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Agenda and topics for the conference on the UCLL and UBA pricing reviews

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CONTENTS

List of defined terms and abbreviations

BCR	Benefit cost ratio
DSL	Digital subscriber line
EUBA	Enhanced UBA
FTTH	Fibre-to-the-home
GDP	Gross domestic product
LFC	Local fibre company
MEA	Modern equivalent asset
MTR	Mobile termination rate
NES	Network externality surcharge
NPV	Net present value
POTS	Plain old telephone service
PSTN	Public switched telephone network
RAB	Regulatory asset base
RSP	Retail service provider
TSLRIC	Total service long run incremental cost
TSO	Telecommunications service obligations
UBA	Unbundled bitstream access
UCLL	Unbundled copper local loop
UFB	Ultra-fast broadband
WACC	Weighted average cost of capital

Purpose of this paper

1. This paper outlines the process and agenda for the upcoming conference on the unbundled copper local loop (UCLL) and unbundled bitstream access (UBA) pricing reviews, to be held on Wednesday 15 April 2015 to Friday 17 April 2015. It also updates parties on our approach to testing and quantifying the need for any potential uplifts to the TSLRIC price for UCLL and/or the mid-point weighted average cost of capital (WACC) estimate for UCLL and UBA. The paper is intended to assist parties with their preparation for the conference.

Background information

2. On 2 December 2014, we released our draft determinations for the UCLL and UBA pricing reviews (draft determinations). Submissions on the draft determinations were received from interested parties on 20 February 2015, and most cross-submissions were received on 20 March 2015.[1] An extension to the deadline for providing cross-submissions on geospatial modelling was given to 2 April 2015.

3. Following release of this paper, we are holding a conference as the next step in our consultation process. After consideration of matters raised at the conference, we intend to release further draft determinations on the UCLL and UBA pricing reviews.

Outline of this paper

4. This paper has two main sections.

   4.1 The first section outlines the process for the conference, including a draft agenda setting out the topics we intend to cover.

   4.2 The second section discusses our current thinking on potential uplifts to our central estimate of a TSLRIC price for UCLL, and to the mid-point WACC estimate for the UCLL and UBA services.

[1] Documents related to the UBA and UCLL price review are available on the Commission's website at: http://www.comcom.govt.nz/unbundled-copper-local-loop-and-unbundled-bitstream-access-services-final-pricing-principle/

Process and agenda for the conference

5. This section provides details regarding the upcoming conference on the UCLL and UBA pricing reviews, including the:

   5.1 purpose;

   5.2 venue and timing;

   5.3 approach to questions from Commissioners;

   5.4 role of expert witnesses (including the code of conduct and certification requirement);

   5.5 treatment of confidential information;

   5.6 treatment of CEG's cross-submission on welfare effects of a UCLL and UBA uplift; and

   5.7 draft agenda.

Purpose of the conference

6. The purpose of the conference is to clarify and test matters that arose during the submissions process.

7. Topics to be addressed are set out in the draft agenda below. Topics will be limited to those matters that have been raised in submissions, cross-submissions, and in this paper.

8. Please note there will be no opening statements from parties attending the conference. We do not expect parties to bring any presentations to the conference.

Venue and timing

9. The conference will be held in Wellington at Cliftons Conference Venue (Majestic Centre) Level 28, 100 Willis Street, Wellington, on Wednesday 15, Thursday 16 and Friday 17 April 2015. The conference will commence at 9.30am each day.

Approach to questions from the Commission

10. Each issue will be introduced by the Commission. Members of the Commission and/or the Commission's staff or experts will question the parties.

11. We may choose to initially direct some questions to experts, where those questions relate to topics on which we are seeking the expert's professional opinion. These questions will be clearly signalled as being for expert opinion and all experts will be asked to comment sequentially on those questions, without reference to the parties. Parties will then be provided an opportunity to comment on the experts' opinions, once all experts have commented.

12. Parties may only ask questions of the Commission for the purpose of clarifying a question. No party will have the right to cross-examine the Commission or any other party during the proceedings.

Role of expert witnesses

13. We expect that experts attending the conference appear as experts in their fields rather than as an advocate for any particular party. We expect experts to follow the guidance provided in the code of conduct for expert witnesses contained in the High Court rules.

14. A copy of the code of conduct is included in Attachment A. Experts are requested to complete and sign the attached certification that they are appearing as experts and agree to follow the guidance in the code.

15. Please provide the details of experts who will be attending, their curriculum vitae, and their signed certification that they are appearing as experts and agree to follow the guidance in the code, to Commission staff via telco@comcom.govt.nz by **5pm on Thursday 9 April 2015**.

Treatment of confidential information

16. Our expectation is that no confidential material will be presented during the conference. Nonetheless, should parties wish to disclose confidential information at the conference, please inform Commission staff of your intention via telco@comcom.govt.nz by **5pm on Thursday 9 April 2015**.

17. We will then decide whether it is necessary to host a closed session or remain in an open forum but on the condition that parties take all necessary steps to protect the material.

Treatment of CEG's cross-submission

18. Having reviewed CEG's uplift cross-submission, entitled *Welfare effects of UCLL and UBA uplift*, provided by Chorus to the Commission on 20 March 2015, we consider that it contains substantive new evidence (ie, it is not properly a cross-submission).[2] It, therefore, should have been submitted a month earlier, as a submission.

19. We have received letters from Vodafone and Spark expressing concern that the CEG cross-submission introduces new material, and regarding their inability to respond to CEG's evidence. We accept that not allowing other parties to this process the opportunity to cross-submit on CEG's evidence prior to the release of our further draft determinations may create fairness issues.

20. We have, therefore, decided to allow time for parties to cross-submit on CEG's evidence. The date for cross-submissions on this evidence is

[2] CEG "Welfare effects of UCLL and UBA uplift" (March 2015).

5pm, Wednesday 6 May 2015.[3] Given that parties will not yet have provided cross-submissions on CEG's uplift report, we do not intend to address CEG's report at the conference.

21. We are assessing whether it is realistic for the Commission to properly review CEG's uplift submission, including testing CEG's modelling, seeking submissions from other parties, and considering what impact CEG's uplift submission has on any decisions to apply an uplift or not (prior to locking down our TSLRIC model), ahead of the further draft determinations. It is likely, therefore, that the further draft determination deadline will have to be extended. We will advise on this in due course.

22. It is important to note that this will not create a precedent for future cross-submissions, which will be dealt with on a case-by-case basis.

Other administrative matters

23. As is normal procedure, the conference will be recorded. A stenographer will also provide a transcript of the conference. Copies of the transcript will be made available on our website.

24. Tea and coffee will be available for all participants. Lunch will not be provided.

25. Please provide the names and position of those people who will participate in the conference on behalf of your organisation to telco@comcom.govt.nz by **5pm on Thursday 9 April 2015**. If numbers are high, the Commission may have to limit the number of attendees, so please provide the order of preference for your requested participants.

26. Should you have any queries, please contact Dee Deligiannis on (04) 924 3716 or by email at telco@comcom.govt.nz.

27. We look forward to a productive conference.

[3] This cross-submission date is based on the four weeks allowed for cross-submissions on the last round of consultation, but also acknowledging that Easter, ANZAC day and our own conference will reduce the time available.

