HOUSTONKEMP
Economists

Comment on the Commerce Commission's paper: *Agenda and topics for the conference on the UCLL and UBA pricing reviews*

A report for Chorus

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Executive Summary

Introduction and overview

Chorus has engaged HoustonKemp to provide advice in relation to the New Zealand Commerce Commission's (the Commission's) review of the unbundled copper local loop (UCLL) and unbundled bitstream access (UBA) prices. In particular, Chorus has asked us to comment on specific aspects of the Commission's paper of 2 April, entitled: *Agenda and topics for the conference on the UCLL and UBA pricing reviews.*

The Commission's paper sets out proposed analytical frameworks for assessing the following two issues:

- whether an uplift should be added to the Commission's central estimate of the TSLRIC-based price for the UCLL service to take account of the potential net benefits that may arise from faster migration to the fibre network; and
- whether an uplift should be applied to the Commission's mid-point estimate of the WACC used to determine the regulated prices for the UCLL and UBA services to take account of the potential costs associated with setting the regulated WACC below the true WACC and thereby discouraging investment in future new innovative technologies.

This report provides our analysis with respect to four aspects of the Commission's paper, namely:

- the separation of the issues into distinct frameworks;
- the use of the consumer welfare standard (to the exclusion of the total welfare standard);
- the proposed approach to estimating the value of migration to the fibre network; and
- the proposed approach to estimating the optimal WACC uplift.

In general, in our opinion, the Commission has not sufficiently recognised the implications of its uplift decision on investment incentives in both the fibre and the copper networks. Ensuring that the regulated price and WACC send appropriate signals for investment decisions will be critical for ensuring dynamic efficiency in the industry. Ultimately, the benefits to consumers from appropriate investment decisions are likely to significantly outweigh the short-term benefits that may result from setting the price and/or WACC at inefficiently low levels.

Specifically, the Commission's proposed framework could usefully be extended to account for the following:

- the implications for total surplus (in addition to consumer surplus)
- with regard to the UCLL price uplift framework:
  - the implications on investment in the fibre network, including: incentives for future expansions and investments in upgrades for technological progress; the effect on Chorus' ability to meet its contractual obligations; and the incentives on retailers to invest in supporting systems;
  - the spill-over benefits to the wider economy, as many of those benefits accrue directly to telecommunication end-users;
- with regard to the WACC uplift framework, the implications on:
  - Chorus' incentives to invest in assets that improve (or retain) system reliability and quality;
  - Chorus' incentives to expand or upgrade the copper network; and
  - Chorus' ability to invest generally (including meeting its contractual obligations for the fibre network).

The separation of the issues

The Commission's proposed framework involves the separate consideration of the net benefits of a price increase and the net benefits of a WACC uplift.

In our opinion, the separation of the two issues in this way risks significantly under-estimating the total net benefits of a WACC uplift by failing to incorporate the migration effects into the analysis.

Although the Commission notes the need to avoid double-counting and to consider the effects simultaneously, it is not evident how this will be done in practice.

One alternative may be to develop an iterative model, based on the Commission's proposed frameworks, which allows for the adjustment of the WACC uplift to account for the migration benefits. Alternatively, the Commission may wish to consider expanding the model provided by CEG to incorporate such effects.

Use of the consumer welfare standard

In our opinion, the total surplus measure, by virtue of targeting overall economic welfare, is the better measure of the impact of the Commission's decisions on New Zealanders for two reasons:

- it is likely to be a better measure of the impact of the Commission's decisions on New Zealanders as whole, even in the static sense; and
- it ultimately provides a standard that promotes the long-term interests of consumers (in their role as telecommunications customers) by providing signals that are more likely to be consistent with efficient incentives for investment and therefore dynamic efficiency.

In addition, there is a risk that the Commission's currently proposed approach adopts a narrower basis for assessing the effects of decisions on consumer welfare than has been the case in the past. Thus, not only does it shift the Commission further away from the preferred total welfare standard, it also potentially increases regulatory uncertainty.

The proposed framework for assessing an uplift to the TSLRIC price

The framework for the Commission's analysis risks under-counting the total benefits from a WACC uplift, by considering the benefits from migration on a net rather than gross basis. It is unclear from the Commission's report how it intends to combine the price and WACC uplift frameworks into a unified assessment, but we note that if the Commission were to aggregate the net benefits from each framework this would effectively double-count the costs to consumers of a price increase.

Furthermore, there are three aspects of the Commission's estimation of the benefits of migration that we believe could potentially be improved.

First, it would be useful to expand the benefits in the model to include the implications of the UCLL price on investment in the fibre network. Although Chorus is contractually committed to investing in the majority of the fibre network, the price of UCLL services is likely to affect:

- the incentives for investment in those parts of the fibre network that are not currently subject to contractual commitment, including future expansion or upgrades to the network;
- the implications on Chorus' financial health and therefore the risk of the company not being able to meet its contractual obligations; and
- retailers' incentives to invest in supporting systems.

Second, it would be useful to take account of the additional spill-over benefits resulting from the increased migration, in terms of the increase in GDP. Relevant studies suggest that a significant proportion of these spill-overs directly benefit end-users in their role as consumers of telecommunication services.

Third, it may be appropriate to adopt a cross-price elasticity assumption towards the upper-end of the estimated range as the following factors suggest that this elasticity may be relatively high for New Zealand:

- during the initial period of introduction of the fibre services, take-up rates will be below long-run levels given customers' natural inertia in adopting new technologies – this potentially suggests a greater responsiveness to price relativities; and
- the price differential between UFB and copper-based services is likely to be relatively small or non-existent suggesting an increase in the price of UCLL services could have a more significant impact on migration to the fibre network given the quality differential.

Framework for considering an uplift to the WACC

We agree that there is a need to take account of the asymmetric costs associated with setting the regulated WACC above versus below Chorus' WACC. Although there may be limited pre-existing empirical analysis available to support a specific WACC uplift for the UCLL services, there are strong economic reasons for believing that an underlying asymmetry exists in the costs associated with setting the regulated WACC above versus below Chorus' WACC.

We concur with the broad framework the Commission has developed but note it is not yet a complete model. Developing appropriate estimates of the probability of investment in new technology taking place and the net benefits of such technology is likely to be a sizeable modelling exercise in its own right.

In our view, the model developed by CEG is likely to provide the Commission with a better starting point, as it:

- is at a more advanced stage than the Commission's own model;
- takes account of the effects on both consumer and total surplus;
- is transparent in its required assumptions and how these feed through to the final estimates, providing a useful basis for undertaking sensitivity and scenario tests; and
- is already in its third generation, having been based on the models developed by both Dobbs and Frontier, and has therefore already been subject to scrutiny and refinement.

Should the Commission choose to use the framework it has outlined, not only is considerable additional work needed to complete it, but in our opinion it should be expanded to take account of further asymmetric costs that would be associated with setting the regulated WACC at a level that is too low. Specifically, it is likely that a WACC that falls below Chorus' WACC could impede Chorus' incentive and ability to invest in:

- assets that improve (or retain) system reliability and quality;
- expansions or upgrades to the copper network; and
- unregulated assets, to the extent that a regulated WACC that is below Chorus' WACC results in financial constraints on the firm's ability to invest.

If the Commission's estimation exercise is to result in a plausible estimate of the optimal WACC, in our opinion, these factors should also be considered.

Monte Carlo simulation

The degree of uncertainty in the input parameters required for TERA's TSLRIC model, in combination with the more complex way in which the WACC feeds into prices in a TSLRIC versus building block approach, suggest it may be useful for the Commission to assess its confidence in the TSLRIC mid-point estimate through the use of Monte Carlo analysis.

The usefulness of such analysis will depend critically on the quality of the information that is being fed into the model. Monte Carlo techniques are of most use when the distribution functions of the input variables is

well understood, in which case they are able to return meaningful estimates of the distribution function for the variable of interest.

However, uncertainty regarding the probability distribution of the input variables is likely to result in:

- a wider estimate of the probability distribution function for the variable of interest (in this case, TSLRIC), especially if there is a tendency to err on the side of caution when estimating the input variable distributions; and
- a lack of confidence in the modelled probability distribution for the output variable.

If the Commission is not able to obtain reasonably reliable estimates of the probability distributions for the input variables, the value of undertaking a Monte Carlo exercise will be greatly reduced. Whether or not there is merit in undertaking such an exercise therefore depends on the information that is available from Chorus and other industry participants.

1. Introduction

Chorus has engaged HoustonKemp to provide advice in relation to the Commission's review of the UCLL and UBA prices. In particular, Chorus has asked us to comment on specific aspects of the Commission's paper of 2 April, entitled: *Agenda and topics for the conference on the UCLL and UBA pricing reviews.*

The Commission's paper sets out proposed analytical frameworks for assessing the following two issues:

- whether an uplift should be added to the Commission's central estimate of the TSLRIC-based price for the UCLL service to take account of the potential net benefits that may arise from faster migration to the fibre network; and
- whether an uplift should be applied to the Commission's mid-point estimate of the WACC used to determine the regulated prices for the UCLL and UBA services to take account of the potential costs associated with setting the regulated WACC below the true WACC and thereby discouraging investment in future new innovative technologies.

In this context, Chorus has asked that we consider:

- the economic meaning of the term 'promoting competition for the long term benefit of end users' and whether the Commission's interpretation is consistent with this meaning;
- the Commission's use of the consumer (rather than total) welfare standard in its assessment of the net benefits of applying a price or WACC uplift;
- the Commission's dismissal of any impact on investment in the fibre network on the basis that this is committed;
- the Commission's approach to estimating the value of migration to the fibre network; and
- the Commission's proposed approach to assessing the net benefits of a WACC uplift, which is based on the approach Oxera used in relation to electricity lines businesses.

In general, in our opinion, the Commission has not sufficiently recognised the implications of its uplift decision on investment incentives in both the fibre and the copper networks. Ensuring that the regulated price and WACC send appropriate signals for investment decisions will be critical for ensuring dynamic efficiency in the industry. Ultimately, the benefits to consumers from appropriate investment decisions are likely to significantly outweigh the short-term benefits that may result from setting the price and/or WACC at inefficiently low levels.

