

Annex G

Evaluation of the surcharge for the network externality

Introduction

G.1 In the May consultation, the Director outlined a number of important considerations in the development of an appropriate 'externality surcharge'. The surcharge was designed to account for the external benefits that callers to and from mobile telephones receive from the addition of new subscribers to a network. However, the Director noted that in both theory and practice the calculation of the surcharge was complex and that he did not believe any single estimate of the surcharge would be sufficiently reliable. Consequently, he preferred to make a judgement based on the estimates that he considered had provided a relevant, although incomplete, perspective.

G.2 The Director maintains this approach in this explanatory statement. However, he has considered the comments of the MNOs and other parties and has revised his use of certain estimates as a consequence.

G.3 The remainder of this annex is organised as follows:

- the justification for an externality surcharge;
- deriving the optimal surcharge in theory;
- deriving the optimal surcharge in practice; and
- the Director's conclusions on the appropriate surcharge.

Justification for an externality surcharge

G.4 An externality is a cost or benefit that is imposed on one or more parties by a consumption (or production) decision taken by another party. Since the cost (or benefit) does not affect the party who makes the decision, the latter in general does not take this cost (or benefit) into account. Hence, the presence of externalities can lead to sub-optimal decisions. In principle, to achieve economic efficiency, prices should be adjusted to 'internalise' the externality, so as to provide the decision-maker with an incentive to consider the effects of her decision on others. To the extent that the externality is already internalised by the market participants, either by consumers or producers, such corrective action is not needed.

G.5 If a market is characterised by a positive consumption externality (i.e. one that generates a benefit to others) and the externality is not (completely) internalised, the level of consumption will be below the efficient level. Each consumer will consume up to the point where her marginal private benefit is equal to the price. However, the efficient level of consumption is the one at which the marginal cost equals the marginal social benefit (which, due to the externality, is higher than the marginal private benefit).

G.6 The decision by a consumer to be part of a mobile network generates a number of externalities, the most relevant of which is referred to here as the 'network'

externality'. The network externality is the benefit obtained by existing telephone users when a person decides to become a new mobile subscriber, because they will be able to call or be called by his/her (callers value these calls) or, at least, will have the option to do so (the so-called 'option value'). However, the person deciding whether to join a mobile network will only take account of the benefit that she obtains and not the benefit that his/her decision generates for others (the 'external benefit'). Hence, a person may choose not to join the network because his/her private benefits do not cover the price of becoming a subscriber, even though economic welfare would be enhanced if (s)he did, because of the benefits obtained by others. As a consequence, the number of subscribers is below the efficient level.

G.7 In some cases, consumers internalise externalities themselves. For example, some people may contribute to the costs of acquiring the mobile handset and pay the relevant subscription for others with whom they have substantial community of interest (e.g. parents for their children or firms for their employees). However, not all of the network externality is thus internalised and, therefore, there is an argument for introducing some corrective pricing to reflect this uninternalised externality.

G.8 For some consumers there is an argument, therefore, that prices should be below cost, i.e. subsidised, to entice them to become (or remain) mobile subscribers. The set of consumers for whom this consideration is relevant are the 'marginal subscribers', who are defined as those subscribers who would not join (or remain on) the network in the absence of a subsidy, but whose addition to, and retention on, the network increases economic efficiency because of the external benefits generated. It should be noted that subsidies provided to infra-marginal subscribers do not affect welfare, because these would subscribe even in the absence of a subsidy (this is indeed the definition of infra-marginal subscribers).

G.9 If a subsidy is to be provided to marginal subscribers by the MNOs, then they need to have the opportunity to recover such costs. Hence, Oftel considers that it would be appropriate for the wholesale termination charge to include a contribution towards the recovery of these subsidies. This is referred to as the 'externality surcharge'.

Comments on the justification for an externality surcharge

G.10 Energis argued that it was highly questionable as to whether an externality surcharge could be justified at this late stage in the take-up of mobile services. Mobile penetration was around 73% in August 2002 and mobile operators could no longer rely on adding new subscribers to their networks. Energis cited from the CC report (at paragraph 2.354) in support of its argument:

'In a market in which most people who want to make and receive mobile calls already have a mobile phone, the value which new subscribers place on calling and being called and the additional value which existing subscribers will place on calling and being called by each new marginal subscriber are both likely to be lower than was previously the case, when subscribers who joined were keen to communicate.'

G.11 BT argued that the new Directives do not permit a subsidy raised on interconnection charges to encourage mobile operators to take on more customers than they would choose as a result of normal commercial incentives.

G.12 BT further argued that a surcharge for mobile call termination and not for fixed call termination violates the principles of the new Directives, insofar as it is not technologically neutral. BT said it would subsidise marginal users of mobile services from fixed-line customers, but not marginal fixed-line users from mobile customers.

G.13 The Director interprets Energis as saying that the magnitude of the network externality (representing benefits accruing to existing fixed and mobile subscribers) associated with new users declines as the number of subscribers increases. This is true to the extent that it seems reasonable there should be some correlation between a consumer's private valuation from subscribing, and existing fixed and mobile subscriber's valuations of calling that subscriber. The Director understands Energis to be arguing that it follows from this that, over time, the optimal externality surcharge should fall, because the external benefits associated with bringing each new subscriber on to the network are lower. However, as the private benefits are also falling, it is plausible the ratio between the private and external benefits should remain reasonably constant. This ratio is known as the Rohlfs-Griffin or R-G factor. The CC also took this view (at paragraph 2.354):

'Overall, although there will inevitably be individual exceptions to the general pattern, we take the view that the R-G factor is likely at most to have remained fairly constant over time and may have declined somewhat; at any rate, we see no reason why it should have increased in recent years.'