Draft conference agenda

Day 1: Wednesday 15 April 2015

9.30am – 9.45am	**Introduction** ▪ Chair's introductory statements
9.45am – 11.00am	**Session 1** ▪ Our framework for carrying out the UCLL and UBA pricing review determinations
11.00am – 11.20am	Break
11.20am – 12.40pm	**Session 2** ▪ Our framework for carrying out the UCLL and UBA pricing review determinations (continued)
12.40pm – 1.30pm	Lunch break
1.30pm – 3.00pm	**Session 3** ▪ Asset valuation and re-use ▪ Determining asset lives
3.00pm – 3.20pm	Break
3.20pm – 4.45pm	**Session 4** ▪ Exclusion of capital costs (capital cost boundary and treatment of contributions from end-users)
4.45pm – 5.00pm	Summary of day one from the Chair

Day 2: Thursday 16 April 2015

9.30am – 9.45am	**Review of day one and any outstanding issues**
9.45am – 11.00am	**Session 1** ▪ Selecting the MEA for the UCLL and UBA services
11.00am – 11.20am	Break
11.20am – 12.40pm	**Session 2** ▪ Deployment of aerial infrastructure in the access network
12.40pm – 1.30pm	Lunch break
1.30pm – 3.00pm	**Session 3** ▪ Cost allocation between services
3.00pm – 3.20pm	Break
3.20pm – 4.40pm	**Session 4** ▪ Cost to price (aggregation, determining prices for the EUBA variants, price profile)
4.40pm – 5.00pm	Summary of day two from the Chair

Day 3: Friday 17 April 2015

9.30am – 9.45am	**Review of day two and any outstanding issues**
9.45am – 11.00am	**Session 1** ▪ WACC parameters ▪ Uplifts to the TSLRIC price and/or WACC
11.00am – 11.20am	Break
11.20am – 12.40pm	**Session 2** ▪ Uplifts to the TSLRIC price and/or WACC (continued)
12.40pm – 1.30pm	Lunch break
1.30pm – 3.00pm	**Session 3** ▪ Backdating
3.00pm – 3.20pm	Break
3.20pm – 4.40pm	**Session 4** ▪ Placeholder for any other topics
4.40pm – 5.00pm	Closing remarks including comments from the Chair

Analytical frameworks for considering an uplift to the TSLRIC price and/or WACC

Purpose of this section

28. This section discusses further work we have been undertaking on whether an adjustment should be considered either to our central estimate of the TSLRIC-based price for UCLL or to our central estimate of the WACC for UCLL and UBA. In considering whether the use of our central estimate gives best effect to section 18, we examine whether any departure from that central estimate should be made in order to promote competition for the long-term benefit of end-users of telecommunications services in New Zealand.

29. For the purposes of this paper, we use the term "central estimate" to refer to the TSLRIC price (and WACC estimate) in the draft determination. We acknowledge that the central estimates may well change in light of our consideration of the submissions and cross-submissions received following the draft determination, and that submissions argued that the proposed TSLRIC price in the draft determination was not in fact a "central estimate" but is biased upwards or downwards due to the modelling decisions adopted by the Commission.[4] However, it is our current view that the framework outlined in this paper would still be applicable in the event that the central estimate (of either the TSLRIC price or the WACC) were to change.

30. The analytical framework that we have developed is comprised of two parts.

    30.1 The first relates to migration effects, and considers whether an uplift should be added to our central estimate of the TSLRIC-based price for the UCLL service. Here we examine the potential benefits that might arise from faster migration of customers from copper to fibre, and the increased costs arising from higher prices for those customers who remain on copper-based services.

    30.2 The second relates to investment effects, and considers whether there might be a case for a specific uplift to the mid-point WACC estimate used to determine the regulated prices for the UCLL and UBA services. In this case, the potential benefits considered relate to reducing the risk that investment in new innovative technologies might be delayed or not occur because the allowed WACC is too low due to mis-estimation. The framework for this analysis is based on a modified version of the approach developed by Oxera in the context of the WACC percentile for electricity lines businesses, during a review we conducted in 2014.

31. Finally, we also discuss the possibility of using Monte Carlo simulation to address uncertainty associated with several of the key inputs to the TSLRIC model, as suggested by CEG in its initial submission on the draft determination.[5]

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4 See for example, Vodafone submission, 20 February 2015, paragraph B2.20; Wigley cross-submission, 20 March 2015, paragraphs 1.1 and 3.4; Chorus submission, 20 February 2015, paragraph 291; Hausman submission, paragraph 49.

5 CEG "Uplift asymmetries in the TSLRIC price" (February 2015).

32. In developing the analytical framework outlined in this section, we have been mindful of the need to avoid double-counting the same effects. We note that a number of submissions on the draft determinations talk about the need for an uplift to either or both of the WACC used in the TSLRIC modelling and the price that results from that modelling.[6] We have been careful to separately identify the migration and the investment effects in our developing framework in this area, as well as to ensure that any relevant linkages are recognised.

33. 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.

34. Our analysis of potential TSLRIC and/or WACC uplifts is based on the potential gains and losses in consumer welfare, rather than total welfare.[7]

[6] See for example, Chorus submission, 20 February 2015, paragraph 263.

[7] In his submission on behalf of Chorus, Professor Hausman noted that "Economists have determined that consumer welfare should be the goal of regulation". Professor Hausman "Response to the Commerce Commission's draft determination on uplift", page 9, paragraph 16. Further discussion on the use of a consumer welfare versus total welfare standard, in the context of Part 4 of the Commerce Act, is contained in our decision on the WACC percentile for electricity lines and gas pipeline businesses. Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), Attachment A, pages 120-136.

Framework for considering an uplift to the TSLRIC price for the UCLL service

35. This section sets out a framework for considering whether an uplift should be added to the TSLRIC price for the UCLL service. This framework allows the potential benefits associated with faster migration of customers from copper to fibre to be compared to the costs of higher retail prices for copper-based services.

36. In developing this framework, we have taken account of the views expressed by parties in their submissions and cross-submissions on the draft determination. In the UCLL draft determination, we concluded that our central TSLRIC estimate for the UCLL service did not require an uplift for section 18 reasons, based on a qualitative assessment of the merits of an uplift. We invited submissions on the need, if any, for a section 18 uplift to the central TSLRIC estimate.

37. In submissions on the UCLL draft determination, a range of arguments have been made on whether an uplift to the TSLRIC price is appropriate, and on the need to quantify the effects of such an uplift. For example:

    37.1 In its report commissioned by Chorus as part of its initial submission on the draft determination, CEG argued that there are asymmetric consequences arising from setting UCLL prices too low, relative to setting them too high. According to CEG, under-estimating the UCLL price would weaken incentives for Chorus to maintain and invest in its copper network (and for Chorus and LFCs to invest in their ultra-fast broadband (UFB) networks), and would also impede migration of customers from copper to fibre-based services.[8] However, CEG did not attempt to quantify these effects in its initial submission.

    37.2 Professor Hausman's submission on behalf of Chorus contains some estimates of the potential gains in consumer welfare arising from faster internet services, based on consumers' willingness to pay for a 10 Mbps increase in speed.[9] Professor Hausman also submitted that the increase in consumer welfare from new telecommunications services is approximately 20 times the potential consumer welfare loss arising from a price increase.[10]

    37.3 Spark submitted that the combined UCLL and UBA price of $38.39 in the draft determinations exceeds what it considers to be a plausible competitive wholesale price, and that the resulting higher retail price for DSL has an estimated social cost of between $128 million and $214 million per annum.[11]

    37.4 Vodafone submitted that the Commission cannot assume that the certain and substantial direct effects of higher prices will be offset by dynamic efficiency benefits, which are not clearly identified and are not accompanied by any

8 CEG submission "Uplift asymmetries in the TSLRIC price", February 2015, paragraph 26.

9 Hausman submission "Response to the Commerce Commission's Draft Determination on Uplift", paragraph 11.

10 ibid, paragraph 44.

11 Spark submission "UBA and UCLL FPP pricing review draft decision", 20 February 2015, paragraph 10.b, and Attachment D.

clear explanation of how they accrue to end-users.[12] Vodafone also submitted that the Commission's treatment of positive externalities in the draft determination is based on assumption and does not provide an adequate basis for applying a section 18 uplift.[13]

38. Various cross-submissions also provide further comment on the potential gains and losses arising from a move away from the UCLL TSLRIC price in the draft determination. While we do not fully respond to these comments in this paper, a number of cross-submissions have noted the difficulty associated with quantifying the potential gains associated with faster migration from copper to fibre. For example, in its cross-submission on behalf of Chorus, HoustonKemp noted that quantifying such gains is inherently difficult due to limited data being available on households switching from broadband to UFB, and as a consequence, such benefits are typically addressed in a more qualitative way.[14]

39. Paragraphs 45 to 71 below set out an analytical framework that identifies the key issues relevant to evaluating the potential welfare consequences of increasing the wholesale price for the UCLL service above the central estimate produced by our TSLRIC model. This includes a quantitative assessment of the benefits and costs from an uplift to the UCLL TSLRIC price, although a number of other relevant factors are also mentioned in more qualitative terms.[15]

40. To assist us in this matter, we engaged Professor Carlo Cambini from the Florence School of Regulation to review and comment on our proposed approach. Professor Cambini concluded that the methodological approach to evaluating the welfare gains and losses from an uplift to copper prices is correct, and provided some possible refinements in terms of some of the parameters used in the analysis.[16] In addition, Professor Cambini noted that there were likely to be some additional benefits from the UFB deployment, relating to the potential effect of UFB on GDP (and indirect income-related effects), and he summarises some of the recent empirical literature on the impact of broadband on economic growth.

