Annex L

Oftel's cost-benefit analysis of regulation

L.1 The Director recognises that regulatory intervention is appropriate only when there is a reasonable expectation that its benefits will exceed its costs. This assessment must take account of the benefits to all users, including those calling mobiles as well as the mobile customers themselves.

L.2 As the Director noted in the May consultation, models of economically efficient pricing are in principle well suited to deriving estimates of the welfare gains from regulation. The Director's approach to the assessment of the appropriate level of voice termination charges involves an estimation of the set of charges that maximises the welfare of consumers, subject to ensuring that MNOs are able to earn a reasonable return on their investment. The Director's reservations about the relevance and practicality of deriving Ramsey prices means that such estimates should not be regarded as precise, and consequently he does not use these models to derive 'optimal' prices for fixed-to-mobile calls or mobile termination. Rather, the Director uses these models to provide an indication of the direction and broad magnitude of the effect of regulation. In order to estimate the welfare gains from regulation, the Director compared two scenarios:

i) a scenario in which termination charges are brought down via the charge control to the Director's fair target charge and where other prices are assumed to be set on a Ramsey basis ("constrained Ramsey"); and

ii) an unregulated scenario in which MNOs set high termination charges, but are assumed to make no supernormal profits (i.e. make sufficient revenues to cover costs, including the cost of capital) ("zero-profit unregulated").

L.3 The Director stated that he believed this comparison represented a conservative estimate of the likely gains from regulation. This was because the welfare comparison assumed the same level of profit in both scenarios (in each scenario MNOs just cover costs including the cost of capital), i.e. it assumed a complete 'swings and roundabouts' effect. The resulting total welfare gain will therefore reflect a pure change in surplus. Allowing for the more realistic situation of imperfect competition (less than complete 'swings and roundabouts' effect) would involve larger welfare gains from regulation as well as transfers of surplus between MNOs and consumers.

L.4 The Director performed the above comparison using the relevant versions of the model produced by Dr Rohlfs and described in his paper *A model of prices and costs of mobile network operators, 22 May 2002*. Dr Rohlfs' model is based on four services: mobile subscription, mobile-originated usage other than off-net, fixed-to-mobile usage and off-net usage. Both the constrained Ramsey run and the zero-profit unregulated run used in the CBA described herein were based on linear demand functions. While the Director prefers the use of constant elasticity demands for determining efficient prices, linear demands were used because the unregulated scenario does not have a solution where demand remains inelastic, as is assumed at all points on the constant elasticity demand curve. The two alternative scenarios

were updated from the May 2002 calculation to reflect adjusted cost inputs, and the Ramsey model was additionally constrained to yield a fixed-to-mobile price consistent with the fair charge for termination (the fixed-to-mobile price being the sum of mobile termination and the fixed network operator retention).

L.5 On 1 July 2003 the Director released further information on these calculations and the outputs (see www.oftel.gov.uk/publications/mobile/2003/gain0703.htm). On the basis of this analysis, the Director concluded there would be substantial welfare gains from regulation – of the order of £225M per quarter in 2005/06.

Revised estimate of welfare gains

L.6 As a result of revisions to cost inputs since the May consultation, the Director believes it appropriate to re-run the results of his welfare analysis.

L.7 The revised cost assumptions are as follows.

Table 1 Revised cost assumptions for welfare comparison

Variable	Cost assumptions – May Consultation	New cost assumptions	Source
Subscription LRIC	19.83* (£ per qtr)	19.83 (£ per qtr)	Table 7.10 of CC report for total CARS costs over total subscriber base
Mobile originated LRIC	7.57ppm	7.23ppm	Weighted avg of mobile-to-fixed and on-net. M2F = avg of 900/1800 origination + fixed termination + retail cost. On-net = avg of 900/1800 on-net + retail cost
Fixed-to-mobile LRIC	5.79ppm	5.67ppm	Estimated fixed retention + termination cost (from LRIC model)
Off-net mobile LRIC	9.96ppm	9.56ppm	Estimated retail cost + origination (from LRIC model) + termination (from LRIC model)
Common cost	194.79 (£m per qtr)	222.98 (£m per qtr)	Network common cost from LRIC model + non-network common costs (administrative costs)

Note: cost figures are in real terms, 2000/01 prices

L.8 The revised results are as follows.

