifics of each option, e.g. the 20% cap in our preferred option,*
- *the effectiveness of the options in addressing the objectives,*
- *the practicalities of the options for you,*
- *any disadvantages/adverse effects of these options for you, and*
- *any other information or views that you feel are relevant to preventing flip-flopping.*

286 Three believes that Option 2, which restricts both the number and size of rate changes to a maximum of 20%, is unnecessarily complex. In particular, due to uncertainty in traffic volumes, it creates a large risk for an MNO of either setting MTRs too low (and therefore losing revenue) or too high (and therefore not complying with the charge control). Three believes that there would an incentive to set a high MTR during the first quarter (as this is exempt from the size restriction rule) in order to avoid needing an increase greater than 20% during the remainder of the year.

287 Three's preferred option is Option 4, namely, removing the ability to differentiate rates by the time of day altogether by setting single, constant flat MTR for the whole year. This will have the added advantage of considerably reducing the compliance and monitoring burden on Ofcom and the industry.

288 If Ofcom wishes to retain some flexibility in giving the ability for MCPs to set MTRs, then Three believes that a simple restriction on the number of changes, rather than size of changes, would be more effective.

Question 9.5: *Are there other, more proportionate solutions that we should consider?*

289 Yes. Three's preferred option is Option 4. However, if Ofcom is minded to retain flexibility in setting rates by time of day, then it would be more proportionate limit the number of changes rather than the size of each change.

Question 9.6: ***Is it clear which types of calls are included in, and which types are excluded from, the new charge control and in turn the compliance calculation? If not, which call types do you want clarified?***

290 It is clear that most traffic types would be included in the proposed price control. Three believes that this is a much better approach than the specific exclusions that apply within the current price control. For Three, this can mean that as much as ✂% (confidential) of what might be regarded as mobile terminating traffic is currently excluded from the current MTR price control.

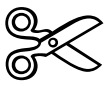
291 Three's only query is in relation to the treatment of "ported-in" traffic, which the Ofcom Consultation reports as included within the 2007 market review, but proposes that they should now be excluded[133]. However, we had previously understood from Ofcom that ported-in calls were also excluded within 2007 price review on the basis that the terminating MNO does not set the charge for these calls.

Question 9.7: ***Is Ofcom taking the right steps to monitor compliance?***

292 Three believes that the current MTR price control is unnecessarily complex in terms of the traffic types that are excluded and this places a large administrative burden on both Ofcom and the MNOs. A simpler approach – either in terms of the types of minutes that are included or by setting a single, constant flat rate or both – would all but remove the need to monitor compliance at all and the associated administrative burden. Moreover, a single, constant flat MTR would be completely transparent as to whether an MNO was setting the correct charge.

Question 9.8: ***Are MCPs able to provide the information required to demonstrate compliance and for Ofcom to monitor compliance?***

293



133 Ofcom Consultation, page 30.
134 This is due to ✂. (Confidential)

Question 9.9: ***Do you agree with the conclusions of our distributional impact assessment?***

294 No. Three believes that all customer groups will be better off. Please see Section 1. above and Annex C. for Three's evidence and analysis of distributional impacts.

Question 9.10: ***Do you agree with our EIA, that reducing MTRs will have no significant impact on any specific identifiable group?***

295 No. Reducing MTRs will have a significant positive impact on all identifiable groups. Please see Section 1. above and Annex B. and C. for Three's evidence and analysis.

If you disagree with this statement we would welcome any evidence you hold showing why this statement might be incorrect.

296 Our main evidence is that reducing MTRs to pure LRIC will appreciably increase competition in the UK mobile voice market and that this will have direct benefits – in terms of lower prices, greater innovation and greater investment – for all customer categories. Please see Section 1. above and Annex B. and C. for Three's evidence and analysis.

Annex A. Introduction and summary.

297 LECG has been commissioned by Hutchison 3G UK Ltd. ("Three") to provide an economic assessment of a number of selected issues arising out of Ofcom's Market Review of termination rates.

298 The areas are:

- **a.** The role of asymmetry in the decision whether to set termination rates based on LRIC or LRIC+.
- **b.** The distributional impact of LRIC+ and in particular the effect on low users.
- **c.** The treatment of the value of spectrum.
- **d.** A review of international comparisons and the lessons for the Market Review.
- **e.** The value of beta in the cost of capital estimate.
- **f.** Data forecasting and the cost allocation to data in Ofcom's Analysys model.

299 Our main findings are:

The role of asymmetry in the decision whether to set termination rates based on LRIC or LRIC+

300 With LRIC+, entrant operators are disadvantaged in the retail market. For a given retail tariff, they have a higher off-net traffic outflow, with or without on-net / off-net differentiation. If there is some initial advantage that needs to be overcome, such as an incumbency advantage that would express itself in a low initial market share and in the need to overcome a switching cost to join the entrant, a mark-up on LRIC prevents smaller operators from competing as aggressively as with LRIC. Moreover, a high mark-up can drive a small entrant out of the market.

301 For example, while Three's retail tariffs provide amongst the best value, they are, for the same tariff, less profitable than other operators' tariffs due to higher off-net outflows at high termination rates. This limits Three's ability, as a smaller operator, to offer even more aggressive tariffs and reduces competition in the market. As a smaller operator, Three is constrained to insure that outflows are not too high so as to produce a termination traffic deficit.

302 New entrants, such as Three, are particularly constrained in the high-end market and low-end pre-pay markets. In the low-end pre-pay market the constraint arises from, until recently, costly 3G handsets. A low prepay user base means that Three cannot attract sufficient incoming

traffic from high-end users of other networks and therefore is limited in its own high-end tariffs. Three's ability to compete is therefore limited to medium users, for which handset prices play a smaller role and whose off-net traffic is balanced. With LRIC, Three would become a stronger competitor in more market segments and, due to its position as the only small operator, this would increase competition in the market overall.

303 Our core finding is that the specific situation of the UK, in which there is one small 3G only operator, should imply that benefits for competition from moving from LRIC+ to LRIC are large.

The distributional impact of LRIC+ and in particular the effect on low users

304 Mobile operators engage in second-degree price discrimination. Such discrimination implies that pre-pay users have high margins. Therefore, reduced fixed-to-mobile revenues for pre-pay users are likely, to a large extent, to be absorbed by operators. This theoretical finding is supported by empirical literature which does not find a waterbed effect for low users.

The treatment of the value of spectrum

305 The value of spectrum enters the LRIC+ estimate, but not the LRIC estimate. The treatment of the value of spectrum by Ofcom in LRIC+ appears very discretionary. This is due to the problem that spectrum is largely still not tradable and, even more importantly, that the value of spectrum is determined by regulatory decisions on entry, rather than in a free market. Ofcom's discretion regarding the value of spectrum extends to a very large share of the "+" component of LRIC+.

306 It is unclear whether an objective value of spectrum could be found. The discretionary nature of spectrum valuation therefore gives further support for the use of LRIC over LRIC+.

A review of international comparisons and the lessons for the Market Review

307 International comparisons are intrinsically difficult and have yielded conflicting results, depending for example on country or period of comparison. In particular, many comparisons focus on RPP vs. CPP comparisons (such as the U.S. comparison) and are therefore of limited applicability.

The value of beta in the cost of capital estimate

308 We find that the reduction in the value of "beta" in the cost of capital stems largely from a composition effect in the index. In the financial crisis, other important components of the FTSE All Share Index, notably financial services and raw materials, have increased their variance and their covariance with the index, leading to a reduction in covariation of mobile companies. Due to the continued "stress" of financial markets and related volatility of raw materials we believe that there is support for mobile telecoms betas to stay low during the regulatory period. Therefore, Ofcom is correct in finding that the cost of capital for mobile telecoms has fallen since 2007.

309 In addition, we find that other recent UK regulatory decisions have also resulted in low beta estimates.

Data forecasting and the cost allocation to data in Ofcom's Analysys model

310 We find that Ofcom's data forecasts are supported by external sources. We then proceed to compute a LRIC of HSPA data in the Ofcom Analysys model. We find that LRIC is indeed a good methodology for HSPA data, since the investment appears to be genuinely incremental. Our results are generally below the cheapest current retail tariffs for mobile broadband services, implying that there is no excessive cost allocation to data.

Annex B. LRIC+ / Pure LRIC and asymmetry.

311 The central development in Ofcom's Market Review vis-à-vis previous termination rate decisions is the shift from "LRIC+" to "LRIC", as also proposed by EC Recommendation EC C/2009/3359 ("EC Recommendation").

312 Ofcom dedicates Annex 12 of the Market Review to this issue. In this section we contribute to this discussion. In particular:

a. We clarify the key difference between LRIC+ and LRIC. LRIC is an estimate of the marginal cost of termination as discussed in the economic literature. LRIC+ is marginal cost plus a mark-up.

b. We show the importance of smaller operator's (such as Three's) asymmetrically small position vis-à-vis the other operators for the determination of pure LRIC as the efficient termination rate regime. Three's asymmetry has been all the more pronounced due to: (i) the 5-to-4 merger of Orange UK and T-Mobile UK; and (ii) the fact that it is the only 3G operator. With asymmetric market positions, the small operator is constrained in its ability to compete in the retail market when termination rates include a mark-up.

313 Our finding is that asymmetrically smaller operators' ability to compete is hindered by termination rates that include a mark-up over marginal cost, especially when there is only one small operator in the market. In contrast, with LRIC, smaller operators will be able to compete more aggressively.

314 For example, since Three is asymmetrically small and still not profitable, it is, in contrast to the other operators, required to grow its customer base in order to become successful in the market. New entrants and other smaller operators, such as Three, are therefore very important for competition and low user prices.

315 We therefore find a compelling reason for the introduction of LRIC rather than LRIC+ in the UK mobile market, over and above a general statement about the benefits of LRIC v. LRIC+. For the asymmetric situation of the UK market, in particular following the joint venture of Orange and T-Mobile, we find that LRIC should benefit competition by opening up the retail market for the asymmetrically small operator, Three.

Pure LRIC is an (average) marginal cost measure, LRIC+ is marginal cost plus mark-up.

316 We think that the Ofcom initial definitions of LRIC+[135] and pure LRIC,[136] although standard in regulatory practice, require a translation to the standard economic concepts of total cost and marginal cost since the literature does not use the terms LRIC and LRIC+.

317 We first show that LRIC+ is a measure of the total cost of termination, given an appropriate cost base, while LRIC is an estimate of marginal cost. These translations are not purely definitional, but instead they allow a discussion in terms of the extensive economic literature in the areas of (i) interconnection and (ii) non-linear pricing.

318 The economic insights from the literature, together with the asymmetry in the market in terms, lead to much stronger support for LRIC over LRIC+ for the particular case of the UK mobile market.

LRIC+ is a measure of total network cost.

319 Generally, LRIC or long-run incremental cost is something of a misnomer. In our opinion the confusion starts with the – in our view understandable but misconstrued – attempt to find regulating prices in an oligopolistic market characterised by fixed costs through an appeal to what "efficient" prices in a "hypothetically competitive" market would be.

320 The LRIC approach is to essentially consider costs that are really fixed costs as variable in the long-term. In an extreme form, all costs are variable in the long-term. Several refinements of LRIC exist which are essentially different in considering only a limited cost base. LRIC+ in the Ofcom Market Review is a network type LRIC with mark-up for certain network related costs.[137]

321 The fact that LRIC+ is really a measure of total network costs with certain mark-ups becomes clear when studying the Analysys model. The model extends over the years 1990/91 to 2040/41 and proceeds in the following steps:

135 Ofcom Market Review, A12.11-A12.12.
136 Ofcom Market Review, A12.13-A12.18.
137 Which admin or other costs are included or excluded is not relevant to our discussion, as we only require that LRIC+ is equal to LRIC plus a mark-up.

a. Total traffic of all services (termination, on-net, origination, data, SMS, etc) is estimated, for each year. By use of a busy hour rule that traffic is converted into peak traffic, which drives investment into capacity.
b. The traffic per service is applied to a "routing factor matrix", which is essentially a conversion matrix that converts one unit of demand for a service into units of demand for network elements.
c. The result is a total demand for network elements, for each year.
d. Using equipment lifetimes, it is determined how much new investment, in terms of equipment units, needs to be carried out in each year.
e. The required new investment is multiplied with unit prices for equipment. Added are operational costs and mark-ups. This results in "total costs incurred by network element".
f. Total costs incurred are repartitioned over the years, weighted (essentially, subject to additional restrictions such as 2G constraints) by volume of traffic.
g. This results in total costs recovered by network element.
h. Again the routing factor matrix is applied to arrive at total cost recovered by service.
i. The termination rate is equal to total cost recovered by the termination service divided by termination minutes.

322 Therefore, in a precise definition, LRIC+ of termination is the average total network cost of a termination minute, weighted by the demands of a termination minute on the network and the weight of termination minutes in total traffic demand. The measure is therefore a total network cost measure. It is LRIC only in the sense that the "increment" is total traffic.[138]

Pure LRIC is an attempt to quantify the marginal costs of termination.

323 Pure LRIC in the Analysys model features two modifications to LRIC+:
a. Certain costs are excluded from the computation, such as handset costs and other subscriber acquisitions costs, certain mark-ups and spectrum costs.
b. With the exclusion of these costs, the model is run twice: once with demand from all services, and once with total demand minus termination demand.

138 Arguably the most important economic element of the LRIC+ computation in the Analysys model is not the size or meaning of the increment, but rather the application of the "economic depreciation mechanism", which converts costs incurred to costs recovered.

324 The difference between the two runs is total incremental costs from the termination service, and dividing those costs by the number of minutes yields the LRIC per minute. In order to translate LRIC to the literature, we deduce that LRIC is a proxy for the marginal cost of termination.

LRIC+ is pure LRIC plus mark-up.

325 In our view, it would not be correct to suggest that both LRIC+ and LRIC are measures of marginal cost in the sense of the level at which an "efficient" price in a "competitive" market would be set and that therefore the problem of choosing LRIC or LRIC+ is one of the best definition of LRIC. In contrast, choosing one over the other features a real economic choice.[139] The choice is between the use of a marginal cost concept and the use of marginal cost plus a mark-up.

LRIC+ and pure LRIC in the literature.

326 The termination rate debate benefits from an extensive literature in a homogeneous set-up, starting with Laffont, Rey, Tirole (1998a, and 1998b)[140] and Armstrong (1998)[141]. In this setting, usually two networks[142] are situated at opposite ends of a Hotelling line. They compete for users who are uniformly distributed along that line and face a cost of subscribing to either operator, which increases linearly with the distance between them and the operators. The distance model is used as a proxy for the fact that consumers are heterogeneous in their tastes and firms are differentiated. A distance cost arises since a user's tastes do not concur completely with the offer of the operator.

327 Much of the literature discusses the effects of a termination rate above marginal cost. This allows for immediate application to the Ofcom discussion of LRIC v. LRIC+. LRIC is a proxy for marginal cost. It is not necessary to qualify the exact nature of LRIC+[143] in the sense of which mark-ups are included, since by definition LRIC+ is larger than LRIC and would therefore correspond in the literature to the 'above

139 On a purely pragmatic level, with 0.5p for pure LIRC in 2014/15 and 1.5p the results are too far apart to be representative of the same cost concept. As our description of the Analysys model shows, the marginal concept used in LRIC+ is the whole output of the network, which is not distinguishable from total cost.
140 Laffont, Jean-Jacques, Patrick Rey and Jean Tirole. 1998a. "Network Competition: I. Overview and Nondiscrimination," RAND Journal of Economics, 29(1), pp.1-37, and Laffont, Jean-Jacques, Patrick Rey and Jean Tirole. 1998b. "Network Competition: II. Price Discrimination," RAND Journal of Economics, 29(1), pp.38-56.
141 Armstrong, Mark. 1998. "Network Interconnection in Telecommunications," The Economic Journal, 108(448), pp.545-564.
142 Extended by Hörnig to multiple networks, 2009. "Competition between multiple asymmetric networks: A toolkit and applications." Working paper.
143 LRIC+ is in our view a measure of average network cost.

cost' termination rate. The literature can therefore give insights into the choice of LRIC and LRIC+; most importantly, it can relate the question of asymmetry of operators to that choice.

328 Within the body of literature, we will explicitly derive results that rely largely on a recent paper by Lopez and Rey (2009)[144] to demonstrate the following:

- **i.** With LRIC+ termination rates, low tariffs by the small company in the market do not translate into low monthly bills; the small company is therefore disadvantaged.
- **ii.** In contrast, with LRIC rates, the small company can compete on the same footing as the large companies.
- **iii.** With LRIC+ rates it is much more likely that the small company will be driven out of the market, even if it has the same costs as the larger companies.

Economic theory shows that LRIC+ rates make competing harder for a smaller company and can drive it out of the market.

329 The standard model on interconnection rates features two companies, in our case an entrant *E* and an incumbent *I*, which are located at each end of a Hotelling line, i.e. *I* is at *0* and *E* is at *1*, consumers *i* are distributed uniformly between the incumbent and the entrant at position x_i and receive utility from calls of $u(q) - t\,|\,x - x_i\,|$, where t is a cost representing that the operator does not completely fulfil the consumer's need. There is a fixed cost f for each customer and each call has a marginal cost of $c = c_o + c_T$[145], where O and T denote origination and termination respectively. The off-net cost that an originating network faces is either a pure LRIC cost of CT , or a LRIC+ cost of $a = m + c_T$, where m is the "+" markup.

330 Each company offers a three-part tariff of a fixed monthly subscription fee, an on-net per minute price and an off-net per minute price. This tariff structure is a simplification, since operators in practice differentiate between customer groups by differentiating tariffs, but also a generalisation in the sense that it is often efficient to offer tariffs that cover fixed and marginal costs from the activities that cause them and therefore allowing such cost recovery imposes the fewest restrictions. Network i would offer $T_i(q.\hat{q}) = F_i + p_i q + \hat{p}_i \hat{q}$ where "hats" denote off-net.

144 Lopez, Angel and Patrick Rey. 2009. "Foreclosing Competition through Access Charges and Price Discrimination," IDEI Working Papers 570, Institut d'Économie Industrielle (IDEI),Toulouse.
145 On-net and off-net calls are assumed to have identical marginal costs.

331 A further simplifying assumption of the model is a balanced calling pattern, i.e. that users call each other user with the same probability. This is a simplification whose relaxation has recently created new branches in the literature. However, it is less restrictive than might appear initially, since call volumes q are dependent on prices, so that if on-net prices are lower than off-net prices, on-net call volumes will be higher than the market share of an operator. In reality, we find that there is a complex relationship between different customer segments. In particular calling between post-pay and pre-pay customers is not balanced. We will analyse the effect of this imbalance in the following chapter. As we will show, the imbalance of calling patterns between customer groups worsens the competitive impact of the mark-up over termination rates for smaller operators, such as Three, since Three is a small 3G operator with higher handset costs.

332 In this set-up, the market share of an operator matters if, and only if, termination rates are set at LRIC+. Under LRIC+, market shares determine how expensive an operator is, since with an equal probability of calling each other consumer, a smaller operator will have more off-net calls. There are various ways in which asymmetry between operators can be introduced into the standard interconnection model. Carter and Wright (1999) use an exogenous utility benefit for belonging to the incumbent network.[146] We follow Lopez and Rey (2009) by introducing a switching cost s. Slightly varying from Lopez and Rey we interpret the switching cost as a positive cost that a user needs to pay to switch from the incumbent to the entrant. This is meant to represent the situation that Three faces today: the market has very high penetration, so that growth must to a significant degree come from stealing customers from other operators.