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12 Vodafone submission "Vodafone New Zealand submission to the New Zealand Commerce Commission on Process Paper and Draft Pricing Review Determinations for Chorus' unbundled copper local loop and unbundled bitstream access services", 20 February 2015, paragraph B2.24.

13 ibid, paragraph Section B3.

14 HoustonKemp, "Response to Spark New Zealand's Attachment D: Illustrative estimate of social cost of high price, A Report for Chorus", 12 March 2015, page 7.

15 In the analysis below, the Commission is interested in identifying the benefits and costs to end users of a given uplift to the UCLL TSLRIC price, rather than attempting to derive an efficient uplift. In the following analysis, it is assumed that an uplift of $1 is applied to the UCLL TSLRIC price, and resulting changes in consumer welfare arising from such an uplift are estimated.

16 Carlo Cambini, "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", 16 March 2015.

41. We have developed an Excel spreadsheet in which the welfare effects of an uplift to the TSLRIC price for the UCLL service are estimated.[17] The spreadsheet, incorporating a number of Professor Cambini's recommendations, is attached to this paper. Professor Cambini's report has also been separately released with this paper.

42. 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, 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. What we are interested in are the incremental effects from such an uplift to the UCLL price. We capture these incremental effects by comparing two demand scenarios in the following analysis – one with no UCLL uplift, and another with a UCLL uplift. The difference between these two scenarios is attributed to the uplift.

43. An uplift to the UCLL price could have a number of effects on the deployment and uptake of new technologies such as FTTH. Both Professor Vogelsang and Professor Cambini refer to the work of Bourreau et al, who considered three effects of wholesale pricing of the old technology (copper) on the deployment of the new technology (fibre). Both conclude that the most important effect in New Zealand will be the effect of the wholesale copper access price on the migration of customers from copper to fibre, given that the UFB is contractually committed and subsidised by the government.[18] The implications of an uplift applied to the UCLL TSLRIC price for migration from copper to fibre are the focus of paragraphs 45 to 71 below.

44. Finally, we note that any attempt to quantify the effects of an uplift to the UCLL TSLRIC price, either specifically in terms of the impact on customer migration to fibre or more generally in terms of incentives to invest, is inherently difficult and subject to considerable uncertainty[19]. Professor Vogelsang has referred to there being no empirical analysis to draw on, and that any such analysis would be too complex and would lack quantitative data.[20] As noted above, a number of submissions on the UCLL draft determination contained partial analysis of a change in the UCLL price, for example by looking at the social costs of higher copper prices, or the aggregate benefits from higher speed internet access, while other submissions discussed the potential benefits and costs in qualitative terms only.

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17 See "TSLRIC Uplift_Final.xlsx".

18 See Vogelsang I., July 5, 2013, paragraph 44; and Cambini C., "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", Section 1.

19 As noted in paragraph 38 above, HoustonKemp makes a similar point.

20 Ingo Vogelsang, "Report on several submissions in the FPP proceeding for UCLL", 6 November 2014, paragraph 3.

Framework for quantifying the potential effects of a TSLRIC uplift

45. For the purposes of considering the potential welfare effects arising from an uplift to the UCLL TSLRIC price, the following assumptions are made:

    45.1 the central TSLRIC estimate of the monthly recurring charge for the UCLL service is increased by $1 per month;

    45.2 the $1 increase in the wholesale UCLL price is fully passed through into the retail prices of those copper-based services that rely on the UCLL service (including both retail DSL and POTS services);[21]

    45.3 the increase in the retail price for copper-based services leads to increased demand for fibre-based services (with the extent of customer switching based on a cross-elasticity of demand for fibre with respect to DSL prices of 1.2);[22] and

    45.4 the potential benefits and costs are assessed over a 15-year timeframe, with a discount rate of 10%.[23]

46. 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, as identified by Professor Cambini in the various empirical studies he has reviewed.[24] Professor Vogelsang has also referred to such effects as "indirect spillovers [which] affect the economic growth of a country via improvements in productivity and the like".[25] 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).[26]

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21 A pass-through assumption of 100% might be reasonable on the basis that competition between Retail Services Providers (RSPs) is strong in New Zealand. It is noted that the UCLL draft determination resulted in an increase in the UCLL price from $23.52 per month to $28.22 per month, an increase of $4.70 per month. Following the release of the UCLL draft determination, a number of Retail Service Providers increased their retail prices for ADSL/telephony bundles by $4 per month, implying a pass-through rate of 85%.

22 See Vogelsang I., July 5, 2013, paragraph 45, which in turn is based on Shinohara, S., Akebatsu, Y., and M. Tsuji, "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 26-28, 2011. Available at http://hdl.handle.net/10419/52312.

23 We initially used a timeframe of 10 years, but have extended this to 15 years in light of Professor Cambini's recommendation. In terms of the discount rate, 10% has been used for the purposes of this analysis, although our results and conclusions are not materially affected by alternative discount rates.

24 Cambini, C., "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", section 4.

25 Vogelsang I., July 5, 2013, paragraph 56.

26 In this regard, Professor Vogelsang recommends a similar position, stating that "the latter indirect [spillover] effects should be the concern of the central government", whereas a case can be made for network effects to be the concern of the Commerce Commission. Vogelsang I., July 5, 2013, paragraph 56.

47. In terms of specific parameters, the cross-elasticity of demand for fibre with respect to DSL prices is important, as this determines the extent to which demand for UFB subscriptions will be higher under the scenario where a UCLL uplift is applied (compared to the scenario where no UCLL uplift is applied). The assumed estimate of 1.2 indicates that a 1% increase in retail prices for UCLL-based services will increase demand for fibre-based services by 1.2%. We note that Professor Vogelsang did characterise this cross-elasticity estimate as being "comparatively high".[27] Professor Vogelsang also noted that:[28]

> … while higher (lower) prices for copper-based services clearly could induce (prevent) end-users to switch to UFB services, it is hard to predict the extent to which that will occur. … while a positive (negative) migration effect can be expected from an increased (decreased) UBA charge, the size of the effect is highly uncertain.

48. We are aware of a small number of other studies which attempt to estimate the cross-elasticity between fibre demand and DSL prices. These are summarised in Attachment B, along with the study referred to by Professor Vogelsang. In his review, Professor Cambini states that the economic literature has scant evidence on the value of this cross-elasticity.[29] We also note that the sensitivity of UFB demand to changes in DSL prices is likely to be a function of the gap between retail fibre and retail DSL prices, and that as this gap closes, the sensitivity of UFB demand to further changes in the retail price of DSL may increase.

49. While we have used a cross-elasticity of demand for fibre of 1.2 in the following analysis, we also present the results using a range of cross-elasticities (from 0.6-3.0), based on the range of cross-elasticities reported in Attachment B.

50. Further specific assumptions relating to the potential welfare effects of an uplift are discussed in the following sections.

51. In summary, the following potential welfare effects arising from an uplift are considered:[30]

    51.1 externality effects from faster migration to the UFB: these welfare gains reflect the increase in utility enjoyed by other UFB subscribers from having additional subscribers join the UFB. Such a "positive externality" for other fibre customers might be due to being able to communicate with a wider customer base (for example, using high-definition video-based services) or to the extent that the higher penetration of fibre stimulates more innovative

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27 Vogelsang I., July 5, 2013, paragraph 45.

28 Ibid, paragraph 46.

29 Cambini, C., "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", section 2.

30 The effects listed here reflect the main effects that have been raised in submissions on the draft determination. However, there may be additional effects of an uplift to copper prices, See for example, those listed in paragraph 70 below.

applications and content over fibre which would not otherwise be available (or would only become available at a later date);[31] and

51.2 potential private welfare losses from higher copper prices: these losses reflect the higher price of copper-based services for those subscribers who remain on UCLL-based services.[32]

52. Each of these potential effects is discussed below.

Assessing potential externality effects

53. An uplift to the central TSLRIC estimate for the UCLL service may result in faster migration from copper to fibre which in turn may generate positive externality effects. Such effects may arise where an additional subscriber to the UFB generates benefits to existing UFB subscribers. These could include the benefits from having more people to communicate with using platforms that are only available with ultrafast connectivity (such as high-definition video). An expanded UFB market may also induce higher levels of innovation and investment in new applications, which would benefit not only the marginal UFB subscriber but also existing UFB subscribers.

54. In order to quantify this effect, we have estimated the likely demand for UFB subscriptions under two scenarios: the first scenario is where no uplift is applied to the UCLL price, and the second scenario is where an uplift is applied, and which is passed through into higher retail prices for DSL services and which results in greater substitution away from copper and towards UFB.[33] As a result, the level of UFB demand is higher under the uplift scenario.