Table 2 Results of revised welfare comparison

		Unregulated	Regulated - Ramsey (FTM=6.65ppm)
Solution prices	Subscription (£)	16.6	16.0
	Mobile orig. (ppm)	4.89	9.14
	Fixed to mob. (ppm)	26.4	6.65
	Off-net (ppm)	16.9	14.4
Solution quantities	Subscription M	50.9	49.0
	MO M mins per qtr	12483	11250
	FTM M mins per qtr	2150.9	4191.1
	Off-net M mins per qtr	3145.2	3174.5

Changes relative to values at calibration prices and quantities	Change in profit (£m)	606.8	382.0
	Change in CS (£m)	-541.1	-541.1
	Change in S (£m)	65.6	-159.2
	Welfare gain from regulation per quarter	**£224.8m**	

L.9 This per quarter gain must be converted to a gain over the period of the price control, taking into account the glidepath and discounting of future benefits.

Table 3 Welfare gains over the period of the charge control

Change in total surplus in 2005/06 (£m per quarter)	224.8			
Change in total surplus in 2005/06 (£m per annum)	899.18			
Real discount rate	3.50%	Note: Treasury Social Time Preference rate = 3.5% real		
		0	1	2
Period	**Total**	**2003/04**	**2004/05**	**2005/06**
Termination charges (ppm)				
900MHz operator		7.53	5.14	4.61
1800MHz operator		8.88	5.81	5.19
Percentage of target reduction				
900MHz operator		0%	82%	100%
1800MHz operator		0%	83%	100%
Average operator		0%	82%	100%
Simple linear interpolation of surplus		0.00	740.85	899.18
Forecast termination mins from April 02 model (million)		6,315	6,382	6,552
Proportion of 2005/06 traffic		96%	97%	100%
Crude adjustment for volume growth		0.00	721.67	899.18
Present value of surplus (real 2000/01 terms)	**1,536.66**	0.00	697.26	839.39
	2001/02	2003/04	2004/05	2005/06
Historical RPI	2.93%	2.94%	2.90%	2.90%
Compound RPI	1.029	1.067	1.098	1.130
Total Surplus (2003/04 terms) £m	**1,639.53**			

NB: All figures are in real 2000/01 terms (unless otherwise stated)

L.10 From this analysis, the Director concludes that there are substantial gains from regulation of termination charges. The Director believes this conclusion is robust to various sensitivities. He now addresses the comments of MNOs on the analysis outlined in the May consultation, including comments on the sensitivity of the results described above.

Comments from MNOs on the Director's analysis

L.11 Comments from MNOs covered six main areas:

i) the choice of the Rohlfs model for cost-benefit comparisons;
ii) the treatment of pre-paid customers;
iii) the consideration of dynamic effects, including effects on investment;
iv) the use of Ramsey pricing models for welfare analysis;
v) the choice of scenarios and the underlying assumptions in the cost-benefit comparison; and
vi) the treatment and measurement of network externalities and welfare in the Rohlfs model.

L.12 Some of these comments are set out in the Director's Annex G (Evaluation of surcharge externality, and these are referred to where appropriate.

The choice of the Rohlfs model

L.13 The MNOs and DotEcon considered that Oftel's modelling of the impact of the charge control using the Rohlfs model was not an accurate reflection of the true welfare impact.

L.14 Vodafone, T-Mobile and DotEcon queried the Director's reliance on the Rohlfs model, given that they had presented models which showed much higher optimal mark-ups on fixed-to-mobile call prices, and which implied a charge control would lead to losses in total welfare rather than gains as the Director had shown.

L.15 As noted in Annex G on the externality surcharge, the Director considers the models developed for Vodafone (Frontier Economics), T-Mobile (CRA) and DotEcon are flawed because of implausible elasticity assumptions and/or methodological deficiencies (which were discussed in the CC report at 2.346, 2.519(c) and Appendix 9.1). In addition, these models are unable to provide a plausible base case scenario (estimating charges in the absence of regulation); rather, they compare a regulated scenario to optimal (Ramsey) prices, which are assumed to be set by the MNOs. As discussed below and in Annex G, the Director does not believe this to be a reasonable model of MNO behaviour. He continues to believe that the Rohlfs model is currently the most suitable model for conducting welfare comparisons.

