Reply to Comments on my November 25, 2014, paper "Current academic thinking about how best to implement TSLRIC in pricing telecommunications network services and the implications for pricing UCLL in New Zealand"

Prepared for the New Zealand Commerce Commission

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1. Background

The New Zealand Commerce Commission (in the following: NZCC or "the Commission") has asked me to reply to submissions and cross-submissions relating to my November 25, 2014, paper "Current academic thinking about how best to implement TSLRIC in pricing telecommunications network services and the implications for pricing UCLL in New Zealand". The submissions, and relevant paragraphs for reply are:

- Jerry Hausman's paper for Chorus "Response to the Commerce Commission's Draft Determination on Uplift" with particular emphasis on the main arguments referring to my work in paragraphs 53-69, but also a broad review of the entire Hausman paper.
- CEG's February 2015 submission "Uplift asymmetries in the TSLRIC price", with particular emphasis on section 5 but also a broad review of this entire paper.
- Chorus' submission, paragraphs 285-291 and 642-687 (the latter is the appendix which provides some more detail in relation to the same issues covered by the former paragraphs).
- Spark's submission, paragraphs 370-386.
- Vodafone's submission, paragraphs B3.7-B3.16.
- CEG's March 2015 submission "Welfare effects of UCLL and UBA uplift"
- CEG's March 2015 cross-submission "Issues from submissions UCLL and UBA"
- Network Strategies' 20 March 2015 cross-submission "Review of issues from UCLL and UBA submissions"
- WIK consult's Cross-submission "In response to the Commerce Commission's 'Draft pricing review determination….."

2. Executive summary

2.1 Background

1. The New Zealand Commerce Commission (in the following: NZCC or "the Commission") has asked me to reply to selected submissions and cross-submissions relating to my November 25, 2014, paper "Current academic thinking about how best to implement TSLRIC in pricing telecommunications network services and the implications for pricing UCLL in New Zealand".

2.2 The Hausman submission

2. Prof. Hausman makes two very general points, from which he derives the conclusion that the Commission should apply an uplift to the WACC and/or price derived by applying TSLRIC. The first argument in brief states that the value of innovations to consumers resulting from such an uplift vastly exceeds the burden from the resulting price increases. The second argument is that the sunk costs for access networks require an uplift for the real option foregone by facilities investment, given that future demand for the facilities is uncertain.

3. Prof. Hausman is totally unclear about the way in which a WACC uplift/price increase for UCLL/UBA will result in increased innovations. There has to be a possibility for higher profits through innovation that is triggered by the WACC uplift/price increase (which in itself provides for a higher profit without any innovation). Hausman seems to suggest that the benefits from the deployment of high-speed broadband (such as the UFB) are at stake; but irrespective of what the Commission decides on the uplift question, the UFB is largely committed and hence the benefits from UFB will most likely emerge anyway. Relevant would be the innovation effects that could be attributed to the uplift, not the aggregate innovation effects that would occur anyway. The main question on innovation incentives in Chorus' copper network is, how the profitability of such innovations compares to the profitability of business as usual, i.e., to the sale of copper UCLL/UBA.

4. For simplicity we assume that the new products replace the old UCLL/UBA offerings one-by-one (diversion ratio = 1). This means that the firm offers a new product in addition to or instead of the old product and that for any unit sold of the new product the firm loses the sale of a unit of the old product. Assuming now that the innovations are not regulated an uplift/price increase for UCLL/UBA would raise the opportunity costs of innovations for Chorus and in that sense reduce the innovation incentives. If either the willingness-to-pay for the new product were "anchored" by the price of the old regulated product or if the new product were regulated the uplift/price increase of UCLL/UBA would have no effect on Chorus' innovation incentives. To conclude, with or without regulation of new products Chorus' innovation incentives from a WACC uplift/price increase for UCLL/UBA are likely to be negative or at best neutral for new services that replace the old services one-by-one.

5. I conjecture that the diversion ratio is likely to vary between types of regions and will generally differ from one, but not by much. (a) Since Chorus is investing in UFB anyhow (which implies virtually zero forward-looking costs), there would be hardly any business case for other innovations in Chorus' UFB regions. (b) In LFC regions the incentives for Chorus to switch to VDSL from a WACC uplift/price increase in UCLL/UBA are ambivalent, because both regular copper-based services and new cooper-based products are affected by copper-to-UFB migration. (c) In cable TV regions Chorus will likely be price constrained by competition so that a WACC uplift/price increase in UCLL/UBA is unlikely to have any major effect on product innovations. (d) In non-UFB regions with DSL the above argument for a diversion ratio of one could hold. However, here competition from LTE could factor in, leading to a calculation similar to the one in LFC regions. (e) In non-DSL regions the WACC uplift/price increase for UCLL/UBA plays little or no role for innovation incentives. My overall conclusion is that there are likely to be very few if any innovation incentives for Chorus from a WACC uplift/price increase in UCLL/UBA. Innovation incentives for other infrastructure competitors could be higher in the sense that these competitors are likely to increase their market-share against Chorus and would also be more profitable than before.

