

Final Report

Review of the MTR Reconsideration Draft Cost-Benefit Analysis

Prepared for

Vodafone New Zealand

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Executive Summary

This report, prepared by Covec for Vodafone New Zealand, presents the results of a thorough review of the Commerce Commission's quantitative cost-benefit modelling used in its Reconsideration Draft Report on mobile termination.

We have reviewed both the Reconsideration Draft and the Commission's accompanying spreadsheet cost-benefit model and have found a number of errors and other issues. The most serious problem is that the Commission has significantly underestimated the size of the 'waterbed' effect of regulation, and the corresponding detriments in the mobile market. The waterbed effect is the effect whereby mobile operators respond to a regulated reduction in mobile termination rates by increasing charges to mobile subscribers. As the Commission has accepted, this will be the rational profit-maximising response of any mobile operator.

The Commission appears to have characterised the waterbed effect by assuming that mobile operators will seek to recover half of the total loss in termination revenues that they suffer as a result of regulation. The Commission does this by calculating the increase in mobile average revenue per user (ARPU) per annum to offset half of the lost termination revenue. However, in performing this calculation the Commission's model fails to account for the fact that an increase in ARPU results in a reduction in the number of mobile subscribers, which offsets some of the increase in mobile revenue. The net effect is that the Commission's claimed assumption that mobile operators recover half of the lost termination revenue does not hold true in the modelling. In fact, in the Commission's model, mobile operators only recover approximately one third of the lost termination revenues.

The effects of correcting this error so that the revenue recovery target is actually achieved while leaving all other aspects of the model unchanged are shown in Table 1. It is clear that this change alone is sufficient to eliminate almost all of the estimated net benefits of regulation.

Table 1 Effects of correcting the waterbed calculations to achieve assumed total revenue recovery.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	3.52	-0.55	-95%	-105%
CED	-23.95	-19.93	-144%	-1547%

Alternatively, the waterbed effect could be characterised as pass-through from lost termination revenues to ARPU on a per-subscriber (not total) basis. In this case the Commission's calculations are correct, in the sense that half of the lost termination revenues per subscriber are translated into increased ARPU. However, in this case the Commission's assumption of a rate of pass-through of 50% is implausible and is unreasonably low. This rate of pass-through is the minimum that would occur in the extreme case of monopoly supply and linear demand. If the market is more competitive or if demand is non-linear then mobile pass-through will exceed 50%. An assumption of

50% mobile pass-through is also inconsistent with the Commission's assumptions about pass-through rates in the fixed-to-mobile (FTM) market.

We propose more a plausible mobile pass-through assumption starting at 67% in 2006 and rising to 75% by 2010 to reflect an expected increase in competition in the mobile market. The effects on the net benefits of this change are shown in Table 2. Again, this is sufficient to eliminate almost all of the estimated net benefits of regulation.

Table 2 Effects of changing the mobile pass-through assumptions.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	17.71	1.83	-75%	-82%
CED	-7.87	-15.38	-114%	-1217%

In addition to underestimating the waterbed effect, the Commission's cost-benefit analysis suffers from a number of other problems, all of which lead it to overestimate the net benefits from regulation. In brief, these issues are:

1. The so-called 'FTM effect' that helps to offset the waterbed effect is assumed to be implausibly strong and further contributes to the underestimate of the size of the waterbed effect.
2. The Commission's methodology of estimating mobile market 'marginal cost' per mobile subscriber is flawed and results in an underestimate of the producer detriments in the mobile market.
3. The waterbed calculations omit producer detriments in the FTM market, which results in an underestimate of the waterbed detriments under the total surplus test.
4. The waterbed calculations also omit detriments arising from increased mobile origination prices that reduce the volume of mobile-originated calls by inframarginal customers.
5. The Commission is incorrect in its assumption that Telecom's competitors in the FTM market will not need to match its 100% pass-through commitment under the commercial counterfactual.
6. The Commission also overestimates the increase in FTM pass-through that will result from regulation and effectively assumes that the FTM market eventually becomes perfectly competitive.
7. An estimate of the indirect costs of regulation, for example caused by setting the regulated MTR at the wrong level, have been omitted from the Commission's model which results in an overstatement of the net benefits of regulation.

8. The Commission is incorrect to assume that per-unit costs of mobile termination will instantly fall as a result of the transition from 2G to 3G mobile technology.

We have amended the Commission's cost-benefit model to generate a more reliable estimate of the size of the waterbed effect, and to address all of the other issues listed above. The net benefits generated by our amended model under the consumer welfare (CW) and total surplus (TS) tests under different assumptions about demand are shown in Table 3 if the waterbed effect is calculated as revenue recovery, and in Table 4 if the rate of mobile pass-through is increased to more reasonable levels. In combination, these amendments mean that regulation of mobile termination rates is estimated to have a detrimental net effect on both consumers and total economic welfare.

Table 3 Original and amended net benefit results with corrected waterbed revenue recovery calculations (NPV, 2006 \$m).

Demand	Original		Amended	
	CW	TS	CW	TS
Linear	72.11	10.39	-115.43	-105.46
CED	54.80	1.38	-149.61	-131.64

Table 4 Original and amended net benefit results with original waterbed methodology but increased mobile pass-through (NPV, 2006 \$m).

Demand	Original		Amended	
	CW	TS	CW	TS
Linear	72.11	10.39	-76.39	-82.18
CED	54.80	1.38	-103.40	-102.09

In addition, we have improved and extended the sensitivity analysis conducted by the Commission on its net benefit results. We show that the Commission's finding that there are positive net benefits from regulation can be reversed with relatively small changes in some key parameters individually. Thus the Commission's results are not robust to reasonable levels of parameter uncertainty. On the other hand, the conclusion of our amended model that regulation will be economically harmful is robust to relatively large changes in individual key parameters.

1. Introduction

This report, prepared by Covec for Vodafone New Zealand, presents the results of a thorough review of the quantitative cost-benefit modelling used by the Commerce Commission (“the Commission”) in its Reconsideration Draft Report (the “Reconsideration Draft”) on mobile termination, dated 22 December 2005.

We have prepared this report by reviewing both the Reconsideration Draft and the Commission’s accompanying spreadsheet model that contains the quantitative cost-benefit analysis. In this report we concentrate on the quantitative aspects of the Reconsideration Draft and set aside other non-quantitative issues such as the decision to regulate termination on 3G networks, market definition, and dynamic efficiency. This does not mean, however, that we agree with the Commission’s analysis or conclusions on these issues.

This report consists of two main sections. In section 2 we examine in detail the Commission’s quantitative cost benefit modelling. We have previously commented on many aspects of the Commission’s modelling as it has evolved throughout the mobile termination investigation. In this report we will not repeat our previous critiques of the model, and instead will focus mainly on the new aspects of the model that have appeared since the conference held on the Commission’s Draft Report, most notably the modelling of the ‘waterbed’ effect.

In section 3 we improve and extend the sensitivity analysis performed by the Commission in the Reconsideration Draft to show how the cost benefit results respond to changes in the important parameters. This analysis is used to assess the reliability of the Commission’s net benefit results and the strength of the case for regulation. We also assess the sensitivity of an amended version of the model that incorporates our proposed changes.

2. Analysis of the Cost-Benefit Modelling

In this section we present a review and analysis of the Commission's quantitative modelling that it has used to justify its case for regulation. We discuss in detail a number of issues that we have with the model, including what we believe are some critical errors. In each case we present our calculations of the impacts on the net benefits of regulation of each of our suggested corrections and amendments individually, relative to the Commission's results. At the end of this section we summarise the aggregate impact of all the changes. For reference, Table 5 replicates the net benefits of regulation as estimated by the Commission under the consumer welfare (CW) and total surplus (TS) tests for different assumptions about the shapes of the demand curves in the model.

Table 5 The Commission's net benefit results (NPV, 2006 \$m).

Demand	CW	TS
Linear	72.11	10.39
CED	54.80	1.38

2.1. The Waterbed Effect

In the Final Report and the Reconsideration Draft, the Commission has recognised the existence of the 'waterbed' effect as a source of detriments that offset the potential benefits from regulation of mobile termination rates. The waterbed effect is the effect whereby profit maximising mobile operators will raise (or reduce at a slower rate) charges to mobile subscribers as a result of a regulated reduction in mobile termination rates. This results in a reduction in mobile subscription and/or usage, with consequent detrimental effects for consumer and producer surpluses.

2.1.1. The Commission's Overall Approach to the Waterbed

Due to data constraints, the Commission has chosen to model the waterbed effect as an increase in mobile average revenue per user (ARPU), which in turn results in a reduction in the number of mobile subscribers. In our opinion this is a relatively crude way of modelling the waterbed effect, given the complexity of prices in mobile markets. All mobile customers face a multitude of different prices, and many face prices for both subscription and usage. A more sophisticated approach would take this into account, for example by using different demand elasticities for subscription and usage, and accounting for these effects separately.

While a more sophisticated model of mobile prices and demand would produce a more accurate estimate of the size of the waterbed effect, there are at least two drawbacks associated with such an approach. The first is that a greater amount of information about the demand for mobile services and subscription would be required. While such data is not impossible to obtain or estimate, it would nevertheless be time-consuming and costly. The second and possibly more serious drawback is that it would be more difficult to estimate the impact of the waterbed effect on multiple mobile prices. Doing

so would require more detailed information and a model of competition in the mobile market.

Taking into account the advantages and disadvantages, in our opinion the Commission's basic approach using a single mobile ARPU is an acceptable way to generate a tractable model of the waterbed effect. We therefore do not propose any modifications to the basic way that the waterbed effect is modelled. We do however have some criticisms of the way this calculation is performed, and how the subsequent welfare effects associated with the waterbed are calculated, which we will discuss in the following subsections.

2.1.2. Mobile Pass-through and the Size of the Waterbed Effect

The first step in estimating the detriments due to the waterbed effect is to estimate how mobile operators will respond to a reduction in the mobile termination rate (MTR). Since the Commission's waterbed model uses mobile ARPU as a subscription 'price', the key question is how ARPU will change in response to a reduction in the MTR. As the Commission explains in paragraphs 620 and 621 of its Final Report, there are (at least) two ways that this problem could be approached.

The first approach is to recognise that an x cpm reduction in the MTR will lead to a reduction in termination revenues per mobile subscriber (on average) of Mx , where M is the average number of FTM minutes received by a typical mobile subscriber. If the pass-through rate is r then the increase in mobile ARPU due to the waterbed effect is Mxr .

The second approach is to calculate the total amount of termination revenue that a mobile operator will lose as a result of regulation, and assume that some fraction of this total is recovered through increased mobile ARPU due to the waterbed effect. This requires calculating the ARPU under the factual such that the difference in the mobile operator's total 'subscriptions' revenue between the factual and the counterfactual is equal to the required amount of revenue recovered.

Contrary to the Commission's apparent belief, these two methods are *not* equivalent in the sense that, when calculated correctly, they do not generate the same increase in ARPU under the waterbed effect. Under the first approach, the change in ARPU, Mxr , can also be calculated as the rate of pass-through times the loss in total termination revenue, divided by the counterfactual number of mobile subscribers. For example, if S is the number of mobile subscribers under the counterfactual then the total number of FTM minutes terminated is MS , and the total loss in termination revenue is MSx . Then the change in ARPU can be calculated as $MSxr / S$, which gives Mxr as before. This method is the way that the Commission has calculated the change in ARPU under the waterbed effect in its spreadsheet model.¹

However, it is straightforward to see that this does not lead to a recovery of a fraction r of the total termination revenue lost. The reason is because the number of mobile

¹ See, for example, rows 34 and 35 of the "Waterbed Linear" tab in the Commission's spreadsheet.

subscribers depends on the ARPU, in the Commission's model. Thus an increase in ARPU under the waterbed effect causes a reduction in mobile subscribers, which reduces the total amount of revenue received from mobile subscribers. Under the Commission's assumption of 50% pass-through, it calculates the increase in ARPU under the waterbed as half of the loss in total termination revenue divided by the counterfactual number of mobile subscribers. This does mean that half of the lost termination revenue *per subscriber* is passed through into higher mobile ARPU, but it does *not* mean that half of the *total* loss in termination revenue is recovered.

To see this, consider for example the Commission's waterbed calculations for the linear version of the model for 2007. In this year, the mobile termination rate reduces by [] CCRI cpm under the factual relative to the counterfactual, resulting in a loss of mobile termination revenue of approximately [] CCRI. Suppose we assume that half of this [] CCRI is recovered via the waterbed effect. The Commission calculates the required increase in mobile ARPU by dividing the required recovered termination revenue by the counterfactual number of mobile subscribers, which results in an increase in ARPU of [] CCRI, from [] CCRI to [] CCRI.