G.14 The consequence of assuming a constant R-G factor, as is done in all of the estimates of the optimal surcharge that have informed the Director's judgement, is that the reduced external benefits deriving from recently joined marginal subscribers are accounted for. If it was assumed that external benefits declined by proportionally more than private benefits, a reducing R-G factor would be a further complicating factor in the consideration of the optimal surcharge. However, to the extent that some existing subscribers are marginal, even if the saturation point were reached, the Director believes some degree of externality surcharge may well remain appropriate.

G.15 With regard to BT's point about the new Directives, the Director notes that the relevant provisions (in particular, Article 13(1) of the Access Directive) are permissive in nature, not mandatory. The Access Directive implicitly envisages that there may be a range for charge control regulation, from light to heavy. As the 20th recital to the Access Directive notes:

'Price control may be necessary when market analysis in a particular market reveals inefficient competition. The regulatory intervention may be relatively light, such as an obligation that prices for carrier selection are reasonable as laid down in Directive 97/33/EC, or much heavier such as obligation that prices are cost oriented to provide full justification for those prices where competition is not sufficiently strong to prevent excessive pricing...'

G.16 In any case, Article 13 of that Directive clearly reveals that efficiency and consumer benefits are paramount. Fundamentally, the externality surcharge is designed precisely to reflect these considerations. As Article 13(2) specifies:

‘National regulatory authorities shall ensure that any cost recovery mechanism or pricing methodology that is mandated serves to promote efficiency and sustainable competition and maximise consumer benefits...’ (emphasis added.)

G.17 With regard to technological neutrality, the Director’s position begins with section 4(6) of the Act, which provides that:

- ‘(6) The fourth Community requirement is a requirement to take account of the desirability of Ofcom’s carrying out their functions in a manner which, so far as practicable, does not favour-
- (a) one form of electronic communications network, electronic communications service or associated facility; or
 - (b) one means of providing or making available such a network, service or facility,

over another.’ (Emphasis added)

G.18 The Director does not consider that the externality surcharge discriminates in favour of the use of a particular type of technology. In both mobile and fixed telecommunications, schemes exist to ensure that those otherwise unlikely to subscribe have incentive to do so. The funding of marginal subscriber connections is achieved differently in fixed telecommunications, where universal service obligations and special retail tariffs ensure that some fixed subscribers who would not otherwise subscribe are brought onto the network. Overall, the objective is comparable to that achieved via the externality surcharge proposed for calls to mobiles. In any event, the 18th recital to the Framework Directive makes it clear that NRAs’ obligation is not absolute, but instead permits proportionate steps being taken to promote certain services.

The Director’s conclusion regarding the justification for an externality surcharge.

G.19 The Director considers that an externality surcharge remains justified.

Deriving the theoretically appropriate surcharge

G.20 The Director believes three issues need to be considered in deriving the theoretically appropriate surcharge:

- (1) the size of the subsidy, including:
 - (1a) the numbers of marginal subscribers;

-
- (1b) the extent to which subsidies can be targeted and externalities internalised;
 - (2) the funding of the subsidy; and
 - (3) the degree of competition in the retail market, and the extent to which the subsidy will be used to fund marginal subscribers.

The size of the subsidy

G.21 In the May consultation, the Director noted that the determining features of the size of the subsidy were the number of marginal subscribers and the existing ability of the MNOs to target subsidies on marginal subscribers.

G.22 The number of marginal subscribers depends on estimates of the marginal cost and the marginal social benefit. The latter comprises the sum of the marginal private benefit and the external benefit. The marginal private benefit is captured in the demand for mobile subscription.

G.23 As noted above, the size of the external benefit relative to the private benefit is referred to as the Gross Externality Factor or the R-G factor. A value of 1 for the R-G factor would imply that there were no external benefits, or that they were entirely internalised.⁷¹ This is therefore the lower bound. A value of 2 would imply that the external benefit to existing subscribers was large as the private benefit obtained by the marginal subscriber. On the basis that it is reasonable to suppose that the external benefit to existing subscribers is unlikely on average to exceed the private benefit to the marginal subscribers, a value of 2 for the R-G factor provides a reasonable upper bound. However, the value of 2 does not allow for any internalisation of the externality by consumers, and the value of 1 does not allow for any (uninternalised) externality at all. As explained above, it is likely that some internalisation of this externality takes place. Hence, given these considerations, the Director indicated in the May consultation that he believed that a reasonable range for the Rohlfs-Griffin factor is 1.3 to 1.7.⁷²

Comments on the number of marginal subscribers

G.24 Vodafone argued that the R-G factor was a matter for empirical estimation, not *a priori* reasoning. It said it did not accept that the R-G factor must lie between 1 and 2, before allowing for internalisation. Vodafone referred to analysis prepared by Frontier Economics which suggested that the magnitude of the elasticity of fixed-to-mobile calls and mobile-originated calls with respect to the number of mobile subscribers was not consistent with an R-G factor less than 2, but was rather consistent with a figure closer to 2.5.

⁷¹ Throughout this annex, the terms R-G factor and gross externality factor are used interchangeably. The gross externality factor captures both the option externality of subscription and cross-elastic externalities. The net externality factor reflects the portion of the gross externality factor that is not embodied in cross-elastic effects. It primarily reflects the option value of subscription, apart from usage.

⁷² This range excludes the internalisation of the externality by MNOs, which is addressed (at least in the Rohlfs model) as a further deduction to this range.

G.25 T-Mobile further argued that with the limited amount of internalisation by consumers and MNOs, the R-G factor would be expected to be more within the range 1.5 to 2 and could even be greater than 2. The R-G factor could be greater than 2 taking account of demand “feed-back” effects. These arise because a person’s decision to join a network may not only produce direct benefits to others but may also lead to other people now placing greater value on mobile ownership, in being able to call the new subscriber and, so deciding to join themselves, creating greater external benefits.