Specifically, the Commission's proposed framework could usefully be extended to account for the following:

- the implications for total surplus (in addition to consumer surplus)
- with regard to the UCLL price[1] uplift framework:
  - the implications on investment in the fibre network, including: incentives for future expansions and investments in upgrades for technological progress; the effect on Chorus' ability to meet its contractual obligations; and the incentives on retailers to invest in supporting systems;
  - the spill-over benefits to the wider economy, as many of those benefits accrue directly to telecommunication end-users;
- with regard to the WACC uplift framework, the implications on:
  - Chorus' incentives to invest in assets that improve (or retain) system reliability and quality;
  - Chorus' incentives to expand or upgrade the copper network; and

[1] We note that the Commission sets the prices for both UCLL and UBA services, the comments made throughout this report regarding the UCLL price are also generally relevant to the prices the Commission sets for the UBA services.

- Chorus' ability to invest generally (including meeting its contractual obligations for the fibre network).

This report provides our analysis with respect to each of these issues and is structured as follows:

- section two discusses the merit of the Commission's proposal to separate the assessment into two distinct frameworks;
- section three considers the economic meaning of the term 'promoting competition for the long term benefit of end users' and whether the Commission's use of the consumer welfare standard (to the exclusion of the total welfare standard) is consistent with this objective;
- section four reviews the Commission's approach to estimating the value of migration to the fibre network, which is assumed to arise from an increase in the price of the UCLL services; and
- section five reviews the Commission's proposed approach to assessing the optimal WACC uplift, which is based on the approach Oxera used in relation to electricity lines businesses.

2. The Separation of the Issues

2.1 Introduction

The Commission's paper sets out proposed analytical frameworks for assessing the following two issues:

- whether an uplift should be added to the Commission's central estimate of the TSLRIC-based price for the UCLL service to take account of the potential net benefits that may arise from faster migration to the fibre network; and
- whether an uplift should be applied to the Commission's mid-point estimate of the WACC used to determine the regulated prices for the UCLL and UBA services to take account of the potential costs associated with setting the regulated WACC below the true WACC and thereby discouraging investment in future new innovative technologies.

The Commission's analysis separates these issues, while also recognising that there will be a need to avoid 'double-counting' any effects, stating:

> *As noted in paragraph 30 above, migration effects are considered in the context of an uplift to the overall TSLRIC price for the UCLL service. Investment effects, on the other hand, are addressed through consideration of a WACC uplift, due to the potential signal our decision regarding the allowed WACC for UCLL and UBA may send to investors in telecommunications services more generally. We note that if an uplift is adopted, for example, because of concerns about future investment incentives, this would also provide incentives for migration, and that the effects of an uplift on both these outcomes need to be considered together.*

2.2 Comment

Despite the Commission's statements regarding the need to avoid double-counting and consider the effects of an uplift on investment and migration incentives simultaneously, it is not clear how the Commission plans to do this in practice. It is therefore unclear whether the proposed approach will be applied in such a way as to ensure the Commission makes a decision that appropriately balances its own estimates of the costs and benefits of an uplift.

In our opinion, the separation of the two issues in the way the Commission has proposed risks double-counting the costs associated with a WACC/price uplift by comparing these costs with two subsets of the available benefits. Specifically a WACC uplift will increase the UCLL price and thereby:

- encourage migration; *plus*
- reduce the risk of under-investment.

There is a risk that the Commission's analysis indicates that neither of these benefits alone is enough to offset the estimated costs to consumers associated with a WACC (and therefore price) uplift whereas in aggregate there would be significant net benefits. We therefore strongly suggest that the Commission combine its analysis into a unified framework.

We recognise that combining these two effects into a unified framework may not be simple given the Commission's currently proposed frameworks. For example, a WACC uplift would suggest a price increase, which would result in migration benefits, which would then suggest a higher WACC uplift would be optimal. The current framework does not allow for the simultaneous optimisation of this problem.

However, this is a critical issue if the Commission is to make an appropriate trade-off between the costs and benefits of its decision. One alternative may be for the Commission to take an iterative approach in estimating the optimal WACC uplift. This would involve:

- estimating the investment-associated benefits of a given WACC uplift, holding migration constant;
- calculating the associated UCLL price increase;
- estimating the implication of such a price increase on migration and the resultant benefits;
- estimate the cost associated with the price increase;
- assess whether the sum of the investment and migration benefits is above or below the welfare cost; and
- adjust the WACC uplift until the sum of the benefits equates with the (total) estimated cost.

It should be possible to set up such an iterative model using the Commission's proposed frameworks (potentially amended to account for the issues outlined in the remainder of this paper). Alternatively, it may be the case that an extension of the model provided by CEG is more suitable for this role.[2]

[2] CEG (March 2015) *Welfare effects of UCLL and UBA uplift (Public Version)*

3. The Appropriate Welfare Standard

3.1 Introduction

Section 18 of the Telecommunications Act sets out the purpose of the Act, as follows:

> 1. *The purpose of this Part and Schedules 1 to 3 is to promote competition in telecommunications markets for the long-term benefit of end-users of telecommunications services within New Zealand by regulating, and providing for the regulation of, the supply of certain telecommunications services between service providers.*
> 2. *In determining whether or not, or the extent to which, any act or omission will result, or will be likely to result, in competition in telecommunications markets for the long-term benefit of end-users of telecommunications services within New Zealand, the efficiencies that will result, or will be likely to result, from that act or omission must be considered.*
>
> 2.A *To avoid doubt, in determining whether or not, or the extent to which, competition in telecommunications markets for the long-term benefit of end-users of telecommunications services within New Zealand is promoted, consideration must be given to the incentives to innovate that exist for, and the risks faced by, investors in new telecommunications services that involve significant capital investment and that offer capabilities not available from established services.*

The Commission's preliminary interpretation of this purpose suggests that regulatory decisions should be based on the implications for consumer welfare rather than total welfare. In other words, the Commission has based its initial analysis of the potential net benefits of TSLRIC and/or WACC uplifts on the potential gains and losses to consumers in their role as users of the telecommunication services, rather than all New Zealanders.[3]

We have two concerns with this preliminary application of the purpose statement:

- fundamentally, we disagree that a test based on only consumer surplus is consistent with an economic interpretation of this purpose statement; and
- additionally, the way the Commission has applied a consumer welfare based test in the telecommunications sector differs from the approach taken in the recent review of the WACC percentile in the electricity and gas sector, which was more cognisant of the effects on total welfare (as a proxy for the long-run implications for consumers).

3.2 The total surplus standard and dynamic efficiency

In our opinion, the total surplus measure, by virtue of targeting overall economic welfare, is the better measure of the impact of the Commission's decisions on New Zealanders as a whole.

The total surplus also ultimately provides a standard that promotes the long-term interests of consumers (in their role as telecommunications customers) by providing signals that are more likely to be consistent with efficient incentives for investment. A total surplus standard is more likely to be consistent with maximising dynamic efficiency in the relevant industry, as it provides appropriate incentives for investment in order to provide the products of most value to consumers in a least-cost way. Over the longer term, dynamic efficiency considerations are likely to be more important than static efficiency concepts for maximising consumers' welfare.

[3] Paragraph 34.

In its 2013 paper, Sapere noted a number of studies demonstrating that dynamic efficiency considerations are likely to be more significant than those of static efficiency.[4] This included the following statement from Professor Eleanor Fox:

> *Dynamic efficiency gains can easily swamp static efficiency gains: that is, they can swamp the gains that result from pushing price closer to costs.*

And from Judge Easterbrook:

> *An antitrust policy that reduced prices by 5 percent today at the expense of reducing by 1 percent the annual rate at which innovation lowers the cost of production would be a calamity. In the long run a continuous rate of change, compounded, swamps static losses.*

Sapere provided examples of similar statements from the New Zealand Treasury, Australian National Competition Council, Professor Lewis Evans and Professor Jerry Hausman.

It is for this reason, that we consider the total welfare measure to be a better indication of the implications of the Commission's decisions on the consumers in the long-term. This is particularly pertinent given the express requirement in Section 18(2) to consider efficiencies.

3.3 Inconsistency with the Commission's previous approach

The Commission's indicative view appears to be at odds with the approach taken in the electricity and gas sector. Specifically, the current paper takes a relatively narrow view of the benefits to end users, for example:

> *Our analysis of potential TSLRIC and/or WACC uplifts is based on the potential gains and losses in consumer welfare, rather than total welfare.*[5]

> *We emphasise that our analysis focuses on the incremental benefits and costs faced by end-users of telecommunications services…*[6]

> *However, in considering the potential consequences of an uplift, we have focused on the benefits and costs to end-users of telecommunications services within New Zealand…*[7]

This is not consistent with the approach the Commission adopted in its recent review of the appropriate WACC percentile for price-quality regulation for the electricity lines and gas pipeline services, where it said:[8]

> *Therefore, notwithstanding our in-principle view that using the consumer welfare standard is more consistent with an overall objective of the long-term benefit to consumers, it may be appropriate in practice to give some weight to producer surplus. However, this would only be to the extent producer surplus provides an appropriate proxy for some otherwise difficult to quantify (or unquantifiable) long-term (net) benefit to consumers, in particular as an indicator of the margin for error regarding incentives to invest. In the current context, the effect of giving some weight to producer surplus would be a higher WACC percentile that would otherwise be the case.*

[4] Stuart Shepherd and Alistair Davey (30 January 2013), *Comment on how to best give effect to the purpose of Section 18 in relation to UBA pricing,* paragraphs 64-72.

[5] Paragraph 34.

[6] Paragraph 42.

[7] Paragraph 46.

[8] Commerce Commission New Zealand (30 October 2014) *Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons Paper*, paragraph 2.37.

The Commission was even more explicit about its approach in its Draft Decision regarding the electricity lines' and gas pipelines' WACC:[9]

> *Our analysis, and that of our experts, therefore adopts both consumer welfare and total welfare approaches. This means that in reaching our draft decision as to what will best promote the long term benefit of consumers by promoting outcomes consistent with outcomes produced in competitive markets, we have had regard to transfers from suppliers to consumers, but have also had regard to aggregate efficiency considerations.*

This is despite the fact that, in our opinion,[10] the Commission's objectives in the two sectors appear to be substantively similar.