However, in doing this calculation the Commission fails to account for the fact that this increase in ARPU also results in a reduction in the number of mobile subscribers of [] CCRI, from [] CCRI to [] CCRI. The change in total revenue received from mobile subscribers is therefore given by [] CCRI, which falls short of the revenue recovery target of [] CCRI. In general, the amount of revenue recovered via the waterbed in a given year is:

$$\text{Factual ARPU} \times \text{Factual Subscribers} - \text{Counterfactual ARPU} \times \text{Counterfactual Subscribers}$$

That is, the change in total revenue that mobile operators receive from mobile subscribers between the factual and the counterfactual. Applying this calculation shows that, under the Commission's methodology, mobile operators only recover approximately one-third of the lost termination revenues, not half.

It is unclear to us whether or not the Commission intended to model the waterbed effect as revenue recovery. The wording and calculations in the spreadsheet model indicates that it did.² However the discussion in paragraphs 620 and 621 of the Final Report suggests that the Commission may view mobile pass-through as being from termination revenues to ARPU on a per-subscriber basis. In our view, either approach could be used for calculating mobile ARPU under the waterbed effect. However, we believe that the Commission's approach is flawed in both cases, for reasons that we will explain below.

First, as explained above, if the Commission views the waterbed effect as revenue recovery, then it has not done the calculation of the increase in ARPU correctly, with the result that the actual revenue recovered is significantly less than what was assumed. Correcting the ARPU calculations so that the assumed fraction of lost total termination

² For example, row 34 of the 'Waterbed Linear' tab is labelled *Loss of MT profits recovered through mobile subscription prices*, and is calculated as half of the total loss in termination revenues.

revenue is recovered requires taking account of the fact that the number of mobile subscribers is dependent on the level of mobile ARPU. In the Appendix to this report we derive an expression that can be used to correctly calculate the increase in ARPU that achieves a desired revenue recovery target.³

There are two additional problems with the Commission's calculation of the change in ARPU under the waterbed effect. The first is that the number of mobile subscribers under the commercial counterfactual in each year is calculated using the change in counterfactual ARPU compared with the previous year, together with a constant elasticity assumption. However, the ARPUs under the commercial counterfactual were calculated relative to the ARPUs under the Final Report counterfactual. The number of mobile subscribers under the commercial counterfactual should therefore be calculated in the same way – using the change in ARPU between the commercial counterfactual and the Final Report Counterfactual in any given year.

The second problem relates to the calculation of the change in mobile subscribers due to the waterbed effect in the constant-elasticity case. The Commission's model does this by calibrating a constant-elasticity demand curve for mobile subscription in each year using the assumed mobile subscription elasticity (-0.43) and the counterfactual number of mobile subscribers.⁴ It then calculates the new number of mobile subscribers at the mobile ARPU under the factual using this demand curve. However, this calculation fails to take account of the FTM effect. Instead, in the Commission's model the FTM effect reduces only the *change* in the number of mobile subscribers between the factual and counterfactual.⁵ The end result is that the change in the number of subscribers thus calculated does not equal the difference between the counterfactual and factual numbers of subscribers.⁶ Nevertheless, the Commission's model uses both the factual number of subscribers and the change in the number of subscribers, which are calculated in this inconsistent manner, in its calculations of the waterbed effect under constant elasticity demand.

We have revised the Commission's model to correct all of the above errors. Using the formula given in the Appendix to this report, we can calculate the increase in ARPU that actually achieves a recovery of the assumed fraction of the lost termination revenues and correctly accounts for the FTM effect. This causes the size of the waterbed effect to increase substantially. For example, the actual increase in ARPU required for 2007 to recover 50% of the lost mobile termination revenues is [] VNZRI under linear demand, and [] VNZRI under constant elasticity demand, compared to the Commission's estimate of [] CCRI in both cases.

Table 6 summarises the changes to the waterbed calculations that are actually required to recover 50% of the lost termination revenues (under both the factual and the

³ This correction must also be applied to the calculation of the waterbed effect under the Commercial Counterfactual.

⁴ See row 35 in the "Waterbed CED" tab of the Commission's spreadsheet model.

⁵ See row 37 in the "Waterbed CED" tab of the Commission's spreadsheet model.

⁶ Row 37 does not equal the difference between row 34 and row 36 in the "Waterbed CED" tab.

commercial counterfactual), and the resulting impacts on mobile subscriber numbers, versus the Commission’s calculations. Note that we have not changed the Commission’s “pass-through” rate of 50% in this case. However, we should point out that the pass-through rate does not correspond to the usual interpretation of a pass-through (for example from marginal costs to prices) if the waterbed effect is modelled as revenue recovery. Therefore, theoretical results such as 50% pass-through of a monopolist do not apply to the interpretation of this parameter in this case.

Table 6 Correcting the waterbed calculations to achieve assumed total revenue recovery.

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] VNZRI

This correction to the Commission’s modelling has a large impact on the overall size of the waterbed effect and hence the detriments from regulation, as shown in Table 7.

Table 7 Effects of correcting the waterbed calculations to achieve assumed total revenue recovery.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	3.52	-0.55	-95%	-105%
CED	-23.95	-19.93	-144%	-1547%

If, on the other hand, the Commission views mobile pass-through as being on a per-subscriber basis, then its calculation of the change in ARPU is correct, but its assumption of a 50% rate of pass-through is unreasonably low. In this case, as we will explain below, the pass-through parameter has the usual interpretation. As has been shown in a paper by Jerry Hausman and Gregory Leonard,⁷ a rate of pass-through of marginal cost into price of 50% is the theoretical minimum rate that would occur in any market. This

⁷ “Efficiencies from the consumer viewpoint”, *George Mason Law Review*, (1999), 707 – 727. Section IV contains the relevant results.

happens for a monopoly with a linear demand curve. If there is more intense competition or if demand is at all convex to the origin then pass-through will exceed 50%.

The results shown by Hausman and Leonard also apply for the issue at hand. In the calculation of the waterbed effect, we do not have a change in marginal cost but rather a reduction in a marginal revenue that a mobile operator gets for each mobile subscriber. If a mobile subscriber receives on average M minutes of calls and the termination rate per minute is t , then a mobile operator receives on average Mt worth of revenue for each subscriber that it signs up. If t reduces then marginal revenue per subscriber reduces. In this case, a reduction in t is exactly equivalent to an increase in a per-subscriber marginal cost, and thus the theoretical minimum pass-through rate is 50%.

Given that the New Zealand mobile market is not a monopoly and that demand is almost certainly not linear, we cannot understand why the Commission has used a mobile pass-through assumption of 50%. Theory and evidence suggests that this is excessively conservative and biases the Commission's results towards a finding of positive net benefits from regulation. Instead we suggest that, at a minimum, the rate of mobile pass-through should be 67%. This is the theoretical rate of pass-through of a Cournot duopoly under the assumption of linear demand.

In addition, the Commission has calculated a starting rate of pass-through in the FTM market of 68%, in spite of the fact that Telecom has the majority of the market share, making the FTM market more like a monopoly than the mobile market in which market shares are closer to being equal. It is simply inconsistent to assume a 68% rate of pass-through initially in the FTM market but a 50% rate in the mobile market.

Furthermore, in the Final Report the Commission argued (in paragraphs 606 and 607) that because Telecom is an integrated operator, it is under less pressure to pass-through reductions in mobile termination rates to its mobile subscribers, since some fraction of the FTM calls originated by its fixed-line customers terminate on its own mobile network and are therefore not subject to regulation. If true, then this argument suggests that as pass-through rates rise in the FTM market they should also rise in the mobile market, as greater FTM pass-through will put greater pressure on Telecom to recover lost revenues via higher mobile prices.

We also believe that the rate of mobile pass-through will rise over time. Recent announcements by Econet suggest that there are likely to be three mobile operators in the relatively near future. [

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Figure 1 Mobile market share projections from Vodafone's long-range plan.

The theoretical benchmark of Cournot competition with three firms and linear demand gives a pass-through rate of 75%. In light of the above arguments, in our opinion a reasonable and plausible assumption for the rate of mobile pass-through is 67% in 2006 and then increasing geometrically to 75% in 2011, as shown in Table 8.

Table 8 Alternative mobile pass-through assumptions.

	2006	2007	2008	2009	2010	2011
Pass-through	67%	69%	70%	72%	73%	75%

We have adjusted the Commission's model to include this assumption in the calculation of mobile ARPU under the waterbed effect under both the factual and the commercial counterfactual, where the latter is calculated relative to the original Final Report counterfactual. In addition, even if the ARPU calculation itself is correct, the Commission's model still suffers from the two other problems previously identified – that the number of mobile subscribers under the commercial counterfactual should be calculated relative to ARPUs under the Final Report counterfactual and not the commercial counterfactual ARPU of the previous year, and that the change in the number of mobile subscribers under constant elasticity demand does not equal the difference between the factual and counterfactual mobile subscriber numbers. Correcting these errors plus changing the mobile pass-through to the rates shown in Table 8 have the effects on the waterbed calculations shown in Table 9 and subsequent effects on the net benefit shown in Table 10.

Table 9 Effects on the waterbed calculations of amended mobile pass-through rates.

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Table 10 Effects of changing the mobile pass-through assumptions.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	17.71	1.83	-75%	-82%
CED	-7.87	-15.38	-114%	-1217%

In summary, in our opinion the Commission significantly underestimates the size of the waterbed effect and therefore overestimates the net benefits from regulation. If the Commission views the waterbed effect as recovery of lost termination revenues by mobile operators, then it has not correctly calculated the increase in mobile ARPU required to achieve its assumption that half of the lost revenues are recovered. If the Commission views the waterbed effect as pass-through from lost termination revenue to ARPU on a per-subscriber basis, then it has used an implausibly low assumption for the rate of pass-through. In either case, correcting the Commission's error results in a large increase in the size of the waterbed effect that eliminates all or almost all of the net benefits of regulation. These changes alone are enough to cast serious doubt on the justification and economic desirability of regulation of mobile termination rates.

2.1.3. The 'FTM Effect'

We disagree with the assumed size of the so-called 'FTM Effect' in the Commission's model. This is the effect whereby the reduction in mobile subscriptions due to the waterbed is offset by the fact that with lower FTM prices mobile subscribers will each receive more FTM calls, which makes mobile subscription more attractive. The Reconsideration Draft model assumes that, under linear demand, 15% of the reduction in mobile subscribers is offset by this effect in 2006, rising to 28% by 2010, and from 13% to 31% under constant-elasticity demand.

By our calculation, under the Commission's assumptions, regulation will result in 'marginal' mobile subscribers receiving additional FTM calls of approximately 8.7 to 16.3 minutes per annum on average between 2006 and 2010 (an increase of between 7.3% and 12.6%), as shown in Table 11. That table also shows the resulting numbers of mobile subscribers that do not drop out of the mobile market because of the FTM effect.

Table 11 Additional FTM minutes received per marginal mobile subscriber and the resulting number of mobile subscribers who are assumed to remain in the mobile market.

Demand	2007	2008	2009	2010	2010
Additional minutes per annum					
Linear	8.7	6.0	8.7	8.9	13.5
CED	10.9	8.0	11.0	11.2	16.3
Additional minutes as a percentage of total FTM minutes received					
Linear	7.3%	4.8%	6.9%	7.0%	10.5%
CED	9.1%	6.4%	8.7%	8.8%	12.6%
Resulting number of retained marginal mobile subscribers					
Linear	[
CED]				

] CCRI

We do not believe that the additional benefits associated with such a small increase in the number of FTM minutes received per year will result in a significant offset to the waterbed effect, and certainly not to the extent that an additional few minutes received per year will result in thousands of subscribers choosing to retain their subscriptions.

In addition, there is an inconsistency with the assumption of the existence of an FTM effect and one of the Commission's justifications for regulation – that mobile subscribers do not care about the cost of FTM calls made to them, and therefore implicitly do not care about how many FTM calls they receive. This is one of the justifications that the Commission has given for concluding that each mobile operator has a 'termination monopoly' and is therefore able to set its termination rate above cost. That conclusion is incompatible with the existence of such a strong FTM effect.

In summary, in our opinion an offset to the waterbed due to the FTM effect should not be included in the cost-benefit model. Table 12 shows the effects on the Commission's net benefit results of removing the FTM effect from the waterbed calculations.