333 Let market share be denoted by a, and let v denote the indirect utility.[147] The net surplus offered by the entrant network E is:
$w_E = \alpha_E v(p_E) + \alpha_I v(\widehat{p_E}) - F_E - s$

334 The incumbent network offers the same net surplus without the switching cost s. Solving the model shows that operators charge marginal prices at cost and compete solely on the subscription fee. This is a standard result and intuitively due to the fact that the subscription fee is the most efficient way to extract consumer surplus.

146 Carter, Michael and Wright, Julian (1999). "Interconnection in Network Industries". Review of Industrial Organization, 14:1—25.
147 Indirect utility is utility as a function of prices at the maximum point of consumption.

335 Therefore, the net surplus can be rewritten as:
$w_E = \alpha_E v(c) + \alpha_I v(c+m) - F_E - s$

336 The above equation is sufficient for the purposes of our illustration, so we have not developed this model further. LRIC+ translates into a positive *m* in our model. With a positive *m*, the benefit of being on the small network is reduced, since to determine the benefit for the user, expensive off-net calls are "weighted" by the high market share of the large operator α_I, while cheaper on-net calls are weighted only with the small market share of the entrant α_E. Since a switching cost must be paid in order to join the entrant network, the fixed fee F_E that the network can ask of its users is reduced by that amount.

337 The entrant therefore faces the problem that even if it has cheap tariffs, in the eyes of consumers they might be expensive since their users make a larger proportion of off-net calls. The entrant therefore needs to offer lower subscription fees in order to compete in terms of total monthly bills. However, in order to offer competition through lower subscription charges, it needs to overcome a switching cost.

338 This is true even if traffic remains balanced and the smaller operator benefits from the mark-up by receiving a higher wholesale termination charge per minute. The higher termination charge would not provide sufficient "funding" for the small operator to lower its fixed subscription charges to compensate its users for the mark-up. Lopez and Rey show that under certain conditions, namely if switching costs are high and if the mark-up over LRIC is high, the small operator disappears from the market.

339 On the other hand, under a pure LRIC framework the traffic outflow problem does not exist, so that only the "normal" problem of overcoming switching costs needs to be addressed by an entrant.[148] In this case the assumption of symmetric market share would be more justifiable.

340 The overall conclusions of the theoretical literature on interconnection under asymmetric market shares is therefore that LRIC+ disadvantages smaller operators compared to larger operators. As we will show for the case of Three, this constraint not only reduces Three's ability to compete overall but also constrains it to certain (mid-market) segments; the effectiveness of Three's competition is particularly muted in the high-value and pre-pay segments.

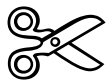
148 We note that Three has argued in this respect regarding the issue of Mobile Number Portability.

341 This concludes our preliminary theoretical framework of LRIC and LRIC+. In the remainder of this chapter we: (i) show the extent of asymmetry in the market; (ii) analyse the effect of on-net / off-net call proportions; (iii) show that Three has been an aggressive competitor; (iv) give evidence on the importance of opening up the retail market; and (iv) briefly highlight Three's success in mobile broadband, a market not hindered by interconnection issues.

Three's asymmetric position in the UK mobile market.

342 Following the T-Mobile UK / Orange UK merger, the UK market has become highly asymmetric. Based on shares at Q2 2009, Vodafone had a 26% market share, O2 around 29% and the new Orange / T-Mobile around 38%. Three, in contrast, only had ✂% (confidential) market share at ✂ (confidential) quarterly revenues. The HHI, whose quadratic weighting counts increased asymmetry as increased concentration, increased from 2,303 to 3,035.

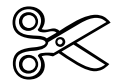
Figure 28: UK mobile market 2009Q2, retail revenues market shares.



Source: Ofcom Telecommunications Market Data Tables, Three (confidential)

343 In terms of call volumes, the picture is similar, with Three having a 9% market share in 2009Q2 against 22% for Vodafone, 33% for O2, and 36% for T-Mobile / Orange.

Figure 29: UK mobile market 2009Q2, voice call volumes market shares.

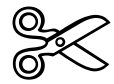


Vodafone
O2
T-Mobile
Orange
Three

Source: Ofcom Telecommunications Market Data Tables, Three (confidential)

344 Lastly, we present subscriber figures for voice telephony. In 2009 Q3, Three had around 4.7m subscribers against Vodafone's 16.4m, O2's 20m and T-Mobile / Orange's 32.7m.[149] Three is therefore only just over one quarter of the size of the next largest firm and only about 1/7th the size of the new market leader T-Mobile / Orange.

Figure 30: UK mobile market 2009Q3, subscribers.



Vodafone
O2
T-Mobile
Orange
Three

Source: Ofcom Telecommunications Market Data Tables, Three (confidential)

149 Our understanding is that the figures of the Ofcom Telecommunications Market Data Tables relate to mobile voice customers rather than mobile broadband (dongle) customers.

345 In these indicators, Three therefore suffers from being a significantly smaller market player than the other operators. It should be noted that the T-Mobile / Orange merger has significantly increased the asymmetry of Three's market position. Three had been growing market share over the past few years, but the merger, rather than any failings of Three, have brought it back to being the single small company in the market.[150]

346 There is an undertone in the EC Recommendation that smaller companies could become, figuratively speaking, addicted to high termination rates and that such high termination rates would provide disincentives for smaller operators to compete aggressively. Such an analysis cannot apply to Three for the simple reason that Three is a 3G only operator. 3G handsets have been and still are more expensive than 2G handsets, a fact that has made it difficult for Three to compete in the prepay market. It is, however, such competition in the prepay market that relies on incoming termination revenues and might then be thought to provide disincentives to operators to compete aggressively.[151] These disincentives did not exist for Three and it cannot be deduced therefore that Three was a "lazy" competitor that did not achieve the market share that it should have achieved.

347 The fact that Three is a 3G only company, combined with high termination rates has made it difficult for Three to penetrate a market which was highly developed at the time of Three's launch in 2003. We point out that Three has only just started to become profitable after seven years of operation, after high levels of investment to date. The continued presence of Three represents an extremely high investment into the UK mobile market.

Three's achievements thus far can be contrasted with other markets.

348 Three's success in staying in the market and ultimately outstaying T-Mobile as the fourth operator should be contrasted with the experience in other markets. The most striking contrast is with Germany. In the 3G auction in Germany, six operators won WCDMA licenses, of which there were four incumbents and two entrants: a joint venture of France Telecom / German alternative operator Mobilcom and Telefonica / Sonera. Yet France Telecom / Mobilcom never started operations and "Quam", the operating company of Telefonica / Sonera, shut down in the summer of 2002 after operating for only a number of months.

150 For an economic analysis of the merger, see http://www.market-analysis.co.uk/PDF/Academic/harbordhoernigwelfareplusmergerpaper03march2010.pdf.
151 A view that we would not necessarily subscribe to.

349 Consolidations involving smaller players have also occurred notably in the Netherlands, Denmark and Austria. Most recently, a Swiss merger between the second and third mobile operator was blocked. Against this background, the steady development of Three, which constitutes possibly the distinguishing factor for the UK mobile market, cannot be overestimated.

350 These achievements notwithstanding, LRIC+ termination rates have resulted in tangible disadvantages for Three as suggested by the theoretical framework set out above, which we demonstrate in the following section.

Tariff pattern translates into lower net revenues (retail revenues minus termination costs) for Three and impedes its ability to compete.

351 In the theoretical model presented above, mobile operators are allowed to choose three part tariffs, consisting of on-net per minute charge, off-net per minute charge and fixed subscription charges. In order for the smaller operator to compete with the larger operator in terms of total monthly bills, it must charge a lower subscription.

352 Seemingly, a key element of this analysis is the on-net / off-net price differentiation by operators. Ofcom has discussed whether such on-net / off-net differentiation exists in the UK market. Ofcom argues that "currently, only a few retail tariffs in the UK have different on- and off-net call charges and, therefore, the impact of this issue is now less likely to be significant"[152].

353 Our own analysis suggests that Ofcom has underestimated the effect of any on-going on-net/off-net differentiation. An analysis by Pure Pricing shows that on-net / off-net differentiation continued to exist extensively in Q1 2010. A majority of the pre-pay contracts offered by operators had higher per-minute tariffs for off-net calls compared to on-net (see below). In post-pay tariffs, on-net / off-net differentiation often took the form of large inclusive bundles of on-net minutes, including several unlimited on-net bundles.[153] These bundles have the effect of making the contracts offered by smaller networks less attractive from a customer's point of view, even at identical per-minute prices.

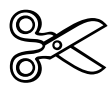
152 Ofcom Market Review, A12.90.
153 Pure Pricing UK Mobile Pricing Factbook, Q1 2010.

354 However, the existence of on-net / off-net differential is not crucial in the finding that Three as a small operator is disadvantaged by LRIC+. The key element is instead the competitive constraint on Three that arises from the combination of: (i) Three having more off-net minutes than other operators; and (ii) all operators paying more for off-net calls than the cost for on-net calls. The combination of these two factors mean that Three has significantly lower retail profitability for the same call packages than other operators, and, as a result, is not able to offer tariffs as aggressively as it would with mobile termination rates at LRIC.

355 Naturally, one also needs to consider the termination revenues that are created by these tariffs in order to complete the analysis. If switching costs or another exogenous form of initial disadvantage is taken into account, then these termination revenues are not sufficient to enable Three to offset the profit loss from higher call outflows. In addition, as we show in the next chapter, high-volume tariffs will generate termination revenues in low-volume / pre-pay tariffs. Since Three is constrained in pre-pay tariffs due to the fact that it is a 3G operator with expensive handsets, it will not attract correspondingly high termination revenues compared to its competitors. Therefore lower retail profitability due to high off-net flows translate into lower overall profitability due to limited "recycling" of other operators' off-net calls into Three termination revenues. Overall the result is a constraint on Three's ability to compete.

356 Figure 31 gives an estimate of on-net / off-net call volumes proportions for the five major MNOs.

Figure 31: On-net / off-net proportion for all operators.



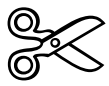
■ On-net □ Off-net

Notes: Vodafone, O2, T-Mobile and Orange off-net proportions defined as interconnection call volume divided by total call volume, as published in Ofcom Telecommunications Market Data Tables. Three off-net proportion defined as off-net outgoing volume divided by total outgoing volume. All figures as of Q3 2009.
Source: Ofcom, Three (confidential)

357 The figure above shows that Three has around ✂% (confidential) of its voice calls off-net, while this proportion is in the region of around 45%-50% for the other operators. We note that this figure does not take into account the effects of the T-Mobile/Orange merger. Since calls between T-Mobile and Orange customers would be on-net calls in the future, both operators' off-net proportions will fall further.

358 The following four figures give more insight into the on-net / off-net traffic flows, showing graphs over time of on-net call volumes, off-net call volumes, the proportion of on-net calls in total voice calls and off-net calls in total voice calls.

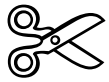
Figure 32: On-net call volumes.



Vodafone O2 T-Mobile Orange Three

Notes: Vodafone, O2, T-Mobile and Orange: total call volumes minus interconnection call volumes, as published in Ofcom Telecommunications Market Data Tables.
Source: Ofcom, Three (confidential)

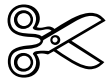
Figure 33: Off-net call volumes.



Vodafone O2 T-Mobile Orange Three

Notes: Vodafone, O2, T-Mobile and Orange: interconnection call volumes, as published in Ofcom Telecommunications Market Data Tables.
Source: Ofcom, Three (confidential)

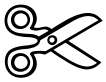
Figure 34: Proportion of on-net calls.



Vodafone O2 T-Mobile Orange Three

Notes: Vodafone, O2, T-Mobile and Orange on-net proportions defined as (total call volume - interconnection call volume) / total call volume, as published in Ofcom Telecommunications Market Data Tables. Three off-net proportion defined as on-net outgoing volume divided by total outgoing volume.
Source: Ofcom, Three (confidential)

Figure 35: Proportion of off-net calls



Vodafone O2 T-Mobile Orange Three

Notes: Vodafone, O2, T-Mobile and Orange off-net proportions defined as interconnection call volume divided by total call volume, as published in Ofcom Telecommunications Market Data Tables. Three off-net proportion defined as off-net outgoing volume divided by total outgoing volume.
Source: Ofcom, Three (confidential)

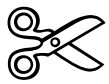
359 It is particularly striking that Three has a volume of off-net calls approaching that of T-Mobile, yet it only had around ✂m (confidential) customers as opposed to more than 16m customers and a quarterly call volume of about ✂bn (confidential) minutes as opposed to T-Mobile's 4.5bn minutes. It is clear that with around ✂bn (confidential) minutes of off-net calls per year, a "+" surcharge of about 1p means that there is a payment of £✂m (confidential) over marginal cost for Three, or around £✂ (confidential) per subscriber, whereas, for example for T-Mobile roughly the same fixed cost contribution to interconnection payments only translates into around £6 per subscriber. If that fixed cost contribution disappears, Three's disadvantage of, in this case, around £✂ (confidential) per subscriber per year, will disappear, allowing Three to compete more aggressively since, effectively, its relative cost base is reduced.

360 One might think that mobile interconnection payments are roughly balanced and therefore there is little concern for interconnection rates. However, the balancing is only the result of the retail tariffs that are designed in such a way as to not create high wholesale payment outflows.

Individual tariff analysis.

361 It is helpful to consider a selection of detailed tariffs to understand in greater detail the effect of expensive off-net calls relative to marginal on-net call costs. We have taken, as an example, three similar £25 tariffs by Three, Orange and Vodafone. With aggregate proportions for off-net calls used as the split between on-net / and off-net, we find that Three has a revenue outflow of around ✂% (confidential), Orange of around 17% and Vodafone of about 10%. The net revenue after interconnection payments is therefore much lower for Three, resulting in lower profitability for the same contract, since the off-net revenue outflow is prices in excess of marginal costs.

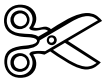
Figure 36: Total MTR outflow as % of monthly tariff.



Notes: Assuming 50% of inclusive call minute bundles are used by consumers. Off-net MTR assumed to be 4ppm. Excludes SMS and MMS termination rates.
Source: Pure Pricing (Tariffs), Ofcom, Three (Call volumes) (confidential)

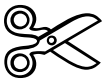
362 These tariffs lead to the termination payment analysis as shown in Table 1. Again, the picture emerges that there is significantly higher outflow of termination rates for Three. Each Three subscriber contributes significantly more to fixed cost recovery of other networks, than other networks' subscribers contribute to Three's fixed costs.

Table 3: MTR outflow of comparable call packages, March 2010



363 In a further tariff comparison we consider pre-pay tariffs. The following table shows offers of all operators from March 2010. Again we use the aggregate on-net / off-net call proportions to show that aggressive tariffs by Three do not necessarily result in low call costs for consumers. We note that there is widespread on-net / off-net differentiation for these tariffs.

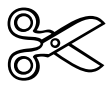
Table 4: Pre-pay tariffs, March 2010



364 While Three has the lowest tariff of (20p,0p) for off-net / on-net prices per minute, compared to (25p,5p), (20p,10p), (25p,8p) and (20p,20p) it is, using the off-net / on-net split, the second most expensive company in the market. This problem restricts Three's ability to price even more aggressively.

365 A last piece of evidence for on-net / off-net traffic flows is shown in the following figure. Again we have taken the aggregate on-net / off-net call proportions for different operators. We have considered a number of different tariffs with increasing volumes to the bottom. This picture gives the valuable insight that Three is not able to compete on high-value any-time any-network tariffs due to high termination rates.

Figure 37: Total MTR outflow as % of monthly tariff.



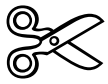
Notes: Assuming 50% of inclusive bundles are used by consumers. Off-net MTR assumed to be 4ppm. Excludes SMS and MMS termination rates.
Source: Pure Pricing (tariffs), Ofcom and Three (calling patterns) (confidential)

366 One can see quite clearly that for all operators, the MTR outflow of higher volume tariffs increases more than proportionally. For Three the outflows, under the assumption of a 50% use of package allowance, quickly reach more than 60% to 80% of call revenues. The increase is due to the fact that higher packages give higher discounts: however, the call termination charge is linear.[154] With such high revenue outflows and an increasing gap between Three and the other operators, it becomes more and more difficult for Three to compete as call packages get larger.

Three's traffic position.

367 We consider it also useful to examine Three's traffic patterns in isolation. Figure 12 shows that in earlier years of Three's operation, Three had a very large mobile-to-mobile traffic deficit, with termination volumes (which include fixed and mobile) far below even outgoing mobile traffic, let alone outgoing total traffic.

Figure 38: Three call volumes, Q2 2005-Q3 2009.



Outgoing off-net mobile Outgoing off-net fixed Outgoing on-net Terminations

Notes: Call volumes shown in millions of minutes per quarter.
Source: Three (confidential)

154 This illustrates also our point above that any Ramsey pricing would need to be carried out by customer group as is the case in RPP systems.

368 The initial traffic imbalance was the result of very aggressive customer acquisition. However, such a large traffic deficit (which diverges from the balanced traffic assumption of the theoretical model) is unlikely to be financially sustainable. Therefore, following its initial launch, Three became constrained in the retail packages it could offer, and has been forced to follow a strategy of trying to control the volume of outgoing off-net traffic in order to reduce its traffic imbalance. Ultimately the result from the constraint to keep traffic flows in balance is lower growth for Three due to a constrained ability to compete. For the market this results in less competition from the maverick operator and therefore likely also results in higher prices.

In spite of disadvantage, Three is still an aggressive competitor.

369 Three is an aggressive competitor and its lack of market share cannot be ascribed to a type of termination honey pot strategy as seems to be implied by the EC Recommendation. We have used market research reports published by Pure Pricing to understand whether Three has been an aggressive competitor in the market. The following table gives a summary of the analysis.

Table 5: Operators with highest average value ratios, 2005-2009

Category	Operator with highest value ratio
£30 to £39.99 monthly charge, 12 month contract, incl. promotions	Three
£30 to £39.99 monthly charge, 18 month contract, incl. promotions	Three
Less than £30 monthly charge, 18 month contract	Three
Pre-pay £10 top-up	Three
Pre-pay £30 top-up	Three
Sim only: less than £20 monthly charge, 30-day contract	Three
Sim only: £20 or more monthly charge, 30-day contract	O2
Business: Individual £25-£39.99 monthly charge, 24-month life	O2
Business: Individual £40-£54.99 monthly charge, 24-month life	Orange
Business: Three users, one account £25-£39.99 monthly charge, 24-month life	T-Mobile
Business: Three users, one account £40-£54.99 monthly charge, 24-month life	Orange / T-Mobile
Mobile broadband £15 or less monthly charge, 3-month life	Three
Mobile broadband £15 or less monthly charge, 24-month life	Three
Mobile broadband more than £15 monthly charge, 3-month life	T-Mobile
Mobile broadband more than £15 monthly charge, 24-month life	Three

Notes: Shows the operator with the highest average 'value ratio' over the period 2005 to 2009, within the categories defined by Pure Pricing. Note that not all categories were published every year between 2005 and 2009.