The Director’s response

G.26 The Director remains convinced that the R-G factor is unlikely to exceed 2 in practice. To assume otherwise would imply that existing subscribers value communicating with a marginal subscriber by more than the marginal subscriber values having a communications link to all existing subscribers. It would also assume no or very little internalisation of the externality by consumers.

G.27 With regard to the range of R-G factors that the Director considers reasonable, and whether the R-G factor could be close to its upper bound of 2, the Director considers this unlikely because it would imply no or very little internalisation by consumers. The CC came to a similar conclusion (see paragraph 2.350 and supporting evidence in paragraphs 8.116-8.117 of the CC report).

G.28 With regard to the feedback effects described by T-Mobile, the Director does not accept that these substantively increase the marginal external benefits associated with marginal subscribers (and therefore the R-G factor). T-Mobile argues that the external benefit attaching to a given marginal subscriber is greater than assumed by the Director, because that marginal subscriber’s subscription decision will benefit other marginal subscribers, and hence cause more marginal subscribers to join (providing further benefits). The Director considers this effect might be relevant if the network involved was small in size, in which case the impact of marginal subscribers joining could be significant for other potential subscribers. However, for a mature network with high penetration (with over 40 million subscribers), bringing on further marginal subscribers to the network would seem far less likely to generate substantial benefits to other potential subscribers. Further, to the extent that the benefits will only be realised if these potential subscribers actually join, the Director believes it is clear that feedback effects would only have an inconsequential effect on the R-G factor in the current context.

G.29 The Director remains of the view that a plausible range for the R-G factor is 1.3 to 1.7. This reflects the consideration of an upper bound of 2 and the reasonable assumption of substantial (but less than full) internalisation by consumers of external benefits.

Targeting and internalisation

G.30 A key issue that affects the size of the required subsidy is the extent to which it is feasible for MNOs to target the provision of subsidies on marginal subscribers. One possibility is the scenario where absolutely no targeting can be achieved, i.e.

the MNOs charge the same price to all subscribers, both marginal and infra-marginal ones. The subsidy would be at a maximum in this case. However, this scenario is clearly unrealistic, since the MNOs offer a variety of tariff packages and engage in substantial price discrimination. At the other extreme, there is the scenario with perfect targeting, i.e. the MNOs charge a bespoke price to all marginal subscribers and provide no subsidy to infra-marginal subscribers, which would result in the lowest required subsidy. There are other possibilities. For example, it could be assumed that the MNOs were able to separate out marginal from infra-marginal subscribers, but among the group of marginal subscribers were unable to offer different prices to different consumers. Or it could be assumed that the MNOs were unable completely to separate these groups and that some infra-marginal subscribers were able to 'free-ride' on the subsidy intended for the marginal subscribers.

G.31 A second issue with respect to targeting is the incentive of MNOs to target subsidies on marginal subscribers, as opposed to higher value and more profitable infra-marginal subscribers. The incentive to target will largely be a function of how profitable such targeting is for the MNO.

Responses on targeting

G.32 The MNOs suggested they would have problems with both their ability to target marginal subscribers (which they suggested should give rise to a higher surcharge) and their incentives to do so (which they also said should lead to a higher surcharge).

G.33 O2 and Orange argued that MNOs were unable to target particular customer groups in the way suggested, and that it was not realistic to assume that it was possible to offer a subsidy to marginal subscribers and not to other existing or potential subscribers.

G.34 T-Mobile also questioned both the ability and incentive to target marginal subscribers. T-Mobile argued that there are substantial difficulties in isolating true marginal consumers. For example, pre-pay packages were intended to segment low- from high-value subscribers but now nearly 70% of subscribers are now on pre-pay. MNOs also have no ability to prevent or detect arbitrage (for example, marginal subscribers selling-on subsidised handsets to higher value subscribers) and spending by customers was a poor indicator of the value placed on a service. T-Mobile said that, for example, light users with phones for emergency purposes may be willing to retain their phones in the face of significant price increases, whereas some heavy users may give up their phones in such circumstances.

G.35 With regard to the incentive to target, T-Mobile argued that in a competitive market MNOs would not be able to divert funds from infra-marginal to marginal customers because other MNOs would use termination revenues to attract infra-marginal customers, and any operator not doing-so would be vulnerable to losing the more profitable subscribers.

G.36 Vodafone also questioned the incentives to target marginal subscribers. It suggested that the High Court in the 2003 Judicial Review⁷³ accepted that the CC's method of calculating the externality surcharge failed to take account of the fact that MNOs have no incentive to apply any surcharge solely to marginal subscribers. On this basis, it was wrong for Of tel to consider the CC's recommended surcharge within its range of values for the justified surcharge.

The Director's response on the ability to target

G.37 The ability to target subsidies on marginal subscribers is clearly an important consideration in the setting of the appropriate surcharge. The Director believes there is ample anecdotal evidence to suggest that targeting is possible. The extent of price discrimination in retail tariffs (manifest by the range of tariffs offering different subscription/handset prices and varying usage prices) is evidence of such an ability. As the CC noted at paragraph 2.363 of that report:

'The most appropriate package would be one offering a basic inexpensive handset and high call charges. Such a package would be attractive to marginal subscribers but not to high-volume users. Another possible package could offer an initial tranche of calls at relatively low prices but successive calls at relatively high prices, again making the package unattractive to high-volume users.'

G.38 The ability to price discriminate suggests that the overall subsidy required will be lower for two reasons. First, subsidies can be targeted more towards those who need them – i.e. marginal customers, rather than infra-marginal customers. Second, price discrimination facilitates internalisation of the total externality by MNOs, in particular, the positive benefit accruing to existing mobile customers from bringing on marginal subscribers to the network. As noted in paragraph 63 of *Of tel's Response to the Competition Commission's Letter on Externalities of 28 March* (Of tel 15/4/02):

'...MNOs are likely to be able to internalise a substantial proportion of the total externality, and in particular the positive benefit which accrues to existing mobile customers. They can internalise this benefit by capturing the additional benefit that accrues to existing mobile subscribers through price discrimination. This may have a further effect in reducing the size of the subsidy to be recovered from a surcharge on mobile termination.'