The treatment of pre-paid customers

L.16 T-Mobile claimed that the failure of the Rohlfs model to take into account pre-pay customers was a 'fundamental flaw', and that regulation would drive out pre-pay customers:

> "The key driver of the estimated welfare gain in the assumption that subscription costs are currently, and will be after regulation, recovered mainly through subscription charges. However, around 70% of the market is on zero subscription pre-pay tariffs, and, as such, their subscription costs are currently being recovered through call prices…A regulated scenario is then presented in which a greater share of subscriber costs is recovered from a slightly higher average subscription charge and outgoing and incoming call prices are brought down towards their marginal costs. As there is little change in the subscription charge there is little impact on subscriber numbers."

L.17 The Director rejects this criticism. As is discussed more fully in the annex on Ramsey pricing (annex K), the Director believes that all of the Ramsey models are deficient in not adequately capturing price discrimination – this is a reason for not relying on such models to derive regulated charges. The Director is using the Rohlfs model to estimate only the direction and broad magnitude of welfare gains, and it is fit for this purpose.

L.18 In any event, the Director does not agree with T-Mobile's claim that such an increase in the average subscription charge would lead to a drastic fall in pre-pay subscriber numbers. While pre-pay, with its avoidance of monthly subscription charges, has clearly been an important factor in expanding mobile penetration in the last few years, it is not correct to say that pre-pay customers do not currently bear any ongoing costs from holding a mobile phone subscription. Pre-pay subscribers do in fact bear costs from holding handsets which are paid for up-front. Therefore it is not tenable to conclude that pre-pay customers will refuse to pay a 'slightly higher' handset or subscription charge (whether monthly or one off), particularly when taken in combination with the MNO's ability to recover higher subscription charges from post-paid subscribers. The Director believes the quantity outputs under the regulated scenario are therefore reasonable.

The consideration of the dynamic effects from regulation

L.19 Orange claims that the Director has not undertaken any analysis of the dynamic costs and benefits of the proposed regulation.

> "Oftel's approach to the cost-benefit analysis also completely ignores any dynamic considerations. The model can be fairly criticised as entirely static: the welfare gains and losses arise from changes in consumer surplus using static demand curves. MNO costs, the range of mobile services offered and the state of competition are all assumed (implicitly) to be unchanged by the regulation."

L.20 The Director's welfare analysis is static, as it compares two future situations with and without the proposed regulations. However, the Director's approach to cost-benefit analysis is standard in assuming that a number of factors are exogenous (outside the control) of the welfare model. In addition, given that the regulation of termination is intended to be competitively neutral, it should not affect retail competition. The important part of the welfare analysis is that it allows a comparison of the two scenarios – the fact that there may be changes outside the model does not invalidate the analysis, but simply means the quantified benefits should be taken as an order of magnitude rather than as exact forecasts.

L.21 Further, Orange (along with T-Mobile and Vodafone), claim that the Director's proposals will have a negative effect on investment, both in their existing 2G networks and on new investment in 3G networks.

> " Regulation might hold back future investment in the mobile network and in improved technologies. To the extent that such investment would reduce costs, productive efficiency is lower than it might otherwise be.
>
> Lack of investment might hold back the development of new services. In view of the development of advanced data services using new technologies such as 3G services, this issue is clearly very important. Offering a new service that customers desire creates consumer surplus; if the service is not offered when it would otherwise have been, this surplus is foregone." (Orange submission, p. 30)
>
> "(ii) As marginal customers are likely to drop their subscriptions, so total call volumes are likely to fall. This could leave the MNOs with stranded 2G assets. This is significant at a time of major technological change from 2G to 3G. If MNOs plan to use 3G capacity, they will be incentivised, if there is spare 2G capacity, to delay the installation of 3G coverage." (Vodafone submission, p.26)

L.22 The Director does not agree that his proposals will have the effect of reducing efficient investment. His estimates of the cost-based target charge include a return on capital; therefore he considers that reducing termination charges would not impair the financial ability of the MNOs to pursue their 2G investment.