Source: Pure Pricing

370 Pure Pricing is a market research service of mobile tariffs. It attaches a value to each tariff element in order to arrive at an estimate of the total 'value' provided by a contract. This is divided by the monthly tariff to arrive at a 'value ratio'. These ratios are calculated for different categories of mobile telephony contracts, such as "18 month contracts with lower than £30 monthly charge" or "Pre-pay £10 top-up". In 2009 Pure Pricing also started published value ratios for mobile internet products.

371 Out of the 15 tariff categories that were considered by Pure Pricing between 2005 and 2009, Three had the best average value ratio in 9 of

the categories, compared to 2 for O2, 2 for Orange, 3 for T-Mobile and none for Vodafone. In fact, in most individual years, Three offered the most valuable tariffs.

In the past, high 3G handset costs have made it difficult for Three to be an aggressive competitor in the pre-pay market or to rely on termination revenues.

372 The fact that Three tended to price their products at lower rates is not surprising. The Commission's view of a non-aggressive strategy of entrants that rely on high termination rates could not be profitable for Three. Such a strategy, if indeed it exists, would rely on creating high termination revenues. Three is not in a position to do this, since it is a 3G only operator.

373 New 2G entrants might be able to offer cheap prepay tariffs; the profitability of which relies on attracting incoming termination revenues. For a call, calling parties can engage in a type of arbitrage regarding who pays for the call. Since calls are often actually made between a limited number of people, such as between family or friends, in many cases it is possible to minimise the total cost of the call. Higher retail rates in a call-pair therefore lead to more incoming traffic. However, the disadvantage of high retail rates is low use. Therefore, in Europe tariffs that are designed to attract termination are usually pre-pay tariffs.[155]

374 Three is a 3G only operator, as the UK new entrant license was limited to 3G services only. 3G handsets are still more expensive than 2G handsets. With pre-pay contracts, operators are not in a position to subsidise handsets significantly due to the possibility of arbitrage in handsets, also known as "box-breaking". In addition, lower call conveyance costs are less advantageous in pre-pay due to low call volumes per handset. For these reasons, the prepay market has been a difficult market for Three to succeed in. In turn, a strategy of acquiring pre-pay customers that act as a termination honey-pot is not a profitable strategy for Three, and Three is instead forced to compete aggressively in the retail market. Also for this reason of the innate disadvantage in the pre-pay market, it is important for Three that retail markets are no longer foreclosed.

155 We also note that pre-pay tariffs have the lowest discounts due to non-linear pricing and second degree price discrimination, a point which is explained more explicitly in Annex C.

375 We note that Three's inability to compete in the prepay market is due to the fact that, due to the absence of longer term contracts, handsets cannot be recovered through call charges. At the same time we find in subsidies that prepay is likely to be a more profitable segment for 2G operators. The fall in termination revenues is therefore unlikely to be passed on as price increases to low-volume pre-pay customers would reduce those customers' participation rates.

Importance of "freeing up the retail market".

376 An element of complexity of mobile termination rates is the fact that there are two payment flows: those between mobile operators and those from fixed to mobile operators. While mobile operators' rates are roughly symmetric, mobile termination rates have so far been far above fixed termination rates. A good theoretical treatment of this issue is in Armstrong and Wright (2009).[156]

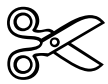
377 The consequence of such fixed / mobile termination rate asymmetry is that mobile operators can usually expect to have higher incoming termination revenues than outgoing termination costs. The debate about the "waterbed effect" is mostly around the question of whether through competitive pressure, that surplus has already been passed on to mobile users and therefore a reduction in the fixed-mobile surplus would require price increases on behalf of mobile operators.

378 While we consider the waterbed effect elsewhere, an element that should not be underestimated is that competition is currently harmed through the mark-up on marginal costs in termination rates. Three's constraints to compete mean less competitive pressure on other operators. Three is now the only operator needing to acquire new customers in order to achieve a long-term sustainable market position. Freeing Three from these constraints should ultimately lead to more competition. In addition, allowing marginal costs to be the guide in retail pricing for off-net calls should also allow operators to price more efficiently. Indeed, the fact that Three is impeded from competing should imply that the waterbed effect is at least incomplete, since competition is not as fierce as it would be with Three facing LRIC rather than LRIC+ rates.

156 Armstrong, Mark and Julian Wright. 2009. "Mobile Call Termination," The Economic Journal, 119(538), pp.270-307.

379 We note that Three is a proponent of marginal cost termination rates, since it will allow it to compete more freely in the retail market. This is despite the fact that Three also has a wholesale termination surplus that it will lose. In pure accounting terms, i.e. without any changes in retail tariffs, we estimate that Three would lose between £✂ (confidential) and £✂m (confidential) from lowering its termination rate from 4.3p to 0.5p. We give the following estimate in the table below.

Table 6: Wholesale position of Three, 2009 Q3, £m per annum



380 In spite of this direct negative impact, Three believes that the benefit from being able to compete better in the retail market outweighs the disappearance of the fixed-mobile surplus.

Three's market share in the mobile internet market proves its ability to compete.

381 Three also notes that in the mobile broadband market it has a leading position. In the summer of 2009, Mobile Today estimated that Three had 40% of mobile broadband connections, Vodafone 25%, T-Mobile 25%, Orange 13% and O2 4%.[157]

382 Mobile internet does not require mobile-to-mobile interconnection, since the connection is to an internet service provider. This means that interconnection is not an issue in mobile internet since, unlike the mobile telephony market, mobile internet is not a two-sided market consisting of two distinct customers. While the mobile broadband market is new and there is a relatively level playing field for all operators and therefore the market shares are not directly comparable, it is nevertheless the case that Three is able to price independently of interconnection issues and is

157 Mobile Today, 19 June 2009.

in that sense not hampered by network externalities that are introduced due to above cost termination rates.

Conclusion on LRIC and LRIC+.

383 Whilst we agree with Ofcom's approach and conclusions regarding the choice between LRIC+ and LRIC we believe that the conclusions that Ofcom reaches are further supported by a detailed analysis of the actual market situation in the UK, including but not limited to the high level of asymmetry in the UK market.

384 When there is high asymmetry, the smaller entrant operator suffers from a termination regime which is above marginal cost. It is constrained in its tariffs that it can offer due to higher off-net traffic. As a result, the market is less competitive than it is likely to be with pure LRIC. Pure LRIC opens up the retail market for Three (or any prospective future entrant). Indeed, Three is the most important competitor in the market since it is the only operator that actively needs to acquire new customers.

385 A continuation of a LRIC plus mark-up measure would result in disadvantaging Three and as a result, would hinder more effective competition in the market.

Annex C. Distributional analysis: impact on different user groups.

386 Ofcom carries out a fairly extensive analysis of the possible distributional impact of the proposed reduction in termination rates.[158] In particular Ofcom is careful to consider the impact on many different user groups, such as mobile only users, fixed users, fixed/mobile users, pre-pay users, low users and so on.[159]

387 In this chapter we provide additional insights into the distributional problem, and in particular the question of whether low volume users are likely to be harmed by the reduction in termination rates. We propose a framework for the analysis which fits naturally with the mobile market and which should be seen as a complement to Ofcom's analysis.

388 We find that:

a. Mobile operators carry out extensive second-degree price discrimination. They give volume discounts. Pre-pay tariffs are low user tariffs.

b. Different call retail prices imply that calls should not be balanced by call package. In particular, one would expect that post-pay tariffs feature a termination deficit, while pre-pay users have a termination surplus.

c. It is therefore not straightforward to allocate termination revenues to individual tariffs, since one also needs to consider the originating tariff and therefore all tariff offers together. This is an issue which constrains Three. Since Three has in the past been constrained in the pre-pay market, it has a low pre-pay user base. With a limited amount of pre-pay users, Three is also constrained in the high-end market, since it cannot compensate the high-end termination deficit with a pre-pay termination surplus. Lowering termination rates will allow Three to compete better in the high-end of the market. Given its small asymmetric market position, this should increase competition for larger size tariffs.

d. With second degree price discrimination, low users bring higher margins, since they do not have an incentive constraint. High users need volume discounts to avoid arbitrage to lower usage tariffs. The fact that low users have high profitability should mean that a lessening in profitability from termination (if those revenues are truly attributed to pre-pay users) can, at least to an extent be absorbed.

e. This issue questions whether the loss of fixed-to-mobile termination revenues would lead to lower penetration through higher pre-pay

158 Ofcom Market Review, Annex 13.

159 We note that due to the innate construction of utility functions, economics is not very well suited to distributional analysis. Ofcom's analysis of many different user segments, and also of considerations of both possible retail price and call volume effects addresses this inherent problem.

prices. We find empirical support for this by a finding that the waterbed effect is incomplete and, as such, is likely to affect higher usage customers. In other words, one would expect the shape of the tariff curve to change, rather than its starting point, as a result of falling MTRs.

Operators engage in second-degree price discrimination.

389 We observe that the very large number of tariff packages of mobile operators means that they price discriminate between different categories of users. Since users can self-select into tariff packages, price discrimination generally do not rely on observable characteristics of users such as age, sex, etc. Also, it is not possible for operators to know and enforce individual users' preferences. Price discrimination is therefore of "second degree".

390 The economic literature on second-degree price discrimination by a monopolist is standard. Its key feature is the so-called tariff curve, which plots usage volume on the horizontal axis against total tariff cost on the vertical axis. Second-degree price discrimination leads to a simple form of non-linear tariffs; firms essentially give volume discounts to higher users.

391 The economics of second-degree price discrimination in an oligopoly is much less developed. Relevant theoretical articles are Armstrong and Vickers (2001)[160] and Ivaldi and Martimort (1994)[161]. An application to telephony, including an empirical analysis of the effect of competition on the US cellular market, is found in Miravete and Röller[162]. The literature shows that some of the key insights from the monopoly situation do translate into competition. For a purely descriptive and intuitive exposition such as ours, we therefore abstract to a large degree from the complications that arise in the theoretical treatment of oligopolistic non-linear pricing.

Basic theoretical framework of the tariff curve.

392 We believe it is useful to consider the basic economic framework of a tariff curve under second-degree price discrimination in order to clarify the incentive and participation constraints. The following exposition is taken without modification from J. Tirole: The Theory of Industrial Organisation.[163]

160 M. Armstrong and J. Vickers (2001), "Competitive Price Discrimination", RAND Journal of Economics Vol. 32, No. 4, Winter 2001 pp. 1–27.
161 M. Ivaldi and D. Martimort (1994), "Competition under non-linear pricing" – Annales d'Economie et de Statistique.
162 E. Miravete and L. H. Röller (2003), "Competitive non-linear pricing in duopoly equilibrium: the early US cellular phone industry", working paper.
163 J. Tirole (1988), "The Theory of Industrial Organisation", MIT Press.

393 For simplification we consider that there are two types of users, a low-demand type θ_1 and a high-demand type θ_2. Users receive utility $\theta V(q)$-T(q) if they purchase a volume of calls q at a tariff T. The monopolist offers two bundles to users: a bundle (q_1, T_1) aimed at θ_1 users and a bundle (q_2, T_2) aimed at θ_2 users. Marginal costs are assumed to be constant at c. There is a proportion λ of θ_1 users and (1-λ) of θ_2 users. The monopolist has the following profit maximisation problem: it maximises total profits over the two user groups subject to the low-demand user just participating and the high-demand user not using the tariff package intended for the low-demand user.

Max $\Pi^m = \lambda (T_1 - cq_1) + (1-\lambda)(T_2 - cq_2)$

Subject to

$\theta_1 V(q_1) - T_1 = 0$ – the participation constraint, i.e. that the θ_1 users participate, which is binding

$\theta_2 V(q_2) - T_2 \geq \theta_2 V(q_1) - T_1$ – the incentive constraint, i.e. that the θ_2 users are better off choosing the tariff intended from them rather than for low-demand θ_1 users.

394 By substituting for T_1 in the second constraint and rearranging it follows that $T_2 = \theta_2 V(q_2) - (\theta_2 - \theta_1) V(q_1)$, i.e. the tariff to high-demand users θ_2 is lower than their value for it (they retain some value). How much value they retain is determined by the relative difference in the two user groups. In practice, when the differentiating factor is volume, this means that the higher-demand users get volume discounts so that they do not use the low-demand tariff. The first order conditions of the above problem are

$$\theta V'(q_1) = c \Big/ \left(1 - \frac{1-\lambda}{\lambda} \frac{\theta_2 - \theta_1}{\theta_1}\right)$$

$$\theta_2 V'(q_2) = c$$

and therefore the high user equalises his marginal value with marginal cost, whereas the low user pays excess profits to the monopolist.

395 The basic insights of this model are therefore that:

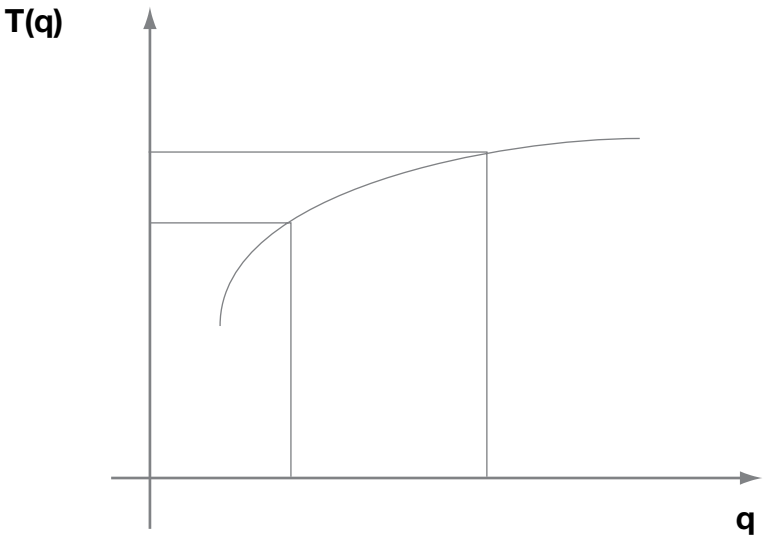
a. High users pay marginal costs;

b. Low users are more profitable than high users;

c. Low user tariffs are at levels which just allow for their participation in the market.

396 A tariff curve can then be depicted as shown in Figure 39.

Figure 39: Tariff curve.



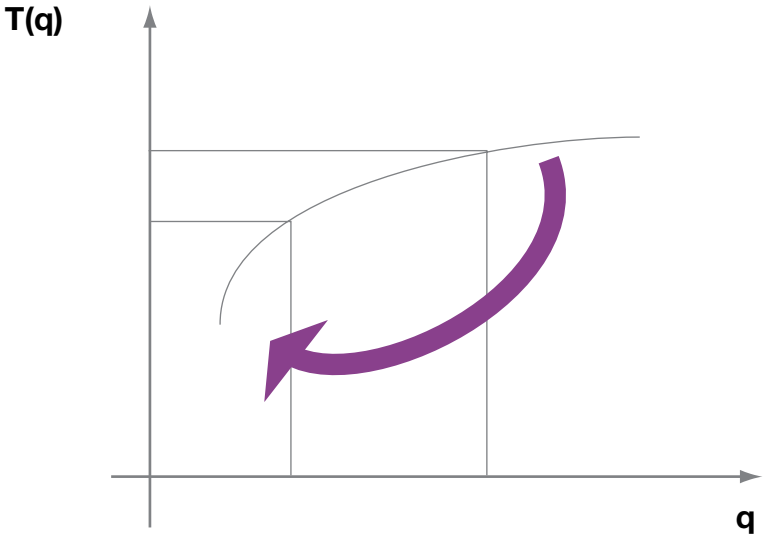
397 Translated literally, we would expect that low users are the most profitable in terms of margin, while the highest users pay marginal costs and therefore do not contribute to profitability. Incidentally, that reasoning can also be used to justify the use of pure LRIC: operators themselves only charge marginal costs to the highest users. If one regards other operators as high-volume users, then also these operators would, with non-linear pricing, only pay marginal costs.

398 There are some additional characteristics of the mobile market that need to be taken into account. Firstly, fixed network costs are important. Non-linear tariffs are used to recover fixed costs. The existence of volume discounts implies that fixed costs are recovered more from lower users than from higher users. Therefore the monopoly model, which asks where the monopolist gains its monopoly profits, is translated into asking which user group recovers fixed costs. The existence of price discrimination is therefore not necessarily a sign of market power. Miravete and Röller argue that it is welfare improving over a tariff restriction to linear prices. Secondly, pre-pay users can in general be identified as low users. Thirdly, there are certain fixed costs per user present, most importantly subscriber acquisition costs. With low user tariffs, these fixed costs are directly passed to a subscriber and present a naturally lower bound of participation. Lastly, the curve also shows that, if users engage in call-origination arbitrage (i.e. the lower tariff users originate calls) there should be a natural traffic flow from high users

to low users and therefore low users should have higher termination traffic than low users. That traffic flow is also implied by negative price elasticities of demand.

399 The traffic flow is shown in the modified tariff curve in Figure 40

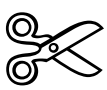
Figure 40: Tariff curve and call direction.



Disadvantage of Three through termination rates at LRIC+.

400 Due to reasons such as the higher price of 3G handsets, Three has a lower proportion of pre-pay subscribers compared to the other operators.

Table 7: Pre-pay / post-pay subscriber numbers



401 Due to this high proportion of post-pay subscribers, Three subscribers tend to have high origination traffic and low termination traffic.

402 The traffic flow makes it clear that an analysis of different user groups must be seen in the context of their effects on other user groups, in particular when there is a mark-up on termination rates. Low pre-pay users attract termination traffic and revenues, however, that traffic is originated by high users. It is therefore not straightforward to allocate the termination revenue solely to low pre-pay users. For operators with a sufficient pre-pay base termination revenue might also be used to allow for particularly low outgoing off-net tariffs of high users. If all operators have many high users with low tariffs, then a proportion of other operators' high users' calls will arrive at an operator's low pre-pay users. Through reciprocity in particular when market shares are symmetric, it is possible to "recycle" the low user tariffs through a flow of termination revenues.

403 Therefore, in the case in which operators are symmetric, pre-pay profitability is not as dependent on termination revenues as it may seem. This effect holds in addition to the result of the tariff curve itself which states that pre-pay users are highly profitably due to the absence of an incentive compatibility constraint.

404 The flow is a strong problem for Three due to LRIC+ termination rates. It also makes it clear that high termination revenues are not an alternative strategy. As we stated in Annex B, high usage tariffs generate off-net traffic outflows. However, the flow states that the corresponding traffic inflows do not go to the same high-users, but rather, to a certain degree, to low pre-pay users. The high users, seen for themselves, are therefore out of balance regarding their traffic flows. The traffic flows need to be recycled by low pre-pay users instead. However, due to Three's higher fixed costs of handsets, Three has not been able to compete as effectively in the prepay market. It therefore does not have a corresponding sufficiently large prepay user base which can act as a "honey trap" for incoming traffic from high-usage tariffs. As a consequence, the high traffic outflows, if used extensively and aggressively, would result in unbalanced traffic due to lower prepay market shares. This problem constrains Three's ability to compete in the high user market.