55. In order to estimate the magnitude of this incremental demand for UFB services, a $1 uplift is used for illustrative purposes, and the starting price for retail DSL/telephony services is taken to be $79 per month.[34] The $1 uplift would, under the assumptions above, translate into a $1 increase in retail prices, from $79 to $80 per month, representing a copper-based price increase of 1.27%. Given a cross-elasticity of demand for fibre (with respect to the price of DSL) of 1.2, this would result in an increase in UFB demand of 1.52%. The demand for UFB would therefore be 1.52% higher as a result of the $1 uplift, compared to UFB demand in the absence of such an uplift.

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[31] The Commission has previously acknowledged that there may be such potential benefits. For example, see: Commerce Commission, "Unbundled Bitstream Access Service Price Review: Update on matters relevant to the UBA price review", 13 August 2013, paragraphs 120-124. CEG also discuss similar beneficial welfare effects, see CEG "Uplift asymmetries in the TSLRIC price", February 2015, paragraph 47.

[32] In addition, there may be some subscribers who decide to give up their fixed line subscriptions altogether in response to the price increase for copper-based services (ie, rather than migrate to fibre). This would generate an additional welfare loss under the "UCLL uplift" scenario.

[33] It should be noted that the following analysis assumes that the retail prices for fibre-based services do not increase in response to the increase in DSL prices. As is noted later in this section, to the extent that fibre prices also increase, the benefits from faster migration to fibre will be diminished.

[34] This is the retail price offered by Spark and Vodafone for ADSL (40GB) and landline subscriptions.

56. As a starting point for determining the level of UFB demand, it is assumed that UFB demand in the absence of any UCLL uplift is 100,000 subscriptions in 2015[35], increasing by 100,000 per annum to reach 1 million UFB subscriptions over 10 years (2024).[36] Under the scenario where a $1 uplift is applied to copper prices, this UFB demand profile increases by 1.52%.

57. In reviewing our proposed approach for considering migration between copper and fibre and the role of network externalities, Professor Cambini referred to empirical work which had identified a positive relationship between fibre adoption in one period and fibre adoption in the following period.[37] Professor Cambini proposed an adjustment to the UFB demand to take into account this observed relationship over time.[38] Table 1 summarises the resulting profile of demand for UFB services with and without an uplift applied to the UCLL service. We have assumed that UFB demand is capped at 80% of households, to reflect the coverage of the (expanded) UFB.[39]

Table 1: Estimated UFB Demand, with and without UCLL uplift

	Demand for UFB services	
	No UCLL uplift	*UCLL uplift*
2015	100,000	101,519
2016	340,000	345,165
2017	405,000	411,152
2018	493,333	500,827
2019	587,500	596,424
2020	684,000	694,390
2021	781,667	793,540
2022	880,000	893,367
2023	978,750	993,617
2024	1,077,778	1,094,149
2025	1,177,000	1,194,878
2026	1,276,364	1,295,751
2027	1,375,833	1,396,732
2028	1,475,385	1,497,796
2029	1,553,469	1,553,469

Source: Commission estimates; Professor Cambini.

35 The number of UFB connections as of December 2014 was 69,301 connections, up from 19,915 connections in December 2013. See http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/deployment-progress

36 This is broadly consistent with forecasts by Deutsche Bank, which indicate UFB subscriptions of approximately 1 million by 2024. See https://www.chorus.co.nz/file/48863/Effect-of-fibre-on-copper-bitstream-prices.pdf Figure 3-1.

37 Cambini, C., "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", section 3.

38 Professor Cambini's approach is applied the attached spreadsheet. For further details, see the separate report by Professor Cambini.

39 The number of households over 2015-2029 is based on StatsNZ data. If UFB demand were to exceed the 80% cap, this would imply that UFB penetration would exceed 100% in those areas covered by the UFB, which is unlikely to be plausible.

58. One possible way of measuring such externality effects would be to derive an externality value as a proportion of total consumer expenditure of UFB services, and to then apply that proportion to UFB expenditure under each of the UFB demand scenarios in Table 1. The difference in the NPV between these two scenarios could be attributed to the uplift.

59. Current retail prices for fibre-based broadband and telephony services provided over the UFB start at around $85 per month[40], or $1,020 per annum. Table 2 summarises the UFB demand shown in Table 1, along with the total retail expenditure on UFB services under each scenario, based on an annual spend of $1,020 per subscriber.

Table 2: Estimated UFB Demand and Expenditure, with and without UCLL uplift

	Demand for UFB services		**Expenditure on UFB services**	
	No UCLL uplift	*UCLL uplift*	*No UCLL uplift*	*UCLL uplift*
2015	100,000	101,519	$ 102,000,000	$ 103,549,367
2016	340,000	345,165	$ 346,800,000	$ 352,067,848
2017	405,000	411,152	$ 413,100,000	$ 419,374,937
2018	493,333	500,827	$ 503,200,000	$ 510,843,544
2019	587,500	596,424	$ 599,250,000	$ 608,352,532
2020	684,000	694,390	$ 697,680,000	$ 708,277,671
2021	781,667	793,540	$ 797,300,000	$ 809,410,886
2022	880,000	893,367	$ 897,600,000	$ 911,234,430
2023	978,750	993,617	$ 998,325,000	$ 1,013,489,430
2024	1,077,778	1,094,149	$ 1,099,333,333	$ 1,116,032,068
2025	1,177,000	1,194,878	$ 1,200,500,000	$ 1,218,776,051
2026	1,276,364	1,295,751	$ 1,301,890,909	$ 1,321,666,467
2027	1,375,833	1,396,732	$ 1,403,350,000	$ 1,424,666,709
2028	1,475,385	1,497,796	$ 1,504,892,308	$ 1,527,751,431
2029	1,553,469	1,553,469	$ 1,584,538,727	$ 1,584,538,727

Source: Commission estimates; Professor Cambini.

60. The difficulty is in establishing the value of the network externality (to be applied as a proportion to the above expenditures). The submissions on the draft determination do not appear to shed any light on this issue. The only example that we are aware of where a regulator has attempted to determine the value of a network externality in a telecommunications context is in the United Kingdom, where Ofcom's 2004 statement on mobile termination rates (MTRs)[41] set a network externality surcharge (NES). The NES amounted to a margin of 0.5 pence per minute (ppm), which was included within the MTRs determined by Ofcom as 5.63 ppm for Vodafone and O2, and 6.31 ppm for T-Mobile and Orange. The NES reflected the value to existing mobile subscribers of having additional subscribers join a mobile network and hence having a larger base of subscribers who could be contacted.

[40] See for example Spark, at http://www.spark.co.nz/shop/internet/.

[41] Ofcom, "Wholesale Mobile Voice Call Termination - Statement, 1 June 2004", available at http://stakeholders.ofcom.org.uk/binaries/consultations/mobile_call_termination/statement/Statement_on_Wholesale_Mobi1.pdf

61. Such a network externality in respect of mobile services was considered particularly relevant at the time, as mobile penetration was relatively low during the early 2000s. Ofcom's NES could be considered a relevant reference point for assessing the potential network externality associated with the UFB, given that UFB penetration is at an early stage in New Zealand.

62. Based on the volume of interconnection minutes supplied by each of the UK mobile operators, the implied value of the network externality allowed by the NES can be estimated. In 2005, the total volume of interconnection minutes of the four UK mobile operators was approximately 40 billion minutes.[42] Given the NES of 0.5 ppm, this implies a network externality value of £200 million in 2005, or 2% of total retail revenues earned from mobile calls in 2005 (£9,880 million).[43]

63. The NES applied by Ofcom appears to capture the network externality effect whereby the utility of existing subscribers increases as more subscribers are added to the network. However, it does not appear to capture the potential gains from new innovations which might come about as a result of expanding the UFB customer base.

64. For the purposes of this analysis, a range is used for the assumed value of any network externality, up to a value of 50% of the increased consumer expenditure on UFB services. Table 3 summarises the potential incremental externality benefits arising from the uplift, expressed in NPV terms over 15 years,[44] for different values of the cross-elasticity between fibre demand and copper prices.

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

		Network externality as % 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

Source: Commission estimates

Potential welfare costs

65. Under the scenario where an uplift is applied to the UCLL price, those consumers who continue to subscribe to copper-based services will face higher retail prices.