Table 12 Effects of removing the 'FTM Effect'.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	70.37	5.17	-2%	-50%
CED	47.79	-8.92	-13%	-748%

2.1.4. Mobile Market Producer Detriments

Unlike the Final Report, in the Reconsideration Draft the Commission makes an attempt at estimating producer surplus losses in the mobile market due to the waterbed effect.

The difficulty with this is estimating the appropriate marginal cost for use in the calculation of producer surplus. In paragraphs B11 to B14 of the Reconsideration Draft the Commission discusses how it has used benchmarked OECD retail prices to estimate the price-cost margin for the New Zealand mobile market. This results in an estimate of marginal cost of 70% of mobile ARPU, or approximately \$367 per mobile subscriber.

In our opinion the Commission's approach to this matter is fundamentally flawed. First, their methodology is predicated on an assumption that there is an identical cost for providing mobile services in all countries. This is clearly not true, as mobile costs depend on a number of factors including market size, geographical coverage, service quality levels, network traffic levels, land and labour costs, and so on, which would all differ across countries. In general, there are many reasons why the same good may sell for different prices in different countries, and it is very tenuous to assume that this is purely due to differences in the intensity of competition. Second, the Commission's methodology would imply that in countries where the benchmarked prices fell below the OECD average had negative price cost margins, which seems highly unlikely.

A more suitable approach would start from recalling that the mobile market producer detriment is the loss of producer surplus that mobile operators suffer as a result of the waterbed effect. The producer surplus that was associated with these subscribers was the excess of revenue generated from them over and above the costs of providing mobile services to them. The reduction in producer surplus as a result of the waterbed effect is therefore the reduction in revenues associated with the marginal subscribers, minus any cost savings that the mobile operator is able to achieve as a result.

In the extreme, if a mobile operator were unable to save any costs as a result of the number of its customers and usage of its network shrinking slightly due to the waterbed effect, then the loss in producer surplus is just equal to the loss in revenue associated with the marginal subscribers. The key question, then, in measuring the mobile market producer surplus loss is the amount of costs that a mobile operator will *save* as a result of the waterbed effect. The appropriate 'marginal cost' to use in the mobile market producer detriment calculation is therefore the *cost saved per marginal customer*.

The number of subscribers who discontinue their mobile service as a result of the waterbed effect is between approximately 0.5% and 1% of the total number of subscribers of a mobile operator. There are good reasons to believe that the cost savings per marginal subscriber for such a small change in the number of subscribers will be relatively small. In terms of network costs, the equipment used to build a mobile network comes in units that support 'lumpy' amounts of capacity. If the reduction in the number of mobile subscribers is small, the optimal design of the network will not change even in the long run, and the mobile operator will not save any network costs due to the waterbed effect.

The most likely cost savings that a mobile operator will be able to achieve in the long run as a result of the waterbed effect are customer service costs such as billing, customer

support, and so on.⁸ We therefore believe that the value of the mobile ‘marginal cost’ (costs saved per marginal mobile subscriber) used in the waterbed producer surplus calculation should be significantly lower than the Commission’s estimate. However, there is still some uncertainty associated with the appropriate cost estimate. We therefore suggest using a range of \$100 to \$200 per mobile subscriber. This results in significant reductions in the net benefits of regulation under the total surplus test, as shown in Table 13 and Table 14.

Table 13 Effects of adjusting the mobile ‘marginal cost’ (MC = \$100).

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	72.11	-10.60	0%	-202%
CED	54.80	-19.24	0%	-1497%

Table 14 Effects of adjusting the mobile ‘marginal cost’ (MC = \$200).

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	72.11	-2.74	0%	-126%
CED	54.80	-11.51	0%	-936%

2.1.5. Omitted FTM Producer Detriments

The calculation of the waterbed effect includes an ‘FTM detriment’ which arises from the fact that the waterbed effect causes a reduction in the number of mobile subscribers who can be called, and therefore causes welfare losses in the FTM market. The Commission calculates the FTM detriment by calculating the lost consumer surplus in the FTM market associated with calls to marginal mobile subscribers who no longer subscribe under the waterbed effect. This is calculated by calibrating a demand curve for FTM calls to a typical individual mobile subscriber and finding the consumer surplus associated with these calls. This is then multiplied by the total number of subscribers who cease to subscribe under the waterbed effect to obtain the total FTM detriment.

In addition to this consumer surplus loss, there will also be a loss of producer surplus in the FTM market to the extent that the factual FTM price exceeds the cost of FTM calls. The Commission omits this detriment in its calculation of the FTM detriment, and thus understates the size of the waterbed effect under the public benefits test. We cannot understand why the Commission has not included the producer surplus component of the FTM detriment. Unlike the mobile market producer detriments, there is no problem

⁸ If the network operator also supplies the customer’s handset, in the long run this cost would be saved also. However, revenues from handset sales are not typically counted as part of ARPU, and therefore should not be included in the estimate of the per-customer costs that a mobile operator saves due to the waterbed effect.

associated with estimating the appropriate marginal cost, as the Commission has an estimate for the FTM market that it has used elsewhere in the cost-benefit calculations.

It is relatively straightforward to amend the model to include FTM producer surplus losses due to the waterbed effect. We can calculate the FTM producer surplus per marginal mobile subscriber as the difference between the counterfactual FTM price and the estimated FTM cost, multiplied by the number of FTM minutes received by a marginal subscriber. We then multiply this by the number of marginal subscribers to estimate the total FTM producer surplus loss. As shown in Table 15 these calculations give FTM producer detriments of approximately \$1.4m in NPV terms.

Table 15 FTM producer detriment calculations (\$).

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Incorporating these producer detriments under the total surplus test has the effect of reducing the net benefits of regulation by between 14% and 102% relative to those estimated by the Commission, as shown in Table 16.

Table 16 Effects of including FTM producer detriments.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	72.11	8.95	0%	-14%
CED	54.80	-0.03	0%	-102%

2.1.6. Additional Omitted Detriments

We believe that the Commission has omitted one further detriment due to the waterbed effect. It is likely that many mobile prices will adjust in response to a reduction in termination revenue, including prices for mobile originated calls. The increase in ARPU for all mobile subscribers in the Commission's model captures the fact that mobile subscribers who remain in the market (i.e. the inframarginal mobile subscribers) will pay higher prices for mobile origination. This will cause a transfer from the remaining mobile subscribers to mobile operators, which is included in the Commission's calculation of the mobile 'subscription' detriment under the consumer welfare test.

However, in addition to this, the inframarginal mobile subscribers are likely to make fewer mobile-originated calls as a result of higher origination prices. This will lead to a reduction in all types of mobile-originated calls, including mobile-to-mobile and mobile-to-fixed calls. This detriment is in addition to the MTM detriment that the Commission models. The MTM detriment arises from the fact that there are fewer mobile subscribers

who can be called under the waterbed effect. In addition to this, remaining mobile subscribers will make fewer calls due to higher mobile origination prices.

As mentioned above, in our opinion the transfer component of this additional detriment is already captured in the Commission's analysis of the mobile 'subscription' detriment. However the allocative efficiency loss (both consumer and producer surplus) in the mobile market associated with a reduction in the quantity of mobile-originated calls should also be calculated as a detriment.

We have generated an estimate of this detriment in a manner similar to the method that the Commission has used to calculate the FTM and MTM detriments. That is, we calibrate a demand curve for mobile-originated calls made by a typical mobile subscriber using the data available for 2005 and the Commission's assumption of the mobile-to-mobile elasticity of -0.59.⁹ We then estimate the average increase in price for such calls under the factual relative to the counterfactual due to the waterbed effect and use this to calculate the welfare that is lost. We only calculate the allocative efficiency component of this welfare loss.

The per-minute prices in each year under the factual and counterfactual are estimated using the same percentage changes as mobile ARPU relative to 2005. For example, in the Commission's model, the price for mobile origination is 42.72 cpm in 2005 and the mobile ARPU is \$518.25. In 2007 the counterfactual ARPU has risen to [] CCRI, an increase of [] CCRI, and the factual ARPU is [] CCRI, an increase of [] CCRI. We therefore assume that the mobile origination price increases by [] CCRI under the counterfactual and [] CCRI under the factual in 2007, giving [] VNZRI and [] VNZRI respectively. The quantities of mobile originated calls made by each mobile subscriber are then calculated from these prices using the demand curve that we calibrated using the 2005 data.

We also estimate a corresponding producer surplus loss. We estimate the marginal cost for a mobile originated call as a fraction of the per-minute price for such a call. We assume that this fraction is the same as the ratio of the mobile 'subscription' cost to the factual mobile 'subscription' price. As we disagree with the Commission's methodology of estimating the 'subscription' marginal cost at 70% of ARPU, we have used our fixed estimate of \$200 per subscriber instead.

The above welfare losses are calculated on a per-subscriber basis. We then multiply these by the number of mobile subscribers under the factual to obtain the total welfare losses. Table 17 summarises our calculations and Table 18 shows the impact of these on the Commission's net benefit results.

⁹ Implicitly we are assuming that the elasticities for mobile-to-mobile and mobile-to-fixed calls are the same, and equal the Commission's estimate of the mobile-to-mobile elasticity.

Table 17 Calculation of mobile origination detriments.

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Table 18 Effects of including mobile origination detriments.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	71.64	-34.24	-1%	-430%
CED	54.35	-41.95	-1%	-3146%

2.2. FTM Pass-through

The rate of FTM pass-through is the rate at which FTM firms pass on reductions in mobile termination rates to consumers via reduced FTM retail prices. This is therefore one of the crucial parameters of the model, since without pass-through there can be no benefits to end users of regulation. The Commission makes assumptions about the rates of pass-through under the counterfactual and factual, and uses these to generate the FTM prices that prevail under each scenario.

Under the counterfactual, the Commission has taken account of Telecom's commitment to pass-through 100% of the MTR reductions to FTM retail prices. However, it assumes that other fixed-line operators will have significantly lower rates of pass-through, starting at 71% in 2005/06, rising to 85% by 2010/11. The Commission justifies this assumption by asserting (paragraphs 96 and 97) that Telecom's competitors already charge less than Telecom for FTM calls and so will be under less pressure to pass

through MTR reductions, and because Telecom's competitors have a greater proportion of residential customers.

In our opinion these assumptions are flawed, for the following reasons. First, as the Commission notes, in the FTM market we observe that Telecom has higher average prices than its competitors, and yet greater market share. The most likely explanation for this is that Telecom enjoys the benefits of some brand loyalty, switching costs, 'one-bill' effect, or some combination of these. Otherwise, in a situation of symmetric competition, we would expect to see a firm with higher prices having a lower market share.

In the case of asymmetric competition, as we observe in the FTM market, in equilibrium some 'marginal' consumers will be just indifferent between using Telecom or one of its competitors. For such a consumer, the net benefits of using Telecom equal the net benefits of using the competitor, taking into account the asymmetry in the gross benefits of belonging to Telecom (due to brand loyalty, switching costs, etc) and the difference in prices. If Telecom lowers its price, it will therefore gain market share from its competitors. Thus, unless Telecom's competitors match Telecom's pass-through, they will lose market share even if they currently have lower prices than Telecom, and even if they continue to have lower prices than Telecom after the price cuts.

Furthermore, in Table 7 of the Reconsideration Draft, the Commission shows that historically the rates of pass-through of other operators have been significantly greater than that for Telecom. There is no reason to believe that the forces that have compelled Telecom's competitors to adopt a higher rate of pass-through will not continue to operate in the future.¹⁰

An implicit assumption of the Commission's pass-through modelling under the counterfactual is therefore that Telecom's competitors are willing to lose market share in the FTM market rather than lower their prices to the same extent as Telecom. While this could be true, without further information it is safer in our opinion to assume that Telecom's competitors will match Telecom's pass-through, that is, that overall FTM pass-through will be 100% in all years under the counterfactual. The effects of this change using the Commission's model are summarised in Table 19.

¹⁰ Furthermore, the Commission states in paragraph 232 of the Reconsideration Draft that Telecom achieve its 100% pass-through commitment by passing through most of the benefits to only some categories of customer, and this may adversely affect competition in the FTM market. In our opinion this is unlikely, as to achieve an overall 100% pass-through rate under such a strategy would require pass-through rates in excess of 100% for the targeted customer segments.