405 That problem however would cease when termination rates are at pure LRIC. We would therefore expect that for high users, Three would become less constrained in its competition, since it need not rely on low users to collect outgoing traffic from high users. Reducing Three's

competitive constraint by introducing LRIC rates should improve competition for high users.

Fixed-to-mobile termination and the tariff curve.

406 A significant proportion of mobile operators' termination revenues come from fixed-to-mobile traffic. With lower mobile termination rates at a level comparable to fixed termination rates, there is a question as to whether the loss in termination revenues would not affect the users with high proportion of termination revenues. These users are pre-pay users.

407 The tariff curve however throws doubt on this assessment. Pre-pay users have high margins. Therefore, a reduction in revenues for pre-pay users through lower fixed-to-mobile termination would still leave many of these pre-pay users profitable. On the other hand, pre-pay users are already at their "participation constraint". Therefore increasing prices for them would drive some of them from the market. One would therefore think that, at the very least, a potential negative effect on pre-pay users would be mitigated by their bottom position on the tariff curve, which combines high profitability and binding participation constraints.

408 Indeed, as we will discuss below, Genakos and Valletti (2009)[164] find in an empirical study that low users are not affected by reductions in termination rates.

164 Genakos, Christos and Tommaso Valletti. 2009. "Testing the "Waterbed" Effect in Mobile Telephony" CEPR Discussion Papers 7611.

Annex D. The value of spectrum.

409 The value of spectrum holdings enters as a cost into the LRIC+ estimate, but not the LRIC estimate. Ofcom proposes to adopt a LRIC measure rather than a LRIC+ measure, which in our view is correct since, once termination rates are symmetric between larger and smaller operators, they should reflect marginal rather than average costs. With the exclusion of spectrum costs in LRIC, these costs would only become important in the event that Ofcom changed its regulatory stance and decided instead on a LRIC+ measure[165].

410 In the previous Market Review, the value of spectrum was an important discussion point in the appeal to the Competition Commission by Hutchison 3G UK Limited and British Telecommunications plc against Ofcom's decision regarding termination rates of 27 March 2007[166].

411 The Competition Commission's analysis and our own discussion reveal that there are considerable problems in determining spectrum value. These relate to factors that are inherent in the characteristics of spectrum as an asset:

a. Mobile spectrum at 1.8 GHz, as used in the Ofcom Analysys model, was awarded in beauty contests and therefore neither primary nor secondary market values are available.

b. 3G spectrum at 2.1 GHz was awarded in an auction in 2000, but no secondary trading has been possible.

c. The value of spectrum in a market is always also linked to the oligopolistic nature of that market and the regulatory auction design, since acquiring spectrum is the only way to enter a market. For this reason, international comparisons of auction results are highly questionable regarding inferences on value.[167]

412 These factors make it very difficult to determine the "value" of spectrum. From a regulatory viewpoint, the inherent difficulty of valuing spectrum leads to a significant amount of discretion in the calculation of LRIC+, as evidence by the varying results of the 2007 Ofcom Market Review, the Competition Commission review and the 2010 Ofcom Market Review. Since the value of spectrum forms a substantial part of the "+" element in LRIC+, the LRIC+ charge itself is therefore problematic.

165 Spectrum value is discussion in Ofcom Market Review, Annex 9.

166 References under section 193 of the Communications Act 2003, Competition Commission cases 1083/3/3/07(Hutchison) and 1085/3/3/07 (BT), Competition Commission Determination on 16 January 2009.

167 Paul Klemperer, in his discussion on European spectrum auctions lists why he regards some auctions as failures and others as successes. By failure Klemperer means that a license was sold below its maximum value, indicating that even the value in a market transaction might not be the correct benchmark.

413 The choice of LRIC would reduce such regulatory uncertainty and discretion. We believe that the inherent problems with spectrum valuation are a further reason why LRIC should be favoured over LRIC+.

414 In this chapter, we discuss Ofcom's approach with respect to spectrum. We then show how spectrum values would be computed under a system which would be consistent with Ofcom's regulatory practice and actual auction values. Even that estimate however suffers from relying on hypothetical auction holdings that are not legal or feasible in practice.

OFCOM approach logical development of 2007 appeal to the Competition Commission.

415 In the 2007 Competition Commission appeal, BT argued[168] that the value of 3G spectrum to be included in the mobile termination rate charges should be capped at the value of 2G spectrum, since 3G was a more efficient technology and so the use of 3G spectrum should not lead to higher overall charges. Therefore the value of 3G spectrum should not be more than *3G spectrum value = (2G network cost + 2G spectrum cost) – (3G network cost)*[169]

416 The Competition Commission accepted this logic in principle[170]. With this approach, the Competition Commission arrived at a value of 2x10 MHz of 3G spectrum at 2.1 GHz of £2.5bn in 2008/9 prices.

417 Ofcom however rejects the Competition Commission approach "in the light of new information"[171]. That new information essentially consists of Ofcom's view that by the end of the regulatory period in 2014/15 spectrum at 1.8 GHz and 2.1 GHz will be "liberalised" (here meaning technology neutral), so that therefore any spectrum value difference should come from the physical propagation properties rather than the network costs of technology employed in a particular spectrum band. Ofcom finds little difference in propagation properties and therefore attaches the same value to spectrum at 1.8 GHz and 2.1 GHz of £500m for each 2x10 MHz of spectrum in 2008/9 prices.

418 The consequence of Ofcom's view that liberalised spectrum values at 1.8 GHz and 2.1 GHz should be equal is that it cannot any longer apply

168 Paragraphs 83 to 148 of BT's amended notice of appeal, as discussed at length in the determination of the Competition Commission of 19 January 2009, pages 12-122.
169 Ofcom Market Review Annexes, Fig. 20, page 117.
170 Competition Commission Determination of 19 January 2009, par 2.9.74.
171 Paraphrased from Ofcom Market Review, A9.25.

BT's 2G cap approach. Instead, it decides to inform its value estimate by considering recent spectrum awards and the implied value from recent bids for T-Mobile in the UK.[172]

419 Ofcom's approach is an answer to the Competition Commission and a consistent approach to LRIC+ spectrum pricing. The problem with the Competition Commission's approach is brought to light in the new differentiation between LRIC and LRIC+. LRIC+ is an average cost concept in the sense that total network costs are apportioned to each service, whereas LRIC is a marginal cost concept. This distinction is a significant clarification over the Competition Commission's approach, which mixes a LRIC+ (and therefore average) cost model with a marginal view of the value of spectrum. We think that Ofcom resolution and development of the Competition Commission decision is correct in the sense that it:

a. Uses a measure of marginal value of additional spectrum needed for the marginal cost approach of LRIC (which turns out to be zero).

b. Uses a measure of average values, namely market values from auctions, in conjunction with the average cost approach of LRIC+.

Comments on Ofcom approach to spectrum value in LRIC+ model.

420 Since we agree in principle with Ofcom's approach to separating out spectrum costs for LRIC and LRIC+, this section of Annex D exclusively deals with the LRIC+ estimate.

421 In the LRIC+ model, Ofcom uses a "hypothetically efficient operator" with 2 x 30 MHz of spectrum at 1.8 GHz and 2 x 10 MHz of spectrum at 2.1 GHz. Spectrum costs are taken to be a one-off cost of £0.5bn per 2 x 10 MHz in 2008/9 prices, equalling a cost of £1.5bn for 2 x 30 MHz of 1.8 GHz spectrum plus £0.5bn for 2 x 10 MHz of spectrum at 2.1 GHz.[173]

422 The contribution of spectrum costs to termination rates is substantial, according to Ofcom equating to about 39% of LRIC+ costs, i.e. to about 0.58p of 1.5p and therefore about 58% of the "+" in LRIC+. It is therefore a very large cost contributor.

172 Ofcom consultation, A9.40.
173 Ofcom Market Review, Annex 9, Table 22.

Regulatory coherence.

423 We believe that there is a need for coherence in regulatory decisions. Otherwise they become arbitrary and discretionary, which in turn can easily lead to decisions that are, in economic terms, discriminatory and favour one company over another.

424 We therefore disagree with Ofcom's view that AIP is not a relevant measure for spectrum values in a termination rate determination, due, amongst other points to *"Ofcom's conservative policy towards setting AIP fees".*[174]

425 It may very well be the case that Ofcom has taken a conservative view on AIP charges[175]. However, if that is the view taken by Ofcom in one proceeding then we believe that it would be inconsistent to take a substantially different view in another proceeding.

426 Coherence in regulatory decision making, here regarding the value of spectrum, is important since it forces Ofcom not to bias the result in favour of the decision at hand. Coherence limits overly discretionary power of a regulator.

427 Economically, the different treatment of spectrum values in AIP and the MTR decision discriminates against Three. In contrast to all other operators, Three does not have any spectrum that was given to it in beauty contest. Therefore Three does not benefit from the "conservative approach" in AIP while at the same time what it actually paid in the 2000 auction for spectrum is also not taken into consideration but instead only about 1/6th of its actual license price is used. As a result, Three's actual costs are adjusted downwards, as are the other operators' 3G costs. However, the other operators' 2G spectrum costs are adjusted upwards by 1181%, as hard-coded into the Analysys model.

428 As we have shown in Annex B, it is in Three's competitive interest to not include a mark-up on termination rates. Designing an "efficient" spectrum holding with an upward adjustment on AIP results in higher cost recovery for operators. That higher cost, resulting in higher LRIC+, is therefore discriminating against Three even if it results in the same high LRIC+ charge. Such discrimination does not arise with the LRIC version of the model.

174 Ofcom Market Review, A9.19.
175 And we understand that this continues to be the view of Three.

Ofcom's international benchmarking.

429 Ofcom rejects AIP in favour of international benchmarking. Ofcom engages in a descriptive international benchmarking of auctions since 2000. Not surprisingly, the variations of spectrum prices are very large[176]. Ofcom does not carry out a statistical analysis which would control for all the factors that Ofcom itself discusses[177]. We doubt whether on the basis of the available data forecasts could be made with reasonable accuracy[178].

430 While Ofcom proceeds to use Analysts' opinions to justify its value of spectrum, we think that the comparative auction value approach should be discarded as not, at least at this stage before spectrum liberalisation has really taken place, implementable.

Consistent approach to spectrum valuation.

431 In light of these difficulties, we carry out an exercise where spectrum is valued completely on the basis of coherence and consistency.

a. When there is a market value for spectrum from an actual transaction, then that market value, possibly adjusted, should be used as the cost incurred in the Ofcom MTR decision since the market valued the spectrum in this way at the time.

b. On the other hand, we believe that if spectrum is not allocated in an auction, then there is little point giving it a market value. If, in addition, at least such an exercise as AIP has already been carried out for such spectrum, then the result of that exercise should be used for spectrum that has no market value as a best proxy. For the termination rate market review, this would mean that one would use AIP values for the 1.8 GHz spectrum, and deduce the market value of 2.1 GHz spectrum from the 2000 spectrum auction award.

The 2000 3G auction.

432 A central point in the Competition Commission's discussion was whether the 2000 UMTS spectrum auction values should be used in the mobile termination rate determination. While the discussion centres around whether "cost recovery" should be allowed in principle and if spectrum

176 Ofcom Market Review, Annex 9, Table 20.
177 Ofcom Market Review, A9.47.
178 We note that many different spectrum bands are shown in the table that have different values due to technology restrictions (e.g. 450 MHz and 2.1 GHz). We also note that "means" are used. We question the analytical value of summary table 21 in Annex 9 of the Ofcom Market Review.

values have been adjusted following the 2000 auction, we believe that a closer analysis of the auction is warranted.

433 Firstly, it is clear that any regulatory design has an impact on the value of spectrum rights. If the 3G auction in 2000 had had four licenses of 2 x 15 MHz each, or if it had been an unrestricted auction for 12 2 x 5 MHz blocks, the outcome would have been very different. Operators cannot choose the regulatory design[179]. Therefore, we believe that in the first instance, the regulatory design should be taken as given in the determination of the value of spectrum for the purposes of the termination rate.

434 Second, the price paid in an auction may not only reflect the value in a "competitive market", but it might also be a price to protect oligopolistic rents. These rents occur since spectrum is limited and therefore the number of operators in the market is determined by the regulatory authority rather than through free entry and exit.

435 Moreover, the rents exist because the number of operators in the market is limited due to fixed costs and entry barriers are high due to those costs and spectrum policies. It is questionable whether a "competitive market" value of spectrum can be found for this reason. Spectrum auctions in other countries have the same feature so the use of Ofcom of cross-country data implicitly accepts the oligopoly problem as a reality of the market.

436 It is in our view possible to address the Competition Commission's concerns by considering the design and results of the 2000 3G auction a little closer.

437 The auction was structured such that there were five separate licenses, a large A license with 2 x 15 MHz paired spectrum, a large B license also with 2 x 15 MHz of spectrum and Three licenses C, D and E with 2 x 10 MHz of spectrum each. The A license was protected for entrants. Bidding behaviour was as follows:

438 There were initially 12 bidders in the auction, four incumbents and eight potential entrants. TIW, in which Hutchison had a majority stake which was later disclosed, won the protected license after topping another bid by cable operator NTL, for £4,384,700,000. NTL subsequently left the

179 This is in our view the main obstacle to international comparisons. Regulators influence the value of spectrum yet their objectives differ, as exemplified by different coverage obligations, number of licenses on offer and so on. The achieved sales prices reflect these objectives, rather than a notion of maximum possible value.

auction after a bid of around £4bn for one of the smaller CDE licenses was topped by an incumbent. The final outcome of the auction was therefore for TIW/Three to win the protected license, for Vodafone to win the A license for close to £6bn, while BT (now O2), One2one (now T-Mobile / "Everything everywhere") and Orange (now "Everything everywhere") won licenses C, D and E respectively for around £4bn each. There was therefore a significant premium that the incumbents paid.

439 There are different interpretations of that premium. In the Competition Commission procedure, BT argues that there could have been an attempt to raise rivals' costs[180]. The Competition Commission itself appears to think that some money might have been paid by existing operators to stay in the market. Lastly, NTL appeared to have a budget constraint of around £4bn.

440 In our view this analysis is correct but can be completed. The recent T-Mobile / Orange merger is an illustration that the maximum number of companies in the market is likely to be four, or a maximum of five as the market operated between 2003 and 2010. The protected A license was a fifth license. The value of that fifth license should therefore be a relatively good forward looking estimate of the "competitive" value of 2x15 MHz of 3G spectrum, where "competitive" is used here in the sense of the maximum number of companies that the market could sustain. Due to the presence of fixed costs, this will still leave oligopoly rents for the companies. If spectrum had no intrinsic value other than oligopoly rents, then our assessment would be that with five companies, the value is as was paid by TIW/Three, while with six companies the entrants' value would have been negative.

441 We deduce from this that the price that TIW/Three paid is a reasonable estimate of the competitive value of spectrum, with competitive defined as above. Since the premium paid by Vodafone for an additional 2 x 5 MHz is 49% over the average values of the C,D and E licenses, one can therefore estimate that the competitive value of 2 x 10 MHz of spectrum at the time of the auction in 2000 is around £2.9 billion. We note that this figure is around 20% higher than the Competition Commission's estimate.

442 We believe that this figure should enter the Analysys model in the year 2000.

180 Competition Commission Determination 2009, par 2.5.6.

Administrative Incentive Pricing.

443 The AIP for 2x1 MHz at 1.8 GHz is currently set at £1.68m, leading to an annual fee of £50.4m for a 2x30 MHz license.

444 We think that this figure is appropriate for use in the Analysys model. We understand that the payments are very likely to be increased to the "full value"; they are due to be at least doubled. There appears to be sufficient regulatory certainty to also apply that full value rate from 2011.

AIP and adjusted 2000 auction price.

445 For the above reasons, we think that AIP, adjusted upwards from 2011, and the TIW/Hutchison auction price, adjusted for the lower bandwidth of 2x10 MHz, are the appropriate inputs into the LRIC+ version of the Ofcom Market Review.

446 When implementing these spectrum values in the model, we arrive at LRIC+ of 1.17p.

Current value or consistency.

447 The result of our consistency exercise shows that there is a large amount of discretion. Our exercise does not consider the "current value" of spectrum, since establishing such a value would in our view be too unreliable.

448 On the other hand, the spirit of the Ofcom Analysys model is not to consider historic values but to value all assets at current values. By carrying out a historic value exercise for spectrum, such valuation would diverge from the spirit of the Ofcom model.

449 We do not believe that this tension inherent in LRIC+ can be resolved. This leaves LRIC+ with a very high degree of discretion for Ofcom. The discretion not only extends to the finding of spectrum values, but also to the choice of current vs. historic cost methodologies.

450 The discretion present in all approaches is all the more difficult, since high and low spectrum values affect the large and small operators in different ways. High values for spectrum are not values that constitute a safeguard since they impede Three's ability to compete in the market.

Annex E. International comparisons.

451 In this section we examine the existing literature on international comparisons of termination regimes.

452 We have reviewed nine studies on international comparisons of termination regimes, five of which are based on econometric analyses. The studies are:

453 Econometric analyses:
- CEG. 2009. "Wholesale Termination Regime, Termination Charge Levels and Mobile Industry Performance";
- Dewenter, Ralf and John Kruse. 2005. "Calling Party Pays or Receiving Party Pays – The Diffusion of Mobile Telephony with Endogenous Regulation" Helmut Schmidt University Working Paper 43.2005;
- Genakos, Christos and Tommaso Valletti. 2009. "Testing the "Waterbed" Effect in Mobile Telephony" CEPR Discussion Papers 7611;
- Jang, Show-Ling, Shau-Chi Dai and Simona Sung. 2005. "The Pattern and Externality Effect of Diffusion of Mobile Telecommunications: The Case of the OECD and Taiwan" Information Economics and Policy, 17, pp.133-148;
- Littlechild, Stephen. 2006. "Mobile Termination Charges: Calling Party Pays versus Receiving Party Pays" Telecommunications Policy, 30(5-6), pp.242-277;

454 Qualitative analyses and case studies:
- Analysys Mason. 2008. "Case Studies of Mobile Termination Regimes in Canada, Hong Kong, Singapore and the USA: Report by Analysys Mason for Ofcom";
- Frontier Economics. 2008. "Assessing the Impact of Lowering Mobile Termination Rates: A Report Prepared for Deutsche Telekom, Orange, Telecom Italia, Telefonica and Vodafone";
- Ofcom. 2009. "Review of Mobile Tariffs in the UK and US" Annex 9 in "Wholesale Mobile Voice Termination: Preliminary Consultation on Future Regulation"; and
- Zehle, Stefan. 2003. "CPP Benchmark Report"[181].

455 In general, we note that the conclusions of the international comparisons literature should be applied to the UK market with careful consideration

181 Available at http://www.coleago.co.uk/uploads///Downloads/CPP%20Benchmark%20Report%20SZ%20Jun%2003.pdf.

of the context, for two reasons. Firstly, many of the studies in the literature examine the impact of receiving party pays (RPP) or bill and keep (B&K) regimes on market outcomes compared to calling party pays (CPP) or calling party network pays (CPNP) regimes. The termination regime proposed by Ofcom is not a B&K regime, and it is not the case that the lower termination rates proposed would automatically lead to RPP tariffs.