66. In order to estimate the additional expenditure on UCLL-based retail services, the $1 uplift is applied to the volume of retail services which consume the UCLL service as an input. This will includes both DSL and POTS services. According to published figures, Chorus had the following fixed-line connections as of 30 June 2014 (and 30 June 2013).

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42 Ofcom, Telecommunications Market Data Tables (2005), page 20, available at http://stakeholders.ofcom.org.uk/binaries/research/cmr/tablessep06.pdf.

43 Ibid, page 17.

44 Each of the results shown in represent the difference in NPV terms between the uplift and no uplift scenarios.

Table 4: Chorus fixed-line connections

	30 June 2014	30 June 2013
Total fixed connections	1,781,000	1,784,000
- fibre	42,000	19,000
Total (excluding fibre)	1,739,000	1,765,000

Source: Chorus Management Commentary (August 2014), Attachment One.

67. It is assumed that the number of copper-based fixed-line subscribers in 2014 is 1,739,000 subscribers, and that this declines each year by the change in the number of UFB subscribers under the "UCLL uplift" scenario. We assume that the number of copper-based fixed-line subscriptions cannot fall below the level consistent with the number of households that lie beyond the UFB coverage (ie, 20% of households).

68. The resulting number of copper-based subscriptions, and the additional cost for such subscribers arising from the $1 monthly increase in retail prices, is summarised in Table 5.

Table 5: Estimated Additional Consumer Expenditure from Uplift

	Fixed-line copper connections	Additional consumer expenditure
2015	1,495,354	$ 17,944,253
2016	1,429,367	$ 17,152,405
2017	1,339,692	$ 16,076,304
2018	1,244,095	$ 14,929,139
2019	1,146,129	$ 13,753,549
2020	1,046,979	$ 12,563,747
2021	947,152	$ 11,365,823
2022	846,902	$ 10,162,823
2023	746,370	$ 8,956,439
2024	645,641	$ 7,747,686
2025	544,768	$ 6,537,211
2026	443,787	$ 5,325,443
2027	380,715	$ 4,568,580
2028	384,522	$ 4,614,265
2029	388,367	$ 4,660,408

Source: Commission estimates.

69. Using a 10% discount rate, the NPV of the additional expenditure faced by consumers of copper-based services over the 15 years would be -$93.4 million. Table 6 summarises the estimated welfare costs from higher copper prices for different values of the cross-elasticity between fibre demand and copper prices

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

Other considerations

70. There are also likely to be a number of other considerations which may affect the net benefits from an uplift to the UCLL TSLRIC price. We have not attempted to quantify these factors, although these are generally likely to reduce the net benefits from applying an uplift to the UCLL price. These factors include the following:

    70.1 the potential for retail prices for UFB-based services to increase in response to any increase in retail prices for DSL services. Given that wholesale UFB prices are contractually capped, any increase in UFB-based retail prices would involve an expansion in RSP margins. Competition between RSPs is likely to constrain any such increase in retail margins. However, to the extent that retail prices for UFB-based services do increase, this would tend to mute any migration effect;[45]

    70.2 negative externalities for the subscribers remaining on copper-based services;[46]

    70.3 supply-side constraints in connecting UFB customers; and

    70.4 there are also likely to be additional welfare losses for those individual subscribers who switch to fibre in response to the higher copper price. While these customers are better off on fibre than on copper following the price increase, they will be worse off compared to the lower copper price.

71. We also note that we have not considered whether a reduction in the UCLL price to a level that is below our central estimate of the TSLRIC for the UCLL service might be justified. This is because setting such a regulated price will not by definition allow for the recovery of the efficient forward-looking costs of supplying the UCLL service, and is likely to therefore have a detrimental effect in terms of competition and incentives for efficient investment in the future. This is unlikely to best give, or likely best give, effect to the section 18 purpose statement.

We are interested in your views on this framework at the conference

72. We intend to question parties and experts on aspects of the framework outlined in paragraphs 35 to 71 above at the conference, in particular:

    72.1 do you agree with the proposed framework for assessing the potential welfare effects of any uplift in the TSLRIC price?

    72.2 if not, what alternative approach should be used, and why should that alternative be preferred?

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45 See for example Wigley "Cross submissions as to draft UCLL and UBA FPP determinations", 20 March 2015, paragraph 9.15. In addition, there may also be a response in terms of LTE prices.

46 See for example Vogelsang I., 2 July 2014, paragraph 28.

72.3 in terms of the above framework, are you aware of any empirical evidence which is relevant for quantifying any externality effect attributable to an uplift to the TSLRIC price?

72.4 do you have any comments on the other parameters and/or assumptions made in the above framework?

Framework for considering an uplift to the mid-point WACC estimate for UCLL and UBA

73. This section outlines a possible framework for considering the extent of any uplift to be applied to the mid-point WACC estimate for UCLL and UBA. The 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.

74. The framework is based on a modified version of the approach developed by Oxera for considering a WACC uplift for electricity lines businesses, during a review we conducted in 2014.[47]

Chorus and its expert advisors have argued for an uplift to the mid-point WACC estimate

75. Our draft determinations for the UCLL and UBA pricing reviews applied a mid-point WACC estimate.[48]

76. Submissions from Chorus (and its expert advisors CEG and Professor Hausman) have argued for an uplift to the overall TSLRIC prices and/or the mid-point WACC estimate. For example, these submissions noted that an uplift is important because of the:

    76.1 impact it may have on incentives to invest in new telecommunications services and technologies. Professor Hausman's submission noted that regulation can have significant effects on the introduction of new services;[49] and

    76.2 potential costs to consumers of network outages resulting from under-investment.[50]

77. Submissions from other parties generally argued that an uplift is not required. For example, these submissions stated that:

    77.1 the decision needs to balance both the investment incentives for Chorus as the access provider, for all access seekers, and the wider industry, to secure the environment for both short-term and long-term competition;[51]

    77.2 the Commission previously considered and rejected an uplift to the mid-point WACC in previous telecommunications decisions, including TSO net cost determinations and the draft TSLRIC determination for PSTN services;[52] and

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47 Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014).

48 Commerce Commission "Cost of capital for the UCLL and UBA pricing reviews: Draft decision" (2 December 2014), pages 46-57.

49 Professor Hausman "Report by Professor Jerry A. Hausman: Response to the Commerce Commission's Draft Determination on Uplift", page 5, paragraph 7.

50 CEG "Uplift asymmetries in the TSLRIC price" (February 2015), pages 9-10, paragraphs 39-40; Professor Hausman "Report by Professor Jerry A. Hausman: Response to the Commerce Commission's Draft Determination on Uplift", pages 10-11, paragraphs 18-21.

51 Spark "UBA and UCLL FPP pricing review draft decision" (20 February 2015), page 64, paragraph 350.

77.3 empirical evidence is needed to support any uplift to the mid-point WACC estimate, particularly in light of the work we undertook on the WACC for electricity lines and gas pipelines businesses last year.[53]

Possible framework for considering whether a WACC uplift should be applied

78. In response to these submissions, we have given further thought to our analytical approach to determining whether an uplift to the mid-point WACC estimate should be applied. Consistent with our 2014 review of the WACC uplift for electricity lines and gas pipeline businesses, we consider that there are two primary questions that need to be addressed:[54]

    78.1 Is there any reason to depart from the mid-point WACC estimate (ie, the best parameter based estimate we have of the cost of capital)?

    78.2 If so, what is the most appropriate percentile?

79. As explained during our 2014 review, answering the first question requires consideration of whether there is asymmetry in terms of the expected losses from under- and over-estimating WACC (given that the actual WACC is not observable, so must be estimated).[55] Further, even if such an asymmetry is identified, consideration needs to be given to whether a WACC uplift is the best tool to address the asymmetry.[56]

80. This paper does not analyse whether we should depart from the mid-point WACC estimate. Rather, a possible quantitative framework is developed to inform our thinking regarding the extent of any WACC uplift, in case we ultimately decide that an uplift is appropriate.

81. The analytical framework outlined in this section focuses on the potential role of a WACC uplift in incentivising investment in innovative new telecommunications services.[57] As noted above, submissions on behalf of Chorus highlighted the

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52 Wigley & Company "Submission on draft pricing review determination for UBA and UCLL services" (20 February 2015), paragraphs 10.1-10.2.

53 For example: Wigley & Company "Submission on draft pricing review determination for UBA and UCLL services" (20 February 2015), paragraph 10.42; Spark "UBA and UCLL FPP pricing review draft decision" (20 February 2015), paragraphs 347 and 371.

54 Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 28, paragraph 2.6.