In contrast to the analysis undertaken in relation to electricity lines and gas pipelines businesses, the current paper appears to disregard the wider costs and benefits associated with any decision regarding the price and/or WACC uplift. This is despite the Commission setting out at some length the rationale for considering both consumer and total welfare implications in its *Attachment* to its *Reasons Paper* for the electricity lines and gas pipeline services WACC review.[11]

In particular, in the context of the electricity lines and gas pipelines, the Commission considered the short-comings of measures of static consumer surplus, noting:

> *In particular, there are limitations to the extent to which any theoretical representation or analytical model of static consumer surplus can adequately take into account all the relevant benefits to consumers over the long term, and all relevant dynamic and inter-temporal effects. For example, one submitter [Covec on behalf of BARNZ] highlighted that s52A does not involve a "pure maximisation of static consumer surplus" – consequently, one should take some care to define the consumer surplus standard in a way that is consistent with the 'long term', otherwise 'we are not giving the consumer surplus standard a fair chance'.* [12]

> *Even though the s52A purpose is more consistent with a consumer welfare standard, there are limitations to the extent to which any analytical model of static consumer surplus can adequately take into account all the relevant benefits to consumers over the long term.* Therefore, to the extent that consumer surplus is not defined, represented or quantified in economic models (such as a loss analysis) in a way that adequately takes into account consumer benefits over the long term, it may be appropriate to give some weight to producer surplus.

The current approach may also be at odds with previous statements made by the Commission in regard to the telecommunication sector. For example, in its UCLL Decision 609 (2007) the Commission emphasised the importance of dynamic efficiency:[13]

> *The Commission has previously stated that where tensions exist between static efficiency and dynamic efficiency, it takes the view that dynamic efficiency will generally better promote competition for the long-term benefit of end users. This remains the Commission's position.*

The preliminary view expressed in the Commission's current paper therefore not only shifts the analysis away from what is, in our opinion, a more theoretically correct approach (that takes greater account of the longer-term efficiency considerations) it also potentially increases the degree of regulatory uncertainty, both

[9] Commerce Commission New Zealand (22 July 2014) *Proposed amendment to the WACC percentile for electricity lines services and gas pipeline services*, paragraph 2.17.

[10] Note that HoustonKemp does not have legal expertise and the opinions expressed are those of economists rather than lawyers. We take no position on the legal interpretation of the purpose statements in the relevant provisions for these sectors.

[11] Op. cit., "Attachment A: Consumer welfare vs total welfare".

[12] Commerce Commission New Zealand (30 October 2014) *Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons Paper*, paragraph A32.

[13] Paragraph 207.

in the telecommunications sector and in other regulated industries. Increases in regulatory uncertainty can ultimately be expected to increase the return businesses require to invest in these industries, working to the detriment of consumers.

3.4 Conclusion

In our opinion, the total welfare standard is consistent with the requirement to promote competition for the long-term benefit of end-users. It places greater focus on dynamic efficiency considerations, which are likely to dominate static efficiency benefits in the longer-term.

Furthermore, the approach proposed in the Commission's current paper appears to take a more narrow interpretation of the effects of decisions on long-term consumer welfare than has been the case in the past. This would not only shift the analysis away from what is, in our opinion, a more theoretically correct approach but also increases regulatory uncertainty, not only in the telecommunications sector.

4. Framework for assessing the value of migration

4.1 Introduction

The objective of the Commission's analysis has been to develop an analytical framework that considers whether an uplift should be added to the central estimate of the TSLIRIC-based price for the UCLL services to take account of the potential benefits that might arise from faster migration from copper to fibre. Such benefits need to be compared to the increased costs (higher prices) for those customers who choose to remain on copper-based services. The Commission's analysis is based on the potential gains and losses in consumer welfare, rather than total welfare.

The Commission has asked for responses on:[14]

- whether the proposed framework for assessing the potential welfare effects of any uplift in the TSLRIC price is appropriate;
- if not, what alternative approach should be used and why;
- whether there is any empirical evidence that is relevant for quantifying any externality effect attributable to an uplift to the TSLRIC price; and
- any other comments on the parameters and/or assumptions made in the proposed frameworks.

We address these points in our discussion below, following a brief description of the Commission's proposed framework.

4.2 Description of the Commission's approach

The Commission's framework is intended to measure the incremental net benefit of increasing the price of the UCLL prices by $1 per month. It is assumed that such a price increase will have no impact on the deployment of the UFB, as it is contractually committed.

Within the Commission's framework:

- *gross marginal benefits* are measured as those benefits obtained as a result of faster migration of customers to the fibre network, which are assumed to arise from positive externalities including users' ability to communicate with a wider customer base via the UFB and the stimulation of more innovative applications and content; and
- *marginal costs* are measured as the private welfare losses from higher copper prices for those subscribers who remain on the UCLL-based services.

The Commission's analysis has been based on the following assumptions:

- full pass-through of the $1 price increase to UCLL end customers;
- a cross-elasticity of demand for fibre services with respect to DSL prices of 1.2 (with a range of 0.6 to 3.0);
- a 'base-line' level of UFB demand of 100,000 subscriptions in 2015, increasing to reach 1,553,469 subscriptions by 2029 with a cap of 80% uptake (which is reached in 2029 with or without the uplift in the UCLL price);
- an assumed range for the value of any network externality, up to a value of 50% of the increased consumer expenditure on UFB services; and

[14] Paragraph 72.

- a 15-year timeframe with a discount rate of 10%

The results obtained from this modelling exercise are set out in Tables 3 and 6 of the Commission's paper and are replicated here for convenience.

Table 3: Potential externality benefits (NPV, 15 years)

		Network externality as a % of UFB expenditure		
		2%	25%	50%
Cross-elasticity	0.6	$776,629	$9,707,857	$19,415,714
	1.2	$1,553,257	$19,415,714	$38,831,428
	3.0	$3,883,143	$48,539,285	$97,078,570

Table 6: Potential welfare costs (NPV, 15 years)

Cross-elasticity	0.6	-$93,778,979
	1.2	-$93,396,618
	3.0	-$92,219,534

4.3 Comments on the Commission's approach

4.3.1 Overall framework

In our opinion, the framework for the Commission's analysis inappropriately separates the consideration of the benefits of migration from those of the WACC uplift. If the Commission is to properly identify the benefits associated with a WACC uplift, it is the *gross* and not the *net* benefits of migration that should be added into the WACC uplift consideration. Assessing the net benefits of migration effectively double-counts the cost (to consumers) of the price increase. This is discussed in Section 2 above.

In addition, there are several aspects of the Commission's proposed model that might usefully be improved, which are discussed below.

4.3.2 Included costs and benefits

There are two benefits from the increase in UCLL prices that are not currently incorporated into the framework that, in our opinion, should be, namely:

- the implications for investment in the fibre network; and
- the spill-over benefits to the wider economy, which benefit users in the longer-term.

Investment in the UFB network

The Commission has assumed that an increase in the price of the UCLL services will not affect investment in the fibre network, and states:[15]

> *We emphasise that our analysis focuses on the incremental benefits and costs faced by end-users of telecommunications services that could reasonably be attributable to any decision to apply an uplift to the UCLL TSLRIC price. This incremental nature of the analysis is important, as there are likely to be substantial consumer welfare benefits arising from a fibre network such as the UFB,*

[15] Paragraph 42.

> *although the deployment of the UFB is contractually committed and therefore the majority of these benefits are likely to emerge irrespective of whether an uplift is applied to the UCLL TSLRIC price.*

We note the comments in Professor Cambini's report regarding the incentives to invest in fibre networks:[16]

> *Cave (2010) extends his analysis on the ladder of investment over NGA networks and discusses the impact of the introduction of fibre unbundling...he argues that, in order to provide incentives to alternative operators to climb the last rung of the ladder (ie invest in own fibre network), an increase in the price of wholesale access charges on legacy copper lines would be desirable. His reasoning goes as follows: if the price of the local loop unbundling increases, the alternative operators would be more inclined to invest in their own infrastructures, encouraging the deployment of proprietary fibre networks.*

Given that Chorus' investment in the UFB is committed, Professor Cambini's notes:[17]

> *The UFB network is contractually committed and is operated on a wholesale-only basis…This implies that, differently from what we observe in Europe, the key policy point in New Zealand is not how relative copper and fibre prices will affect incentives to invest in fibre, but rather how they will affect the migration of end users between the networks and what the benefits from accelerated migration might be.*

However, in our view this is an over-simplification of the dynamics of investment in this industry and there are three ways in which the UCLL price could be expected to influence investment in the fibre network, namely through:

- the incentives for investment (by Chorus and LFCs) in those parts of the fibre network that are not currently subject to contractual commitment, including future expansion or upgrades to the network;
- the implications on Chorus' financial health and therefore the risk of the company not being able to meet its contractual obligations; and
- the effect on retailers' incentives to invest in supporting systems.

In relation to the first point, it should be noted that the difference between the UCLL and UFB prices will be an important consideration for investment in *expansions* to the fibre network, beyond Chorus' commitments. The Government has announced plans to extend the UFB network to increase the percentage of New Zealanders able to access fibre technologies from 75 to at least 80 per cent.[18] This is to be undertaken by private sector participants on the basis of a competitive bid process, with the government providing additional funding of between $152 and $210 million. In its announcement, the Government noted that the strength of consumer demand will be key. The price differential, which will influence the demand for fibre-based services, will strongly influence the price which businesses will be willing to bid for the network expansion.

This is likely to increase the regions that are able to attract investment in UFB at a price point acceptable to the Government.

Quantifying this benefit would require:

- an estimation of the additional revenue (generated by increasing demand) that would accrue to the bidding firms – in a competitive bidding process, the bid price would be expected to fall by this level;
- the implications of this for the willingness of firms to invest in such expansions at a price point that is acceptable to the Government; and
- an estimate of the net benefits of such expansion to consumers (the cost of further Government funding for these regions would need to be taken into account in evaluating the net benefits).

Furthermore, it should be recognised that the telecommunication sector is likely to continue to be characterised by rapid technological change, even with the fibre-based network. The UCLL price will have a strong role in incentivising investment in new technology beyond that which Chorus is committed to making.

[16] Page 2.

[17] Page 2.

[18] See http://www.beehive.govt.nz/release/govt-launches-next-stage-broadband-rollout.

Over time, the resultant upgrades in service levels are likely to have a significant impact on consumers' outcomes.