G.39 Price discrimination requires that customers have different demands and that they can be successfully segmented on this basis. The Director believes T-Mobile's evidence on the introduction of pre-pay indicates that demand segmentation is possible. While more consumers are now on pre-pay than post-pay (which T-Mobile takes as evidence that subscribers have switched from post-pay to pre-pay), the number of post-paid customers has also continued to increase strongly between 1997/98 and the first quarter of 2003/04.⁷⁴ The Director believes this supports the view that price discrimination has been feasible and effective. In addition, the fact

⁷³ Case No: CO/1192/03, CO/1308/03, CO/1536/03, (a) *T-Mobile (UK) LTD* (2) *Vodafone Ltd* (3) *Orange PCS Ltd – v – (1) The Competition Commission* (2) *D.G. Telecommunications*.

⁷⁴ Of tel, Market Information – Mobile update, October 2003, Table 9, and Of tel, Annual Market Information – March 2003, p. 56.

that there are a number of different pre-pay tariffs on offer (usually including volume discounts), indicating that MNOs likely have the ability to segment customers to an even finer level of granularity.

G.40 In response to T-Mobile's point on arbitrage opportunities for infra-marginal subscribers, the Director believes these could readily be avoided by offering very simple handsets to marginal subscribers, as suggested by the CC. Therefore, while it is possible that some marginal subscribers might attempt to sell on their handsets to higher value subscribers, if the handsets are very basic they are unlikely to appeal to higher value users.

G.41 The Director also does not accept T-Mobile's suggestion that spending by subscribers is a poor indicator of value. He also therefore rejects the implication that subsidises targeted on lower-spending consumers will not necessarily target marginal consumers, and that much of the subsidy will necessarily be wasted. Subscribers value the ability to (a) make calls, (b) receive calls, and (c) the option to make and receive calls (the so-called 'option value'). For example, light users with phones for emergency purposes will clearly have a high option value, but a low valuation for making (and possibly receiving) calls. While such users may well attract a subsidy (even though it is unnecessary to retain them on the network), the Director is not convinced that such subscribers form such a large proportion of the consumer base, such that targeting is ineffective. It indicates that targeting of marginal consumers by MNOs is likely to be less than perfect, but the Director considers it is implausible that there is not a strong correlation between consumers' spend and value derived.

The Director's response on the incentive to target

G.42 With regard to the incentive to target and Vodafone's reference to the High Court's criticism of the CC's method of calculating the externality surcharge, it should be emphasised that Mr Justice Moses rejected Vodafone's case:

'...it is fanciful to assume that even if it [the Commission] had successfully grappled with the problem of lack of incentive the Commission would have recommended raising the surcharge which would have had greater adverse effects than those it had identified.' (paragraph 135)

G.43 The Director considers that if MNOs have no incentive to target, then this is not a justification for increasing the externality surcharge. Indeed, if the externality surcharge will be entirely 'wasted' on infra-marginal subscribers, the justification for a surcharge falls away entirely. Moreover, if only a little of the surcharge were used to attract/retain marginal subscribers, then given the welfare losses imposed on callers to mobile associated with increasing termination charges above cost, the justification for a material surcharge is weak.

G.44 Nevertheless, the Director believes MNOs will have some incentive to target existing or new marginal subscribers – if these subscribers can be expected to become profitable over time, or if infra-marginal subscribers place greater value on their mobile subscription from being able to call more subscribers. For example, having experienced the benefits of mobile ownership, subscribers who were once

marginal could increase their valuation and usage such that they would no longer be marginal.

The Director's conclusion on targeting

G.45 The Director therefore considers that to a significant extent targeting is possible, which implies that the required subsidy (and hence the size of the externality surcharge) need not be as large as otherwise. If the incentive to target is indeed weak, the Director considers that rather than being a justification for increasing the surcharge, if the majority of the surcharge is to be wasted on infra-marginal subscribers, the surcharge could arguably be reduced further.

Externality subsidy recovered only from termination

G.46 In the May consultation, the Director said that the economically efficient funding of the subsidy to (some) marginal subscribers would involve surcharges on other mobile services as well as termination, including mobile originated calls and subscription. This is because of the relevant welfare trade-offs.

G.47 The Director argued that it would not be the most economically efficient outcome if the entire subsidy were funded through termination charges. This would impose significant and increasing welfare losses on callers to mobile. A more economically efficient outcome could be achieved by funding the subsidy through all prices. Although this would lead to welfare losses on those other services, the size of such losses would be smaller than the incremental welfare losses that would arise if the subsidy were funded solely from a surcharge on termination.

G.48 T-Mobile argued that it was not possible to add a surcharge to the prices of origination or subscription. Even if this were possible, it would defeat the purpose of the surcharge by increasing the price of the service that is supposed to be being subsidised. T-Mobile attempted to illustrate this via a simple example as follows:

Charges are only made for calling. Assume that inbound and outbound calls are balanced, elasticities are close to zero and MNOs charge the caller 10ppm. Assume that it is decided that it is optimal to lower the price to subscribers to 8ppm in order to increase subscription. Given the simple assumptions of this model a 2ppm surcharge on termination will achieve this.

However, it could be argued that another option would be to raise an equivalent sum by adding a surcharge of 1ppm to all minutes. Doing so, given a competitive subscriber market, would in the long run lower the outbound price to 9ppm. The outbound surcharge might be thought to cancel this benefit to the subscriber, increasing the price again to 10ppm, but this is not the case. If the outbound price increased to 10ppm, customers would be profitable (prices would now be 11ppm inbound and 10ppm outbound, whereas they were 10ppm before), and prices would be competed back to 9ppm. Adding a 1 ppm surcharge notionally to all minutes is equivalent to adding 1ppm to termination only.