Table 19 Effects of increasing counterfactual pass-through to 100%.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	57.03	6.52	-21%	-37%
CED	39.42	-3.08	-28%	-323%

We also believe that the Commission is also too optimistic regarding its FTM pass-through assumptions under the factual. As we have previously submitted, assuming an instantaneous rate of pass-through of 100% is equivalent to assuming that the intensity of competition in the market is the same as under perfect competition.¹¹ The Commission has maintained its earlier assumption that the instantaneous rate of pass-through reaches 100% by 2010/11.

In our opinion, a pass-through rate under the factual of 80% in 2010 is more appropriate. This represents an increase in the intensity of competition in the FTM market compared to the current state, but not to such an extent that the market becomes effectively perfectly competitive. The effects of this on the net benefit results are shown in Table 20.

Table 20 Effects of reducing the factual pass-through in 2010/11 to 80%.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	6.99	-2.37	-90%	-123%
CED	-10.93	-13.09	-120%	-1051%

From these results it is clear that unless the Commission's optimistic expectations regarding pass-through under the factual are realised, the case for regulation becomes very weak indeed. The combined effects of increasing the counterfactual pass-through and reducing the factual pass-through as described above are shown in Table 21. Under this scenario there is clearly no justification for regulation.

Table 21 Combined effects of increasing the counterfactual pass-through to 100% and reducing the factual pass-through in 2010/11 to 80%.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	-8.28	-6.11	-111%	-159%
CED	-26.50	-17.43	-148%	-1366%

2.3. Indirect Costs

In the Final Report and the Reconsideration Draft, the Commission has omitted any estimate of indirect costs of regulation. An estimate was previously included in the Draft Report. In the Draft Report, the Commission explained that indirect costs could arise from the impact of regulation on efficiency incentives (paragraph 312), and the fact

¹¹ Under perfect competition, price equals marginal cost, so pass-through is always 100% by definition.

that regulation may not exactly achieve the optimal price due to asymmetric information (paragraph 496).

In addition, the Commission's decision in the reconsideration draft to recommend regulation of termination on 3G networks makes it even more important that indirect costs be included in the cost-benefit analysis. As relatively little is known at this stage about 3G costs and demand, the probability of regulating at the 'wrong' price is relatively high, and the negative effects of doing so are potentially large. In our opinion it is simply too risky to recommend regulation of 3G termination without an allowance for indirect costs.

While it may be argued that the inclusion of the waterbed effect in the cost-benefit modelling could account for some of these indirect costs, the waterbed modelling certainly does not account for the possibility of adverse effects from the MTR being regulated at the wrong level. In our opinion it is therefore necessary to include an estimate of indirect costs in the cost-benefit model.

In the Draft Report the Commission estimated indirect costs by scaling back the benefits of regulation by 25%. We have previously submitted on the inadequacy of this method as it means that costs are calculated as a proportion of benefits. Nevertheless, given the data constraints that are available, it does not seem possible to generate an independent estimate of indirect costs without making a large number of additional assumptions. We therefore propose including indirect costs using the Commission's methodology. It may be appropriate, however, to reduce the ratio of indirect costs to benefits, given the inclusion of the waterbed effect. We have amended the Commission's model to include indirect costs and have assumed that these are in proportion to 10% of the gross benefits of regulation. Table 22 shows the indirect costs of regulation that we have estimated using this methodology, and Table 23 shows the impact on the net benefits.

Table 22 Estimated indirect costs (\$m).

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Table 23 Effects of including indirect costs at 10%.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	50.42	7.05	-30%	-32%
CED	32.83	-2.80	-40%	-303%

2.4. Declining Termination Rates under the Factual

The Commission's cost-benefit analysis assumes that the regulated mobile termination rate reduces over time, in two 1.5 cpm steps in 2009 and 2011, reaching 12 cpm in 2011. The Commission justifies this assumption by providing some evidence which suggests that mobile networks exhibit economies of scale and, therefore, if mobile traffic volumes grow over time, per-unit (average) costs will fall.

We agree that mobile networks are likely to be characterised by economies of scale. In terms of the costs of building a mobile radio network, there are two main cost drivers. The first is the physical land area that is covered. Providing coverage for a given amount of land area requires incurring costs that are independent of the amount of traffic carried within that area. As traffic grows, additional traffic-related costs will be incurred, but the coverage-related costs will remain constant. Thus in terms of different traffic levels, there are fixed costs proportional to the land area covered and variable costs proportional to total traffic carried on the network. This suggests that average costs will fall as traffic grows, at least up to a point.

We understand that in New Zealand, 3G services may be provided using either 2.1 GHz or 800/900 MHz spectrum, while 2G services are currently provided using 800/900 MHz spectrum. Since the physical area covered by a cellsite generally reduces at higher frequencies, the cost to cover a given land area is higher for a 3G network that uses 2.1 GHz spectrum compared to a 2G network. However, if the 3G network uses 800/900 MHz spectrum then the coverage costs are approximately the same for a given area covered. In addition, the costs to provide additional capacity once basic coverage has been established are lower for a 3G network compared to a 2G network, regardless of which spectrum the 3G network uses.

Overall, this suggests that the average cost per minute of traffic on a 3G network will be always below that of a 2G network if the 3G network uses 800/900 MHz spectrum, but may be above that of a 2G network (due to higher fixed coverage costs) if the 3G network uses 2.1 GHz spectrum. With this in mind, Figure 2 shows hypothetical average cost curves for a 2G network and a 3G network that uses 2.1 GHz spectrum. In this case, there is some traffic level at which the average cost curves cross, and below this traffic level the average cost on the 3G network exceeds that on the 2G network.

In such a situation, during the transition phase from 2G to 3G (as is occurring during the Commission's period of study), it is possible that a mobile operator's overall average cost will exceed what its average cost would be if it were a 2G-only network. In Figure 2, suppose the operator has Q_0 total minutes of traffic on its network. If it only operates a 2G network, its average cost is AC_0 . If, however, one quarter of this traffic (for example) is on a 3G network and the remainder is on a 2G network then its weighted average cost can exceed AC_0 . It should also be noted that a reduction in traffic on the 2G network causes an *increase* in the average cost of the traffic on that network, from AC_0 to AC_{2G} .

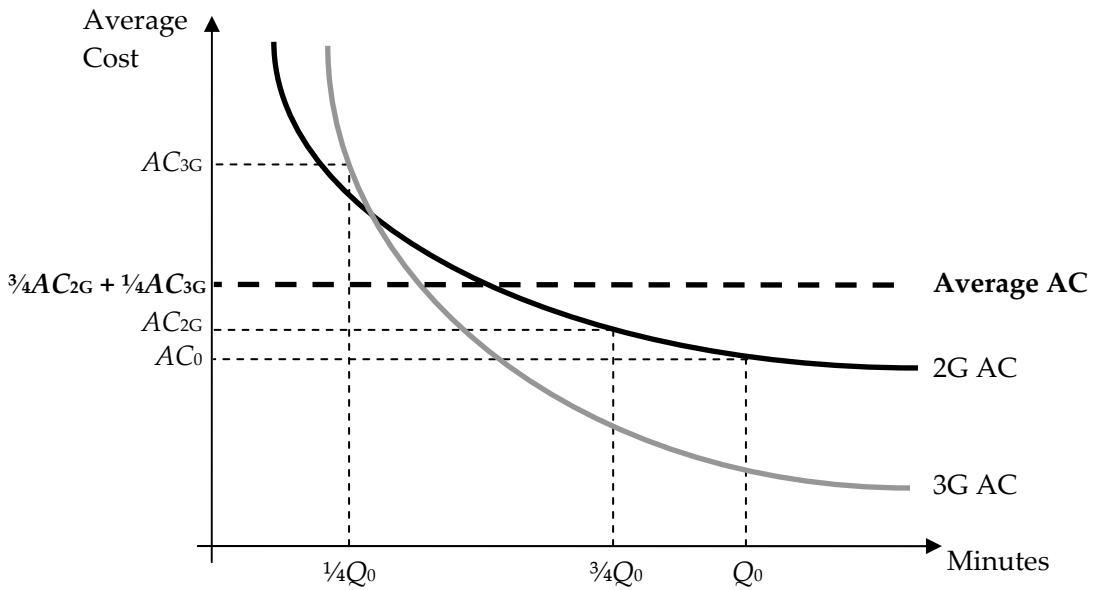


Figure 2 Illustration of combined 2G and 3G average costs when 2G and 3G average cost curves cross.

The same result can also occur even if the 3G average cost curve lies everywhere below the 2G average cost curve (e.g. if the 3G network uses 800/900 MHz spectrum), as illustrated in Figure 3. This apparently counterintuitive result occurs because, during at least the early parts of the transition phase, economies of scale on the 2G network are more exhausted compared to the 3G network.

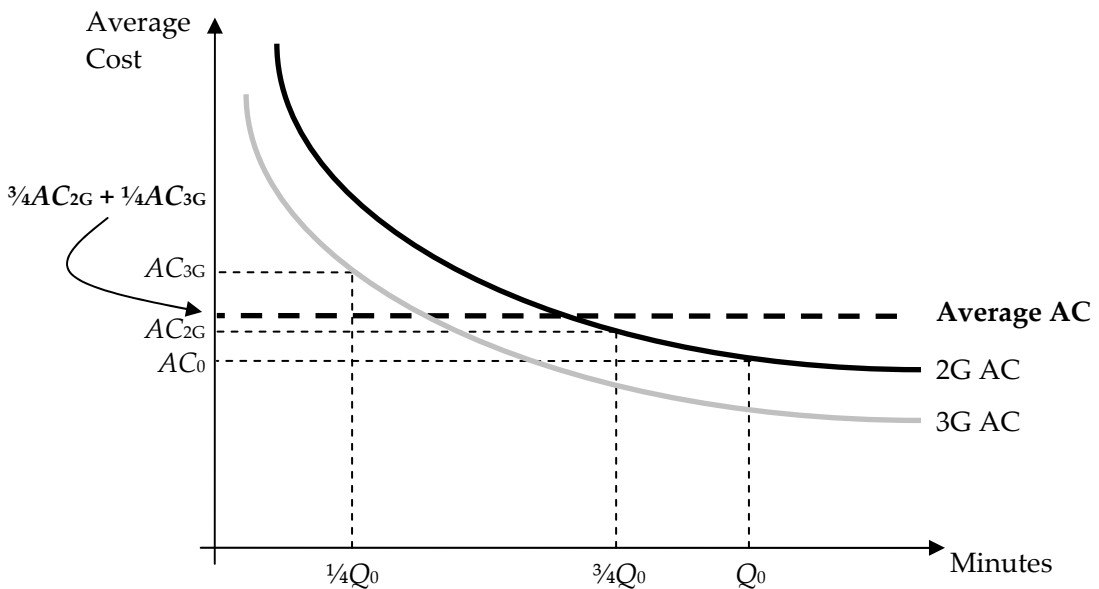


Figure 3 Illustration of combined 2G and 3G average costs when 2G average costs always exceed 3G average costs.

By making specific assumptions about the fall in mobile operators' average costs over time due to the transition to 3G, the Commission is making implicit assumptions about the rate at which traffic is transitioned from 2G to 3G networks and the positions of the

respective average cost curves. If these assumptions turn out to be wrong, the overall per-unit costs of mobile operators will not fall, and could even rise.

In our opinion, in the absence of detailed information about 3G costs and expected 3G volumes, the most aggressive assumption that the Commission can make about the overall cost of termination is that it remain constant over time. This reflects the fact that 2G average costs will rise over time. Although this will be offset by falling 3G costs over time, as the above diagrams illustrate, the 3G cost will initially exceed the 2G cost, even if the 3G cost curve lies always below the 2G curve.

The results of the Commission's cost-benefit analysis are also very sensitive to the assumption that costs of termination fall over time. Without this assumption the net benefits of regulation are reduced dramatically, as shown in Table 24.

Table 24 Effects of assuming a constant regulated MTR at 15 cpm.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	46.61	0.41	-35%	-96%
CED	32.52	-6.45	-41%	-568%

2.5. FTM Retail Costs

As well as the MTR, the model includes three other costs associated with providing FTM calls: fixed origination, transport, and retail costs. The fixed origination and transport costs are set at 1 cpm and 1.2 cpm respectively. However, the retail costs are calculated as 16% of the total cost including the MTR. Since the regulated MTR reduces over time under the Commission's factual scenario, this has the effect that the retail FTM costs also reduce in the model, from 3.28 cpm in 2007 to 2.70 cpm in 2011.