456 Secondly, many of the studies in the literature examine mobile telephony markets that are not comparable to the current UK market in terms of market maturity, range of services offered, or the general national characteristics such as population density or income. It is therefore possible that some of the conclusions from these studies would not translate directly to the UK market.

457 These caveats notwithstanding, the conclusions from the literature support Ofcom's view that a reduction in termination rates would not lead to adverse distributional impacts.

- The findings on the impact of lower termination rates on take-up are inconclusive. Moreover, endogeneity of regulatory decisions may mean that simple econometric analyses tend to find spurious correlations between termination regimes and take-up.
- There is no evidence to suggest that low-usage subscribers in particular would be adversely affected. In fact, some studies suggest that low-usage customers are less likely to be negatively affected than higher-usage customers.

458 Some respondents to the original consultation argued, based on qualitative comparisons, that customers would be adversely affected by lower termination rates. For example, Vodafone submitted a report prepared by Frontier Economics which took the US as a benchmark. The US was chosen over other possible comparators such as Hong Kong, Singapore and Canada based on GDP per capita and total population measures.

459 The authors of the Vodafone report have argued that despite the higher usage in the US mobile telephony market compared to the EU markets, customers are not better off. This is because:

- Penetration rate in the US is lower than most EU countries;
- Signal coverage is lower in the US than in most EU countries, even after taking into account water and desert areas; and
- US customers pay higher monthly fees compared to EU customers.

460 To illustrate the last point, the authors calculate the total expenditure under EU and US mobile tariffs based on OECD telecommunications consumption baskets. The results indicate that only high-demand users find the US tariffs to be better value than EU tariffs. Low-demand users find the US tariffs slightly more expensive, while medium-demand users find the US tariffs to be significantly more expensive compared to EU tariffs.

461 We note that the comparison carried out by Frontier Economics suffers from the two caveats that were set out above. Namely:

- It takes the current US market, which is characterised by a B&K termination regime and RPP retail tariffs, to be a benchmark, despite the fact that the termination regime proposed by Ofcom is not a B&K regime and in no way implies a move towards an RPP regime; and
- It ignores any other possible differences between the UK market and the US market, such as the competitive conditions in the UK telephony market, the sunk investment into the mobile telephony infrastructure, or the fact that the UK mobile telephony penetration rate is already at saturation levels.

462 In addition, the justification for taking the US to be the most suitable benchmark is not robust, consisting of a simple comparison of GDP per capita and total population only. This is a crucial issue because a number of the other potential benchmark countries, such as Hong Kong or Singapore, have higher penetration rates that European averages despite operating B&K regimes. A qualitative comparison based on Hong Kong or Singapore would most likely have given very different conclusions compared to the US.

Summary of conclusions from existing studies.

Lower termination rates lead to higher usage.

463 International comparisons studies generally show that lower termination rates and/or RPP regimes result in higher minutes of use (MoU) compared to higher termination rates and/or CPP regimes. This conclusion was supported by Littlechild (2006) and Analysys Mason (2008).

464 This is consistent with the evidence on tariff structures that arise under different MTR regimes. In general, lower termination regimes or B&K

regimes result in tariffs with higher inclusive minutes, including unlimited tariffs. This was confirmed by Frontier Economics (2008) and Ofcom (2009).

465 One study that goes against this conclusion is CEG (2009). Using a debiased dataset provided by Ofcom, CEG finds that the relationship between MTR and MoU is not significant.

Lower termination rates lead to lower RPM, but possible waterbed effects.

466 Littlechild (2006) and Analysys Mason (2008) conclude that lower termination rates lead to lower revenue per minute (RPM), which would be partly due to the higher MoU found by these same studies.

467 This was again at odds with the findings of CEG (2009). Using Ofcom's debiased dataset, CEG found no significant relationship between MTR and RPM.

468 Genakos and Valletti (2009) conclude that lower termination rates reduce operators' wholesale revenues and result in higher retail prices through the 'waterbed effect'.

Evidence on penetration and termination rates is inconclusive.

469 CEG (2009), Jang, Dai and Sung (2005) and Zehle (2003) conclude that higher MTRs and/or CPP regimes increase take-up.

470 Littlechild (2006) finds no significant relationship between penetration rates and MTR regimes. Analysys Mason (2008) also notes that some B&K countries have penetration rates that are higher than the UK.

471 Dewenter and Kruse (2005) show that while a simple regression may find a relationship between take-up and MTRs, taking into account possible endogeneity in regulation may render this relationship insignificant. This is potentially a problem that also affects other studies.

472 The literature is therefore inconclusive with regards to the relationship between termination rates and penetration. This is somewhat supportive of Ofcom's position that the proposed regime would not have a significant negative effect on penetration.

Low-usage and pre-pay customers would not be excluded.

473 In examining the impact of 'waterbed effect' for different customer groups, Genakos and Valletti (2009) conclude that the waterbed effect does not impact pre-pay customers in their sample. Instead, any increase in retail prices resulting from lower termination rates impact post-pay customers only. This supports Ofcom's position that the proposed regime would not result in the exclusion of pre-pay customers from the market.

Robustness and relevance of existing studies.

Termination regimes and payment structures.

474 Many of the international comparisons look at the impact of calling party pays (CPP), which refers to the payment structure faced by the customer, rather than calling party network pays (CPNP), which refers to the termination rate regime. Conversely, they tend to consider receiving party pays (RPP), which refers to the tariff structure, rather than bill and keep (B&K), the termination rate regime.

475 In practice, most countries with B&K regimes tend to be characterised by RPP tariffs. There are, however, some examples of operators who are now operating CPP tariffs in B&K regimes. Examples of such operators in North America and Asia are given in Littlechild (2006)[182].

476 It is also important to note that the LRIC regime proposed by Ofcom does not amount to a B&K regime, even though it would result in lower termination rates compared to today. Three in particular has argued that the LRIC regime would not result in the introduction of RPP tariffs in the UK[183].

477 Conclusions from the literature therefore must be applied to Ofcom's proposals with care, especially if they are based on a comparison of CPP and RPP rather than CPNP and B&K.

182 Littlechild (2006), Section 4.6-4.7.
183 See Three's response to Ofcom's preliminary consultation on wholesale mobile voice call termination, Section 4.3.3.

Comparability of sample countries and time periods to the UK market.

478 In some cases, the sample of countries and time periods considered in the studies may not be suitable for direct comparison to the UK. For example, the analysis carried out by Jang, Dai and Sung (2005) is specifically designed to look at the impact of CPP on take-up during the early stages of mobile telephony development. In comparison, the UK already has a saturated mobile voice market with little scope for increased take-up.

479 Similarly, Zehle (2003) examines the effect of CPP on countries with lower penetration rates and lower income levels than the UK. The conclusion that consumers would be discouraged from owning phones under RPP due to the possibility of unwanted calls, for example, may not be directly relevant to the UK market.

Role of mobile data services.

480 One particularly important distinction between the mobile telephony markets examined in the comparisons literature and the contemporary UK market is the importance of data services in the UK mobile market. Due to the fact that increased importance of data services in mobile telephony is a recent development, comparisons based on historical data cannot adequately take into account the effect of data services on the effect of termination regimes. This issue will be discussed further in Annex G.

Data and methodological concerns.

481 Dewenter and Kruse (2005) showed that the endogeneity of regulation may be a significant problem in determining the impact of termination regimes on market outcomes. This problem was also noted as a caveat by CEG (2009) and Genakos and Valletti (2009)[184].

184 See CEG (2009) p.5 and Genakos and Valletti (2009) Section 3.1.

Quantitative comparisons.

CEG (2009)[185]

482 CEG carries out econometric analyses of the effects of MTR regimes on take-up, usage, RPM and price indices. The analyses use panel data estimations of the following form:

$$\ln y_{it} = \alpha + \beta \bullet CPNP_{it} + \gamma \bullet MTR_{it} + \lambda \bullet X_{it} + \varepsilon_{it}$$

$$\ln y_{it} = \alpha + \beta \bullet CPNP_{it} + \gamma \bullet \ln MTR_{it} + \lambda \bullet \ln X_{it} + \varepsilon_{it}$$

Where:

y = dependent variables
CPNP = dummy variable taking value 1 if the country has a CPNP regime
X = vector of explanatory variables including GDP per capita, population density, fixed telephony penetration rate and time an region dummy variables
i = countries
t = year

483 The above equations were estimated using dependent variables from Three sources. Usage and RPM data were collected from the Merrill Lynch Interactive Global Wireless Matrix, with modifications by Ofcom in order to account for biases in the data[186]. Price indices based on several representative usage profiles were provided by Teligen. Finally, data on take-up from ITU WTI were also used.

484 The panel data included 39 countries, all of which were members of OECD or EU. The data covered annual data between 2002 and 2007.

485 CEG finds that countries with higher MTR and CPNP regimes tended to have higher take-up, measured in terms of SIM cards per capita. This effect is significant and consistent across specifications. CPNP regimes also tend to result in lower usage, but this effect is not robust with respect to model specifications, especially when time and country effects are taken into account.

486 CEG also finds that the debiased RPM measure provided by Ofcom has a significant effect on the conclusions of the model with respect to prices. While running the estimation with the original Merrill Lynch data

185 CEG. 2009. "Wholesale Termination Regime, Termination Charge Levels and Mobile Industry Performance: A study undertaken for Ofcom".
186 Merrill Lynch data double-counts on-net mobile-to-mobile minutes in RPP countries. CEG notes that other empirical studies based on the Merrill Lynch data do not take this bias into account.

suggests that higher MTR leads to higher RPM, the effect is no longer robust if the debiased measure is used. The effect of the type of MTR regime on RPM is also not significant.

Dewenter and Kruse (2005)[187]

487 Dewenter and Kruse examine the impact of choice of MTR regimes on diffusion of mobile telephony[188]. They note that many of the existing studies on the impact of MTR regimes have ignored the possible endogeneity of regulation. The authors use the following equation to analyse the impact of MTR regimes, using political and institutional variables as instruments for the CPNP variable:

$$y_{it} = \alpha + \beta \bullet CPNP_{it} + \lambda \bullet X_{it} + \varepsilon_{it}$$

Where:

y = a measure of average growth rate of mobile telephony
CPNP = dummy variable taking value 1 if the country operates a CPNP regime at time t
X = vector of explanatory variables including availability of prepaid contracts, competition in the mobile telephony sector, GDP per capita, population, population density and number of fixed telephony lines per capita
i = countries
t = year

488 The panel data covers a worldwide sample of 84 countries, including 39 countries that operated CPNP throughout the period observed, 14 countries that operated B&K throughout, and 31 countries that switched from a B&K regime to a CPNP regime. The panel data is unbalanced and contains annual data from the period 1980 to 2003.

489 The authors find that while running a simple ordinary least squares estimation of the equation shown above (i.e. not taking into account endogenous regulation) suggests a significant positive effect of CPNP on diffusion. However, running a two-stage least squares with instruments for the CPNP variable (i.e. taking into account endogenous regulation) results in the CPNP variable being no longer significant.

490 The authors conclude that CPNP has no effect on diffusion of mobile telephony:

187 Dewenter, Ralf and Jorn Kruse. 2005. "Calling Party Pays or Receiving Party Pays – The Diffusion of Mobile Telephony with Endogenous Regulation" Helmut Schmidt University Working Paper 43/2005.

188 The paper makes no distinction between payment regimes (CPP/RPP) and MTR regimes (CPNP/B&K). Since the context of the paper makes it clear that the authors are referring to the termination regime imposed by the regulator, the terms CPNP and B&K will be used here for clarity.

> "Taking into account the possible endogeneity of regulatory interventions we find in contrast to other studies that CPP has no statistically significant impact on subscriber penetration. […] We therefore expect that a switch from CPP to RPP would not reduce penetration rates, independently whether a country's penetration process has just started or has nearly reached saturation levels."[189]

Genakos and Valletti (2009)[190]

491 Genakos and Valletti look specifically at the evidence for the 'waterbed effect'. The theory behind the waterbed effect suggests that as fixed-to-mobile termination rates are reduced, mobile network operators would make up for the reduced revenue from termination rates by increasing the retail prices of mobile telephony services. In order to test this theory, Genakos and Valletti run the following estimations, using the existence of MTR regulation as instruments for MTR:

$$\ln(Price)_{uict} = \alpha_{uic} + \alpha_t + \beta \bullet \ln(MTR)_{ict} + \varepsilon_{uict}$$

$$\ln(EBITDA)_{uict} = \alpha_{uic} + \alpha_t + \beta \bullet \ln(MTR)_{ict} + \varepsilon_{uict}$$

Where:

Price	= retail mobile telephony prices for each MNO
EBITDA	= earnings before interest, tax, depreciation and amortisation (EBITDA) for each MNO
u	= usage profile
i	= MNO
c	= country
t	= quarter

492 The dataset contains data on mobile network operators in a worldwide sample of 24 countries, collected from several sources including Cullen International, Merrill Lynch and Teligen. The panel data covers the period Q1 2000 – Q1 2006 on a quarterly basis.

493 The authors find that MTRs have a significant negative relationship with retail prices, suggesting that the waterbed effect does exist. However, they also find that MTRs have a positive relationship with profits, measured here as earnings before interest, taxes, depreciation and amortisation (EBITDA). In other words, retail prices rise in response to falling MTRs, but not enough to completely offset the negative effect of falling MTRs on profit margins. The authors therefore conclude that the waterbed effect is strong, but not full.

189 Dewenter and Kruse (2005) p.16. See footnote Error! Bookmark not defined. regarding the use of terms CPP and RPP.
190 Genakos, Christos and Tommaso Valletti. 2009. "Testing the 'Waterbed' Effect in Mobile Telephony" CEPR Discussion Papers 7611.

494 The authors also consider the relationship between pre-pay and post-pay customers and the waterbed effect. They find that pre-pay customers are not affected by the waterbed effect, and that the retail price increases resulting from falling MTRs tend to affect only post-pay customers. This effect is at odds with a frequently-cited claim that lower MTRs would harm low-users and pre-pay customers.

Jang, Dai and Sung (2005)[191]

495 Jang, Dai and Sung examine the determinants of the diffusion rate of mobile telephony, including the type of payment regime used in the country. They use an ordinary least squares estimation of the following form:

$$y_{it} = \alpha_{it} + \beta \bullet CPP_{it} + \lambda \bullet X_{it} + \varepsilon_{1t}$$

Where:

y = a measure of mobile telephony diffusion
CPP = dummy variable taking value 1 if the country operates a CPP regime
X = vector of explanatory variables including population density, GDP per capita, new entrant MNOs, digital technology and fixed telephony penetration rate
i = countries
t = year

496 The data used in the analysis is taken from ITU, OECD and the Taiwanese Directorate-General of Telecommunications, and contains information on 29 OECD countries and Taiwan. The data is in annual format and covers the period 1990 to 2000.

497 The authors find that a CPP regime has a large and significant positive impact on diffusion rates. The magnitude of the effect of a CPP regime on diffusion rates is larger than any other single factor examined by the authors, including competition, new entrants or availability of digital technology.

498 It must be noted, however, that this study explicitly examines the period when mobile telephony is a growing technology, with diffusion rates characterised by an S-curve. The study also considers the effect of CPP only on diffusion rates, and makes no inferences about the effect of MTR regimes on diffusion.

191 Jang, Show-Ling, Shau-Chi Dai and Simona Sung. 2005. "The Pattern and Externality Effect of Diffusion of Mobile Telecommunications: The Case of the OECD and Taiwan" Information Economics and Policy, 17, pp.133-148.

Littlechild (2006)[192]

499 Littlechild gives an overview of the issues in MTR regulation, including a cross-sectional regression analysis of the effects of payment regimes. He carries out a regression analysis of the following form:

$$y_i = \alpha_i + \beta \bullet RPP_i + \lambda \bullet X_{it} + \varepsilon_1$$

Where:

y = RPM, MoU, penetration

RPP = dummy variable taking value 1 if the country operates a RPP regime

X = vector of explanatory variables including GDP per capita, fixed telephony penetration, proportion of subscribers on GSM, number of MNOs, market share of top two MNOs, proportion of prepaid customers and mobile number portability

i = countries

500 The analysis is based on data from a worldwide sample of 44 countries, taken from the Merrill Lynch database. The cross-sectional data was from the year 2004.

501 Littlechild finds a positive relationship between RPP and usage. The average MoU in RPP countries are shown to be around 140 minutes per month higher than CPP countries, after accounting for other factors. This relationship is significant at 1% significance level.

502 There is a negative relationship between RPP and RPM. The average RPM in RPP countries is 12 cents per minute lower than CPP countries. This relationship is also significant at 1% significance level.

503 Littlechild finds no significant relationship between payment regimes and penetration rates.

Qualitative comparisons and case studies.

Analysys Mason (2008)[193]

504 The report from Analysys Mason presents four case studies of countries with RPP regimes: Canada, Hong Kong, Singapore and the US. Of

192 Littlechild, Stephen. 2006. "Mobile Termination Charges: Calling Party Pays versus Receiving Party Pays" Telecommunications Policy, 30(5-6), pp.242-277.

193 Analysys Mason. 2008. "Case Studies of Mobile Termination Regimes in Canada, Hong Kong, Singapore and the USA: Report by Analysys Mason for Ofcom".

these, Canada and Singapore operates a B&K regime, while Hong Kong operates a Mobile Party Network Pays (MPNP) regime.

505 Comparing these four countries to the UK reveals that all of the four RPP countries have higher MoU than the UK. While the UK has average monthly MoU of 190 minutes, the lowest of the four countries, Singapore, has an average monthly MoU of 348 minutes. The US has the highest average MoU at 766 minutes per month.

506 When measured in terms of RPM, all four RPP countries have lower prices than the UK. While the average RPM is 0.108 GBP in the UK, the equivalent figures for the RPP countries range from 0.074 GBP for Canada to 0.027 GBP for Hong Kong.

507 When measured in terms of monthly ARPU, on the other hand, UK has lower prices at 30 GBP, compared to 35 GBP for the US and 40 GBP for Canada. Hong Kong (14 GBP) and Singapore (24 GBP) still have lower prices than UK by this measure.

508 The evidence on the effect of RPP on penetration is mixed. Canada (61%) and the US (82%) have lower SIM card penetration rates compared to the UK (121%). Hong Kong (126%) and Singapore (123%), on the other hand, have slightly higher penetration rates than the UK.

Frontier Economics (2008)[194]

509 Frontier Economics gives an overview of the effects of lowering MTRs, including a detailed comparative analysis of mobile telephony in the EU and the US, which is used as a comparator country representing lower termination rates. While there are other countries with RPP and B&K regimes such as Hong Kong and Singapore, the authors argue that US is a more suitable comparator due to income and demographic factors.

510 The US has a comparatively low SIM penetration rate of 84%, compared to European average of 119%. The percentage of households with at least one mobile phone in the US is 75%, lower than EU average of 83% and lower than all EU member states with the exception of Romania and Bulgaria.

194 Frontier Economics. 2008. "Assessing the Impact of Lowering Mobile Termination Rates: A Report Prepared for Deutsche Telekom, Orange, Telecom Italia, Telefonica, and Vodafone".

511 While MoU is higher and RPM lower in the US compared to the EU, this cannot be taken to be evidence of higher consumer welfare since ARPU is also higher in the US. The authors show that according to consumption baskets used by OECD, the majority of European customers would end up paying more under US tariffs than EU tariffs. They therefore conclude that moving to a low-MTR regime would not necessarily benefit consumers.