L.23 With regard to the effect of 2G high termination charges on investments on the roll-out of 3G services, the Director noted in the May consultation that in his view, 3G services should not be subsidised by 2G termination charges set in excess of costs. In the regulated termination charges, an allowance is made for the funding of subsidies to marginal subscribers through the externality surcharge. 3G is an incremental investment from which a degree of profitability is anticipated. If its profitability is expected to be sufficient to cover its expected cost of capital, then 3G should be capable of attracting funding. The Director is of the view that the investment case for 3G should stand or fall on the basis of its own merit. Hence, distortions from high termination charges should not be allowed to continue on the basis that they could speed the introduction of 3G services.

The approach to the cost-benefit analysis (and the use of Ramsey pricing models)

L.24 There were several comments in submissions about the Director's position on the use of Ramsey pricing models to conduct the cost-benefit analysis:

> "Oftel's approach to conducting the cost benefit analysis is inconsistent with its comments on appropriate pricing structures. At paragraph 5.18 et seq. Oftel discusses the merits of Ramsey pricing in the mobile market. Oftel's conclusion on the subject is summarised at paragraph 5.18. Oftel concludes that, absent regulation, the MNOs would not set a Ramsey structure for all mobile services. Oftel's position is unequivocal on the broad principle of Ramsey pricing in the

mobile market. It is extremely surprising that having reached this conclusion, Oftel then uses a Ramsey based model in its cost benefit analysis. Essentially the cost benefit analysis assumes that MNOs would set a Ramsey structure for all mobile services." (Orange submission, p. 28)

"Given that one of the reasons why Oftel has rejected the Ramsey approach to determining a fair target charge is its concern that mobile operators would not set the remaining unregulated charges at the corresponding Ramsey levels, it is highly surprising that precisely this assumption has found its way into the 'regulated' scenario. This would tend to overstate the benefits from regulation compared to a situation in which unregulated charges were set in the same way as Oftel's 'unregulated' scenario" (DotEcon, pp. 5-6)

L.25 The Director considers that the criticisms of Orange and DotEcon with respect to the Director's adoption of a Ramsey pricing methodology for the CBA are misplaced. The Director has clearly stated that, in the absence of regulation, he does not believe the MNOs would set their prices in accordance with Ramsey principles of cost recovery. However, the charge that the Director cannot then suggest that, once termination charges are fixed, that retail prices are set according to Ramsey principles is inapt. This is in fact a generous assumption about MNO behaviour – for the purposes of the CBA, the model adopts the simplifying assumption that MNOs set Ramsey-based retail prices. But that assumption is for convenience and is not critical to the result of substantial gains from regulation.

L.26 Suppose the Director adopted the assumption that there was imperfect competition in the retail market, say by assuming that once termination charges were set by regulation, retail prices were not set for cost recovery but as per a general model of oligopoly. Then we could expect to see higher retail prices and positive profits for the MNOs under the regulated solution (with termination charges fixed at LRIC plus a markup). However, the relevant welfare comparison would no longer be between the regulated and zero-profit unregulated solutions – for consistency, we would also expect to see an unregulated solution with positive profits, involving higher retail prices as well as monopoly termination charges. This type of comparison was in fact undertaken by Rohlfs in his May 2002 paper (see p. 20). He compared the welfare gain from moving from an unregulated scenario in which positive profits are made, to a principal-agent regulated scenario in which MNOs pursued the same profit-maximising objectives, but with regulatory constraints on termination charges. In this comparison (updated by the Director to reflect updated cost inputs), the welfare gain from moving to the regulated principal-agent scenario from the unregulated scenario is similar to (about 5 per cent higher) than in the Director's base comparison. Therefore, the effect of assuming imperfect retail market competition (which the Director believes is probably a more accurate description of MNO behaviour) largely nets out in any welfare comparison. A similar result follows if the Director, as DotEcon suggests, allows for MNOs to set retail prices as per the 'unregulated' scenario, while holding the price of fixed-to-mobile calls fixed. The welfare gain from regulation is again of similar magnitude (about 5 per cent lower).