55 If the expected losses are broadly symmetric, then we should apply the mid-point WACC estimate. However, if the expected losses are asymmetric, there may be a case for selecting a WACC percentile estimate that reflects this asymmetry. Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), pages 38-39, paragraphs 3.6-3.10.

56 For example, our WACC percentile decision for electricity lines and gas pipeline businesses considered the role of a WACC uplift compared to other possible tools (such as required quality standards), across different categories of investment. Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), pages 89-95, paragraphs 5.53-5.77.

57 This is in contrast to the WACC percentile review for electricity lines and gas pipeline businesses, where our primary concern was regarding the costs to consumers of major network outages. As noted in the

importance of investment in new technologies. We agree that this is potentially an important consideration, due to the rate of technological development in the telecommunications industry and possible benefits to consumers associated with investment in innovative new technologies.[58]

82. 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.

83. However, other factors may limit the significance of any signalling effect our decision regarding whether to apply an uplift for UCLL and UBA may have on investment in new services and technologies. For example:

    83.1 the ability to attract demand, the potential for a competitive response, or the chance of being leap-frogged by competitors if they do not invest, are all likely to be important considerations for a company considering launching a new telecommunications network or service; and

    83.2 the probability of an innovative new telecommunications network or service ultimately being regulated could be considered relatively low, unless it displaces an existing service/network which is currently regulated.

84. We have not considered these factors in detail in this paper. This is because the purpose of this paper is to outline a possible quantitative framework for considering a WACC uplift, rather than answering the question of whether an uplift should actually be applied.

Possible framework based on the approach originally developed by Oxera

85. We have considered how the framework used for reviewing the WACC uplift for electricity lines businesses could potentially be adapted to the telecommunications context. The main analytical framework we used for electricity lines was developed by one of our independent expert advisors, Oxera.[59]

86. A possible framework that could assist us in considering the extent of any uplift to the mid-point WACC for UCLL and UBA is explained in Attachment C. This approach effectively trades off the:

    86.1 costs to consumers of a WACC uplift, in terms of higher prices; against

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draft WACC decision for the UCLL and UBA pricing reviews, substitutes for fixed-line telecommunications services are more readily available than for electricity lines, which is likely to reduce the impact on end-users of network outages. Commerce Commission "Cost of capital for the UCLL and UBA pricing reviews: Draft decision" (2 December 2014), page 51, paragraph 223.

58 Section 18(2A) of the Telecommunications Act requires us to consider the incentives to innovate that exist for, and the risks faced by, investors in new telecommunications services, when conducting our overall consideration of competition for the long-term benefit of end-users.

59 Oxera "Input methodologies: Review of the '75th percentile' approach" (23 June 2014).

86.2 the expected benefits to consumers associated with reducing the risk that investment in innovative new technologies will be delayed or not occur because the allowed WACC is under-estimated. This investment in innovative technologies could potentially relate to new fixed-line or mobile networks, or new services delivered over these networks.

87. When developing the framework, it is assumed that:

87.1 there is the prospect of the incumbent, or another party, investing in a new network or service (based on a new technology), which could lead to significant benefits to consumers;

87.2 if such an innovative new telecommunications network or service is deployed, there is a chance that it may be regulated in the future; and

87.3 when forming their expectations about the allowed rate of return should the new network or service be regulated in the future, investors will consider the approach taken for the UCLL and UBA pricing reviews.

88. The framework currently focuses solely on whether a WACC uplift should be applied to reduce the risk of investment in innovative new technologies being delayed or not occurring, and does not consider the role of other factors (such as the costs to end-users of outages). However, the framework could potentially be adapted to incorporate other considerations which may be relevant when considering whether an uplift should be applied.

89. In summary, under this framework there are three key parameters which would help inform our judgement regarding whether to apply an uplift to the mid-point WACC estimate for UCLL and UBA. These three parameters are:

89.1 *BCR*, which represents the benefit-cost-ratio associated with investment in the new telecommunications network or service;

89.2 *p*, which represents the combined probability that there is a major innovative new technology in prospect, when it might occur, and whether it would be regulated in way that made the allowed WACC for UCLL and UBA influential to investment in the new technology; and

89.3 *m,* which represents the margin by which the allowed WACC can be below the optimal WACC predicted by the model before investment in the new technology will not occur.

90. Although this framework could potentially be used to help inform our decision regarding the extent of any uplift to the mid-point WACC, this will ultimately be a matter of judgement. As noted during our review of the WACC uplift for electricity lines and gas pipelines businesses, there are several key relationships which will

directly influence the optimal WACC percentile, but which are subject to fundamental uncertainty.[60]

We are interested in your views on this framework at the conference

91. We intend to question parties on aspects of the framework outlined in paragraphs 78 to 90 above (and explained in more detail in Attachment C) at the conference. In particular, we intend to explore:

    91.1 whether this framework is suitable for considering the extent of any uplift to be applied to the mid-point WACC estimate for UCLL and UBA; and

    91.2 appropriate values for the three key parameters associated with the model, *BCR*, *p* and *m*, including available empirical evidence that could potentially be used to estimate these parameters.

92. We have engaged Oxera to undertake an analysis to provide a basis for us to consider whether a WACC uplift should be applied for UCLL and UBA – including reviewing the suitability of the framework it originally developed for electricity lines businesses to the telecommunications industry, and quantifying some of the relevant parameters. Oxera's work will not be completed in time for the conference. However, we intend to publish Oxera's findings as soon as practicable in advance of our further draft determinations.

[60] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 11, paragraph X15.

Monte Carlo simulation as a possible approach to generating a range of TSLRIC prices

93. In its submission on the draft determination, CEG noted the uncertainty associated with estimating a number of key parameters in TSLRIC modelling, and outlined an empirical methodology known as Monte Carlo simulation which could in CEG's view be implemented to generate a range of TSLRIC prices for the regulated service.[61] CEG submitted that a price point could be selected within such a range in order to take into account this uncertainty.

94. The key modelling parameters which CEG referred to are:

    94.1 the WACC;

    94.2 unit costs (including unit opex and unit capex);

    94.3 asset lives and price trends; and

    94.4 demand, including forecasts of future demand.

95. According to CEG's initial submission on the draft determination:[62]

> Monte Carlo simulation seeks to simulate the distribution of a random variable using information about the variability of parameters that determine its value. Simulations assist in understanding how the variability of a model's inputs determine variability of its outputs. Typically a large number of simulations are conducted using randomly drawn numbers to generate simulated values for input variables.

96. The CEG submission goes on to describe how Monte Carlo analysis can generate WACC distributions which are in its view consistent with those used by the Commission to apply an uplift for electricity distribution and gas pipelines.[63]

97. Monte Carlo simulation is a well-understood methodology for simulating sources of uncertainty which affect the value of a dependent variable. As noted by CEG, such analysis may in principle be able to be applied in the case of a cost model by simulating the distribution of the model's output using information on the variability of key model parameters (such as WACC, asset lives, unit costs, etc).

98. However, the implementation of a Monte Carlo approach in the context of our TSLRIC model is informationally demanding. We note that while CEG's initial submission focuses on the WACC input, it does not shed any light on how such an approach might be applied to the other areas of modelling uncertainty identified by CEG.

99. We also note that CEG has previously submitted that statistically robust estimates cannot be derived from small samples of observations[64], and it is not clear from

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61 CEG "Uplift asymmetries in the TSLRIC price", February 2015, Section 6.

62 Ibid, paragraph 143.

63 Ibid, paragraphs 146 and 161.

64 CEG "Estimating Benchmark Distributions: A Report for Chorus", available at http://www.comcom.govt.nz/dmsdocument/11078.

CEG's initial submission on the draft determination how Monte Carlo analysis could reliably be applied to individual parameters such as the life of a specific class of asset (such as a duct) or unit costs, where the sample of observations may be relatively small.[65]

100. In light of our proposed approach for considering whether an uplift to the WACC is appropriate, and given the practical implications of a Monte Carlo approach (particularly in terms of the information required), we are interested in the views of parties on whether a Monte Carlo approach, as described by CEG in its initial submission on the draft determinations, should be considered in the context of the FPP.

101. We are also concerned that the application of Monte Carlo analysis in the context of a complex model such as that used to determine the TSLRIC for the UCLL and UBA services, with many possible permutations of modelling decisions, may result in a wide range of TSLRIC prices. Our preference at this stage is to focus on our modelling decisions and input parameters, although as noted above we are interested in the views of interested parties on the practicality of, and the potential value which might be added by, CEG's proposal in their initial submission to use Monte Carlo simulation in the context of our TSLRIC modelling.