6. Prof. Hausman has a history of being adamantly opposed to the TSLRIC concept, because it does not, in his view, adequately address the issue of real options in view of sunk investments. It is therefore no surprise that he again raises this issue for the current FPP proceeding. He so far has very little following on this by regulators. His crown witness Ofcom in 2005 has stated its intention to include consideration of a real-option uplift in the future but has not done so since. Nevertheless, there are two potential consequences. The first is for the regulator to shorten the relevant assumed asset lives from the beginning in response to general or specific knowledge about potential technical or market obsolescence of specific assets. The second is to make midstream corrections (up or down) for asset lives if large unforeseen circumstances arise that particularly affect certain important assets.

7. Prof. Hausman draws lessons on TSLRIC particularly from the US and the EU. These lessons, in my view, are quite misleading, because they are not specific to TSLRIC (the US) or relate to investment incentives for UFB (the EU). They do not apply to the New Zealand context.

8. Prof. Hausman refers to congestion reduction and reduction of internet outages as sources of consumer gains that could be triggered by a UCLL/UBA price uplift. A higher UCLL/UBA price could conceivably induce incumbents to do more network upkeep and maintain higher connection speed, but that would have to come from higher profits from the additional sales made possible by such speed/upkeep. In order to undertake the QoS improvement the firm must make more profit on the additional sales than the cost of the QoS improvement.

9. Prof. Hausman's contention that the consumer welfare from a new product or service equals the area under the demand curve above the price is misleading. In his 2003 article, on which this exposition is based, he notes in a footnote that vanishing products/services have to be treated symmetrically to new products but that they have little importance. However, the consumer surplus lost by a consumer moving from copper to fibre is not trivial relative to the consumer surplus gained. For the marginal migrating consumer it will be almost the same. Thus, the innovation effects for consumers are anything but straightforward.

10. Prof. Hausman raises in particular two critical points about my paper. The first is that I made no empirical estimates to justify my position, which he calls "hand waving". The second is that I only consider one side of the issue and therefore do not arrive at a balanced view.

11. It is true that I have not made any empirical estimates to justify my position. This is in fact not much different from Prof. Hausman's approach. While he produces several numbers, they do not refer to the New Zealand context and only pretend precision where there is none. In contrast, my advice to the Commission is openly based on my own judgment, not on numbers that may apply to the US but not New Zealand.

12. Regarding the second accusation I admit that my balancing looks different from Prof. Hausman's. He puts almost all the emphasis on sunk investments and the value of foregone innovations and quality improvements and very little on consumer price increases, while I doubt the severity of the sunkness issue and the extent of additional innovations that would result from a WACC uplift/price increase for UCLL/UBA.

13. Prof. Hausman criticizes my view that the copper network will be highly profitable. As explained above, this statement does not refer to profits in the TSLRIC world but in a world of actual forward-looking costs. This view should be fully compatible with Prof. Hausman's assertion that most of the costs in an access network are sunk. The question is if price regulation should shield incumbents from the downsides of the market. In fact, in a competitive environment the actual UCLL/UBA prices should be lower that the FTTH TSLRIC level because FTTH is a superior product. According to Prof. Hausman's own statements about consumer valuations such a product would command a substantial price premium over copper access. That is the essence of the performance adjustment alluded to in my paper. It means at the very least that using the FTTH MEA without performance adjustment is treating UCLL/UBA access very generously.

14. To summarize, Prof. Hausman has not shown how an increase in the UCLL/UBA price or allowed WACC would lead to more innovations and has overstated the benefits of such innovations to consumers and understated the costs of innovations.

2.3 The CEG submission: Uplift asymmetries in the TSLRIC price (emphasis on section 5)

15. CEG considers the question of a WACC or price uplift to UCLL/UBA requiring an analysis "grounded in real world outcomes and not the world of the Commission's HEO" (meaning the "hypothetical efficient operator" of the TSLRIC model). I agree that the differences between the real world outcomes and the HEO are relevant for this question, but that is precisely why some of CEG's and Chorus' statements about my observations on the Commission's generosity towards Chorus are misplaced.

16. CEG uses the cautionary Commission statement about performance adjustments as a reason to dismiss such adjustments. However, performance differences are a matter of **reality** (in CEG's dichotomy between real life and HEO). Thus, according to CEG it should be legitimate to use them as factors for the assessment of a potential price increase in UCLL/UBA. Neumann and Vogelsang (2013) provide a method how this could be done, based on the increased willingness to pay for the superior product. Prof. Hausman has provided the number of NZ$285 per year increase in willingness to pay per 10 megabit speed increase. A similar adjustment can be made between copper and UFB.