Ofcom (2009)[195]

512 As part of the preliminary consultation on wholesale mobile voice call termination, Ofcom undertook a review of mobile tariffs in the UK and the US. The review included all standard retail, any-network, any-time tariffs offered by all of the major MNOs in each country on a 18-month contract.

513 In general, the mobile tariffs in the US are characterised by larger inclusive minutes, including unlimited on-net and off-peak calls that are offered with the majority of tariffs. While inclusive minutes in the UK have also been rising, they are still typically lower than the US tariffs.

514 The fixed monthly tariffs in the US tend to be larger compared to the UK. Consumers in the UK have the option of choosing contracts with low inclusive minutes and low fixed monthly tariffs, which is not available in the US.

515 Pre-pay tariffs are much more popular in the UK than the US. Unlike in the UK, US MNOs such as AT&T, Verizon and T-Mobile offer pre-pay tariffs with daily access charges.

Zehle (2003)[196]

516 Zehle presents several case studies of countries that made the transition from a RPP regime to a CPP regime, focussing in particular on the experience from Pakistan and Mexico. Other countries that have made the switch from RPP to CPP include Chile, Argentina, Uruguay, Trinidad & Tobago, Peru, El Salvador and Guatemala.

195 Ofcom. 2009. "Review of Mobile Tariffs in the UK and US" Annex 9 in "Wholesale Mobile Voice Termination: Preliminary Consultation on Future Regulation".
196 Zehle, Stefan. 2003. "CPP Benchmark Report" (http://www.coleago.co.uk/uploads///Downloads/CPP%20Benchmark%20Report%20SZ%20Jun%2003.pdf).

517 In all of the countries surveyed, introduction of CPP led to increased take-up. While the effect is in some cases difficult to distinguish from the levels of growth that would have occurred without CPP, sources such as MNO financial statements support the view that CPP contributed to increased take-up.

518 There is evidence to suggest that CPP also reduces detrimental customer behaviour such as users switching their phones off or switching their numbers inefficiently often.

Annex F. The cost of capital.

519 Ofcom finds a significantly reduced weighted average cost of capital (WACC) in its 2010 consultation compared to the 2007 consultation[197]. The average pre-tax real cost of capital is reduced from 11.5% to 7.6%. To a significant extent, the fall is due to a reduction in beta from a range of 1.0-1.6 in 2007 to 0.7-1.0 in 2010.

520 Ofcom has commissioned the Brattle group to estimate an efficient mobile operator's beta. The Brattle group states that further work would need to be carried out before its beta estimates "could be a reliable guide to the future period of interest to Ofcom"[198]. Our analysis strongly supports Ofcom's cost of capital estimate.

521 In this chapter, we provide such support in three ways:

a. We consider other regulatory decisions regarding betas;

b. We consider the reason for the decline in beta through a decomposition of the FTSE All Share index; and

c. We draw on Ofcom's findings in its Communications Market Report regarding the nature of consumption of telecommunications services.

522 We find that other regulators' beta estimates for their industries are similar or below Ofcom's own estimates. We also find that the lowering of the beta coincides with an increase in beta and an increase in volatility of the financial and raw material components of the FTSE All Share index. Given the existence of support measures for financial companies that are likely to be temporal but can be predicted to extend over the regulatory period, as well as high uncertainty over raw material usage and prices we believe that high betas for these sectors are likely to remain. That development in turn is likely to imply that mobile betas will stay low over the same period. Lastly, Ofcom itself finds that communications spending has turned into one of the least discretionary items of household consumption. That stable spending pattern is likely to be reflected in steadier operator profitability and therefore a lower beta.

Ofcom revision of the average cost of capital.

523 The following table presents the individual items that have led to Ofcom's change.

197 The cost of capital is discussed in Ofcom Market Review A8.100 to A8.131 and in the Brattle report commissioned by Ofcom, Estimate of Equity Beta for UK Mobile Owners, December 2009.
198 Brattle report, page 1.

Table 8: Pre-tax real weighted average cost of capital[199]

WACC component	March 07	March 10
Real risk-free rate	2.2%	2.0%
Inflation assumption	2.8%	2.5%
Equity risk premium	4.5%	5%
Equity beta	1.0-1.6	0.7-1.0
Gearing	10%	25%-35%
Cost of equity (post tax nominal)	9.5%-12.2%	8.0-0.5%
Debt premium	1-2%	1-2%
Corporate tax rate	30%	28%
Cost of debt (post tax nominal)	4.2-4.9%	4.0-4.7%
WACC (pre-tax real)	9.7-13.2%	6.5-8.8%
Average pre-tax real	11.5%	7.6%
Asset beta*	0.90-1.44	0.46-0.75

Notes: *LECG calculations. Asset beta assuming debt beta of zero.
Source: Ofcom Market Review, Annex Table 15

524 As can be seen from the table, the cost of capital is largely due to the change in the equity beta and the increase in assumed gearing levels.

525 In the 2007 decision the gearing level was 10% "for an efficient UK mobile operator"[200]. Higher gearing reduces the weighted average cost of capital as long as debt levels are cheaper than equity and do not increase the equity beta by the same amount. The difficulty with estimating a level of gearing that should enter the estimate of an efficient operator's WACC stems from the fact that all UK mobile operators have significant other businesses which influence their optimal gearing levels. In particular, France Telecom, Deutsche Telekom and Telefonica are large fixed operators and incumbents in large home markets. Both factors contribute to an expectation of more stable cash flows than one might expect from a UK mobile operator. Also Vodafone has very large mobile operators in many countries world-wide. Three is owned

199 The table reproduces table 15 of the Ofcom Market Review Annexes.
200 Ofcom Market Review, A8.124.

by a conglomerate that is active in a wide range of other businesses. Therefore, simply taking existing debt is unlikely to be an accurate reflection of the optimal level of gearing. Brattle notes that Vodafone has increased its leverage from 20% to 35% between 2004 and 2009[201]. It appears to us that Ofcom has used these figures as lower and upper gearing estimates for the new WACC estimate. This appears to us to be a reasonable approach.

"Beta" estimates.

526 In the remainder of this section, we discuss the reduction of the beta estimate from 1.0 – 1.6 to 0.7 – 1.0. As the Brattle report states, further work would need to be carried out before the beta estimates of the Brattle group "could be a reliable guide to the future period of interest to Ofcom"[202]. Ofcom indeed uses the Brattle group estimates as a basis for its own determination. The Brattle group beta estimates range from 0.46 to 0.79 against the FTSE All-World index (Telefonica, Deutsche Telekom and France Telecom are not members of the FTSE All Share index). Ofcom instead wishes to have a beta as measured against the FTSE All Share index. It therefore places particular emphasis on the Vodafone beta against that share index with a value of 0.84 and decides to lower the beta range from 1.0-1.6 to 0.7-1.0[203].

527 We present two pieces of analysis that support Ofcom's choice of beta. On the one hand, we present data from recent decisions of other UK regulators. On the other hand, we give a closer examination of the underlying factors that have led Telecoms betas to fall over the past years.

UK Regulatory Decisions.

528 In Table 9 below, we have summarised recent UK regulators' decisions on cost of capital issues[204].

201 Brattle report, page 10.
202 Brattle report, page 1.
203 Ofcom Market Review, A8.113-A8.118.
204 We note that a further helpful reference is PwC's report for OFGEM entitled "Advice on the cost of capital analysis for DPCR5" of 1 December 2009. On pages 32-33, the report summarises 15 regulatory decisions of UK regulators since 2000 regarding equity betas.

Table 9: UK regulators decisions into Cost of Capital

	Date	WACC (pre tax vanilla)	Cost of equity (post tax)	Equity beta	Gearing
Ofwat[205]	Nov 2009	5.1%	7.1%	0.90	57.5%
Ofwat[206]	Dec 2004	5.1%[207]	7.7%	1.0	55%
Ofgem[208]	Dec 2009	4.7%	6.7%	<1[209]	65%
CAA[210]	Feb 2010	7.6%	8.8%[211]	1.35	60%
CAA[212]	Mar 2009	7.1%[213]	5-8.2%	1.0-1.2	50%
CAA[214]	Mar 2008	6.2%,6.5%[215]	10.2%,10.9%	0.9-1.2,1.0-1.3	60%
Ofgem[216]	Dec 2007	4.94%	7.25%	1.0	62.5%
Postcomm[217]	Dec 2005	8%[218]	7.63-10.27%	0.81-0.94	20%

Notes: *LECG calculations. Asset beta assuming debt beta of zero.

529 We note that the companies under review by these regulators, i.e. electricity transmission, gas distribution and BAA, have higher gearing than Vodafone. In order to compare the equity betas, gearing levels must be taken into account. This can be done by finding an "asset" beta, i.e. assuming that all financing is by shares. A rough estimate for an asset beta can be given by multiplying the equity beta by (1-gearing).[219]

530 As Table 9 illustrates, optimal gearing for gas and electricity distribution networks as illustrated by UK regulatory decisions is around 60%. With such gearing levels, equity betas of 1 would translate into asset betas of around 0.4. In contrast, with gearing of 35% as in the case of Vodafone,

205 Source: Future water and sewerage charges 2010-15: final determinations p128.
206 Source: Future water and sewerage charges 2005-10, p219, 222.
207 Stated as 'gross of tax shield'. This may refer to the vanilla or the pre-tax WACC.
208 Source: Electricity Distribution Price Control Review Final Proposals, (DPCR5) p49.
209 The asset beta is considered to be between 0.24 and 0.34, (p52). In PwC's report, upon which Ofgem rely, the equity beta is considered to fall in the range 0.7-1.1. See Office of Gas and Electricity Advice on the cost of capital analysis for DPCR5,1 December 2009, p3.
210 Source: NATS (En Route) plc price control review for control period 3, p153-6. These figures were due to be finalised in May 2010. The CAA is the regulatory body of BAA.
211 Calculated using figures in the report, with rf=1.75 and ERP=5.2%.
212 Source: Economic Regulation of Stansted Airport 2009-2014 CAA Decision, March 2009, p31,63,66. CAA decided to use the figures calculated by the CC. See Appendix L of Competition Commission report: Stansted Airport Ltd – Q5 price control review – presented to the CAA 23 October 2008 for their full calculations.
213 Point estimate of pre-tax, real WACC.
214 Economic Regulation of Heathrow and Gatwick Airports 2008 -2013, p121-134. Figures relate to Heathrow and Gatwick respectively.
215 Point estimate of pre-tax, real WACC.
216 Gas Distribution Price Control Review December 2007 Final Proposals, p102-106.
217 Royal Mail Price and Service Quality Review, p240-241.
218 Pre-tax, real WACC.
219 This assumes that the debt is risk free, which of course is not correct. However, since the debt beta would be expected to be close to zero, this assumption does not make a big impact on our analysis.

an asset beta would be around 0.55, implicating a higher individual risk with respect to the market movement for Vodafone than for gas and electricity distribution companies. Regarding BAA, it is well publicised that the takeover of BAA by Spanish company Ferrovial has been highly leveraged. As can be seen from the table, Current estimates of leverage by BAA are again around 60%. An implied asset beta would therefore be around 0.55, similar to Vodafone's. On the basis of these comparators, it cannot be said that Ofcom's estimate of beta is overly conservative.

Close evaluation of the change in beta over time.

531 While we believe that the statistical methods used by Brattle follow best practice in the field, there is a question whether low betas will persist over the regulatory period until 2014/15.

532 In order to give some qualitative assessment to that question, we consider the composition of Ofcom's favoured choice of index, i.e. the FTSE All Share index.

533 Beta is defined as the covariance of the individual share with the market divided by the variance of the market. It is therefore the case that even if mobile operators' own variance does not change, its covariance with the market can be affected by changes in the variance of the market which are caused by other constituents of the index.

534 Table 10 lists the industries of the FTSE All Share Index with the number of constituents and their weight as of May 2010.

Table 10: FTSE All Share constituent groups

ICB Code	ICB Industry	No of constituents	FTSE All-Share Index weight (%)
0001	Oil & Gas	25	17.99
1000	Basic Materials	28	12.67
2000	Industrials	120	7.14
3000	Consumer Goods	35	11.29
4000	Health Care	21	7.45
5000	Consumer Services	93	9.88
6000	Telecommunications	9	5.76
7000	Utilities	9	3.33
8000	Financials	256	22.93
9000	Technology	32	1.56
	Total	**628**	**100**

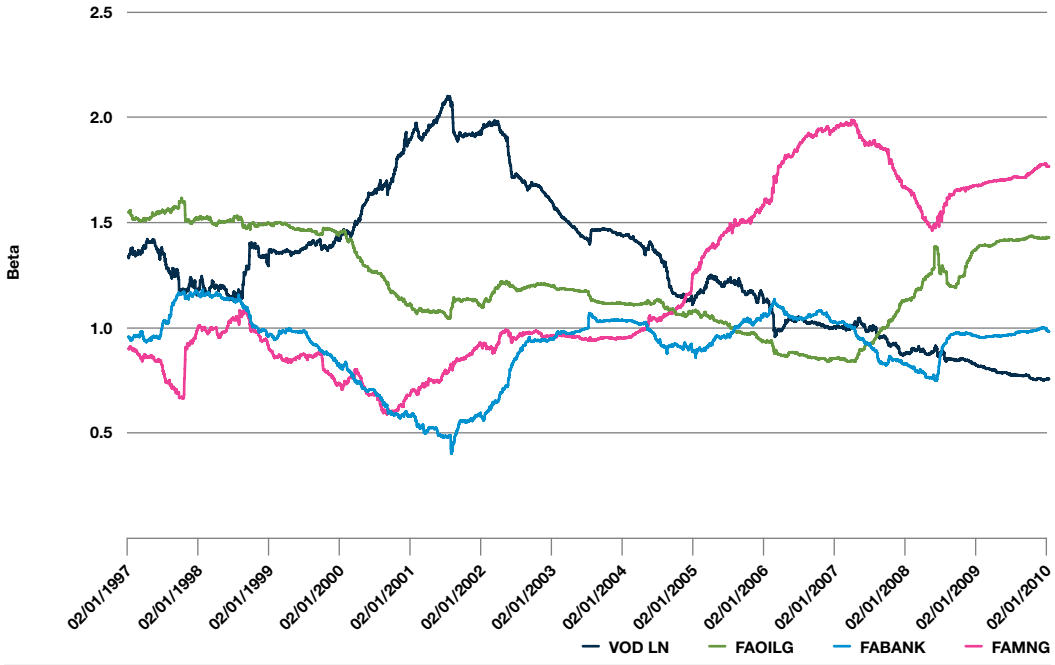
Source: Bloomberg

535 We find that the largest shares are by Financials, followed by Oil and Gas and Basic Materials (mainly mining related activities). These three industries alone make up more than 50% of the FTSE All Share Index.

536 In Figure 41, we compute 2 year rolling one day betas[220] for Vodafone and the three largest industry components of the FTSE All Share Index from 1997 to 2010. We note that an industry beta is always likely to be closer to 1 than an individual company beta, so that the indices cannot be compared directly.

220 This corresponds to the Brattle methodology.

Figure 41: Movement in 2 year betas of sub-indices and Vodafone equities against the FTSE All Share Index.



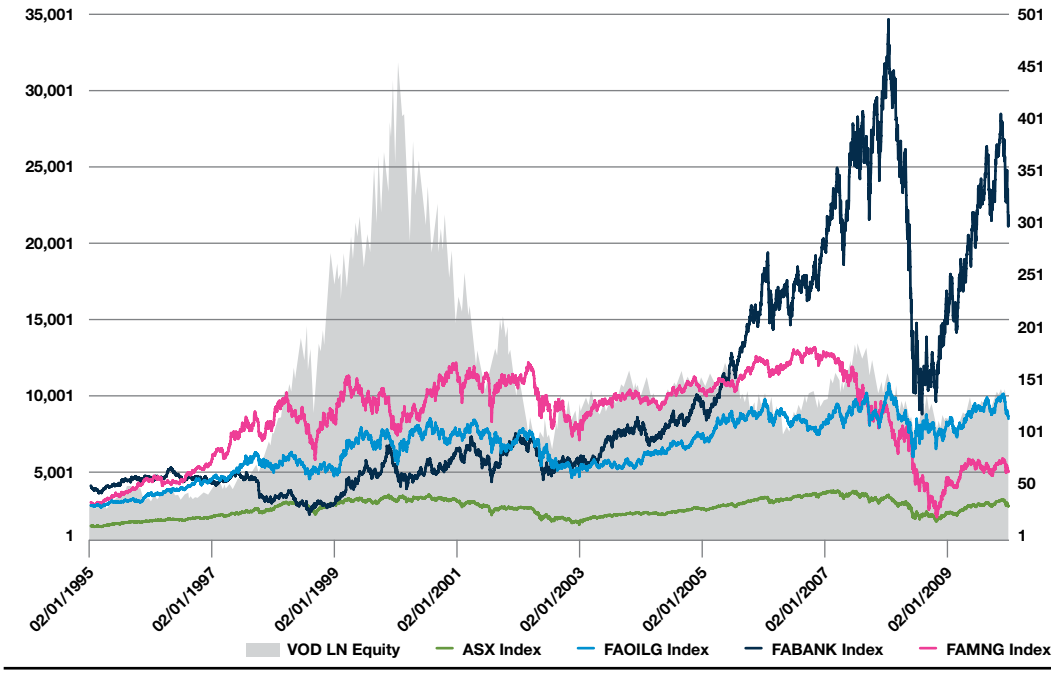
Source: Bloomberg

537 We first note that a longer time series than the one used by the Brattle group in their report is useful to put the Vodafone beta into perspective. It is not the case as Fig. 1 of the Brattle group would suggest that Vodafone's beta has been falling steadily over a relevant time frame. The fall is due to the choice of a start date of November 2001 when Vodafone's beta was very high. In actual fact, before 2000 Vodafone's beta was below 1.5.

538 Secondly, we believe it is helpful to consider the graph together with Figure 42 showing the development of equity prices of Vodafone and the chosen sub-indices. We can observe two periods, the "dotcom bubble" and the "asset bubble and financial crisis". In the dotcom bubble, Vodafone's share price rose to unprecedented levels between around 1997 and the end of 2000, before collapsing back to long-term levels at around 2002/3. During that period, Vodafone's beta shot up to over 2 reflecting the fact that other industry groups did not participate in that boom. Notably, we see that oil shares are very stable during the period but oil companies' beta has an almost inverse movement to Vodafone's. We note that the whole episode can be said to extend over about 5 to 6 years.

539 The current financial bubble and crisis features very volatile equity price movements by financial and raw material companies. This translates into very high beta values for both sectors.

Figure 42: Movement in index prices and the movement in Vodafone equity prices.



Notes: VOD prices do not reflect distributions over the period.
Source: Bloomberg

540 The volatility of the financial sector is likely to continue over the regulatory period. Currently, banks are supported by an array of unusual support, such as bail-outs, central banks accepting lower quality collateral, low central bank lending rates, quantitative easing and so on. Since many of these conditions are, in the end, of a political nature, the timing of withdrawal of support and the regulatory conditions for financial services in the future is uncertain, which very likely leads to sustained volatility in financial stocks. In addition, the uncertainty over countries' ability to repay government debt (and also possible inability to bail out banks should it be required again) all imply that financial sector volatility is likely to remain high.