In addition to the incentives for investment in expansions of the fibre network, an increase in UCLL prices may also reduce the risk to the UFB commitments. As Chorus noted in its previous submission:[19]

> *The importance of setting an appropriate TSLRIC price in this context should not be underestimated. The return on UCLL/UBA necessarily has a bearing on the return to be expected for all Chorus investment. This means the price payable for regulated services affects investment not only in those services, but also in new generation access.*

We also understand that the financial impact of the current price (of $34.44) has been well documented in New Zealand. In a previous review of Chorus' ability to meet its UFB obligations, the Hon Amy Adams (in her role as the Minister for Communications and Information technology) stated:[20]

> *Copper price changes will have a significant impact on Chorus' financial position, and the wide range of actions that Chorus can consider taking itself will not be sufficient to cover the funding shortfall to safeguard the UFB and RBI build commitments.*
>
> *The [Ernst & Young Australia] report confirms the initial figures released by Chorus about the impact of copper price changes on its financial position, and lays to rest claims by some that the figures were overstated.*

One of the mechanisms for closing this shortfall has been the agreement between Chorus and Crown Fibre Holdings (CFH) that would allow Chorus to bring forward the government funding it is able to draw on from October 2015. However, CFH has noted:[21]

> *Similar to many corporate financing arrangements, the advance CFH funding will not be available in the event that there is a material deterioration in Chorus' position…*

Given this, a further potential benefit associated with increasing the UCLL price may be the reduction in the risk to the UFB network, despite the fact that it is contractually committed.

It is also likely that the UCLL prices will affect retailers' incentives to invest in systems and communications intended to support and encourage customers' migration from the copper- to the fibre-based services. Retailers will be incentivised to invest in assets and systems that enhance the benefits from the fibre-based services through the respective margins they earn from customers choosing between the competing networks. The higher the margin earned from customers on the UCLL network, the less likely retailers will be to invest significantly in supporting systems and infrastructure for the fibre network.

We note that the prices for the 30 Mbps or entry level fibre based services are expected to increase over the regulatory period (by $1 each year up to $42.50 on 1 July 2019). It is unclear how such price increases would feed through to end-customer tariffs and we note that the wholesale price of the UCLL services is currently above that of the fibre services but that this relativity is reversed in end-consumer prices (we note Spark's very recent announcement of a reduction in price of entry-level fibre services to that of copper-based services).[22] However, it is likely that the increases in the wholesale price for fibre services will, over time, reduce retailers' incentives to invest in downstream systems and infrastructure. An increase in the UCLL

[19] Page 21

[20] http://www.crownfibre.govt.nz/2013/12/report-on-independent-assessment-of-chorus-financial-position-released/

[21] http://www.crownfibre.govt.nz/2014/07/chorus-agrees-funding-option-cfh/

[22] The current wholesale price of fibre-based services is $37.50 but this will soon increase to $38.50 (mid year), compared to the combined wholesale price of UCLL ($28.22) and UBA ($10.17) services of $38.39 in the draft FPP determinations. This compares to entry-level retail prices for the UFB services of around $85 per month and DSL/telephony services of $79 per month. However, Spark has recently announced a reduction in its entry level fibre retail price to $79, see http://www.sparknz.co.nz/news/ultra-fibre-new/.

price may assist in encouraging such investment, especially if such price increase cannot be fully passed on to end-consumers (discussed further below).

The spill-over benefits

The Commission's preliminary framework does not incorporate spill-over benefits to the wider economy. In our view, there would be merit in the model incorporating an appropriate measure of these benefits, particularly as many of them accrue directly to end-consumers through their use of telecommunication services.

The Commission's preliminary view that it would be appropriate to exclude the spill-over benefits is based on its intention to apply a consumer welfare standard. The paper states:[23]

> *We note that the potential benefits from fibre-based services in New Zealand are likely to include the broader impact of the UFB on economic growth…However, in considering the potential consequences of an uplift, we have focused on the benefits and costs to end-users of telecommunications services within New Zealand, as per section 18(1).*

Leaving aside the issues raised in Section 2 in regard to the relevance of the total welfare standard, in our opinion, the proposed approach does not take account of the fact that a considerable proportion of these spill-over benefits are likely to accrue to end-users in their role as consumers of telecommunications services.

For example, a paper prepared for the UK Department for Culture Media & Sport by SQW (2013) that considers the marginal benefit of taking up faster broadband services[24] found that the bulk of the economic impact comes from improvements in the productivity of broadband-using firms, although increases in labour force participation, teleworker productivity and safeguarding employment in areas that would otherwise be at an unfair disadvantage, were also found to be contributing factors.[25]

As has been well-recognised, faster migration to the fibre network is likely to contribute significantly to New Zealand's GDP. Professor Cambini notes:[26]

> *Worldwide there are ample examples of NGA [Next Generation Access] build-out with low customer take-up. The question therefore is if much welfare is lost by slower rather than faster build-up of NGA coverage. The answer depends on whether the external benefits of broadband infrastructure extend to the incremental move from broadband to NGA.*
>
> *It seems to me that there is a further potential external effect of investment in fibre infrastructures.*

Professor Cambini provides a review of the relevant literature relating broadband and fibre uptake to GDP.[27] In the past, we have been sceptical about the applicability of the cited papers when used to estimate the marginal benefit of increases in the uptake of copper-based broadband services in New Zealand, given the current uptake rate.[28] In particular, we were unconvinced that a 10 percentage point increase in the uptake rate (where uptake is of copper-based services) would provide anything close to a 0.9 to 1.5 percentage point increase in annual per-capital GDP growth. We remain sceptical about the use of these studies in that context and most of these papers do not provide an estimate of the marginal benefit to GDP that is likely to be associated with migration from copper- to fibre-based networks.

[23] Paragraph 46.

[24] SQW (2013) *UK Broadband Impact Study: Impact Report*, commissioned by the Department for Culture, Media & Sport.

[25] Page 3.

[26] Page 12.

[27] Page 12.

[28] HoustonKemp (12 March 2015) *Response to Spark New Zealand's Attachment D: Illustrative estimate of social cost of high price*, Section 4.

However, SQW undertakes a modelling exercise based on research by the Chalmers University of Technology, which found that a doubling of speed is associated with a 0.3 percentage point increase in GDP growth, using a macroeconomic framework for OECD countries.[29] The move from copper to fibre in New Zealand is expected to provide well in excess of a doubling of speed, suggesting that this figure may underestimate the impact for New Zealand. However, given the current GDP of around $240 billion[30] a 0.3 percentage point increase would have a value of around $720 million per annum. If the increase in copper prices increases uptake by 1.52%, this suggests benefits to GDP of around $8.5 million per annum or around $129 million over the 15 year period of relevance (using the Commission's NPV model).

The Chalmers University of Technology paper does not consider the fact that the migration from copper to fibre takes time and that the full benefits of the doubling of speed may not be achieved for some time. SQW explore the implications of this paper by using Monte Carlo simulation to estimate the impact on GDP, based on a range of assumptions for uptake rates and availability. SQW estimated that the availability and take-up of faster broadband speeds will contribute an average of 0.07 percentage points to real annual Gross Value Added (GVA) over the relevant period.[31]

The Monte Carlo approach adopted by SQW makes it difficult to apply its results directly to the Commission's framework, as it is unclear what uptake rates SQW's results are based on and, therefore, what the marginal benefits from increasing uptake rates might be. However, to put these figures in perspective, if the average annual benefit of the availability and uptake of the fibre network in New Zealand is assumed to be consistent with that in the UK, this would suggest an increase in GDP per annum of around $170 million. If a $1 increase in the UCLL price increased uptake by 1.52%, this suggests the marginal benefits may be around $2 million per annum. Using the Commission's NPV approach, this suggests benefits of around $30 million over the period.

Professor Cambini notes that it is *"difficult and contentious to split these figures into benefits accruing to users through the economy as a whole (for example, in terms of higher GDP per capita or higher employment) and benefits accruing to end users in their role as "telecom" end users adopting faster connections."*[32]

We agree with Professor Cambini's recommendation that the Commission account for these benefits *"by adding such aggregate effect to the benefit of the welfare analysis"* as this is likely be a better approach for considering a quantitative effect of the external long term benefits. Alternatively, he suggest that the Commission account for the fact that the current analysis is gross of these external benefits.

We agree with Professor Cambini that these benefits should be incorporated into the Commission's framework, especially as a considerable proportion of them directly accrue to end-users (ie, the improvements in the productivity of broadband using firms).

Other studies that have estimated the wider implications of broadband uptake include:

- Alcatel Lucent (2012)[33] – estimated that the economic benefits to New Zealand end-users of the high-speed broadband applications considered would amount to $32.8 billion over 20 years;
- Sapere Research Group (2014)34 – estimated that businesses that make effective use of the internet are 6% more productive than average businesses and that getting all businesses to use the Internet to its full

[29] Page 15.

[30] Department of Statistics website.

[31] The paper also estimates that the uptake of faster broadband services will have significant positive environmental impacts, as a result of: enabling increased telework arrangements; reducing business travel requirements through the use of video and online collaboration tools; and reductions in server capacity requirements as firms increasingly use the more energy-efficient public cloud platforms.

[32] Page 14.

[33] Alcatel.Lucent (2012) *Building the Benefits of Broadband: How New Zealand can increase the social & economic impacts of high-speed broadband*

[34] Sapere (March 2014) *The value of internet services to New Zealand businesses*

potential could add $34 billion (or 16%) to the economy in productivity and efficiency gains. This may be interpreted as an approximate measure of the potential increase in productivity likely to result from increasing the internet speed. However, it should be noted that this research may be treating a correlation between internet usage and productivity as a causal relationship. The paper also implicitly assumes that demand in the economy will rise to fully absorb the increase in productivity and output; and

- the Ministry of Business, Innovation and Employment has also commented on the benefits of fast broadband.[35]

The following table summarises the studies of relevance and the implications for the estimated benefits of a $1 increase in the UCLL prices on GDP, using the Commission's adopted cross-price elasticity estimate. It should also be recognised that these studies also identified benefits beyond contributions to GDP. For example, the SWQ report noted significant environmental and social benefits, mainly as a result of facilitating telecommuting arrangements. Other commentators have noted the health and education benefits associated with significantly faster broadband.

[35] http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/benefits-of-fast-broadband

Table 1 Summary of findings regarding the benefits of fibre uptake

Study	Estimated impact on GDP	Estimated impact of 1.52% increase in uptake	NPV over 15 year horizon	Comments
Chalmers University of Technology	0.3%; $720 m/pa	$10.9 m/pa	$83.2 m	Based on an estimate of the total available benefits of fibre uptake, but may underestimate this figure for New Zealand as based on a doubling of speed.
SQW (2013)	0.07%; $168 m/pa	$2.5 m/pa	$19.4 m	Bulk of this accrues directly to telecom end-users; may underestimate the impact on New Zealand as based on a doubling of speed as a result of fibre uptake.
Alcatel Lucent (2012)	$32.8 b (20 years)	$498.6 m (20 years)	≈$373.9 m	Estimate of the economic benefits to NZ end-users.
Sapere (2014)	$34 b/pa	$517m/pa	$3.9 b	It is unclear whether Sapere's analysis is appropriate for current purposes.