[65] Taking the example of the asset life for ducts, we would expect that a large amount of information on Chorus' inventory of ducts would be required in order to be able to generate a robust distribution of asset lives. Similar information would be required for other asset classes within the TSLRIC model.

Attachment A: Code of Conduct for expert witnesses

High Court Rules
Schedule 4
Code of conduct for expert witnesses

r 9.43

Duty to the court

1 An expert witness has an overriding duty to assist the court impartially on relevant matters within the expert's area of expertise.

2 An expert witness is not an advocate for the party who engages the witness.

Evidence of expert witness

3 In any evidence given by an expert witness, the expert witness must—

(a) acknowledge that the expert witness has read this code of conduct and agrees to comply with it:

(b) state the expert witness' qualifications as an expert:

(c) state the issues the evidence of the expert witness addresses and that the evidence is within the expert's area of expertise:

(d) state the facts and assumptions on which the opinions of the expert witness are based:

(e) state the reasons for the opinions given by the expert witness:

(f) specify any literature or other material used or relied on in support of the opinions expressed by the expert witness:

(g) describe any examinations, tests, or other investigations on which the expert witness has relied and identify, and give details of the qualifications of, any person who carried them out.

4 If an expert witness believes that his or her evidence or any part of it may be incomplete or inaccurate without some qualification, that qualification must be stated in his or her evidence.

5 If an expert witness believes that his or her opinion is not a concluded opinion because of insufficient research or data or for any other reason, this must be stated in his or her evidence.

Duty to confer

6 An expert witness must comply with any direction of the court to—

(a) confer with another expert witness:

(b) try to reach agreement with the other expert witness on matters within the field of expertise of the expert witnesses:

(c) prepare and sign a joint witness statement stating the matters on which the expert witnesses agree and the matters on which they do not agree, including the reasons for their disagreement.

7 In conferring with another expert witness, the expert witness must exercise independent and professional judgment, and must not act on the instructions or directions of any person to withhold or avoid agreement

Certification for Expert Witness

I, of have read the Code of Conduct for Expert Witnesses as contained in Schedule 4 of the High Court Rules, and agree to abide by that Code when providing opinion, advice or comment at the Commerce Commission's conference on the UCLL and UBA pricing review determinations.

Signed:

Date:

Attachment B: Cross-elasticity of demand for fibre

Table 7: Estimates of cross-elasticity of demand for fibre with respect to DSL prices

Source	Estimate
Shinohara, S., Akebatsu, Y., and M. Tsuji, "Analysis of broadband services diffusion in OECD 30 countries: Focusing on open access obligations"	1.189
"The mobile and fixed broadband battle in Sweden", presentation to the International Conference: Mobile broadband-Competitive dynamics and policy implications, September 11-12, 2012 [66]	0.845-0.945 (max)
Grzybowski, L., Nitsche, R., Verboven, F., and Wiethaus, L., "Market Definition for Broadband Internet in Slovakia: Are Fixed and Mobile Technologies in the Same Market?", 20 February 2014[67]	0.66-0.96
Cambini, C., "Economic aspects of migration to fibre and potential welfare gains and losses from an uplift to copper prices", 16 March 2015, Section 2.	0.60-0.64
Srinuan P., Srinuan C. & E. Bohlin,"The Mobile and Fixed Broadband Battle in Swedish Market: Complementary or Substitution?", 2011.	3.289

[66] See http://www.wik.org/fileadmin/Konferenzbeitraege/2012/Mobile_broadband/Erik_Bohlin_WIK_presentation-v5.pdf. While a cross-price elasticity between fibre and DSL is not explicitly stated, ranges of cross-elasticities between different technology types (xDSL, fibre, cable, mobile broadband) are presented. Where all four technologies are present, the range is 0.219-0.945, and where only xDSL, fibre, and mobile broadband are present, the range is 0.370-0.845.

[67] See https://feb.kuleuven.be/public/ndbad83/Frank/Papers/Grzybowksi,%20Nitsche,%20Verboven%20&%20Wiethaus,%202014%20-%20Market%20definition%20in%20broadband.pdf (Table 4).

Attachment C: Framework for considering a WACC uplift

Purpose of this attachment

103. This attachment describes a possible quantitative framework for considering the extent of any uplift to be applied to the mid-point WACC estimate for UCLL and UBA. This framework is based on a mathematical model we have developed, reflecting the analysis undertaken by Oxera during our review of the WACC uplift for electricity lines businesses in 2014.

Approach in WACC uplift review for electricity lines and gas pipelines

104. In the context of our review of the WACC uplift for electricity lines businesses last year, we were aiming to find the "optimal" WACC which balances the:

    104.1 costs to consumers of an uplift, in terms of higher prices; against

    104.2 benefits to consumers from applying the uplift, though a reduced risk of under-investment.[68]

105. Our primary concern was that the consequences of setting the allowed WACC too low were likely to be greater than setting the allowed WACC to high, due to the potential costs to consumers of under-investment in service quality leading to major supply outages.[69] We considered that an uplift to the mid-point WACC estimate was an appropriate tool to help mitigate this risk.[70]

[68] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014).

[69] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 11, paragraph X18.

[70] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), pages 96-97, paragraphs 5.79-5.83.

106. Effectively, we were seeking to minimise the direct cost to consumers of an uplift to the mid-point WACC estimate *plus* the probability-weighted annualised cost to consumers resulting from under-investment (if the allowed WACC is too low). This is expressed in Equation 1 below:

Equation 1

$$Min \ \rightarrow f(w) = RAB * (w - w_0) + c * \big(1 - CDF(w)\big)$$

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

w_0 is the mid-point WACC estimate, which is treated as a constant

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

107. Our main analytical framework for assessing the appropriate WACC uplift for electricity lines businesses was developed by Oxera.[71] Oxera's general approach was to empirically estimate the expected losses to consumers from over- and under-estimating the true cost of capital for various percentiles of the WACC distribution, on an annualised basis.

    107.1 Oxera's analysis of the appropriate WACC uplift effectively identified a reasonable range for the WACC uplift by *tabulating* the expression in Equation 1 above, and assuming that a sustained differential of 0.5% to 1% between the true WACC and the allowed WACC is required to trigger an under-investment problem.[72]

    107.2 On the basis of its analysis, Oxera concluded that "…a point estimate around the 60th or 70th percentile appears to provide a suitable balance between the costs and benefits…".[73]

108. We ultimately selected the 67th percentile estimate, after considering a wide range of factors which may affect whether an uplift to the mid-point WACC should be allowed. Using the 67th percentile resulted in an allowed WACC for electricity lines businesses that is 47 basis points above the mid-point estimate.[74]

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71 Oxera "Input methodologies: Review of the '75th percentile' approach" (23 June 2014).

72 Oxera "Input methodologies: Review of the '75th percentile' approach" (23 June 2014), Table 7.3 and Table 7.4, pages 69 and 72.

73 Oxera "Input methodologies: Review of the '75th percentile' approach" (23 June 2014), page 73.

74 Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 119, paragraph 6.59.2.

Oxera's framework can be re-expressed mathematically

109. Within the framework outlined in paragraphs 104 to 108 above, the optimal uplift is able to be found by differentiating Equation 1, and setting it equal to zero to get the least cost solution. Oxera did not explicitly adopt this mathematical approach when advising us on the appropriate WACC uplift for electricity lines businesses.