There is absolutely no reason to believe that a reduction in the regulated MTR will have any effect on FTM retail costs.¹² If the model is amended so that FTM retail costs remain constant at 3.28 cpm, net benefits under the public benefits test are reduced by between 8% and 75%, as shown in Table 25.

Table 25 Effects of keeping FTM retail costs constant.

Demand	NPV (2006 \$m)		Percentage Change	
	CW	TS	CW	TS
Linear	72.11	9.54	0%	-8%
CED	54.80	0.34	0%	-75%

¹² Furthermore, even if there is some link between the MTR and retail costs, the MTR reductions in the counterfactual would cause reductions in retail costs in that case as well.

2.6. Summary of Amendments

In summary, we believe the Commission's analysis is flawed for the following reasons:

1. It significantly underestimates the size of the waterbed effect. If the waterbed effect is viewed as revenue recovery, then the Commission's model does not achieve the assumed revenue recovery target. If the waterbed effect is viewed as pass-through on a per-subscriber basis then the Commission has used an implausibly low rate of pass-through in the mobile market.
2. The 'FTM effect' is assumed to be implausibly strong and further contributes to the underestimate of the size of the waterbed effect.
3. The Commission's methodology of estimating mobile market 'marginal cost' per mobile subscriber is flawed and results in an underestimate of the producer detriments in the mobile market.
4. The waterbed calculations omit producer detriments in the FTM market, which results in an underestimate of the waterbed detriments under the total surplus test.
5. The waterbed calculations also omit detriments arising from increased mobile origination prices that reduce the volume of mobile-originated calls by inframarginal customers.
6. The Commission is incorrect in its assumption that Telecom's competitors in the FTM market will not match its 100% pass-through commitment under the commercial counterfactual.
7. The Commission also overestimates the increase in FTM pass-through that will result from regulation and effectively assumes that the FTM market eventually becomes perfectly competitive.
8. An estimate of the indirect costs of regulation, for example caused by setting the regulated MTR at the wrong level, have been omitted from the Commission's model which results in an overstatement of the net benefits of regulation.
9. The Commission is incorrect to assume that per-unit costs will immediately fall as a result of the transition from 2G to 3G mobile technology.

The previous subsections showed the impact on the net-benefit results of correcting each of these issues individually, relative to the Commission's original model. One of our main criticisms of the Commission's modelling is that it has underestimated the size of the waterbed effect. Table 26 summarises our estimates of the size of the waterbed effect under the two alternative modelling assumptions of viewing the waterbed effect as revenue recovery or pass-through on a per-customer basis.

Table 26 Summary of changes to estimated waterbed effect.

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When all of our amendments are taken together, Table 27 shows the overall impact on the net benefit results where the waterbed effect has been corrected to achieve the assumed rate (50%) of revenue recovery. Alternatively, Table 28 shows the overall impact on the net benefit results of all the above changes when the waterbed methodology is unchanged but the rate of mobile pass-through is increased. On the basis of these results, there is no justification for regulation of mobile termination rates.¹³ In fact, such regulation will be harmful to both consumers and society as a whole.

Table 27 Original and amended net benefit results with corrected waterbed revenue recovery calculations (NPV, 2006 \$m).

Demand	Original		Amended	
	CW	TS	CW	TS
Linear	72.11	10.39	-115.43	-105.46
CED	54.80	1.38	-149.61	-131.64

Table 28 Original and amended net benefit results with original waterbed methodology but increased mobile pass-through (NPV, 2006 \$m).

Demand	Original		Amended	
	CW	TS	CW	TS
Linear	72.11	10.39	-76.39	-82.18
CED	54.80	1.38	-103.40	-102.09

¹³ Note that the overall impact will not equal the sum of the individual impacts, as some of the changes interact with each other.

3. Sensitivity Testing

In this section we improve and extend the sensitivity analysis performed by the Commission in the Reconsideration Draft to show how the cost benefit results respond to changes in the important parameters. We present the results of the sensitivity analysis for both the unmodified Commission's model and the model with the amendments that we described in the previous section.

As discussed previously, we believe the Commission's estimate of the size of the waterbed effect is incorrect. We presented two ways that this could be corrected – either by calculating revenue recovery correctly, or increasing the rate of mobile pass-through. Except as otherwise noted below, the sensitivity results for the amended model presented here are for the latter case, where we have used the rates of mobile pass-through given in Table 8.

The net benefit results of the model depend on a number of parameters. It is only feasible to test the sensitivity of the results to changes in one parameter at a time. In the results that follow, we show how the estimated net benefits change when an individual parameter is changed, assuming that all other parameters remain at their original values. In the case of the unmodified Commission model, the original values are those used by the Commission in the Reconsideration Draft. In the case of our amended model, the original values are as described in the previous section for the cases where we have made changes to the Commission's assumptions. The original parameter values and corresponding cost-benefit results are shown on each sensitivity graph as a large dot.

3.1. FTM Pass-through

3.1.1. Counterfactual

The Commission assumes counterfactual pass-through for Telecom of 100% in every year, and pass-through rising from 71% in 2006 to 85% in 2011 for Telecom's competitors in the fixed-to-mobile market. It then calculates an overall pass-through rate using a weighted average of these based on market shares, which gives [] CCRI in 2006, rising to [] CCRI by 2011. We have tested the sensitivity to these results by adding or subtracting a small amount to the overall rate of pass-through in each year. For example, we added 1% to the pass-through rates to obtain a path rising from [] CCRI in 2006 to [] CCRI in 2011. We did this for different amounts added or subtracted, while ensuring that the pass-through in any year never exceeded 100%.

The sensitivity of the Commission's original model to the counterfactual pass-through assumption is shown in Figure 4. Similar results for the amended model are shown in Figure 5. Since we have argued that counterfactual pass-through should be 100% in all years, we present only the effects of a decrease in the counterfactual pass-through for the amended model.

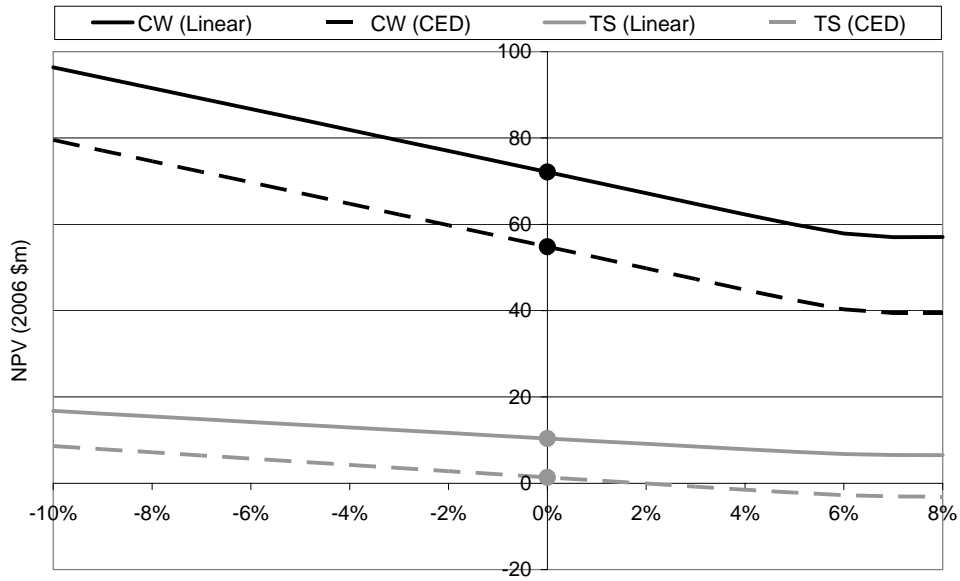


Figure 4 Effects on the Commission’s results of increasing or decreasing the counterfactual pass-through by $x\%$ in all years (up to a maximum of 100%).

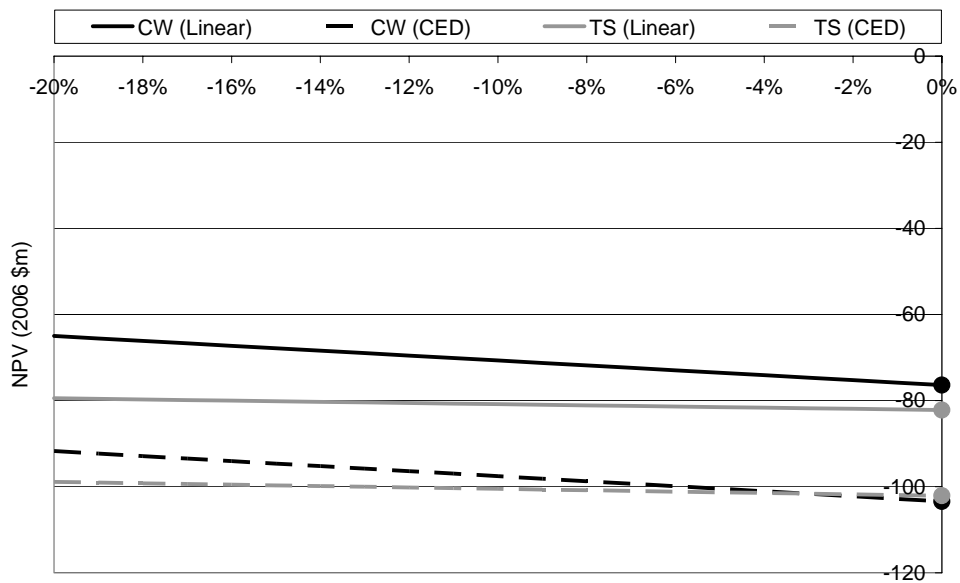


Figure 5 Effects on the amended results of decreasing the counterfactual pass-through by $x\%$ in all years (starting from 100%).

3.1.2. Factual

The Commission assumes the factual rate of FTM pass-through increases from 77% in 2006 to 100% in 2010. We have tested the sensitivity of the model to this parameter in a similar fashion to that used for the counterfactual pass-through above. That is, we add or subtract $x\%$ to the factual pass-through rate in all years, ensuring that it never exceeds 100% in any year. The sensitivity results for the Commission’s model are shown in Figure 6 and for the amended model in Figure 7.

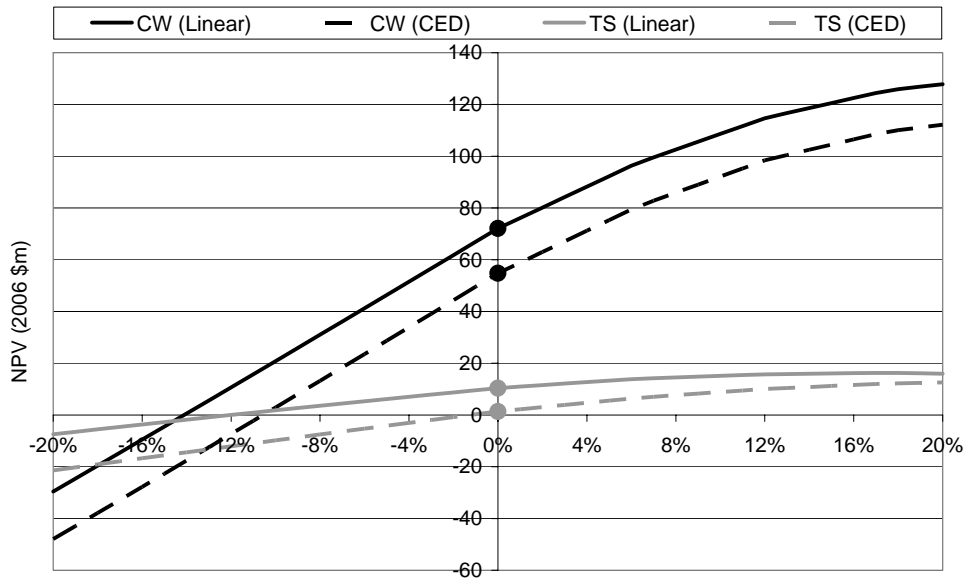


Figure 6 Effects on the Commission’s results of increasing or decreasing the factual pass-through by $x\%$ in all years (up to a maximum of 100%).