G.49 In the absence of externalities, economic theory tells us that efficiency will be maximised where all prices are equal to marginal cost. With externalities, the first best world involves pricing some services (subscription) below marginal cost due to externalities associated with further take up of mobile subscriptions. In this first best world, any cost recovery issues from pricing subscription below marginal cost are assumed away (e.g. the subsidy is assumed to be funded from non-distorting taxation). However, we are in second best world, where prices must be marked up to recover the subsidy to subscription so that MNOs can recover their costs. Ramsey principles tell us that to minimise the deadweight losses associated with recovering such a subsidy, the subsidy should be spread across all services, on the basis of relative inverse elasticities. Hence, even though in a first best world the surcharge might be funded purely from a non-distorting tax on callers to mobile, the minimisation of efficiency losses associated with above-marginal cost pricing means that this does not necessarily follow in a second best world.

G.50 The Director therefore believes that T-Mobile's reasoning, as indicated in its example, is flawed, as its assumption of no elasticity effects ignores the welfare costs of raising outgoing call prices above cost. Suppose (as does T-Mobile) that 8ppm was the outbound price determined to be the point where social marginal benefit equals social marginal cost. This would be the first best solution, in the absence of the need to fund the subsidy. It is not the second-best solution because if the necessary subsidy (2ppm in this example) was recovered entirely from termination the welfare losses from doing so would be such that total welfare would not be maximised. The second-best (welfare) optimal solution will not have outgoing call prices at the point where social marginal benefit is equal to marginal cost. The constrained solution (which maximises overall social welfare) would involve a price for outbound greater than that at which social marginal benefit is equal to marginal cost. In T-Mobile's example, this might indeed be at 9ppm, if this is the point where the gains from lowering the outgoing call price equate with the losses from raising the incoming call price.

G.51 The Director remains of the view that the welfare maximising allowance for externalities is determined by reference to the need to recover the subsidy from all services.

Imperfect competition

G.52 In the May consultation, the Director noted that if the retail mobile market is imperfectly competitive, then some of the surcharge on termination will be taken by the MNOs in the form of supra-normal profit, i.e. not all of the surcharge will flow through into lower retail prices and subsidies to marginal subscribers. This is another source of inefficiency in converting the surcharge on termination into a subsidy for marginal subscribers. The Director addressed this point in *Oftel's Response to the Competition Commission's Letter on Externalities of 28 March, 15 April 2002*

G.53 T-Mobile argued that Oftel had already found the mobile market to be effectively competitive and as such there is no issue regarding the retention of termination revenues in the form of excess profits. Vodafone similarly said that it was inadmissible to use lack of competition in the outbound market as a rationale for

reducing the externality surcharge, given in particular the results from the mobile call origination and access review. Vodafone suggested the Director must prove that the market is insufficiently competitive that it generates excess profits for MNOs in aggregate, in which case it could be argued that MNOs would retain a proportion of any change in call termination charges.

G.54 T-Mobile also argued that the Director's argument that the surcharge would fall if imperfect competition were an issue does not apply to the surcharge as calculated by the CC. Vodafone stated that the result that the surcharge should be lower under imperfect competition with all weight on consumer surplus was unambiguous only in Dr Armstrong's paper and specific to his particular model of imperfect competition.

G.55 The Director has responded to a number of these queries in Chapter 4 of this explanatory statement on the detriments associated with SMP. He believes that the potential for incomplete pass-through of termination profits to retail prices is a relevant factor in deciding on the benefits from regulation and in the consideration of the efficient externality surcharge. The Director believes that it would be socially wasteful for an externality surcharge to be levied if this did not ultimately end up in lower subscription prices for marginal subscribers, given the welfare losses from doing so (i.e. on callers to mobile).

Deriving the externality surcharge in practice

G.56 In the May consultation, the Director concluded that he should not rely on a single estimate of the externality surcharge. This was due to the complexity and multi-faceted nature of the calculation. While several different quantification exercises had been carried out, each of them was incomplete because they only captured a sub-set of the relevant factors and/or because some of the assumptions used (e.g. elasticities) could not in practice be robustly derived from empirical data.

G.57 The estimates which informed the Director's judgement in the May consultation were derived from Rohlfs' efficient pricing models, and the CC / MMC.

G.58 Comments from MNOs focused on:

- the theoretical foundations of the various Rohlfs models;
- problems with respect to the estimates of the MMC and CC; and
- the Director's rejection of other estimates to inform the Director's assessment of the appropriate surcharge.

Theoretical foundations of the Rohlfs model

Comments on the theoretical foundations

G.59 Orange expressed a number of concerns regarding the use of Rohlfs' model:

- Orange argued that Rohlfs' model had weak micro-foundations and important parameter values had little theoretical justification and no empirical
-

verification. Orange said that DotEcon's model has robust micro foundations and econometric estimates are used to estimate elasticities which makes it superior to Rohlfs' models;

- the principal-agent model made unrealistic assumptions regarding competition in the retail market;
- Rohlfs' targeting model assumed that MNOs can distinguish between marginal and non-marginal subscribers and that no part of fixed costs are recovered from termination charges; and
- the Rohlfs model that gives the Director's upper bound for the externality surcharge is likely to overstate the degree of internalisation and is based on initial (i.e. calibration) values which imply excess profits.

G.60 Vodafone also criticised Rohlfs' model:

- Vodafone said Rohlfs systematically understated the super-elasticity of mobile subscription and MO calls, and it criticised Rohlfs' rebuttal of DotEcon and Frontier Economics' econometric analysis; and
- for given values of the cross-price elasticities from subscription to calls (mobile and F2M), the R-G factor can be calibrated by assumption by choosing the appropriate value of the cross-price elasticity of mobile subscription with respect to the price of mobile outbound calls. The observed increase in F2M and mobile calls is either due to a large network externality or if the R-G factor is low, then the cross-price elasticity of mobile subscription with respect to the price of mobile outbound calls must be sufficiently high to explain the movement in subscribers. Given the empirical evidence, Vodafone said that the Director cannot claim that both the R-G factor is low and the super-elasticity of outbound services is low.