541 It appears that raw materials have also become highly volatile, which often is a sign of tight supply. There have been reports of much increased financial sector activity in raw materials, such as for example the move away from long-term contracts in the steel sector. Again for

these reasons higher volatility also remains likely, in particular when considering the currently still very high level of raw material producers' equity prices as shown in the graph above.

542 In contrast, we would like to highlight the Ofcom forecasts for the efficient operator in the model. These can be found in appendix A of the decision, Figure 5 (mobile subscriber penetration), Figure 8 (minutes of use per subscriber), Figure 9 (outgoing messages per subscriber), Figure 10 (2G handset data usage per subscriber), Figure 11 (3G handset data usage per subscriber), Figure 12 (datacard take-up) and Figure 13 (3G data usage per datacard). All of these show relatively moderate increases, in the case of 3G data card usage following an initial jump until early 2009. The underlying demand for the industry is therefore predicted to be relatively stable. The market is also likely not to see significant entry for the forthcoming years and it has consolidated to a four player market. These underlying factors and Ofcom's own forecasts show stability that are unlikely to be present in either financial services or raw materials.

Evidence from Ofcom's Communications Market Report.

543 This is further supported by Ofcom's Communications Market Report 2009, which examined the impact of the recession on consumption of communications services. Data from an Ofcom-commissioned survey showed that when consumers were cutting spending during the downturn, they were unlikely to do this by reducing their mobile telephony spends. Expenditure on mobile phones was less flexible than, for example, expenditure on newspapers and magazines, clothing and footwear, or music, books and DVDs[221].

544 Based on this evidence of stability for mobile telephony demand, it seems to us, from a purely qualitative point of view, that there appear to be sufficient reasons why mobile operators' betas would continue to be relatively low.

221 Ofcom. 2009. "The Communications Market 2009" Section 1.3.3.

Annex G. Data forecasting and data cost allocation in Ofcom's Analysys model.

545 The mobile termination rate estimated by Ofcom declines from 4.3ppm to 0.5ppm relative to the 2007 decision. Partly, as discussed above, this is due to the change in methodology from LRIC+ to LRIC. A further large change however is the much higher data demand forecasts with respect to the 2007 model. In this section, we analyse:

a. Whether Ofcom's data forecasts can be supported by other sources; and

b. If the treatment of data in the model leads to a reasonable allocation of costs to data services.

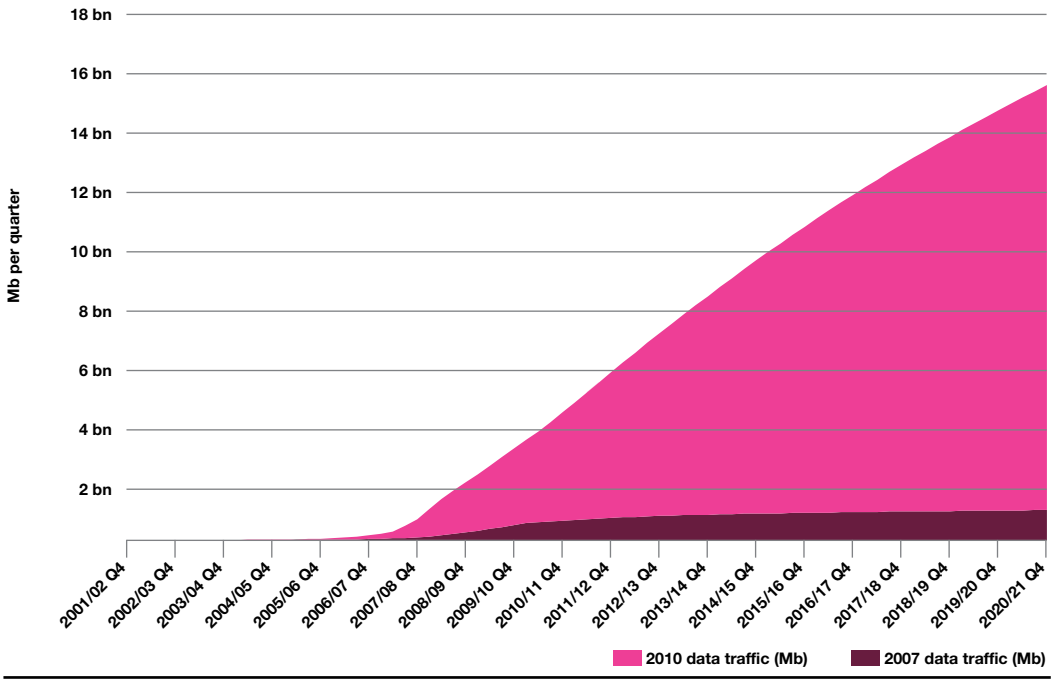
Mobile data forecasts.

546 Firstly, we discuss the data projections in the Ofcom model. We proceed to understand whether these data forecasts can be supported by third party industry sources.

Ofcom model.

547 The 2010 Ofcom model has some changes in its treatment of data services compared to the 2007 model. These are the inclusion of mobile data cards and the separation of 2G and 3G handset traffic. There are also a number of other changes to the 2010 model which affect data volumes: these are increased penetration of mobile handsets, a slower transition from 2G to 3G handsets and the market share of the hypothetically efficient operator. The impact of the changes in the total data volume is set out in the figure below.

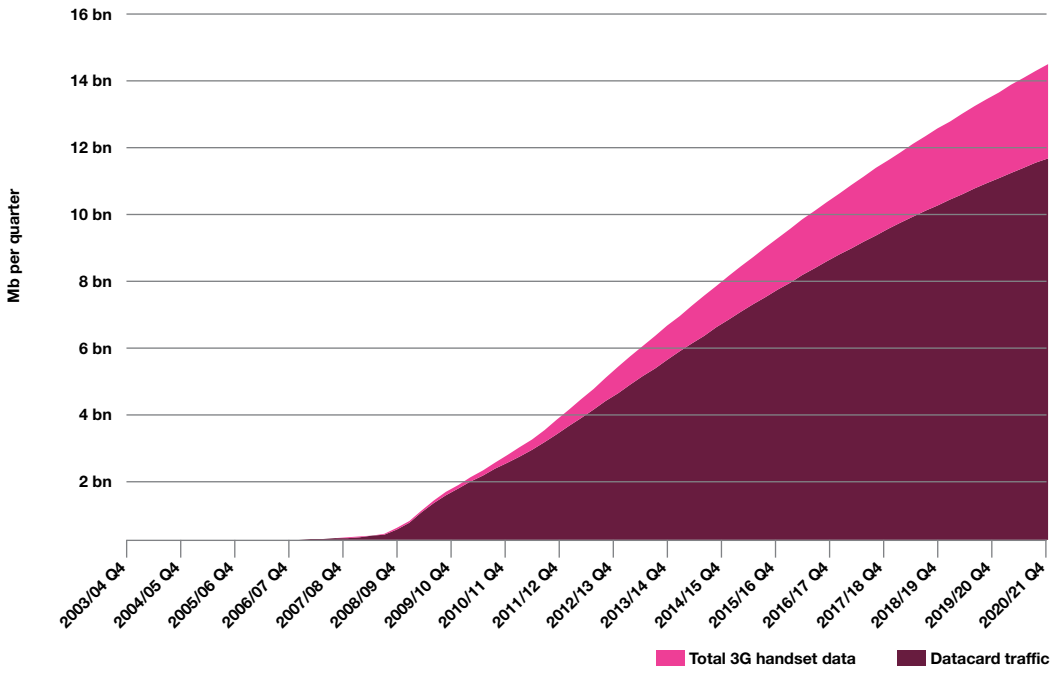
Figure 43: Data traffic 2007 versus 2010 model.



Source: LECG analysis of 2007 and 2010 Ofcom Analysys models

548 The most significant change is the separate inclusion of mobile data cards, which have much higher data rates per subscriber (900Mb per month versus around 20Mb per month for 3G subscriber in 2010/11) and are forecast to have a penetration rate of 27% of the population by 2020/21. As shown in the figure below, datacard traffic is significantly greater than the traffic from mobile handsets.

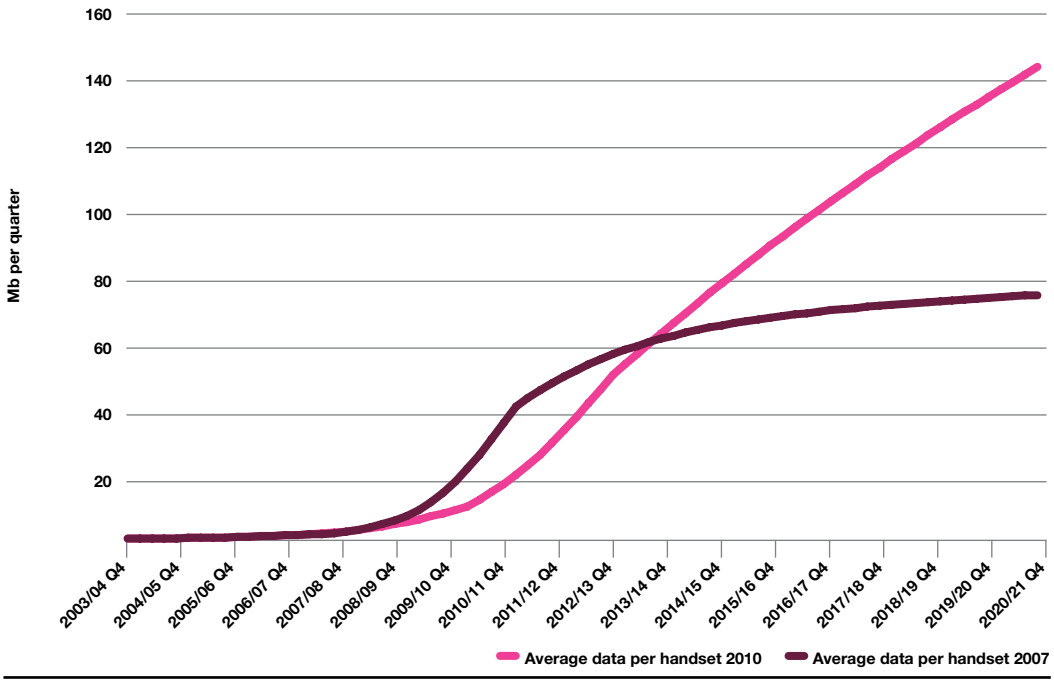
Figure 44: Datacard and 3G handset traffic in 2010 model.



Source: LECG Analysis of 2010 Ofcom/Analysys model

549 Ofcom does not provide directly comparable figures for data traffic for 2G/3G customers in the 2007 model and the 2010 model. This is due to the fact that the 2007 model is based on scenarios derived from weighted average of 2G/3G subscriber traffic, while the 2010 model separates 2G and 3G handset and datacard traffic. The figure below compares average data per 2G/3G handset in 2007 (per quarter) with average data per handset in 2010. This shows that data per handsets are relatively similar until around 2012, when growth forecasts in the 2010 model began to rise significantly above the 2007 estimates.

Figure 45: 2007 versus 2010 2G/3G average handset data per quarter.

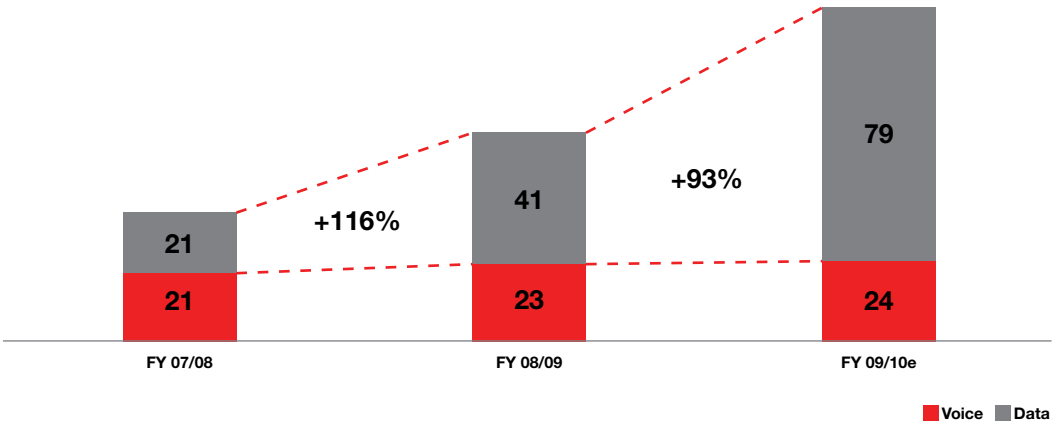


Source: LECG Analysis of 2010 Ofcom/Analysys model

Market developments.

550 We now discuss how the revisions to Ofcom's mobile data forecasts between 2007 and 2010 compare with wider market developments. MNOs have noted the rapid recent growth in data volumes and the expected future growth in data services. For example, Vodafone report the recent rapid growth in data and the project growth for their European operation, set in the figure below.

Figure 46: Vodafone Europe traffic forecast (petabytes).



Source: Vodafone Group Plc, Interim Management Statement, For the 3 months ended 31 December 2009, 4 February 2010

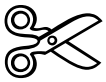
551 This figure illustrates the strong growth in data, from near parity with voice traffic in 2007/08 to over 300% of voice traffic by 2009/10. This is consistent with the comment of Sir John Bond, Vodafone's Chairman:

> "Our industry is undergoing an important change away from the predominance of voice traffic; within a few years most of the traffic on our European network will be data."[222]

552 Similarly, Three have experienced data growth surging from parity with voice in 2007 to many times that of voice by 2010, as depicted in the figure below.

222 Sir John Bond, Chairman's Statement, Vodafone 2009 Annual Report.

Figure 47: Three UK Traffic projections.



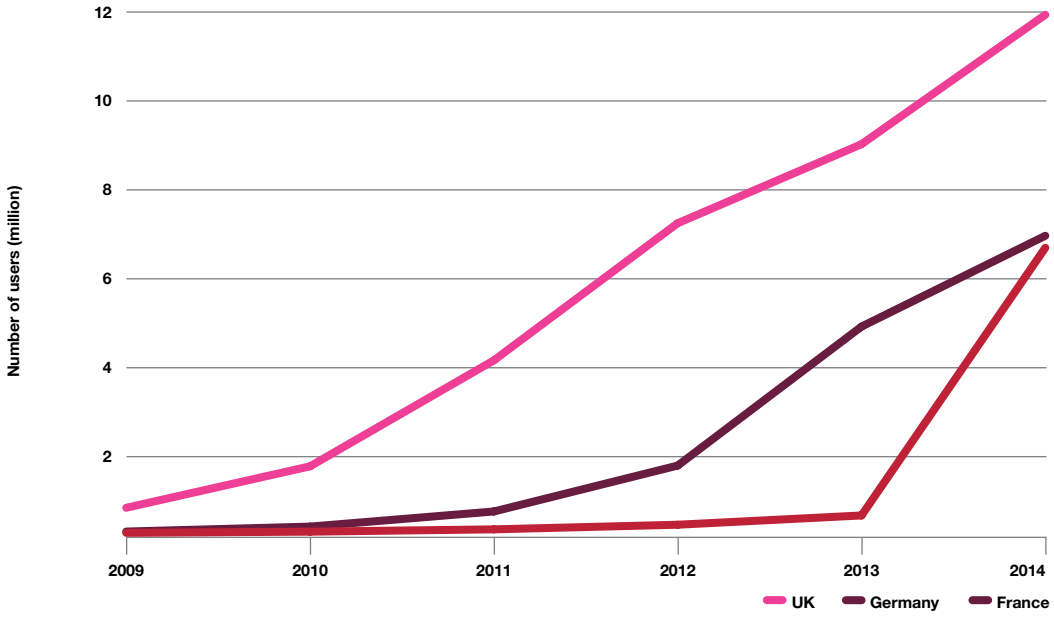
Three voice Three data

Source: Three (confidential)

553 The UK and European mobile data growth rates are consistent with global developments and longer term projections. Nokia Siemens Networks project that mobile data network traffic will grow by 300 fold in the next five years[223]. Cisco have slightly more conservative forecasts that mobile data traffic will grow at a compound annual growth rate (CAGR) of 108 percent between 2009 and 2014, reaching 3.6 exabytes per month by 2014[224]. Cisco's projection of mobile only data users for the UK, Germany and France is set out below.

223 Mika Vehvilainen, Nokia Siemens Networks, Broadband World Forum Europe, Paris, 7 September 2009.
224 Cisco Visual Networking Index, 9 February 2010.

Figure 48: Mobile only data users.



Source: Cisco Visual Networking Index, February 2010

554 This figure illustrates the strong growth in the number of mobile data users, particularly in the UK market.

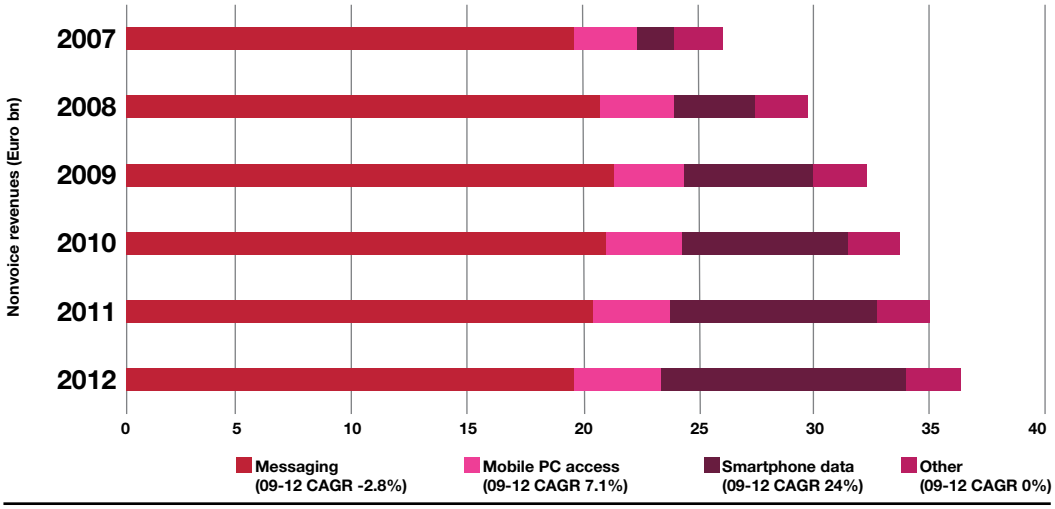
555 The strong continuing growth in mobile data is expected to mean that by 2015 mobile networks are "effectively data networks"[225]. This means that network planning and investment will be heavily influenced by data rather than voice requirements. This suggests that Ofcom's data projections are well grounded with market developments and while forecasting future demand is inherently uncertain, Ofcom forecasts are reflective of market reality.

Data revenue forecasts.

556 Also data revenues are forecast to grow over the next five years, even if not at the same pace as data volumes. Nomura project the growth of European mobile data revenues in the figure below.