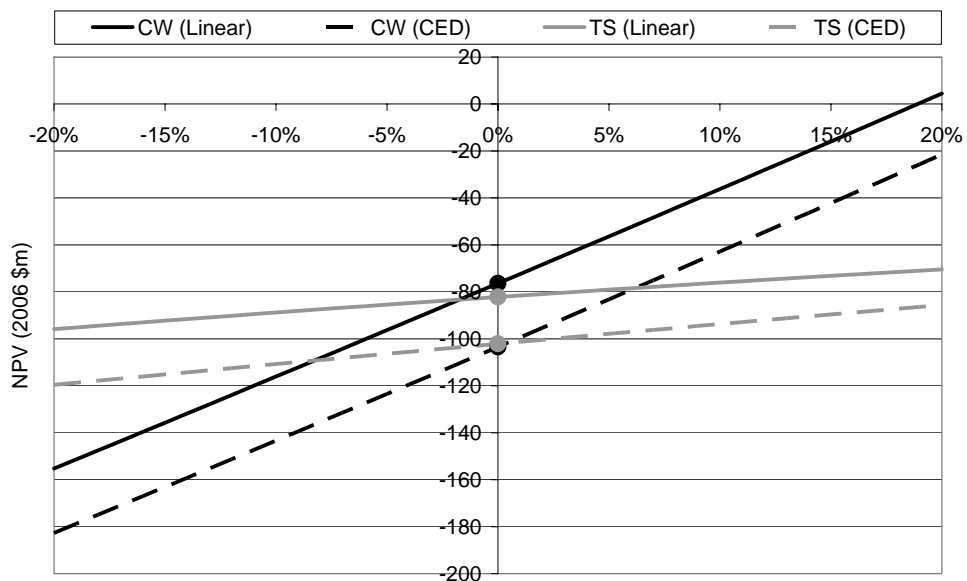


Figure 7 Effects on the amended model results of increasing or decreasing the factual pass-through by $x\%$ in all years (up to a maximum of 100%).

3.2. Mobile Pass-through

Figure 8 shows the effect on the net benefit results of increasing or decreasing the mobile pass-through parameter in the Commission’s model by $x\%$ in all years. Figure 9 shows the sensitivity results after the applying correction discussed in section 2.1.2 so that the actual revenue recovery is achieved, but without changing any other aspects of the model.

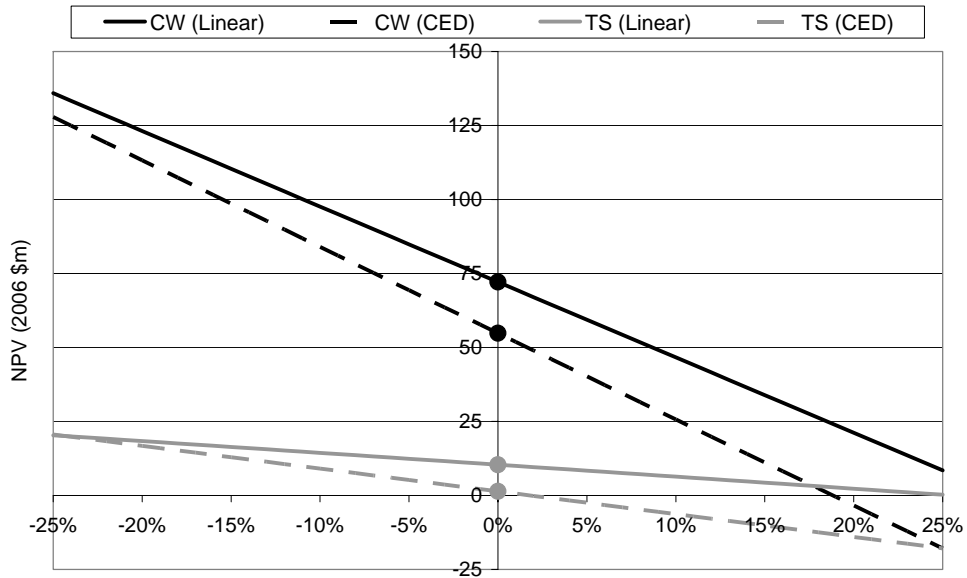


Figure 8 Effects on the Commission's results of different assumptions about the rate of mobile pass-through.

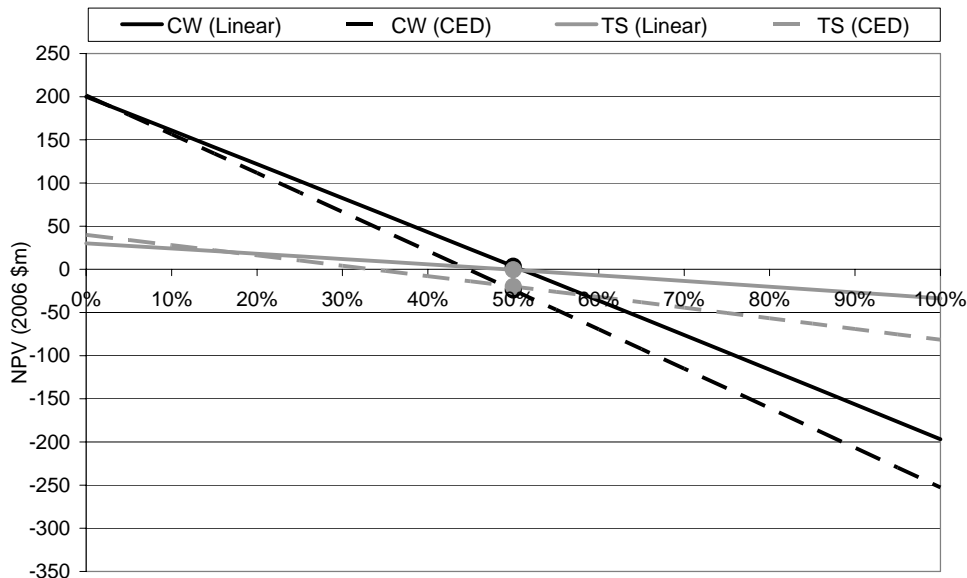


Figure 9 Effects on the net benefit results of different assumptions about mobile pass-through after correcting the waterbed calculations to achieve assumed total revenue recovery.

Figure 10 shows the effects on the amended model where we have increased the rate of mobile pass-through but not changed the way the waterbed effect is calculated, and including our other changes.

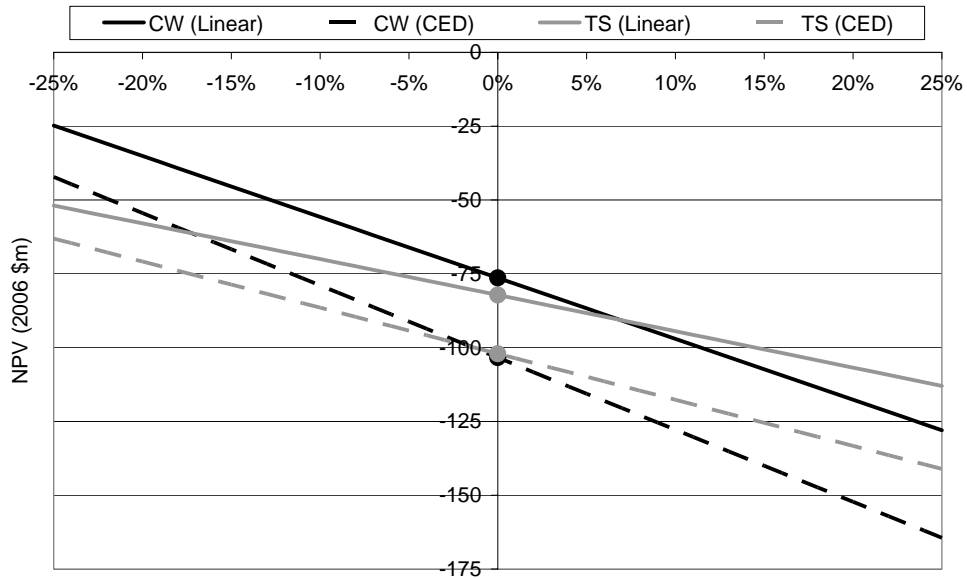


Figure 10 Effects on the amended model results of changes in the rate of mobile pass-through.

3.3. Elasticities

3.3.1. FTM Calling

The Commission assumes an FTM calling elasticity of -0.6. Figure 11 shows the effects on the Commission's net benefit results of different assumptions about this parameter, and Figure 12 shows the effects on the amended model.

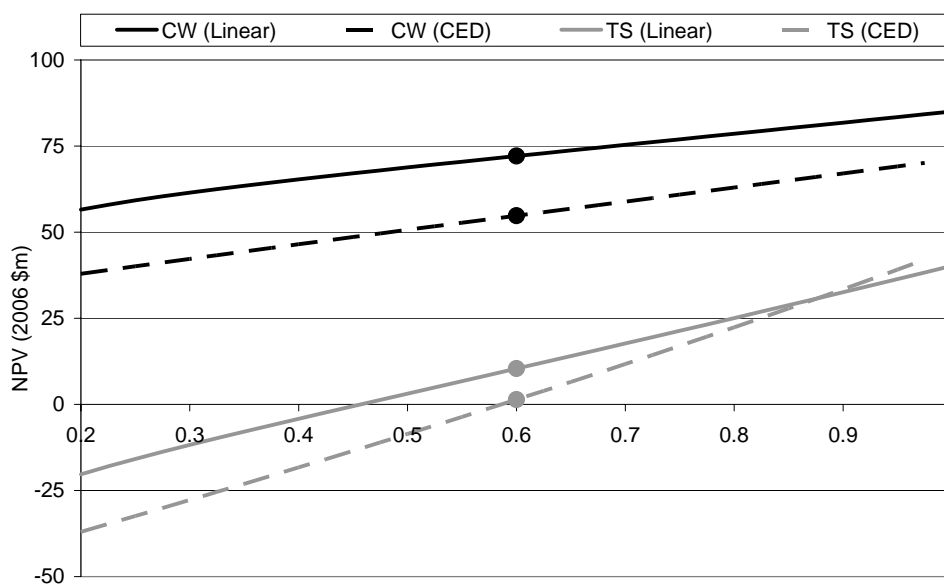


Figure 11 Effects on the Commission's results of different FTM calling elasticities.

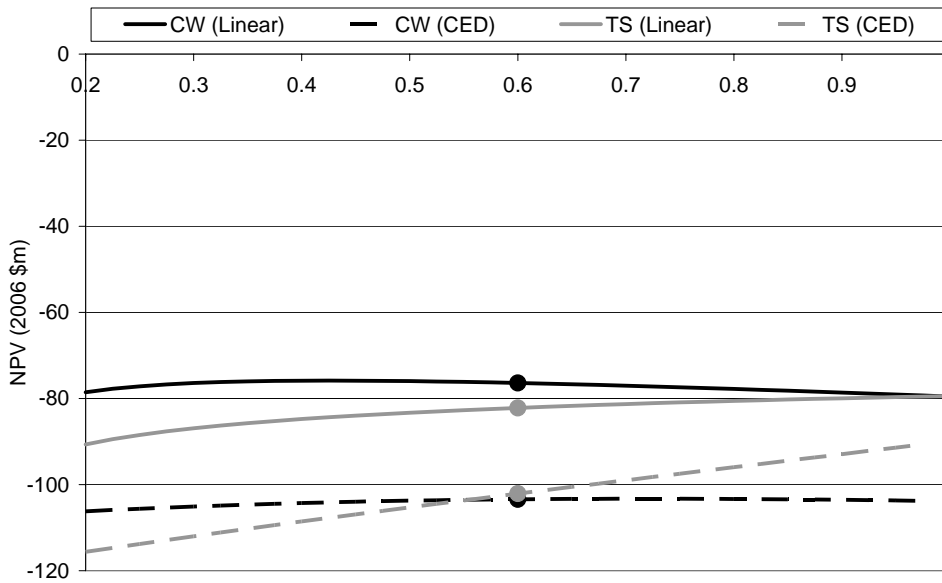


Figure 12 Effects on the amended results of different FTM calling elasticities.

3.3.2. MTM Calling

The Commission assumes an MTM calling elasticity of -0.59. Figure 13 shows the effects on the Commission’s net benefit results of different assumptions about this parameter and Figure 14 shows the effects on the amended model.