110. Differentiating Equation 1 with respect to WACC (*w)* gives:

Equation 2

$$\frac{df}{dw} = RAB - c * PDF(w)$$

Where: PDF(w) is the probability density function of the WACC

111. Setting Equation 2 equal to zero, and re-arranging gives:

$$RAB - c * PDF(w) = 0$$

$$RAB = c.PDF(w)$$

Equation 3

$$PDF(w) = \frac{RAB}{c}$$

112. For illustrative purposes, an optimal WACC uplift for electricity lines businesses (in terms of basis points above the mid-point WACC estimate), derived purely from this quantitative framework, is shown diagrammatically in Figure 1 below. This is based on the following assumptions:

112.1 the WACC probability density function is based on a mid-point estimate of 7%, with a standard deviation of 1.1%;[75]

112.2 the combined RAB for electricity lines businesses is approximately $14.6 billion;[76]

112.3 the annualised net cost to consumers resulting from under-investment, *c*, is approximately $1 billion;[77] and

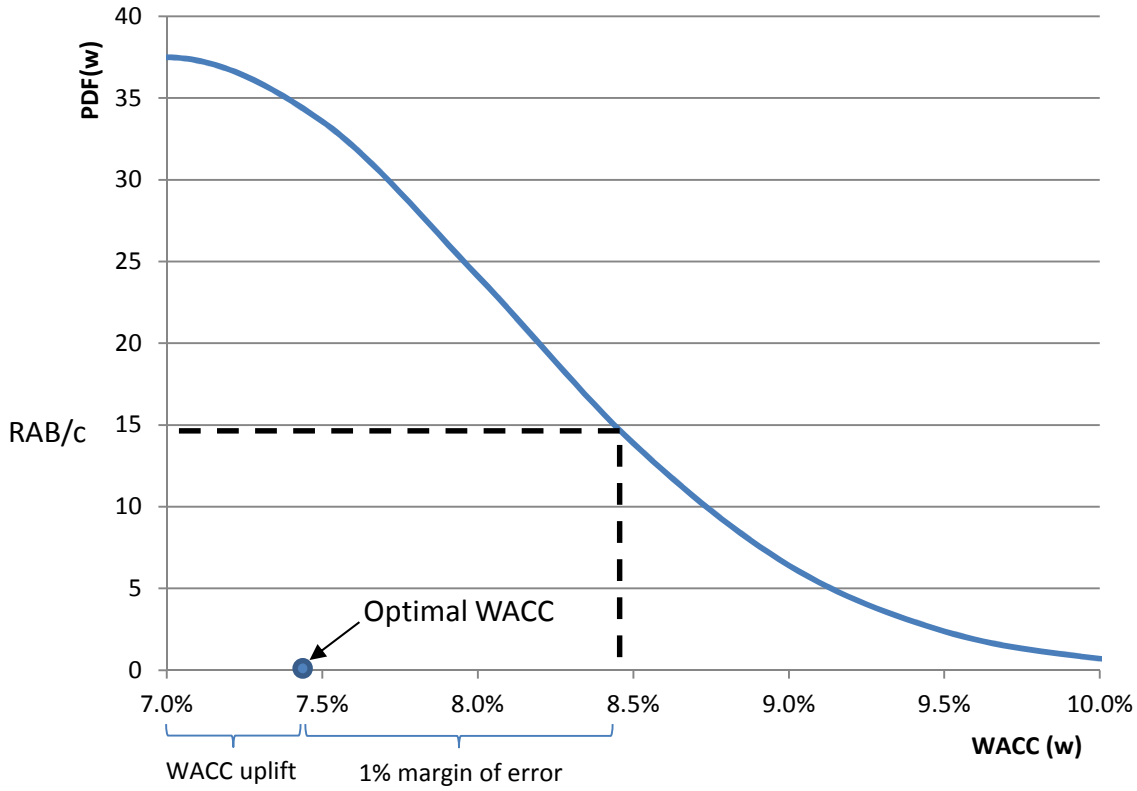
112.4 the allowed WACC needs to be approximately 1% below the WACC predicted by the model for an under-investment problem to occur (a '1% margin of error').

[75] Under the current input methodologies, the standard error of the WACC for electricity lines businesses is 1.1%. The mid-point WACC of 7% is an example for illustrative purposes only.

[76] Oxera "Input methodologies: Review of the '75th percentile' approach" (23 June 2014), page 28.

[77] Oxera considered a range from $1-3 billion, but gave greatest weight to the low end of this range. Oxera "Review of expert submissions of the input methodologies" (27 October 2014), page 22.

Figure 1: WACC probability density function for electricity lines businesses



113. While this approach can be used to find the mathematically optimal WACC (based on the specified model), it is important to note that determining the appropriate regulatory rate of return is a matter of judgement. As explained in the Part 4 WACC uplift review:[78]

> There are several key relationships which directly influence the 'optimal' WACC percentile, but which are subject to fundamental uncertainty. For example, it is extremely difficult to empirically estimate the link between the WACC allowed by the regulator, the level of investment by regulated suppliers, and how this affects quality of service.

114. Therefore, when applying this framework, the ultimate decision regarding the whether a WACC uplift should be applied will depend on judgement regarding key inputs to the model, and other factors which are not captured in the model (such as the strength of other tools and incentives, apart from the allowed WACC, in mitigating the risk of under-investment).

Possible adaption of the electricity and gas WACC uplift approach to UCLL and UBA

115. In response to submissions on the draft determinations, we have considered how the framework used to consider the appropriate WACC uplift for electricity lines businesses could potentially be adapted for the UCLL and UBA pricing reviews.

[78] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 11, paragraph X15.

116. One possible approach is to consider the potential benefits to consumers, from increased investment in new technologies, that could result from a WACC uplift. This differs from our approach to electricity lines, where the main reason we apply the 67th percentile WACC estimate is to mitigate the risk of under-investment leading to major supply outages for consumers.[79]

117. In the telecommunications context, suppose that:

    117.1 the incumbent operator has an existing network with a total asset value *RAB,* as defined by the asset value contained in the TSLRIC model;

    117.2 there is the prospect of the incumbent, or another party, investing in a new network or service (based on a new technology), which could lead to significant benefits to consumers. For simplicity, if the new network or service is deployed, it will have the same asset value as the existing network;

    117.3 there is a chance that if the new network or service is deployed, it may be regulated in the future. When forming their expectations about the allowed rate of return should the new network/service ultimately be regulated, investors will consider the approach taken for the UCLL and UBA pricing reviews;

    117.4 the probability, *p*, combines the chance that there is such a major innovative new technology in prospect, when it might occur, and whether it would be regulated in way that made the allowed WACC for UCLL and UBA influential to investment in the new technology; and

    117.5 any WACC uplift will apply to both the existing network and the new network/service, so that consumers will pay higher prices on both networks.

118. In this setting, *c* can be modelled in terms of the benefit-cost-ratio (BCR) that might be expected from a major telecommunications innovation. Instead of *c* reflecting the annualised costs to consumers from network outages resulting from the allowed WACC being too low, it would instead reflect foregone benefits from investment in the new telecommunications network or service being delayed or not occurring.

[79] Commerce Commission "Amendment to the WACC percentile for price-quality regulation for electricity lines services and gas pipeline services: Reasons paper" (30 October 2014), page 11, paragraph X18.

119. If the net present value of the innovation is given by (*BCR* – 1)**RAB*, then *c* is given by:

Equation 4

$$c = d * (BCR - 1) * RAB$$

Where: *d* is the relevant discount rate

BCR is the benefit-cost-ratio associated with the new telecommunications network/service

RAB is the total asset value of the new network/service

120. To be clear about the convention, a BCR of two would mean that the net present value of the investment in the new technology is equal to RAB (ie gross benefits = 2*RAB).

121. In this example, the total cost function that we are seeking to minimise would be as set out in Equation 5 below. This reflects that the WACC uplift applies to both the existing network and to the new network/service.

Equation 5

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

Where: *RAB* is the total asset value for the existing network, which is the same asset value as for the new network/service

w is the allowed WACC

w_0 is the mid-point WACC estimate, which is treated as a constant

p is the combined probability that there is a major innovative new technology in prospect, when it might occur, and whether it would be regulated in way that made the allowed WACC for UCLL and UBA influential to investment in the new technology

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

122. Differentiating Equation 5 with respect to WACC (*w*), and setting this equal to zero to find the optimum gives:

$$\frac{df}{dw} = RAB + p * RAB - p * c * PDF(w) = 0$$

123. Re-arranging to make PDF(w) the subject gives:

$$p * c * PDF(w) = RAB + p * RAB$$

$$PDF(w) = \frac{RAB(1 + \frac{1}{p})}{c}$$

124. Substituting *c* using Equation 4 and simplifying gives:

$$PDF(w) = \frac{RAB(1 + \frac{1}{p})}{d * (BCR - 1) * RAB}$$

Equation 6

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

125. Therefore, in the context of this model, the two key parameters to inform the decision regarding whether to apply an uplift to the mid-point WACC estimate are:

125.1 *BCR*: the benefit-cost-ratio associated with the new telecommunications network or service; and

125.2 *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 way that made the allowed WACC for UCLL and UBA influential to investment in the new technology.

126. The other key parameter, not directly captured in Equation 6 above, is *m*: the margin by which the allowed WACC can be below the optimal WACC predicted by the model before investment in the new technology will not occur. As noted in paragraph 107.1 above, in the context of their work on electricity lines businesses, Oxera assumed that a sustained margin of 0.5% to 1% is required to trigger an under-investment problem.