L.27 The cost-benefit analysis consequently abstracts from the question of the precise way in which MNOs set retail prices. Again, the Director re-iterates that given

the lack of precision in developing elasticity, cost and price estimates and the uncertainty as to the nature of retail market competition, the cost-benefit analysis should be seen as giving indications of broad magnitude. However, it is quite clear that whichever benchmark the Director adopted for competition in the retail market (i.e. whether he assumes normal or super-normal economic profits) there will be substantial gains from regulation.

L.28 Related to the previous criticism is a further point proposed by T-Mobile:

> "Oftel now has a statutory duty to "maximise consumer benefits". It is therefore puzzling that Oftel has not sought to do so…Rohlfs model is designed to determine the level of fixed-to-mobile prices that maximises welfare…Rohlfs model estimates a termination charge that maximises consumer benefits of 5.65ppm, i.e. significantly higher than the level at which Oftel is proposing to regulate termination charges."

L.29 The Director has previously stated that he does not believe any model of efficient pricing that he has seen is sufficiently reliable to develop 'optimal' prices for fixed-to-mobile calls and mobile termination charges. As discussed in Annex L, the weaknesses of these models primarily relate to deficiencies in capturing all relevant market features and the extensive informational requirements that underpin them, and their sensitivity to changes in this information. In contrast, as noted above, for the CBA the Director has used one of these models to provide an indication of the direction and broad magnitude of the effect of regulation. The Rohlfs model is fit for this purpose, however, given the likelihood of error he does not believe it would be appropriate to regulate using the model's estimate of the 'optimal' price. The Director believes his approach of adopting EPMU for the recovery of common costs and the incorporation of a separate externality surcharge is completely consistent with maximising consumer benefits to both fixed and mobile users.

The choice of scenarios and the underlying assumptions in the cost-benefit comparison

L.30 There were a number of comments from MNOs about the Director's choice of scenarios for the cost-benefit analysis and the reasonableness of the outputs from these scenarios:

> "It is extremely concerning that, in its cost-benefit analysis, Oftel has assumed an increasing wholesale (termination) charge in the unregulated base case scenario…It is totally implausible for Oftel to assume that MNOs are capable of increasing wholesale (termination) rates from current levels (sub 10ppm on average) to 26 ppm over the next two and half years…Oftel's unregulated scenario…is beyond the bounds of reasonableness." (Orange submission, p. 19)

> "The base case for the cost benefit analysis, the 'unregulated' scenario, should be based on reasonable assumptions of the situation 'absent a price control'. The purpose of the cost benefit analysis is to assess whether the proposed additional regulations will generate a net-benefit. Re-running the model assuming a base case 8.75ppm mobile termination rate (the approximate

industry average after the initial 15% reduction recommended by the CC is implemented) calculates a net welfare benefit of only £164m, which given other uncertainties and dynamic impacts (such as lower investment) is likely to over-state any actual benefit." (Orange submission, p. 28)

"Oftel's cost assumptions suggest that at current prices, the industry is earning substantial excess profits despite the lack of empirical evidence for this." (T-Mobile, p. 96)

"Additionally, the assumptions used by Oftel in calibrating its model (including assumptions about the magnitude of fixed costs) imply industry-wide profits of more that £2 billion per annum for all MNOs. Given the level of competition (implicitly acknowledged in the zero profit constraint used by Oftel for the unregulated scenario), this is highly questionable." (DotEcon, p. 6)

L.31 On the issue of unregulated termination charges, the Director has already addressed this issue in Chapter 4. To reiterate, while the Director cannot fetter his discretion, the Director considers it highly unlikely that he would decide to forbear from regulation of termination charges on the basis that either the market was competitive, or that high charges did not have adverse effects on consumers, and then later reverse his decision on the issue of termination charges in a dispute between operators. In these circumstances, the threat of dispute resolution would not constrain termination charges, and the Director maintains his view that termination charges could well be raised substantially above the prevailing charges.