These estimates suggest that the Commission should consider incorporating (gross) spill-over benefits of *at least* $19.4 million over the relevant 15 year horizon (based on Professor Cambini's suggested approach of adding in these benefits in their entirety even if the Commission chooses to adopt its strict application of the consumer welfare standard). Furthermore, a higher amount may be more appropriate given that:

- this estimate is based on a doubling of broadband speed, whereas the introduction of fibre-based services in New Zealand offers significantly greater speed enhancements; and
- this is the lowest estimate of the potential spill-over effects that we have found in the economic literature.

If such benefits are to be incorporated into the analysis, further work is likely to be required to take account of the following:

- the estimates are measures of the gross impacts on GDP, to the extent that consumers will be required to pay a price premium for fibre-based services, this cost differential should be netted off to the extent that the Commission applies a consumer rather than total surplus standard; and
- it is unclear whether the benefits the Commission has referred to as externalities are also taken into account in these studies, to the extent there is some overlap, these should be netted off.

4.3.3 Review of the key assumptions

The key assumptions made in the Commission's analysis are:

- full pass-through of the increase in UCLL prices to end customers;
- the underlying migration assumptions;
- cross-elasticity of demand for fibre with respect to DSL prices – assumed estimate of 1.2 (range of 0.6 to 3.0);
- externality effects – communication improvements and encouragement of app development – assumed to be between 2% and 50% of the increased consumer expenditure on UFB services; and
- private welfare losses from higher copper prices – the direct losses from a result of increasing prices by $1 per month;
- NPV, based on 15 year horizon and 10% discount rate.

We consider these in turn.

The pass-through

The Commission has assumed that the $1 increase in the UCLL price will be passed on to consumers in full, on the basis that the retail market is competitive. Whether this is the case will depend on the strategy adopted by retailers, it may be the case that they choose to pass on less than the full increase. This assumption should, then, be checked with the relevant retailers.

If retailers pass less than the full UCLL price increase through to consumers, this would have two implications for the Commission's analysis:

- the estimated 'harm' to customers who remain on the copper-based network would be proportionately reduced; and
- migration rates *may* be affected, depending on the offsetting effects of the increased price differential between UCLL and fibre-based services and the incentives on retailers to encourage migration (this is discussed below).

In addition to the price differential between copper- and fibre-based services, migration rates also depend on the extent to which retailers encourage switching, for example through their advertising and communication campaigns as well as their investment in ancillary assets and systems that provide enhanced services.

To the extent that the relative wholesale prices of Chorus' copper- and fibre-based services incentivises retailers to encourage faster migration, this could have a significant impact on end-customer behaviour. This is illustrated by Spark's recent announcement regarding the development of its capability to provide VOIP services via the fibre network. The availability of such services is likely to be an important determinant of customers' willingness to pay a higher rate for access to fibre services and therefore the migration rate.

If retailers opt to absorb part of the UCLL price increase rather than pass it on to consumers, this will increase their incentive to speed up migration. The net impact on migration will depend on the interplay between the retailers' choices and customers' response to them.

The Commission may also need to be mindful of the implications on retailers' incentives of the allowed increased in the wholesale prices of fibre-based services, which we discussed above.

It may be useful for the Commission to seek retailers' views on their likely response to a $1 increase in the UCLL price, including their likely pass-through rate as well as their investment and advertising choices. The Commission may also wish to review retailers' past conduct. In the interim, the Commission should note that the pass-through rate may be less than the full $1 and if this is the case the harm to consumers choosing to remain on the copper-based network would be proportionately reduced but the implications for migration would be uncertain.

The underlying migration assumption

The number of households purchasing fibre-based services will depend not only on their willingness to pay the relative price difference but also their ability to access these services. The level of migration assumed by the Commission therefore depends on a number of underlying assumptions regarding not only uptake rates but also the availability of the network. For example, the Commission notes:[36]

> *We have assumed that UFB demand is capped at 80% of households, to reflect the coverage of the (expanded) UFB.*

However, it is unclear what assumptions the Commission has made regarding the availability of the fibre network between 2015 and 2029. It may be useful to separate the assumptions regarding the availability of the network from the migration assumption. This would potentially provide a more comprehensive indication of the interplay between investment incentives (and hence fibre availability), migration rates, and the fibre customer numbers.

For example, we note the comments made in the paper regarding the committed nature of much of Chorus' planned investment in the fibre network. However, it must be recognised that this commitment does not equate to 80 percent of households. For example, Chorus provided the following information on the level of investment commitments in the UFB network by 2019.

Table 2 UFB Commitments (by 2019)

	Premises to be connected
Chorus	830,900
Other LFCs	≈365,000
Total	1,195,900

[36] Paragraph 57.

These figures include supply to multi-dwelling units and equate to a targeted number of 1,340,000 UFB end users with the ability to connect.[37] This number can be compared to the Commission's threshold level of 1,553,469 by 2029.

It may be expected that an increase in the UCLL price will encourage investment in the fibre network, as discussed above. This would then result in an increase in the availability of the fibre network as well as encouraging higher migration rates for those customers able to access the network.

This potentially has significant implications for the estimated benefits of a price uplift. For example, the following table (which is based on the Commission's excel model) provides the results of a simulation that assumes the following:

- in the absence of an uplift:
  - no additional investment in the fibre network is undertaken beyond the 1,340,000 currently committed connections; and
  - of those customers able to access the fibre network, up to 90% take it up; and
- a $1 uplift is sufficient to encourage investment to enable the connections assumed in the Commission's analysis.

The estimated benefits to migration under such assumptions are around $77 million, compared to the Commission's central estimate of $19.4 million.

Table 3 Illustrative effect of accounting for investment incentives on migration rates

	Uptake of UFB services		Externality value	
	No UCLL uplift	UCLL uplift	No UCLL uplift	UCLL uplift
2015	100,000	101,519	$25,500,000	$25,887,342
2016	340,000	345,165	$86,700,000	$88,016,962
2017	405,000	411,152	$103,275,000	$104,843,734
2018	493,333	500,827	$125,800,000	$127,710,886
2019	587,500	596,424	$149,812,500	$152,088,133
2020	684,000	694,390	$174,420,000	$177,069,418
2021	781,667	793,540	$199,325,000	$202,352,722
2022	880,000	893,367	$224,400,000	$227,808,608
2023	978,750	993,617	$249,581,250	$253,372,358
2024	1,077,778	1,094,149	$274,833,333	$279,008,017
2025	1,177,000	1,194,878	$300,135,000	$304,694,013
2026	1,206,000	1,295,751	$325,472,727	$330,416,617
2027	1,206,000	1,396,732	$307,573,000	$356,166,677
2028	1,206,000	1,497,796	$307,573,000	$381,937,858
2029	1,206,000	1,553,469	$307,573,000	$396,134,682
PV			$1,315,470,623	$1,392,448,374
PV gain				$76,977,750

[37] http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/pdf-and-documents-library/ultra-fast-broadband-intiative/broadband-deployment-update-december-2014.pdf

The externality effect

Although estimating the externalities associated with increased fibre uptake (aside from the spill-overs discussed above) can be difficult, we agree with Professor Cambini's assessment that taking account of such externalities is important.[38] He notes that the presence of externalities should directly affect the demand and indirectly the cost and sets out an approach by which the Commission may take account of the demand effects (this approach has been incorporated into the Commission's framework).

In our opinion, the Commission's approach of estimating the net benefits across a range of externalities is appropriate. To the extent this range could be narrowed, this would assist in reducing the extent of judgement that may be required in determining whether the net benefit of increasing the UCLL price is positive. However, we are not aware of any studies of this matter, in addition to those we raise above.

The cross-price elasticity of demand

Professor Cambini has reviewed the Commission's assumed price elasticity of 1.2 in the context of the available economic literature. He provides the following evidence from existing studies.

Table 4 Cross-price elasticity studies cited by Professor Cambini

Author(s)	Data	Estimated cross-price elasticity
Shinohara, Akebatsu and Tsuji (2011)[39]	30 OECD countries, 2000-2009	1.189
Srinuan, Srinaun and Bohlin (2012)[40]	Swedish households, 2009	3.289
Bohlin (2012)[41]	Swedish households, 2009 (where cable is also available) (areas where cable is not available)	 0.219-0.945 0.370-0.845
Grzybowski et al (2014)[42]	Slovakia households, 2011	0.66-0.96
Cambini and Briglauer (2015)	EU27, 2004-2013	0.6-0.64

He noted that the studies based on cross-country data may introduce downward biases into the analysis but concluded that the Commission's assumption of 1.2 is a fair and reasonable average of the values found in recent economic literature. He also noted that he did not find any evidence of the presence of a 'tipping point' or a change in the degree of elasticity of fibre demand with respect to DSL prices.[43]

Despite this finding, in our opinion, the cross-price elasticity of demand is unlikely to be constant across all values of DSL and fibre connection prices. Specifically, in our opinion, the cross-price elasticity is likely to

[38] Page 9.

[39] Shinohara, S, Akebatsu, Y and M Tsuji (2011) "Analysis of broadband services diffusion in OECD 30 countries: Focusing on open access obligations", paper given at 8th ITS Asia-Pacific Regional Conference, Taiwan, June 26028, 2011.

[40] Srinuan, P, Srinuan, C, and E Bohlin (2012) "Fixed and Mobile Broadband Substitution in Sweden", *Telecommunications Policy*, 36, 237-251.

[41] Bohlin E (2012) "The Mobile and Fixed Broadband Battle in Sweden", Prepared for the International Conference on Mobile Broadband-Competitive dynamics and policy implications, Bruxelles, September.