The Director's response on the theoretical foundations of Rohlfs' model

G.61 Contrary to Orange's view, the Director believes that Rohlfs model has robust theoretical foundations – not least regarding the elasticity estimates and the values of the gross and net externality factors (see discussion above and the response to Vodafone's comments below). As noted in the Director's response under the heading *the R-G factor*, Rohlfs' paper of 15 October 2002⁷⁵ roundly rebuts the criticisms of his methodology. In particular, his definition of social welfare is sound and, contrary to the DotEcon model, Rohlfs' model does not rely on undisclosed global properties of his demand system. While Rohlfs' model does not rely on estimated parameters for his demand system, it is more satisfactory to rely on parameters which are corroborated by a priori reasoning, than rely on estimated parameters which violate parameter restrictions implied by a priori reasoning (in particular, by reference to the gross and net externality factors).

⁷⁵ Rohlfs 15 October 2002: *Rebuttal of Dotecon's response to my review of their report "Optimal call termination rates"*.

G.62 While Rohlfs' principal agent model represents a stylised view of competition in the access and outgoing call market, it serves to emphasise that absent perfect competition (or other zero-profit model of competition) in that market, the level and structure of prices will not attain the Ramsey optimum. Secondly, and perhaps more importantly, it is the only estimate which factors in the possibility of a non-optimal response by MNOs in using the funds provided by a surcharge. If the MNOs are correct in stating they have little incentive to provide a subsidy to marginal subscribers, then the Director considers that a principal-agent model is the more correct analytical framework to use than a model of Ramsey pricing. The optimum in this case would involve a much lower mark-up for externalities than the Ramsey model, because the principal-agent approach recognises that MNOs may use part of any subsidy to compete for infra-marginal subscribers (by lowering outgoing call prices).

G.63 In response to Orange's third point, as noted above under the heading *Targeting*, the Director considers that targeting of marginal subscribers is feasible. If MNOs do not have an incentive to do so, then given the welfare losses associated with increasing termination charges above cost, this is not a reason to increase the termination charge further. The Director takes Orange's next argument that it is impractical and unjustified to assume that no part of fixed costs is recovered from termination charges as a criticism that Rohlfs' model overestimates the ability of MNOs to price discriminate. In Rohlfs' three-part pricing plan, the model solves for modified Ramsey prices, in which it is not necessary to recover common costs from services other than subscription. This is because the model assumes these costs can be recovered from infra-marginal consumers; hence, no mark-ups on other services are required and there is no welfare loss. As the Director (and Rohlfs) has pointed out, this may overestimate the ability of MNOs to target subsidies. This was why the Director used the Rohlfs three-part pricing plan as a lower bound, in conjunction with a model with no targeting as an upper bound.

G.64 The Director discusses Orange's points (as well as T-Mobile and Vodafone's) with respect to the degree of externality internalisation below. With regard to the profits assumed at the calibration points, the Director notes that the calibration points identify points on the demand curve in 2005/06. It is a difficult exercise to correctly forecast what the accurate prices and quantities might be at that time, and whether this would involve any excess profits is uncertain. However, as the estimates of optimal prices in the Rohlfs model are generally Ramsey-based (with the exception of the Principal-Agent model), any excess profits implied at the calibration points are removed in the calculation of the optimal pricing structure.

G.65 Turning to Vodafone's points, the Director does not accept that Rohlfs' model systematically understates the cross-elasticities as suggested by Vodafone. As discussed above under the heading *the R-G factor*, there are strong a priori reasons for an upper bound to the gross externality factor (of 2). The external option value of subscription is likely to be small but positive, which implies a net externality factor just above 1. A priori reasoning for the magnitude of cross-elasticities is weaker, but these must be consistent with the values of the gross externality factor and net externality factor. Given these constraints on the implicit values of the cross-elasticities, the Director believes that empirical estimates incompatible with these values are strongly suggestive of estimation errors. In general, empirical estimates

which lie outside plausible bounds suggest empirical estimation difficulties. For example, an estimated relationship between investment and interest rates which yielded a positive coefficient on the interest rate variable would imply a problem with data or estimation technique, not with the standard theory of investment.

G.66 The Director has indicated in Annex L of this explanatory statement that he believes that the estimates of the effect of subscriptions on outgoing usage and fixed-to-mobile demand presented by the MNOs are biased upwards, due to the increasing taste for mobile subscription. That is, the claimed increase in fixed-to-mobile and mobile calls from an increase in subscribers is overstated. This suggests, contrary to Vodafone's view, that it is possible to validly claim that both the R-G factor and the super-elasticity of outbound services are low. Hence, he remains of the view that the elasticities assumed in the Rohlfs model are reasonable.

Internalisation of externalities by MNOs in the Rohlfs model

G.67 T-Mobile argued that contrary to Rohlfs' model, internalisation by MNOs can be expected to be very limited. Orange similarly considered that the assumed level of internalisation of external benefits accruing to mobile subscribers was unreasonable.

G.68 Vodafone argued that Rohlfs' adjustments for internalisation were arbitrary. Moreover, for operators to internalise the externality in the way Rohlfs presupposed, Vodafone said that MNOs would need to be able to price discriminate in the setting of incoming call charges as well as the setting of outbound charges, so that any subsidy to a marginal subscriber would be recovered via a surcharge on the incoming call charges levied on calls to that marginal subscriber. Otherwise the mobile operator would have no incentive to subsidise the marginal subscriber and would be better off not doing so.