L.32 The Director therefore does not consider that setting the unregulated termination charge at 8.75ppm and comparing the welfare outcomes with the regulated case (the exercise undertaken by Orange and its consultants) has any validity for assessing the benefits of regulation. The 8.75ppm in fact already represents a regulatory intervention, so it would clearly not be sensible to accept this as the result of an unregulated market.

L.33 Even in the event that the Director's estimated unregulated termination charge of around 25ppm was not to prevail, the Director believes his result of substantial welfare gains from regulation is robust to a wide range of charges. Indeed, even Orange's calculations indicated a welfare gain in moving from the current regulated charge to the new regulated charge.

L.34 In response to T-Mobile and DotEcon's query about excess profits at the calibration position, the Director makes two points. First, the calibration points are simply that – they only identify points on a demand curve for 2005/06 and are the starting point for the analysis. It is a difficult exercise to correct forecast what the accurate prices and quantities might be at that time, and whether this would involve any excess profits is uncertain. Secondly, it is unclear that profit at the calibration points should have an important effect on the welfare comparisons. The comparison in the welfare analysis is between two zero profit positions – an unregulated solution, and a regulated solution with the fixed to mobile price set and other prices determined by MNOs subject to a zero profit constraint. That is, the model calculates the change in surplus from the calibration points to the unregulated solution, and from the calibration points to the regulated solution. The welfare comparison is the

total difference in surplus between the unregulated and regulated solutions. Consequently, the claim that the welfare benefits from regulation are driven by the reduction in excess profits (implied at the calibration point) is not correct. Both of the scenarios compared incorporate a zero profit outcome, so the base case welfare gain from regulation involves no removal of excess profit.

The treatment and measurement of network externalities and welfare in the Rohlfs model

L.35 Orange claimed that the Rohlfs model also makes unrealistic assumptions with respect to MNOs ability to internalise externalities.

> "Orange does not consider that the Rohlfs model used in the cost benefit analysis is robust. The model assumes that external benefits to other mobile subscribers are largely internalised by the MNOs. Orange considers the assumed extent of internalisation to be unreasonable. If externalities are not in fact internalised to the degree assumed by the model, the benefit of reducing the termination charge is likely to be overstated.

L.36 The Rohlfs models assumes that, to varying degrees, the MNOs can internalise usage externalities. The extent to which they can do so is based on *a priori* reasoning. The Director believes that his results are robust to a much lower level of internalisation than that assumed. With internalisation substantially reduced, the welfare comparison is not greatly different (around 2 per cent less than current estimated gains).

L.37 DotEcon claims that the definition of social welfare used in the Rohlfs model is erroneous.

> "The fundamental problem with Rohlfs approach is that he starts from a reduced demand system in which the external and private effects of changes in subscriber numbers are not distinguished. This means that any attempt to compute a welfare change by taking a path integral (whether over prices or quantities) will be subject to the problem that the answer ultimately depends on the path of integration chosen. Rohlfs claims that this problem can be resolved by picking one particular and intuitively plausible 'natural' path of integration. However, this is not the case, and consequently the definition of social welfare in the Rohlfs model is flawed."

L.38 DotEcon also give a number of examples of how, in particular instances, it believes the definition of welfare proposed by Dr Rohlfs overstates or understates the marginal social benefit of an additional subscriber.

L.39 In response, the Director does not believe that the Rohlfs definition of consumer welfare proposed is inaccurate. DotEcon states that consumer surplus calculated on market demand curves (such as those used by Rohlfs) does not reflect some external benefits to inframarginal subscribers. However, DotEcon fails to take into account differences between its approach and that of Rohlfs – in particular, the incorporation in Rohlfs work of a net externality factor. While DotEcon uses non-market demand curves in its analysis, Rohlfs uses market demand curves and a net externality factor to take account of all other external effects not reflected in market

demand curves, for example, those (non-usage) externalities such as the option to call a subscriber. Consequently, the Director believes that the differences in approach taken by DotEcon and Rohlfs to the measurement of welfare are inconsequential to the determination of the welfare gains from regulation.

L.40 Further information is available in Dr Rohlfs paper entitled “Rebuttal of DotEcon's Response to My Review of Their Report *Optimal Call Termination Rates*" 15 October 2002.