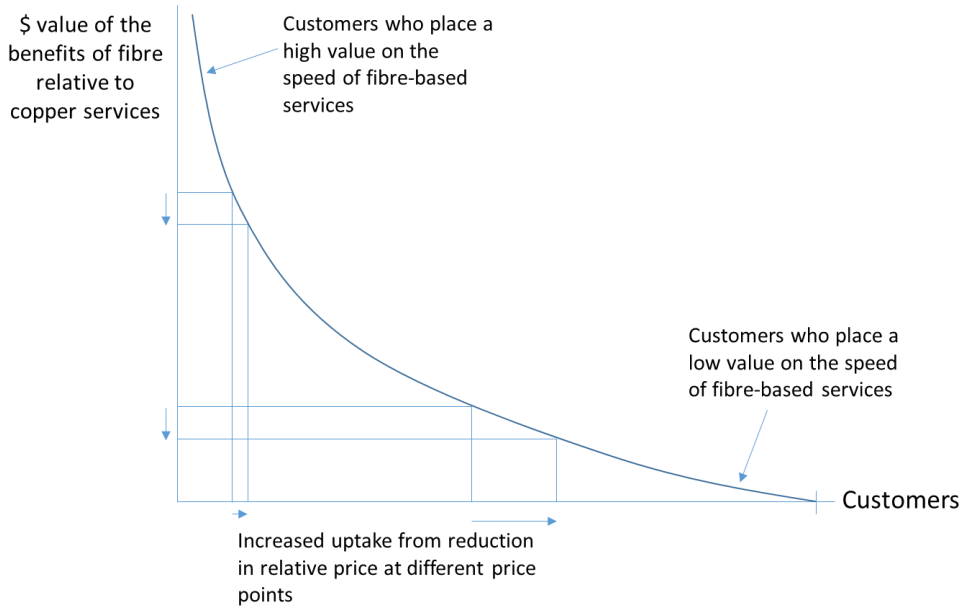
[42] Grzybowski, L, Nitsche, R, Verboven, F, and L Wiethaus (2014) "Market Definition for Broadband Internet in Slovakia. Are Fixed and Mobile Technologies in the Same Market?" *miemo.*

[43] Pages 8-9.

increase as the price of fibre-based services falls relative to the price of copper-based services (all else constant).

Customers will switch to the UFB services when the price difference no longer exceeds the value placed on the quality improvements associated with migrating to the fibre network. Customer's willingness to migrate is therefore more likely to be a factor of the price differential rather than the absolute level of prices. While some customers may place a very high value on this price differential, other customers will have different valuations. One possible distribution of valuations customers place on this differential is illustrated in the following chart. If the shape of this distribution curve is appropriate in the current context, this demonstrates that the impact of reducing the price differential by $1 is likely to increase as that differential falls.

Figure 1 Illustration of the effect of reducing the price differential by a consistent amount as this differential falls



The cross-price elasticity compares percentage changes in the price of 'A' relative to demand for 'B'. Without examining the raw data underlying the empirical examples cited above (which was not provided in the papers), it is difficult to gauge whether the shape of the pseudo demand curve illustrated above is appropriate for fibre uptake or whether an increase in the UCLL price in New Zealand is more likely to result in a higher percentage switch to fibre.

However, the following factors suggest that the cross-price elasticity may be relatively high for New Zealand:

- during the initial period of introduction of the fibre services, take-up rates will be below long-run levels given customers' natural inertia in adopting new technologies – this potentially enables a higher (percent) responsiveness to price relativities; and
- the price differential between UFB and copper-based services is likely to be relatively small or possibly non-existent - the Commission notes that the price of the UFB services will start at around $85 per month,[44] compared to the starting price for retail DSL/telephony services of $79 per month, however we note that Spark has recently reduced the retail price of entry-level fibre-based services to that of copper-based services.[45]

[44] Paragraph 59.

[45] Paragraph 55, also see http://www.sparknz.co.nz/news/ultra-fibre-new/.

Time frame, discount rate and estimate of private welfare losses

We also consider the time horizon and discount rate to be reasonable assumptions at this stage in the analysis. However, it may be worth assessing whether the results are sensitive to adjustments in these assumptions once the analysis is further refined.

Furthermore, we note that if the results are to be incorporated into a cohesive estimate of the benefits of a WACC uplift, these assumptions should be consistent throughout the unified framework.

The estimate of private welfare losses, based on the increased price faced by those customers who choose to remain on the copper-based network is an appropriate approach. However, we question whether the Commission's approach of separating the frameworks is likely to double-count such costs.

4.4 Conclusions

In our opinion, the framework for the Commission's analysis appears broadly sound in that it attempts to appropriately compare the marginal costs and benefits associated with a $1 increase in the UCLL prices. However, there are three aspects of the framework that we believe could potentially be improved:

- it would be useful to expand the benefits in the model to include the implications of the UCLL price on investment in the fibre network, as the price of UCLL services is likely to affect:
  - the willingness of businesses to invest in the proposed expansions to the UFB, as a result of increasing demand for fibre-services; and
  - the risk of Chorus being unable to fulfil its contractual obligations with CFH; and
- it would be useful to take account of the spill-over benefits, in terms of the increase in GDP, in the analysis – relevant studies suggest that a significant proportion of these spill-overs directly benefit end-users (and the remainder are likely to provide long-term benefits to end-users); and
- it may be appropriate to adopt a cross-price elasticity assumption towards the upper-end of the estimated range.

5. Framework for Considering the WACC Uplift

5.1 Introduction

To the extent that the Commission's TSLRIC estimate under-compensates Chorus for its reasonably incurred costs (including the cost of capital) this will reduce the incentive for ongoing investment in regulated telecommunication assets, including the copper network as well as any future telecommunication technology that is likely to be subject to regulation. We agree with the points raised by CEG regarding the need for the Commission to take account of uncertainty in all of its parameter estimates and therefore the confidence it is able to place on the TSLRIC midpoint estimate and elaborate on this in our discussion regarding the benefits of Monte Carlo analysis in Section 5 of this paper.

For the purpose of this section, we have set aside these issues and assume that the Commission's modelling work will ultimately arrive at a mid-point price estimate that can be expected to provide Chorus with a return commensurate with its WACC (including taking account of the asymmetric risks associated with the regulatory framework). This section therefore focuses on the rationale for providing a WACC uplift to account for the asymmetric costs associated with providing a regulated WACC that is above or below the WACC Chorus' applies in its investment decision-making process (referred to as Chorus' actual WACC).

In the current context, an uplift to the WACC is intended to take account of the asymmetric costs associated with under- versus over-estimating the WACC. Specifically, to the extent that the costs (to end-users) of setting a regulatory WACC that is below the actual WACC exceed the costs of setting a WACC that is too high, the Commission should err on the side of caution and apply an uplift in order to maximise the expected net benefits to end users.

The Commission has recognised this in its Draft Decision but, based largely on advice provided by Professor Vogelsang, determined that a WACC uplift is not required due to its TSLRIC approach and decisions.[46] However, Chorus and its advisors disagree with Professor Vogelsang's opinion regarding the generosity of the TSLRIC methodology.[47]

In response to the Commission's Draft Decision, Chorus and its expert advisors (CEG and Professor Hausman) have argued for an uplift to the prices and/or midpoint WACC on the basis that such an uplift would:

- encourage investment in new telecommunication services and technologies; and
- reduce the risk (and therefore costs to consumers) of network outages that may result from under-investment.

The Commission has therefore determined the need to address two questions:[48]

- is there any reason to depart from the mid-point WACC estimate? and
- if so, what is the most appropriate percentile?

We agree with the Commission that these are the appropriate questions to be asked. However, we are not in a position to advise on the most appropriate percentile, given the uncertainty around the central inputs

[46] Commerce Commission New Zealand (2 December 2014) *Cost of capital for the UCLL and UBA pricing reviews: Draft decision*, paragraph 209

[47] Chorus (20 February 2014) *Submission for Chorus in response to Draft Pricing Review Determinations for Chorus' Unbundled Copper Local Loop and Unbundled Bitstream Access Services (2 December 2014) and Process and Issues Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014),* Page 76.

[48] Commerce Commission New Zealand (2 April 2015) *Agenda and topics for the conference on the UCLL and UBA pricing reviews*, paragraph 78.

required in such an estimation. The following discussion therefore focuses on the rationale for departing from a mid-point WACC estimate and how the benefits of such departure could be estimated. We first start with an overview of the Commission's proposed framework.

5.2 Description of the Commission's approach

The Commission has developed a framework to trade off the costs to consumers of a WACC uplift against potential benefits associated with reducing the risk that investment in innovative new telecommunications services might be delayed or not occur if the allowed WACC is under-estimated. The Commission has based its framework on the approach developed by Oxera for the purpose of assessing the appropriate WACC uplift for electricity lines businesses.

The Commission's framework trades off the costs to consumers of a WACC uplift against potential benefits associated with reducing the risk that investment in innovative new telecommunications services might be delayed or not occur if the allowed WACC is under estimated. The framework is based on the analysis provided by Oxera in regard to the electricity lines and gas pipelines sector and has been expressed as follows:[49]

$$Min \rightarrow f(w) = RAB \times (w - w_0) + C \times (1 - CDF(w)) \quad (1)$$

Where: *RAB* is the value of the regulatory asset base
w is the allowed WACC, which is required to be greater than or equal to the mid-point WACC estimate to ensure a reasonable expectation of a normal return
c is the annualised net cost to consumers resulting from under-investment if the allowed WACC is below the 'true' WACC
CDF(w) is the cumulative distribution function of the WACC, which is the probability that the 'true' WACC is less than the allowed WACC

The Commission has noted that this equation can be differentiated and set equal to zero to get a least cost solution, found where the probability density function (PDF) for the WACC is equal to the ration of the RAB to the annual cost associated with setting the WACC too low. The Commission then assumes that investment will be unaffected unless the regulated WACC falls below the actual WACC by at least 1 percentage point, and therefore that the 'optimal' regulated WACC sits 1 percentage point below the least cost solution WACC.

The Commission notes:[50]

> *Although investment in innovative new services will typically not be captured by existing UCLL and UBA regulation, the decision regarding whether to apply an uplift to the mid-point WACC for UCLL and UBA could potentially send an important signal to investors in telecommunications services more generally – particularly if there is the prospect that the new service(s) could be regulated in the future.*

The Commission's framework focuses solely on the implications for dis-incentivising investment in innovative new technologies and does not consider the role of other factors, such as the costs of outages. However, the Commission notes that its framework could be adapted to incorporate other considerations.