G.69 The Director does not consider that the internalisation assumptions of Rohlfs' model are unreasonable. Infra-marginal subscribers will clearly benefit from the introduction of marginal subscribers onto MNO's networks, both in terms of the value such subscribers place on subscription, and in their ability to make more outgoing calls. In the Director's view, the MNO's use of complex multi-part retail tariffs will almost certainly allow them to capture some of this benefit.

G.70 With regard to on-net calls, the Director considers that MNOs will be able to internalise much of the benefits accruing to its own subscribers (as only one MNO is involved). It is possible that internalisation of the externality accruing to callers on other networks from calling its own marginal subscribers cannot so be so readily internalised, and that the incentive to internalise the externalities (by lowering the price of subscription to marginal subscribers) is diluted to some degree. However, there is a positive benefit for subscribers of an MNO when another MNO adds a marginal subscriber, and so this reciprocal benefit will encourage some internalisation even for off-net calls. This is reflected in the assumptions made by Rohlfs – i.e. that less internalisation is assumed for off-net mobile to mobile calls, and none is assumed for fixed-to-mobile calls. However, as reported in Table 5 of Rohlfs' paper of 22 May 2002, the optimal fixed-to-mobile price derived from his model is not particularly sensitive to changes in the assumption regarding the

internalisation of externalities by MNOs. The Director examines this further below in his analysis of different models for estimating the surcharge.

Use of the MMC and CC calculations within the Director's range of plausible values for the externality surcharge

G.71 Orange and Vodafone both raised the issue of the estimate surcharges based on the MMC and CC reports. Both respondents noted that the 1998 MMC figure was essentially out of date and both expressed concerns over the derivation of the CC's 0.45ppm figure. Further details of the CC's 2003 calculation are set out in Chapters 2 and 8 and Annex 4 of the CC report.

G.72 Orange expressed concern that the CC's estimated surcharge on termination was based on all incoming call volumes including those from other MNOs. The CC's choice of denominator was therefore inconsistent with its conclusion elsewhere that payments between MNOs are transfers within the industry, not a net income to the mobile sector. In Orange's view, the CC's choice of denominator would result in under-recovery of the net subsidy it considered justified.

G.73 Vodafone argued that Mr Justice Moses' judgement in the recent judicial review accepted that the CC failed adequately to grapple with the issue as to the benefits which would be achieved by an externality surcharge of 0.45ppm, if there was no incentive for MNOs to target subsidies only at marginal subscribers. While the judgement concluded that, quite regardless of this issue, the Commission would not have allowed any higher surcharge, this does not excuse the Director from the obligation to investigate more fully the likely effects of such a surcharge, and to evaluate it by reference to the objectives of Article 8 of the Framework Directive. In addition to the lack of incentive to target subsidies at marginal subscribers, Vodafone said that the CC's calculations erroneously used the total volume of inbound minutes to mobile phones, including mobile to mobile calls made by marginal subscribers. Logically, the subsidy should be grossed up so as to ensure that marginal subscribers are left, in net terms, with the subsidy that they were intended to receive.

G.74 The Director previously incorporated the MMC's 1998 estimate of 0.5ppm since this figure provided a useful historical check for more recent estimates. It was the figure applied in actual regulated charges in the past (and in a period when the number of mobile subscribers increased dramatically).

G.75 The Director does not share Orange and Vodafone's concern regarding the inclusion of off-net minutes in the CC's calculation of the appropriate externality surcharge. As discussed above, funding the whole of the subsidy through a mark-up on termination charges alone would not be the most economically efficient outcome, because it would impose significant welfare losses on callers to mobiles. The overall welfare loss from applying mark-ups to fund the subsidy would be minimised by funding the subsidy through the prices of all services, because this would minimise the reduction in consumption caused by the required mark-ups. The correction suggested by Vodafone and Orange is thus erroneous, as it assumes that it would be economically efficient for all marginal subscribers to be brought onto the network regardless of the welfare losses imposed on other consumers.

G.76 As noted earlier, the Director does not believe any one approach to estimating the surcharge is superior, and that all approaches considered have weaknesses. In this respect, the Director considers that the CC's estimate has merit, but also, like all of the other estimates, involves simplifications that could bias the estimate up or down.

G.77 The Director has already given his reaction to the consequences of MNOs not having the incentive to target. With regard to the CC's calculation, the flaw in Vodafone's critique is as with Orange's, namely a failure to recognise that it is not efficient for all marginal subscribers to be brought onto the network if in doing so further welfare losses are imposed – ie a trade-off exists between correcting the network externality and funding it via a surcharge on termination, since this involves welfare losses on callers to mobiles.

Use of other estimates to obtain the externality surcharge

G.78 In the May consultation, the Director noted that consultants working on behalf of the MNOs provided various pricing models and estimated externality surcharges during the course of the CC's inquiry, such as DotEcon on behalf of O₂, Frontier Economics on behalf of Vodafone and Charles River Associates on behalf of T-Mobile. For further details of these models, see Chapters 8 and 9 of the CC report.

G.79 The Director did not consider that any of these models provided useful results that should be taken into account in this market review. This is because such models were subject to methodological flaws and/or implausible elasticity estimates. As discussed above, it is reasonable to believe that the R-G factor lies between 1.3 and 1.7 and certainly between 1 and 2. The elasticity assumptions used in these models, including the cross-price elasticities, imply significantly larger values for the R-G factor. Therefore, the Director considers that the elasticity assumptions used in these models are implausible and cannot be relied upon, because they are inconsistent with credible underlying economic relationships. Further difficulties with these models are set out in Dr Rohlfs' comments reported in Appendix 9.1 of the CC report.