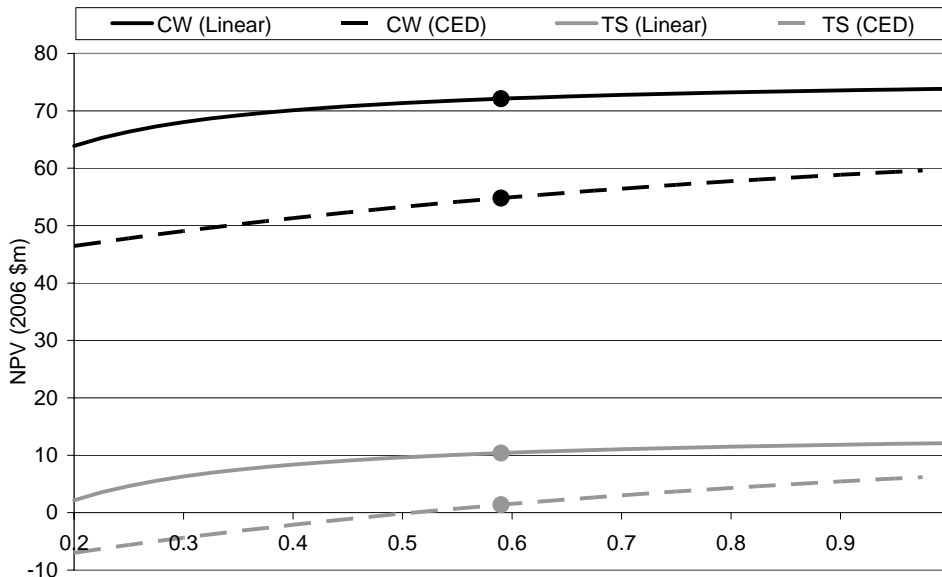


Figure 13 Effects on the Commission's results of different MTM calling elasticities.

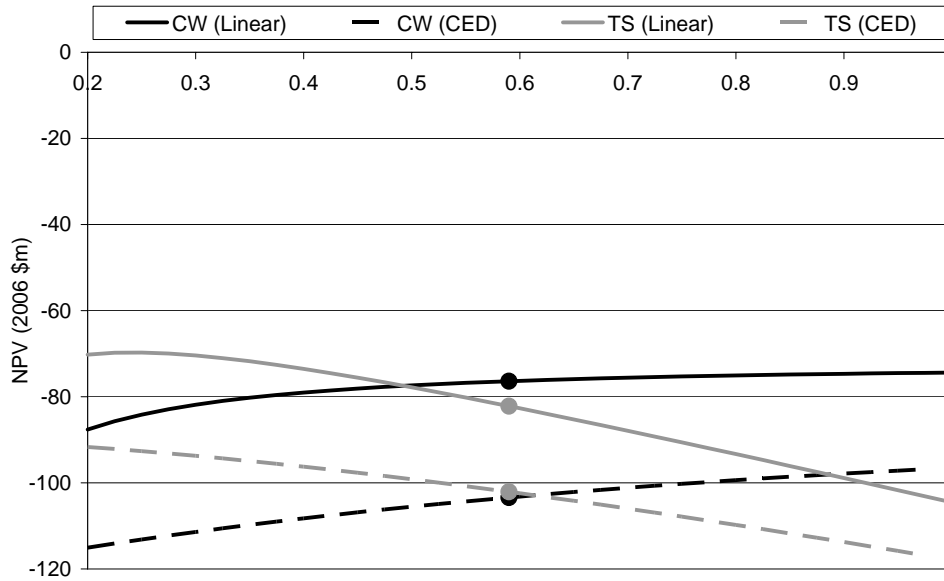


Figure 14 Effects on the amended model results of different MTM calling elasticities.

3.3.3. Mobile Subscription

The Commission assumes a mobile subscription elasticity of -0.43. Figure 15 shows the effects on the Commission's net benefit results of different assumptions about this parameter and Figure 16 shows the effects on the amended model.

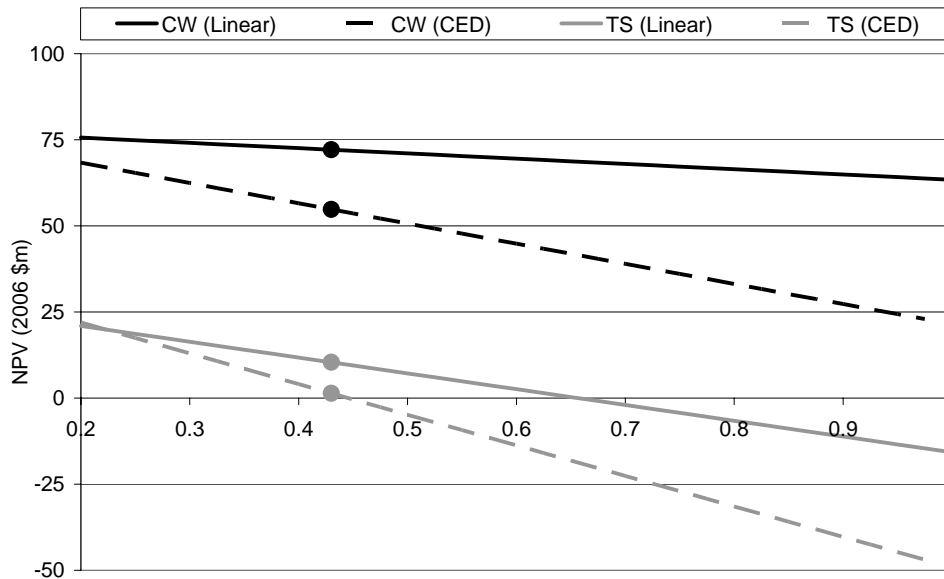


Figure 15 Effects on the Commission's results of different mobile subscription elasticities.

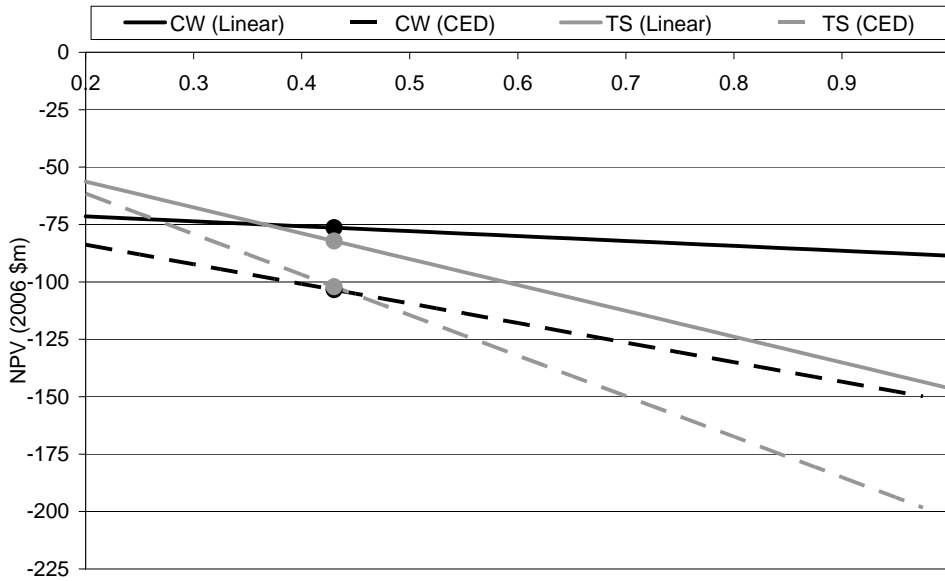


Figure 16 Effects on the amended model results of different mobile subscription elasticities.

3.4. Indirect Costs

In the amended model we have included an estimate of indirect costs in proportion to 10% of gross benefits. Figure 17 shows how the amended results change in response to this assumption.

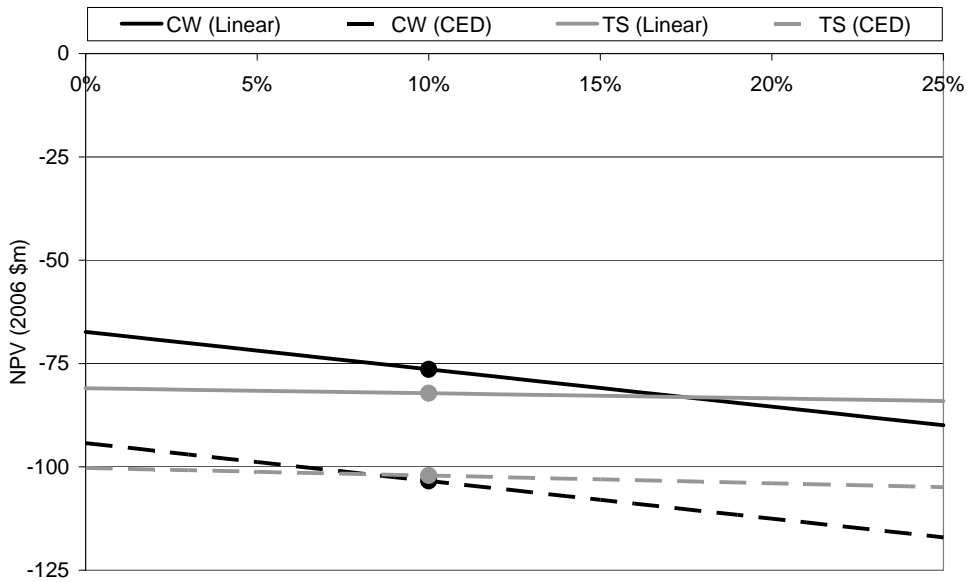


Figure 17 Effects on the amended model results of different indirect costs ratios.

3.5. Mobile Subscription Cost

The Commission assumes that the mobile ‘subscription’ marginal cost is equal to 70% of the mobile ARPU. Figure 18 shows the effects of changes in this parameter. In the amended model we set mobile subscription costs at an absolute value rather than a percentage of the price. Figure 19 shows the effects on the amended results of changes in this parameter assuming at benchmark value of \$300. Note that only the results under the total surplus test are affected in both cases.

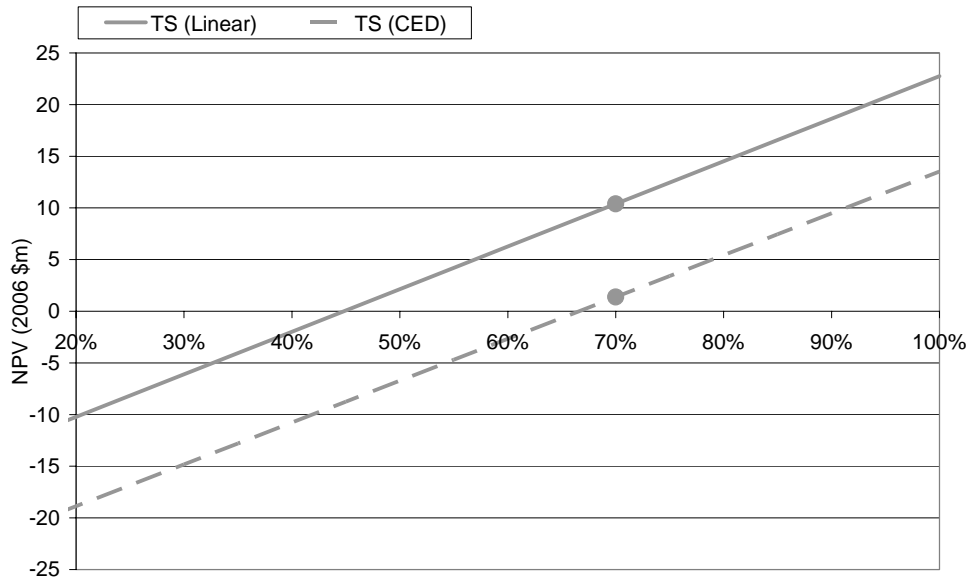


Figure 18 Effects on the Commission's results of different mobile subscription marginal costs.

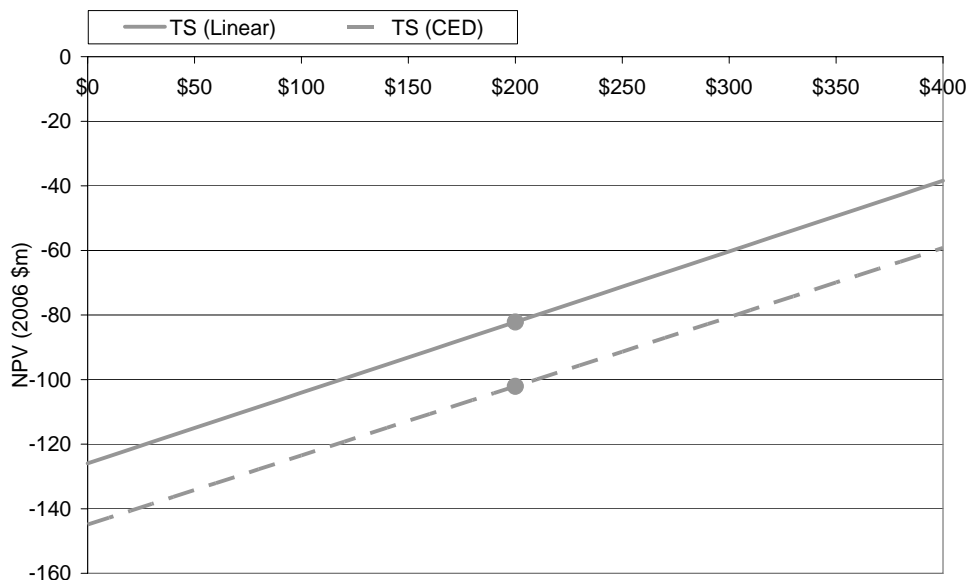


Figure 19 Effects on the amended model results of different mobile subscription marginal costs.