The application of the Commission's framework requires the estimation of three parameters, namely:

- *BCR* - the benefit-cost-ratio associated with investment in the new telecommunications network or service;
- *p* – the combined probability that there is a major innovative new technology in prospect, when it might occur and whether it would be regulated in a way that would make the WACC allowance for UCLL and UBA influential; and

[49] Paragraph 106.

[50] Paragraph 82.

- *m* – the margin by which the allowed WACC can be below the actual WACC before investment in the new technology will not occur.

In this context, the total cost function that is being minimised has been set out as follows (the Commission's "Equation 5"):[51]

$$Min \rightarrow f(w) = RAB \times (w - w_0) + p \times [RAB \times (w - w_0) + c \times (1 - CDF(w))] \quad (2)$$

Where:
RAB is the total asset value for the existing network, which is assumed to be the same asset value as for the new network/service
w is the allowed WACC, which is required to be greater than or equal to the mid-point WACC estimate to ensure a reasonable expectation of a normal return
w_0 is the mid-point WACC estimate, which is treated as a constant
p is as defined above
c is the annualised foregone benefit to consumers if investment in the new network/service does not occur because the allowed WACC is too low
CDF(w) is the cumulative distribution function of the WACC

And the cost (c) is estimated by the BCR, assuming that the net present value of the innovation can be represented by *(BCR-1)*RAB, then:*

$$C = d \times (BCR - 1) \times RAB \quad (3)$$

Where:
d is the relevant discount rate
BCR is as defined above

Differentiating this and rearranging provides the Commission with the following optimisation equation:

$$PDF(w) = \frac{(1+\frac{1}{p})}{d \times (BCR-1)} \quad (4)$$

The Commission's framework would therefore involve solving this equation to arrive at the optimised WACC. The Commission then proposes to subtract the margin by which the regulated WACC could fall below the actual WACC before affecting investment decisions to arrive at its estimate of the WACC that would maximise the estimated benefit to end-users.

5.3 Comments on the Commission's proposed framework

We agree with the fundamental premise the Commission is grappling with, that in establishing the basis for allowing an uplift in the WACC it is useful to quantify the net benefits to end-users associated with such uplift. We also appreciate that the framework set out in the current paper represents an evolution from the one Oxera provided in the case of electricity lines and gas pipelines businesses. In particular, the use of the NPV framework is a useful enhancement.

However, the Commission's proposed framework does not represent a complete model. Developing appropriate estimates of the *p* and *BCR* will be a sizeable modelling exercise in its own right. The Commission's paper provides little information as to: how these variables will be modelled; the key input variables that will be required; and preliminary views regarding the value of these inputs.

In our view, the model developed by CEG is likely to provide the Commission with a better starting point, as it:

- is at a more advanced stage than the Commission's own model;
- takes account of the effects on both consumer and total surplus;

[51] Paragraph 121.

- is transparent in its required assumptions and how these feed through to the final estimates, providing a useful basis for undertaking sensitivity and scenario tests; and
- is already in its third generation, having been based on the models developed by both Dobbs and Frontier, and has therefore already been subject to scrutiny and refinement.

Leaving aside the relative merits of the two modelling approaches and the incomplete nature of the Commission's framework, the remainder of this section offers several suggestions for improving the Commission's model, based on several concerns we have with the framework as it is currently presented. These include:

- the application of a consumer surplus standard – for the reasons set out in Section 2 above (which we do not repeat here) we are of the opinion that the Commission should be cognisant of the implications of its decision on both consumer and total welfare;
- we are sceptical of the ability to accurately estimate certain key variables that are required for the model, suggesting that, ultimately, the framework may not move the debate significantly forward; and
- as it stands, the model omits a number of additional benefits likely to arise from an uplift in the WACC, including the effect of reducing the risk of a lower regulated than actual WACC reducing Chorus':
  - ability and incentive to invest in network/system reliability;
  - ability and incentive to invest in expansions or upgrades to the copper network; and
  - ability to invest in unregulated assets, including the UFB.

We comment on these, and make suggestions for the model's evolution, below.

5.3.1 The ability to estimate the key variables

We note the Commission's comments regarding the 'fundamental uncertainty' associated with several of the key relationships of relevance in Oxera's modelling of the optimal WACC percentile for electricity lines and gas pipelines services.

The difficulties associated with estimating the key parameters suggested in relation to the telecommunications industry will likely be comparable to those for the electricity lines and gas pipelines businesses. The current framework requires judgements to be made regarding the net present value for a innovation. This involves estimating:

- the precise benefit-cost-ratio associated with investment in the hypothetical new telecommunications network or service;
- the probability that such a major innovative new technology is in prospect;
- when such investment might occur (alternatively the Commission may wish to use a long-run average rate of technological innovation estimate); and
- the discount rate households and businesses might apply to the value of those services.

In addition, once the net present value of the innovation has been estimated, it must be combined with estimates of:

- the extent to which investors in such technology will interpret the Commission's decision regarding the UCLL prices as being relevant for their future allowed WACC; and
- the implications on the investment decision of a deviation between the expected allowed WACC and actual WACC for these investors, which will need to also consider:
  - the fact that innovations may have a different associated risk, and therefore WACC, than Chorus; and
  - the appropriate margin for the WACC uplift relative to the estimated optimal uplift.

It will be challenging for the Commission and industry players to arrive at feasible estimates of these variables. This suggests that the Commission (or Oxera) should undertake a wide range of sensitivity tests to determine a reasonable band for the estimated "optimal" WACC. The Commission will then need to make a judgement call regarding where, within this band, it chooses to set the WACC.

5.3.2 The modelled benefits

The benefits included by the Commission are limited to those arising from investment in a major innovative new technology. While there is no doubt that such benefits are likely to be significant, they are not the only benefits to end-users that would be realised from applying a WACC uplift. Specifically, it is likely that a WACC that falls below Chorus' actual WACC could impede Chorus' incentive and ability to invest in:

- assets that improve (or retain) system reliability and quality;
- expansions or upgrades to the copper network; and
- unregulated assets, to the extent that a regulated WACC that is below Chorus' actual WACC results in financial constraints on the firm's ability to invest (including in improvements and expansion to the fibre network).

We discuss each of these points below.

Incentive and ability to invest in system reliability assets

In the case of the electricity lines business, a significant benefit of the WACC uplift was the reduced risk that the network operator would be discouraged from making reliability-enhancing (or maintaining) investments. Thus the WACC uplift was associated with a reduced risk of network outages, with a resulting value to end-users.

We note that the Commission has not included a similar measure in the case of the UCLL prices. Although the cost of a telecommunication outage may not be as significant as that of an electricity outage, it would be inaccurate to suggest that such costs are either non-existent or negligible.

The vast majority of New Zealand households and businesses are supplied with internet and fixed-line phone connections via the UCLL, which therefore form a critical link to the communications network. We note the Commission's view that there are substitutes for fixed-line telecommunication services, which may reduce the impact on end-users of network outages relative to electricity line services.[52] However, it is also important to bear in mind that, while there are available substitutes for fixed line telecommunications services:

- critical services rely primarily on fixed line services;
- mobile networks are themselves often dependent on fixed line services; and
- the wider economy (including most financial transactions and business interactions) also relies heavily on fixed line access services.

A shortfall in the WACC is likely to affect Chorus' ability and incentive to invest in maintenance expenditure. Chorus has advised that the current IPP prices are putting considerable financial strain on the business and reducing both the ability and incentive on the firm to:

- carry out pro-active maintenance (with capex and opex implications);
- replace assets at the end of their life cycle (where efficient); and
- invest in broadband coverage and aggregation of network capacity.

[52] Commerce Commission New Zealand (2 December 2014) *Cost of capital for the UCLL and UBA pricing reviews: Draft decision*, Paragraph 223.

The costs of network outages in the telecommunications sector include:

- the financial cost to downstream firms that are unable to on-sell services for the duration of the outage – such costs may reduce competition in the retail market;
- the cost of downtime to businesses reliant on the communication services – including the costs associated with a reduced ability to conduct electronic financial transactions as well as conduct trade more generally; and
- the inconvenience to individuals during the duration of the outage – including the public safety risks due to outages causing difficulty in coordinating and responding to emergency situations.

The costs of an outage are difficult to estimate and economic literature on this subject is sparse. However, the following box provides a case study of the costs associated with the line outage at Warrnambool in 2012, which illustrates their significance.

Case Study: Warrnambool Outage (2012)

On 22 November 2012, a fire in Telstra's Warrnambool Telephone Exchange in Victoria caused damage to key telecommunications equipment, resulting in an outage lasting 20 days.[53] The outage cut off over 65,000 telephone services (including internet and phone line access, ATM, EFTPOS services and traffic signalling)[54] and affected 100,000[55] people over 67,340 square kilometres.

Submissions to the Commonwealth inquiry into the matter included the following estimates of loss:

- the daily economic impact to Warrnambool City could have been up to AU$400,000 per day or 5 per cent of its daily output;[56]
- economic impact to the Great South Coast region could have been up to AU$950,000 a day or 3 per cent of the region's daily output; and[57]
- the impact on Telstra: costs relating to restoration costs, lost revenue, ongoing liabilities, reputational damage, and capital investment is likely to exceed AU$20 million[58].

The Victorian Government estimated:[59]

- direct costs of AU$18 million to the region;
- flow-on costs of AU$28.3 million; and
- 89 job losses in the region.

The extent of the telecommunications outage is illustrated by survey response statistics of the broad impact:[60]

- 94.6% of respondents suffered some inconvenience related to a business transaction.
- 69.8% were unable, or found it difficult, to make vital purchases such as food or fuel.
- 86.5% were unable to communicate with friends or family.
- 24% were unable to conduct business and had to shut down (for some period of time).

Over 60% of respondents felt that the outage had a negative impact on community life.

Examples of outages and their implications in New Zealand include:[61]

- in 2005 – two separate cable faults paralysed Telecom's broadband and mobile networks in the North Island. This let to overloaded landlines and major difficulties for the New Zealand Stock Exchange;

[53] M Gregory and K Scholfield (2014) *Warrnambool Exchange Fire: Consumer and Social Impact Analysis,* Royal Melbourne Institute of Technology on behalf of Australian Communications Consumer Action Network, page ii.

[54] ZDNet (26 March 2013) *Vic govt puts Warrnambool exchange fire cost at AU$18m*, available at http://www.zdnet.com/article/vic-govt-puts-warrnambool-exchange-fire-cost-at-au18m/

[55] M Gregory and K Scholfield (2014) *Warrnambool Exchange Fire: Consumer and Social Impact Analysis,* Royal Melbourne Institute of Technology on behalf of Australian Communications Consumer Action Network, page ii.