225 Mika Vehvilainen, Nokia Siemens Networks, Broadband World Forum Europe, Paris, 7 September 2009.

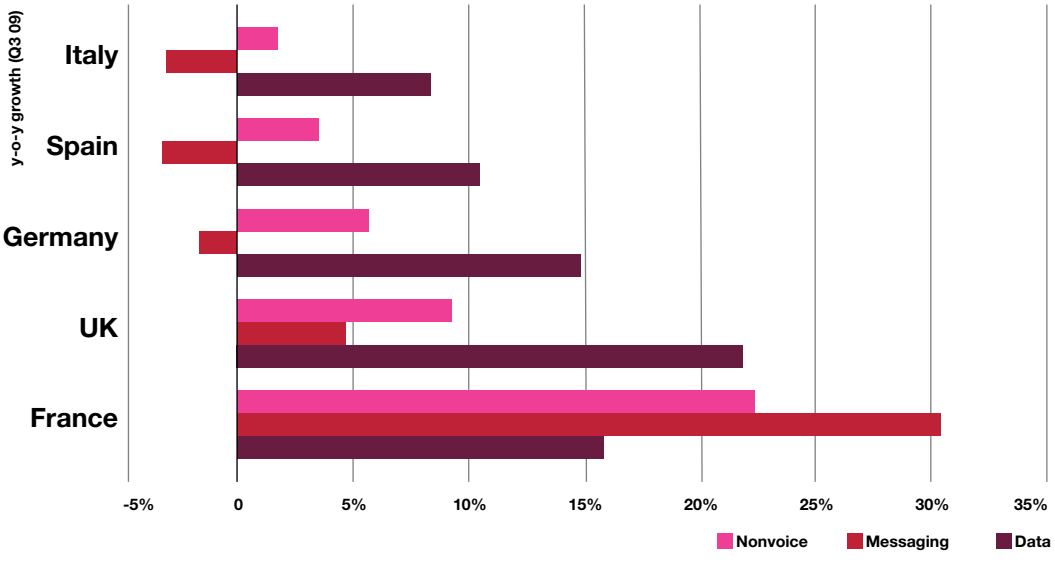
Figure 49: Growth rates for European mobile data.



Source: Nomura, December 2009.

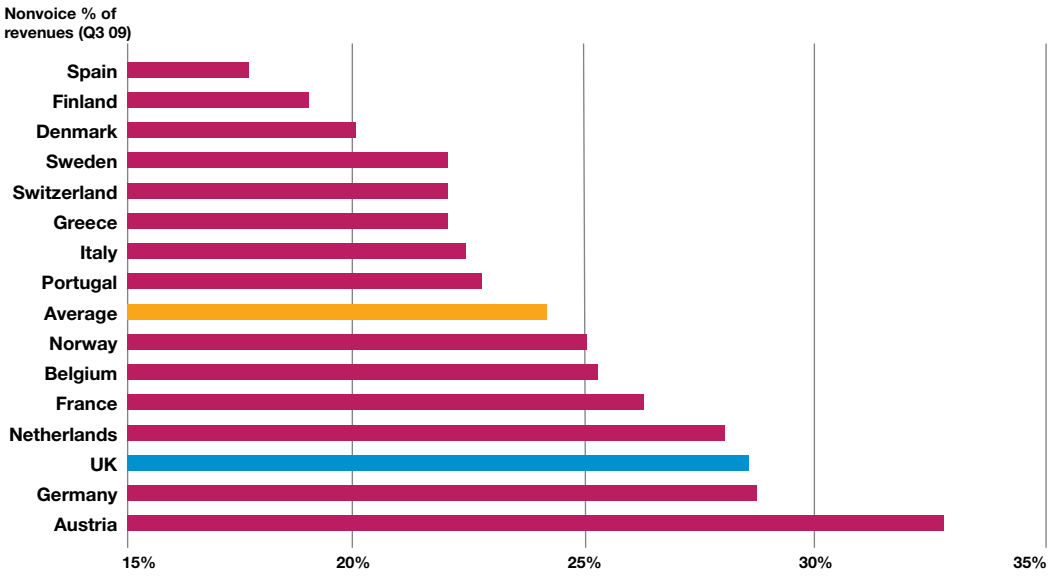
557 This figure highlights the projected increase in data revenues and in particular, the strong growth in Smartphone data and Mobile PC access. In the UK market, data has been relatively stronger than in other European mobile markets and is continuing to grow strongly as indicated in the figures below.

Figure 50: UK mobile data growth rate Q3 2009.



Source: Nomura, December 2009.

Figure 51: European Mobile Non Voice revenue as percentage of total revenue Q3 2009.



Source: Nomura, December 2009.

558 In contrast, mobile voice revenues have recently declined, although this is at least partly due to the recession. Ofcom's telecommunication data report recorded a 2% decline in voice revenues, while volumes grew by 6% in Q4 2009 for the four largest MNOs[226]. Analysts report a decline in voice revenues in 2009 and that is expected to continue in the future[227].

Allocation of cost to data in the Ofcom / Analysys model.

559 The Analysys model produces LRIC+ and LRIC costs for 22 services, of which the "2G incoming voice" service and the "3G incoming voice service" are used to determine termination rates. Naturally, a question arises whether the model produces a reasonable split between costs that are allocated to data services and costs that are allocated to voice services, in particular voice termination services.

560 As a starting point one needs to return to the evolution of data in the model as shown in Figure 44. Most of the traffic growth is from the demand for dongles. The model however outputs the cost of HSPA data rather than the cost of dongle data. Dongle data from smartphone data is

226 Ofcom, "Telecoms Market Data Report Q4 2009", May 2010, page 2.
227 For example, see Arthur D Little/Exane BNP Paribus, "Mobile Internet: blessing or curse", 13 April 2010.

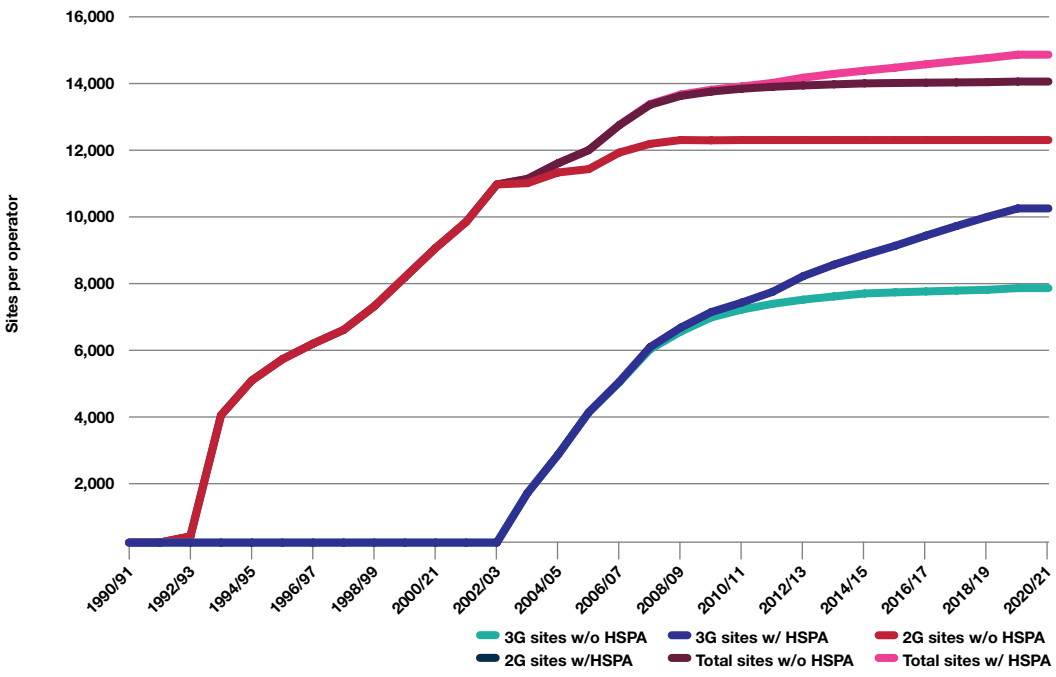
only distinguishable at the traffic input side, but not the service cost side. Therefore, when considering investments, we analyse how the model treats dongle traffic. When considering cost allocation, we concentrate on the question whether the cost allocation of HSPA data is reasonable.

Pure LRIC for data is not only a theoretical exercise, but has a credible counterfactual.

561 For voice termination, the computation of pure LRIC is, although economically meaningful as a proxy for marginal cost, in purely practical terms a somewhat theoretical exercise, since carriers would always offer voice termination – they are legally obliged to interconnect. In contrast, the pure LRIC approach fits HSPA data very well. Carriers can choose to host HSPA data. There is therefore a true incremental cost to hosting such data.

562 We first check that the model does indeed increase investment levels when HSPA datacard traffic is present. Figure 52 reveals the number of base station sites with and without HSPA dongle traffic.

Figure 52: Sites with and without HSPA dongle traffic.

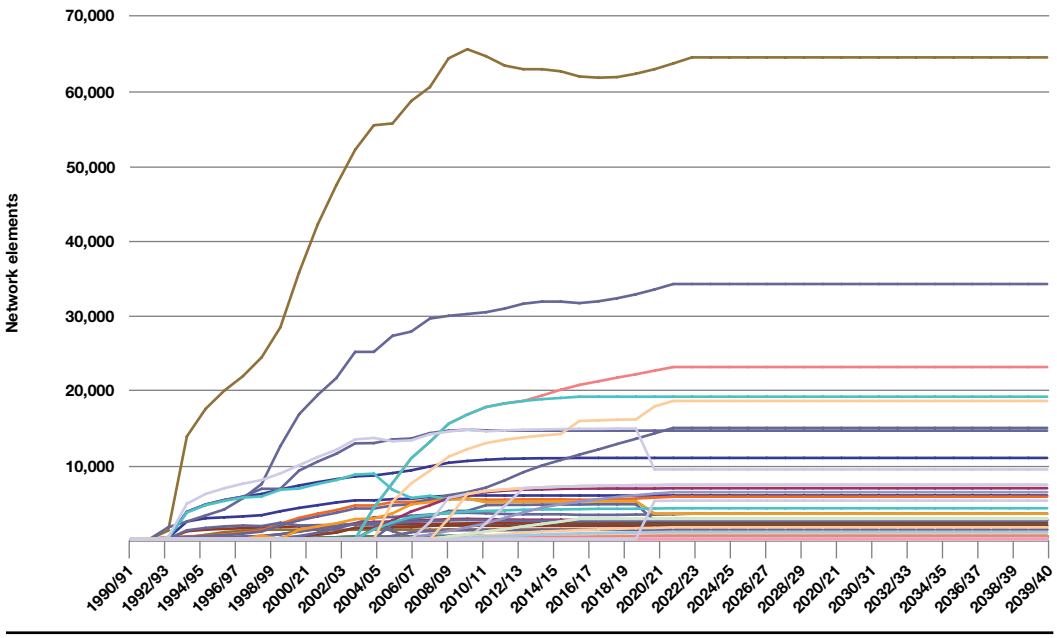


Notes: Data with HSPA dongle traffic corresponds to baseline model. Data without HSPA dongle traffic was generated by setting HSPA dongle traffic to zero.
Source: LECG analysis of Analysys model

563 We also note that 2G sites are unaffected by the variation of dongle HSPA data. In contrast, there is a significant rise in 3G sites from around 2008/9. In 2020/21, the model predicts 7,249 3G sites without HSPA dongles and 9,519 sites with HSPA dongles, an increase of 2,270 sites or about 31%. However, due to site sharing between 2G and 3G sites, the total number of sites (the top two lines) only increases from 13,133 to 13,899 sites, an increase of 766. The small increase in the total number of sites is due to the fact that the model allows the reuse of many 2G sites for HSPA dongle traffic, effectively turning much of 3G dongle traffic into a much smaller incremental cost.

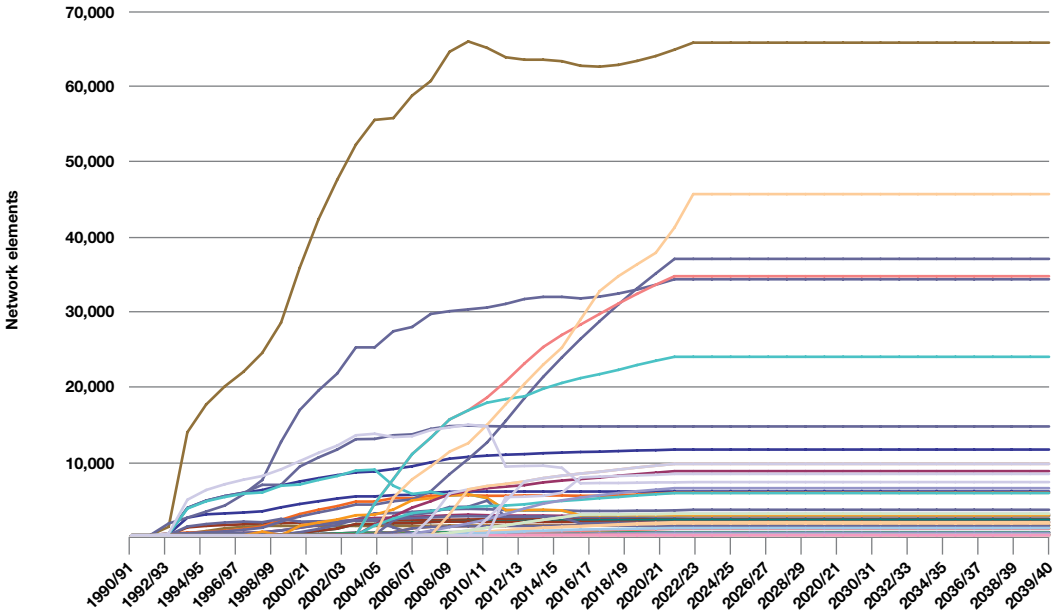
564 This initial view is confirmed when one considers the deployment of other network assets. Due to the high number of network elements, we give a purely visual representation of the evolution of the number of network elements with and without HSPA dongle traffic. This is shown in Figure 53 and Figure 54.

Figure 53: Network assets without HSPA dongle traffic.



Source: LECG analysis of Analysys model

Figure 54: Network assets with HSPA dongle traffic.



565 What can be observed from the figures above is that the deployment of many network assets are not materially affected by the inclusion of HSPA dongles. The network elements that show steep increases are mainly 3G RNCs, core transmission and a number of subcategories of 3G cell site equipment. The figures show that, while the investment into certain assets is significant, in terms of the overall deployment of the network, the cost is likely to be incremental since only certain network elements require significant upgrades.

566 We note at this point that the model has a number of "safeguards" implemented that prevent costs from completely driven by data considerations. These are, mainly, that:[228]

a. 40MB per month for 3G handsets by 2014 and 60MB by 2020/21;
b. <2MB of data for 2G handsets by 2014 and 3MB by 2020;
c. Datacard take up limited to 18% by 2014 and 27% by 2020/21;
d. No growth in data downloaded using data cards – 900MB per month; and
e. 40% of all traffic originated and terminated on 3G handset is routed over 2G network.

228 Ofcom Market Review, Annex 8.

Pure LRIC cost of HSPA traffic.

567 With the incremental nature of network upgrades in mind, we proceed to estimating the pure LRIC cost of HSPA traffic. This computation is carried out analogous to the pure LRIC of termination. By pure LRIC of HSPA traffic we therefore mean the result of the additional cost of the HSPA service in the same way that pure LRIC for termination stands for the additional cost of the termination service.

568 The methodology of the pure LRIC computation works particularly well since the service and investments are genuinely incremental.

569 As indicated before, cost outputs are by HSPA traffic type rather than separated into dongle and handset. The pure LRIC cost is shown in Table 11.

Table 11: Pure LRIC of HSPA

Year	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Pure LRIC HSPA (£ / Gbyte)	187.81	150.94	105.31	80.99	65.46	6.30	4.08	3.70	3.53
Year	**13/14**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**19/20**	**20/21**	**21/22**
Pure LRIC HSPA (£ / Gbyte)	3.37	3.21	3.06	2.92	2.78	2.65	2.52	2.44	2.40

Notes: Pure LRIC of HSPA was computed by changing the two dependents of parameter "Model.LRIC.plus" from "2G incoming voice traffic" and "3G incoming voice traffic" to "3G HSPA". 2008/9 real prices.

Source: LECG analysis of OFCOM / Analysys model

570 We find that pure LRIC HSPA costing per GByte drops significantly from 2008/9 values of around £65 to £6.30 in 2009/10, through to £4.08 in 20010/11 to a steady value of £2.40 in 2021/22.

571 Such a cost can be regarded as reasonable if it is not too far removed from prices in the marketplace and from research carried out by other sources. A brief consideration of offers available in the marketplace in early 2010 reveals that, considering that users use approximately 50% of their traffic entitlement, HSPA dongle prices are in the region of £1.70 to £7.20 per used GByte on the cheapest tariffs. These figures, which are the low end of the current market, are mostly significantly above the

estimate of pure LRIC from the Ofcom / Analysys model, suggesting that operators do recover not just marginal but also part of their fixed costs from mobile data users.

572 Since operators are indeed able to serve current demand above the marginal cost suggested by the Ofcom model, we deduce that the Ofcom model does, in the appropriate pure LRIC version, not overallocate costs to data.

Table 12: Selected mobile internet tariffs

Operator	Three	O2	Orange	T-Mobile	Vodafone
Example plan	Business Broadband 15GB	Business Unlimited	Business Unlimited	Pre-pay 6 month internet Booster	Business Data only
Data allowance per month	15GB	5GB	5GB	1GB	5GB
Monthly charge	£12.77	£15.00	£15.00	£2.84	£18
Price per GB assuming 50% actual usage	£1.70	£6.00	£6.00	£5.67	£7.20

Notes: Shows the mobile internet packages with lowest price per GB. All prices exclude VAT (17.5%). All tariffs available as of March 2010.

Source: Pure Pricing UK Mobile Pricing Handbook

Conclusion on data growth and data cost allocation in the Ofcom Analysys model.

573 Pure LRIC is particularly suited to model the effects of the introduction of HSPA data traffic, since the costs are truly incremental. We show that in the Analysys model only a limited number of network elements see significantly higher deployment to support HSPA traffic, implying that not only costs but also the network element deployment for data traffic is incremental.

574 In contrast, we would argue that LRIC+ as a concept does not combine very well with the incremental nature of HSPA traffic. We are therefore not convinced that LRIC+ results for HSPA data, and in turn of termination rates, capture well the incremental nature of investment for data traffic.

575 We find that characteristics built into the Analysys model designed to bring it into line with observations in the market[229] effectively add as safeguards that prevent data costs from dominating the model, and in turn allow for data costs to be incremental to existing network costs and network deployment. The clearest example of this is site sharing, where 2G sites are assumed to be constant at a relatively high level throughout the period. The 3G HSPA data network shares many of these sites, turning 3G data services into a smaller incremental cost.

576 When we compute the LRIC cost of data, we find costs per GByte of around £4 in 20010/11, falling steadily to £2.40 in 2021/22. We compare these costs to current retail offers and conclude that retail offers are of a similar magnitude.

577 We therefore believe that (i) pure LRIC is the best measure for the actual costs that should be allocated to HSPA data, and that (ii) the pure LRIC values that are computed by the model do not appear to over-allocate costs to data, given evidence of existing retail tariffs.

229 We do not discuss here whether such safeguards are reasonable in a model that purports to portray an "efficient" operator.