3.6. Minutes per Marginal Mobile Subscriber

The Commission assumes that a typical marginal mobile subscriber receives 35% of the FTM minutes of that an average mobile subscriber does. Figure 20 shows the effects of changes in this parameter on the Commission’s model, and Figure 21 shows the effects on the amended model.

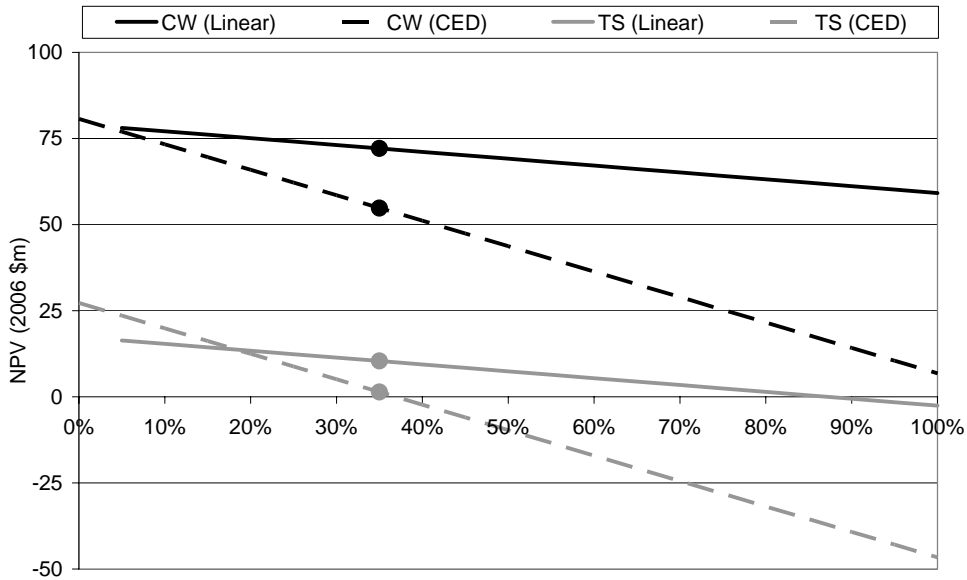


Figure 20 Effects on the Commission's results of changes in the fraction of FTM minutes received by a marginal mobile subscriber.

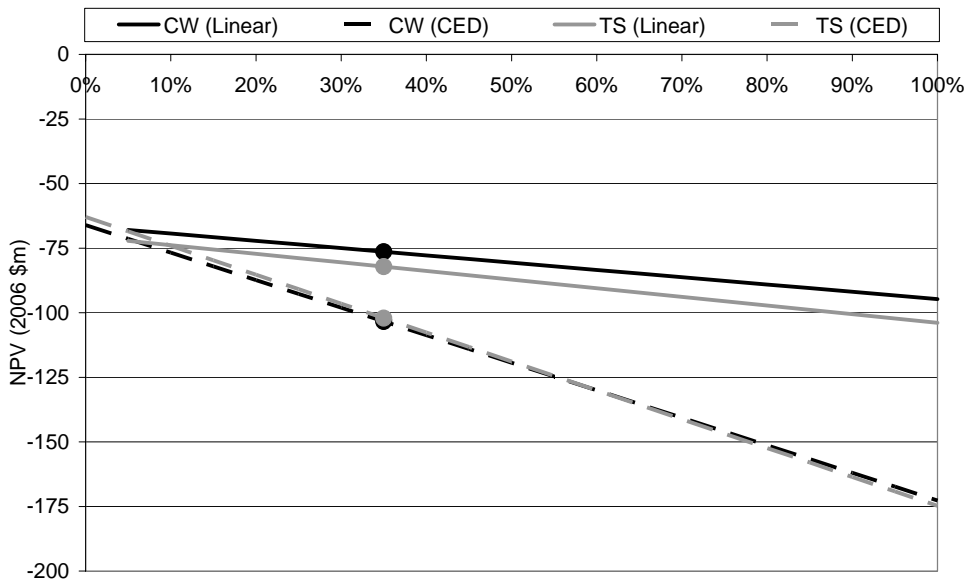


Figure 21 Effects on the amended model results of changes in the fraction of FTM minutes received by a marginal mobile subscriber.

3.7. The Regulated MTR

Figure 22 shows how the Commission’s net benefit results change in response to a change in the regulated MTR that applies in all years and Figure 23 shows the effects of the same type of change on the amended model’s results.

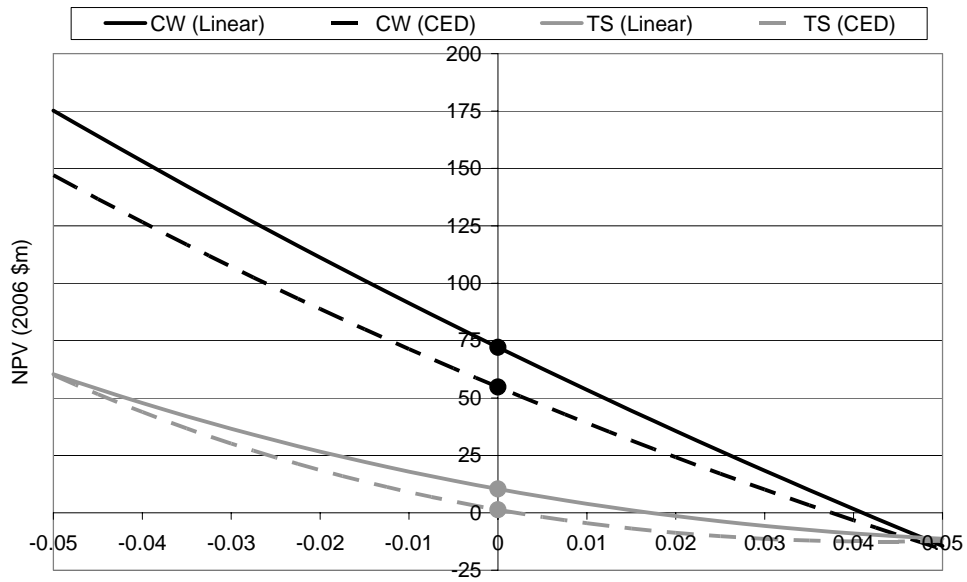


Figure 22 Effects on the Commission’s results of increases or decreases in the regulated mobile termination rate by x cpm in all years.

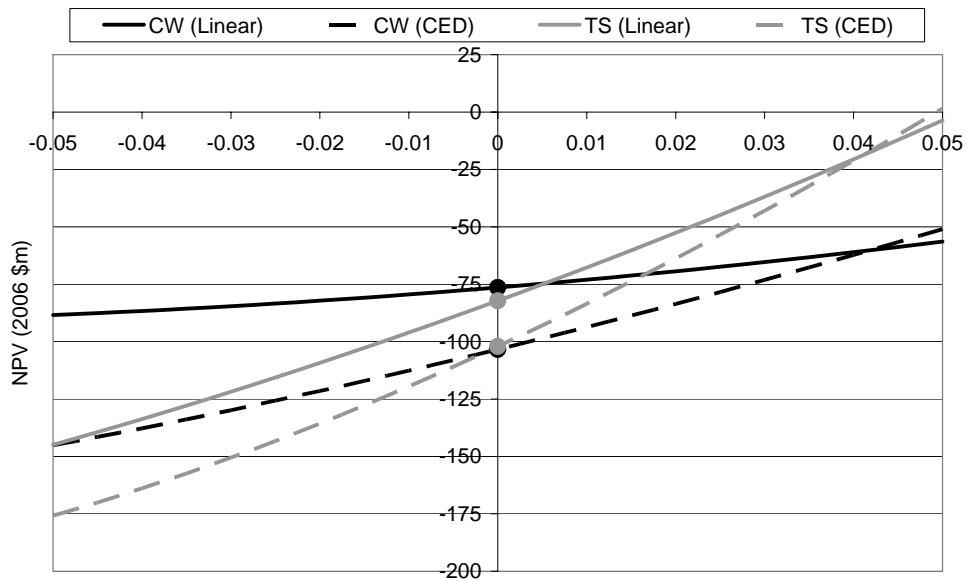


Figure 23 Effects on the amended results of increases or decreases in the regulated mobile termination rate by x cpm in all years.

3.8. Summary of Sensitivity Analysis

The above results indicate that the Commission's conclusion that there are positive net benefits from regulation is cast into doubt even with relatively moderate changes in some individual parameters alone. This is certainly true for the total surplus results, and in many cases is also true for the consumer welfare results. Since we have only considered changes in a single parameter, relatively small changes in multiple parameters could generate negative net benefits from regulation under all the welfare tests. Our conclusion from this sensitivity analysis is that the Commission's conclusion that regulation of mobile termination rates has positive net benefits is not robust to reasonable levels of uncertainty about the key parameters of the model.

On the other hand, the conclusion from the amended model that there are negative net benefits from regulation is robust even to large changes in most parameters individually. The most notable exception is the rate of mobile pass-through, but this would require a large reduction in the input assumption to generate positive net benefits. We can therefore have a reasonable degree of confidence in our overall conclusion that regulation of mobile termination rates will be economically harmful.

Appendix: Corrected Waterbed Calculations

In this Appendix we show mathematically how the calculation of the increase in mobile ARPU under the waterbed effect should be performed, so that the assumed fraction of revenue lost is actually recovered.

Let Q_0 and P_0 respectively denote the counterfactual mobile subscription quantity and price. Similarly let Q_1 and P_1 respectively denote the factual mobile subscription quantity and price. Let e denote the mobile subscription elasticity, and let X denote the total amount of revenue that is required to be recovered from mobile subscriptions via the waterbed effect. Let us also define $R_0 = Q_0 P_0$ and $R_1 = Q_1 P_1$ as the total revenue that a mobile operator receives from subscriptions under the counterfactual and factual respectively. If we allow for the 'FTM effect', then the reduction in mobile subscriptions in response to any price increase is some fraction of what it would be without the FTM effect. Let ξ denote this fraction.

In the Commission's waterbed model and in the 'counterfactual waterbed', the change in mobile subscriptions as a result of the waterbed effect is calculated as:¹⁴

$$\Delta Q = Q_1 - Q_0 = eQ_0 \times \frac{P_1 - P_0}{P_0} \times \xi$$

Thus under the factual, a mobile operator's total revenue from subscriptions is given by:

$$R_1 = \left(Q_0 + eQ_0 \times \frac{P_1 - P_0}{P_0} \times \xi \right) P_1$$

We wish to find the value of P_1 such that the change in total revenue as a result of the waterbed effect equals the revenue recovery target, i.e., $R_1 - R_0 = X$, that is,

$$\left(Q_0 + eQ_0 \times \frac{P_1 - P_0}{P_0} \times \xi \right) P_1 - P_0 Q_0 = X$$

¹⁴ Note that under the commercial counterfactual, Q_0 and P_0 refer to the number of mobile subscribers and the mobile subscription price under the counterfactual used in the Commission's Final Report. In addition, this formula implicitly assumes constant elasticity demand. The Commission's calculations of the change in mobile subscribers under the waterbed effect are therefore incorrect for linear demand. However, the Commission has also used the constant elasticity assumption when calculating the change in the number of FTM minutes in the FTM market in the case of linear demand. We have previously submitted on this point in our response to the Draft Report, however the Commission has not changed its methodology. We have therefore maintained the Commission's constant-elasticity quantity calculations in both the linear and constant-elasticity cases.

Solving for P_1 gives:

$$P_1 = \frac{R_0(\xi e - 1) + \sqrt{4\xi R_0 e X + R_0^2(1 + 2e\xi + e^2\xi^2)}}{2e\xi Q_0}$$

This formula gives the factual mobile subscription price that achieves the required revenue recovery target.