[56] Commonwealth of Australia (2013) *Inquiry to learn lessons from the Warrnambool exchange fire,* page 28,

[57] Commonwealth of Australia (2013) *Inquiry to learn lessons from the Warrnambool exchange fire,* page 28.

[58] Commonwealth of Australia (2013) *Inquiry to learn lessons from the Warrnambool exchange fire,* page 28.

[59] ZDNet (26 March 2013) *Vic govt puts Warrnambool exchange fire cost at AU$18m*, available at http://www.zdnet.com/article/vic-govt-puts-warrnambool-exchange-fire-cost-at-au18m/

[60] M Gregory and K Scholfield (2014) *Warrnambool Exchange Fire: Consumer and Social Impact Analysis,* Royal Melbourne Institute of Technology on behalf of Australian Communications Consumer Action Network, page 1.

[61] Chorus (20 February 2015) *Submission for Chorus in response to: Draft Pricing Review Determinations for Chorus' Unbundled Copper Local Loop and Unbundled Bitstream Access Services (2 December 2014) and Process and Issues Update Paper for the UCLL and UBA Pricing Review Determinations (19 December 2014)*, page 174

- in 2010 – parts of Telecom's new XT network failed, as a result calls in and out of the mobile network failed in different areas of New Zealand throughout the year;
- in 2011 – a fibre optic cable failure led to a number of police stations without certain services. As a result police headquarters, 130 police stations and three communications centres had to use manual processing for certain procedures, with resultant efficiency losses.

Other examples of significant outages in telecommunications networks and the implications for users include:

- SingTel, October 2013 – SingTel was fined $6 million after being found to be mainly responsible for an outage (caused by a fire that damaged several fibre optic cables) that affected close to 270,000 subscribers in Singapore. Home users, government agencies, businesses and electronic payment kiosks were affected by the disruption.

Given the lack of available empirical evidence on the cost of outages in the telecommunications sector, one possible way to estimate this cost may be as follows:

- estimate the contribution of the UCLL-enabled services to the economy as a whole;
- divide this figure by 8,760 (the number of hours in a year) to obtain an hourly contribution rate; and
- assume that an economy-wide one hour outage in the UCLL network would result in a loss of this magnitude.

This figure could be interpreted as an approximate measure of the cost of reliability falling to the extent that, on average, outages across the country increased by 1 hour per annum. We recognise that this would be a rough approximation and that the actual cost will depend on the duration and location of any outage. However, the following table provides some illustrative calculations based on varying levels of contribution from these services. As a comparison, the figures for the Warrnambool loss estimate were based on an impact of 5 per cent of output.[62]

Table 5 Illustrative calculations of the lost-value associated with outages in the UCLL network

Contribution to GDP of UCLL-enabled services	Dollar value of contribution (based on 2014 GDP of $240b)	Per hour dollar value of contribution
5%	$12 b/pa	$1.4 m/pa
7%	$16.8 b/pa	$1.9 m/pa
10%	$24 b/pa	$2.7 m/pa

In order to incorporate this figure into the Commission's analysis, it would need to be combined with information on:

- the impact of an increase in the WACC on Chorus' investment decisions; and
- the impact of these investment decisions on the reliability of the UCLL network.

Incentive and ability to invest in expansions to the copper network

Despite the roll-out of the UFB network, there are on-going investments in the expansion of the copper network. For example, Chorus has copper initiatives in rural areas that are outside the UFB footprint.

[62] Australian Government (May 2013) *Inquiry to learn lessons from the Warrnambool exchange fire*, Chapter 7: Impacts of the Outage.

Chorus' total investment in copper assets for 2013 and 2014 was $69m and $61m respectively. The following table provides a breakdown of the copper capital expenditure.

Table 6 Chorus' copper capital expenditure ($millions)[63]

	2014	2013
Network sustain	35	33
Copper connections	15	21
Copper layer 2	10	8
Product fixed	1	7
Total	61	69

This suggests that around $25 million per annum in investment is unrelated to maintaining the existing functionality of the current copper network. If the regulated WACC falls below Chorus' actual WACC, the incentives on the company to make such investments will fall, resulting in losses to consumers who would otherwise benefit from the system expansions or upgrades.

To include an estimate of the associated loss in the Commission's framework (on a basis consistent with that adopted for the investment in new telecommunications networks) would require estimates of:

- the impact of a shortfall in the regulated WACC on Chorus' investment decisions; and
- the benefit to cost ratio (to consumers) of the affected investments.

Ability to invest in unregulated assets

The Commission has not considered the implications of an increase in the WACC on the incentives to invest in the fibre network on the basis that the deployment of the UFB is contractually committed, which we also discussed in section 4.3.2 above.

As discussed above, the currently proposed prices are likely to place considerable financial constraints on Chorus, to the extent that it may have difficulty funding investments.

One of the mechanisms for closing the financing shortfall has been the agreement between Chorus and Crown Fibre Holdings (CFH) that would allow Chorus to bring forward the government funding it is able to draw on from October 2015. However, Chorus' ability to draw on these funds will be constrained if their financial position is deemed to be too risky.

Furthermore, the financing from CFH is not sufficient to cover the full cost of the UFB network. A WACC for the UCLL prices that is insufficient to cover Chorus' actual capital costs may be negatively perceived by Chorus' investors and thereby increase its borrowing costs or result in liquidity constraints. Therefore, a potential cost associated with setting the regulated WACC below Chorus' actual WACC may be the increased risk to the UFB network, despite the fact that it is contractually committed.

Even if Chorus is able to meet its existing UFB obligations, financial constraints may reduce Chorus' ability or willingness to participate in the government's planned expansion of the UFB coverage from 75% to 80%[64] or to bring the UFB investment program forward, should uptake rates and other factors suggest this would be efficient. Furthermore, we note that the Chorus' current contractual commitments are limited to 830,900 premises. As the number of premises, and therefore the UFB demand, grows there will be a need for

[63] 2014 Chorus Annual Report, page 34.

[64] http://beehive.govt.nz/release/govt-launches-next-stage-broadband-rollout

ongoing investment in this network. Limitations on Chorus' ability to attract financing may reduce its ability and incentive to provide UFB to more premises.

5.4 Conclusion

We agree that there is a need to take account of the asymmetric costs associated with setting the WACC above versus below Chorus' actual WACC. Although there may be limited pre-existing empirical analysis available to support a specific WACC uplift for the UCLL services, the above discussion suggests there are strong economic reasons for believing that an underlying asymmetry exists in the costs associated with setting the regulated WACC above versus below Chorus' actual WACC.

We concur with the broad framework of the model the Commission has developed, although, in our view, the model prepared by CEG is likely to provide the Commission with a better starting point for its analysis.

However, should the Commission proceed to use its framework, the model could usefully be expanded to take account of further asymmetric costs that would be associated with setting the regulated WACC at a level that is too low. Specifically, it is likely that a WACC that falls below Chorus' actual WACC could impede Chorus' incentive and ability to invest in:

- assets that improve (or retain) system reliability and quality;
- expansions or upgrades to the copper network; and
- unregulated assets, to the extent that a regulated WACC that is below Chorus' actual WACC results in financial constraints on the firm's ability to invest.

6. Monte Carlo Simulation

6.1 Introduction

The Commission notes[65] that some submissions have recommended the use of Monte Carlo simulation to deal with the uncertainty associated with a number of key parameters in the TSLRIC modelling. Such analysis would allow the Commission to choose a price point within an estimated TSLRIC range. The key modelling parameters that are uncertain are:

- the WACC;
- unit costs (including unit opex and unit capex);
- asset lives and price trends; and
- demand, including forecasts of future demand.

6.2 Comment

We agree with the comments made by CEG regarding the degree of uncertainty in the input parameters required for TERA's TSLRIC model.[66] We also agree that the potential for error in the TSLRIC estimate depends not only on uncertainty in the WACC but also uncertainty in the other input variables and that the Commission should be cognisant of this fact. In order to ensure Chorus receives a price for the UCLL service that is at least as high as the efficient price, the Commission may wish to select a TSLRIC that is above the mid-point estimate. In selecting the point estimate, the Commission should take account of uncertainty in all input variables, not only the WACC.

Furthermore, the different approaches to setting prices in the telecommunications sector (TSLRIC) versus the electricity lines and gas pipelines sector (building block) implies that there may be merit in treating uncertainty in a more holistic way in this instance, rather than separating out the consideration of the uncertainty in the WACC.

CEG suggests that Monte Carlo analysis may be a useful tool for assessing the probability distribution of the TSLRIC estimate, taking account of uncertainty in a number of input variables.

We agree that Monte Carlo analysis can be a useful tool for assessing the probability distribution of a given variable that depends on a number of unknowns, each with their own probability distribution. Unlike simple sensitivity tests, Monte Carlo simulations allow the underlying parameters to vary at the same time (through repeated sample testing) and can therefore shed insight into how the uncertainty in these parameters feeds through to uncertainty in the variable of interest.

The usefulness of such analysis will depend critically on the quality of the information that is being fed into the model. Monte Carlo techniques are of most use when the distribution functions of the input variables is well understood, in which case they are able to return meaningful estimates of the distribution function for the variable of interest.

However, uncertainty regarding the probability distribution of the input variables is likely to result in:

- a wider estimate of the probability distribution function for the variable of interest (in this case TSLRIC), especially if there is a tendency to err on the side of caution when estimating the input variable distributions; and

[65] Page 30.

[66] Section 6.1.

- a lack of confidence in the modelled probability distribution for the output variable (TSLRIC).

In the current context, the Commission has raised concerns regarding the ability to estimate the probability distributions for the key input variables (aside from the WACC).[67] We concur with the Commission that, if it is not able to obtain reasonably reliable estimates of the probability distributions for these input variables, the value of undertaking a Monte Carlo exercise will be greatly reduced.

Having said that, we should not lose sight of the key point raised by CEG that the Commission should be mindful that uncertainty in the TSLRIC estimate stems not only from the WACC estimate but also from uncertainty in a number of other input variables. This suggests that, at the very least, the Commission should run sensitivity tests to assess the implications of such uncertainty. It also suggests that the Commission may wish to err on the side of caution when choosing estimates for key input parameters in order to lessen the risk that the overall TSLRIC estimate is inefficiently low.

[67] Paragraph 99.

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