G.80 DotEcon argued that the Director misunderstood the relationship between the R-G factor and observed cross-elasticities. In particular, DotEcon said that the calculated R-G factor depended on calibration prices and quantities, elasticities and the global shape of the demand system. The Director's conclusion that the price elasticities estimated by DotEcon implied an implausibly high network externality factor could only be drawn by assuming a globally linear (i.e. linear both at the calibration point and at all other points on the function) demand system. This assumption was not supported by any empirical evidence. DotEcon then suggested that a number of possible interpretations of the supposed inconsistency between the network externality factor and own- and cross-price effects could be posited:

- Elasticities are as observed, and the externality factor is as surmised, in which case demand functions cannot be globally linear;
 - Elasticities are as observed, and demand functions are globally linear, in which case the network externality factor cannot be as surmised; or
-

- Demand functions are globally linear, and the network externality factor is as surmised, in which case elasticities cannot be as observed.

G.81 DotEcon considered that the Director's rejection of the first two of these was highly questionable.

G.82 In response to the three interpretations offered by DotEcon, in the Director's view, only the first and third would be tenable, as he believes a priori reasoning supports a value for the R-G factor of between 1 and 2. With regard to the first, while it is possible that the demand functions are not globally linear, in which case, given a plausible value for the R-G factor, the elasticities are as estimated by DotEcon, it should be stressed that DotEcon's own modelling has been based on linear demands, which they intended to apply only locally. DotEcon's modelling assumption of locally linear demands, while rejecting the possibility of globally linear demands, is clearly problematic. As Rohlfs argued in his 15 October 2002 paper⁷⁶:

'Everything depends on some global model that is not even described, let alone defended. Instead, DotEcon should have described a global model that has the assumed R-G factor, has the same local properties as their linear model, and – most importantly – makes economic sense. As it is, one cannot evaluate the economic reasonableness of whatever global model they may have in mind.'

G.83 On this basis, the Director believes he is justified in rejecting DotEcon's first and second interpretations. In addition to bounds on the R-G factor, the Director also believes that a plausible value for the net externality factor (which reflects only the option value of subscription – i.e. net of cross-elastic effects) must obtain. If the estimated elasticities cause the net externality factor to fall below 1, then one should seriously question the economic meaningfulness of the estimated elasticities. Therefore, given these restrictions on the net- and gross- externality factors, one is left with bounds on the plausible values for the elasticities.

G.84 Vodafone did not accept the Director's rejection of the DotEcon and Frontier models and referred the Director to Table 9.12 of the CC's report. In that table the CC compared the results of Rohlfs', DotEcon's and Frontier Economics' models using a set of common input assumptions (some of which the Director believes lead to an overstatement of the optimal surcharge, e.g. there is no internalisation assumed). Vodafone argued that these assumptions imply an R-G factor of 1.5, which on the Director's reasoning would be plausible. The results show that the Rohlfs model gives an optimal fixed-to-mobile mark-up of 2.9ppm. Both the DotEcon and Frontier models showed 2.7ppm. Vodafone estimates that the element of the mark-up for fixed and common costs is 0.5ppm. Hence, Vodafone suggests each of the models predicts a mark-up of around 2.2ppm, and thus, all of the models could reasonably be employed by the Director in developing an estimate of the optimal surcharge.

⁷⁶ Rohlfs 15 October 2002: *Rebuttal of Dotecon's response to my review of their report, "Optimal call termination rates"*.

G.85 The Director notes that there is some commonality between the models (particularly the Rohlfs and DotEcon models). Indeed, Dr Rohlfs commented to the CC that when DotEcon's model was run with input assumptions he considered more reasonable, it yielded similar results to his own model. The Director believes Vodafone's comparison above, and Rohlfs comments to the CC, provide further support for his use of the Rohlfs model. When the other models use realistic input assumptions, the results obtained will be similar. Therefore, as the other models do not use generally use input assumptions consistent with a priori economic reasoning (e.g. on the level of internalisation), or fail to capture important features of the mobile market (e.g. the ability of MNOs to price discriminate), he believes he is justified in referring only to the Rohlfs models.

Conclusions on the appropriate externality surcharge

Estimates used

G.86 Similar to his approach in the May consultation, in developing the appropriate surcharge the Director has considered a number of estimates that he believes are relevant. As before, he does not consider that any estimate is, on its own, sufficiently accurate due to the omission or simplification of relevant considerations, the reliance on uncertain parameter values and complex interactions between the factors relevant to the determination of the optimal surcharge, such as the existing internalisation of externalities or the form of retail competition. However, each of the estimates considered places different weight on these factors, and thus logically informs his decision.

Table G.1 Summary of quantifications of the optimal externality surcharge

Source	Description	Optimal surcharge
Rohlfs targeting model*	Incorporates ability of MNOs to distinguish marginal and infra-marginal subscribers through price discrimination	0.07 ppm
Rohlfs principal-agent model*	Incorporates MNOs sub-optimal use of higher mark-ups on termination	0.07 ppm
Previous surcharge (MMC)	See MMC report, appendix 5.2 for further details.	0.50 ppm
CC report	See CC report, appendix 8.1 for further details.	0.45 ppm
Rohlfs no targeting model**	A linear pricing model (no price discrimination) with some internalisation of externalities by MNOs assumed.	0.49 ppm
Rohlfs model – reduced internalisation*	Reduces assumptions about amount of externality internalised by MNOs (increasing the usage cross-elasticities, $j_2 = 0.5$, $j_4 = 0.5$, $n = 0.25$).	0.67 ppm

* The Rohlfs models have been updated to take account of revised LRIC inputs.

While the optimal surcharge is the same as that reported in the May Consultation, it has been derived by removing fixed costs from Rohlfs basic model, rather than by adjusting the overall (externality plus common cost) mark-up.

G.87 The complexity of the conceptual and practical issues makes judgement of the appropriate surcharge difficult. In the circumstances and based on the relevant evidence set out above, the Director considers that a reasonable externality surcharge is 0.4ppm.