17. CEG is correct that over-investment in copper is unlikely under a too high price for UCLL/UBA. There will rather be less investment because of faster migration to UFB and to other competitors. Because it is based on the HEO and not the RAB, TSLRIC simply does not generate an Averch-Johnson effect. Even without an Averch-Johnson effect there is, however, still the negative effect of higher prices on consumers. Under-investment is also less of a problem than in an Averch-Johnson world because the firm is not rewarded with a lower rate base.

18. CEG asserts that an innovative new product would be affected ("anchored") by the regulated price of the old product even if the new product were not regulated. As argued above on the Hausman submission, this does not necessarily affect the innovation incentives, which depend much more on the relative prices than on the absolute prices of the old and new products (as long as the incumbent can finance the innovations).

19. CEG adds a new aspect to the effects of a higher UCLL/UBA price on migration. It is that increased migration to UFB could accelerate the date that the copper access network can be shut down, thus reducing the discounted costs of carrying duplicate networks. However, the shutdown may also be delayed, because the remaining copper customers are more profitable under a higher UCLL/UBA price. Given the different direction of these effects it is difficult to determine which effect dominates.

20. CEG sees regulatory stranding arise mainly from the emergence of new low cost technologies that replace the old ones and as a consequence immediately lead to a new lower TSLRIC price. This observation is essentially correct and corresponds to the notion that TSLRIC should emulate the effects of competitive markets. If in fact new technologies

emerge in competitive markets the market price will reflect these new technologies leading to a write-down of the assets of the old technologies. In real life a question would be how quickly the new technologies spread. They would not be there in the spur of a moment but would take some time for deployment. However, usually a new MEA and the accompanying TSLRIC calculation also take some time. FTTH has been deployed in Japan for about 15 years now. So, the switch to the new MEA is not going to be immediate. The way to treat this type of "regulatory stranding" is via the required depreciation/asset life. This is, what the Commission has done.

21. A potentially relevant contribution by CEG (based on Salinger, 1998) is that the expected value of different annuities for different asset lives is above the value of an annuity for the expected asset life. Without concrete data it is hard to assess the size of this effect, but it is worth looking into.

22. CEG essentially reinterprets the re-use of assets as a basis for valuation that does not change anything. This is not, however, how the re-used asset approach has been applied in practice. Proponents of the re-used asset approach see the difference as follows: Under the replacement asset approach the starting point is a new MEA built from scratch and then depreciated over time and converted into an annuity. Under the re-used asset approach an old asset is used at its depreciated value (which can be zero) and assessed with its remaining life. It will then only be replaced with a new asset after that. This then reduces the discounted value of all costs that would be relevant for creating an annuity.

23. I agree with CEG that the Commission's demand assumption based on my advice may be demanding for the incumbents. In my view, adjustments could be considered based on expected demand reductions from fixed-to-mobile substitution but also on demand increases from more households.

2.4 Chorus' submission (paragraphs 285-291 and 642-687)

24. Chorus' main critique of my paper is that I state as factors of regulatory generosity towards the incumbent some items that follow naturally from the New Zealand statutes on the pricing principles. I agree that that this "generosity" only flows from the statute and cannot judge if the new developments of the TSLRIC concept in the EU and Switzerland would have been compatible with the New Zealand statutes. Nevertheless, the conservative approach taken by the Commission is generous relative to an alternative standard, under which prices would result that reflect re-use of equipment and would reflect performance adjustments. This is relevant, when it comes to the question of a WACC uplift/price increase for UCLL/UBA. For example, a UCLL/UBA price without performance adjustment distorts the resulting copper-based prices relative to UFB and will lead to faster migration. If one put a WACC uplift on top of that the distortion will be enhanced.

25. Chorus notes that modifying the TSLRIC method to take account of re-use of assets would be "in direct contradiction with the build or buy principles and promotion of efficient investment" and would "bias an RSP's build or buy decision towards purchasing regulated access at odds with the section 18 purpose". While I agree that taking account of re-use would be wrong in the New Zealand context, the bias that Chorus asserts is less than obvious. If the incumbent can lower its costs relative to the RSPs by re-using assets then it would be more efficient that the incumbent builds rather than the RSP.

26. Chorus is correct that copper investments in rural, non-UFB areas may be worth encouragement. But, in my view, this is quite limited. Most of the action w.r.t. high-speed internet here will instead come from the mobile carriers (4G and higher) and from fixed wireless (under the rural broadband initiative providing fixed wireless broadband to around 90% of homes outside of the UFB area). I conjecture that a large fraction of the remaining rural areas in New Zealand are without DSL and therefore do not fall under the current proceeding. This leaves a small number of loops that would be affected by this proceeding. These loops are largely in place so that the main investments would be in maintenance, possibly in upgrade to DSL. Given the small percentage of loops affected in rural areas even without a WACC uplift/price increase Chorus should be generating ample profit contributions that incentivize the upkeep and upgrades. It is not clear why the whole copper-dependent New Zealand population should have to pay for that.

27. Chorus (based on the CEG submission) makes the case for a higher price for UCLL/UBA based on the competition argument. Accordingly, competition is claimed to suffer from too low regulated prices by the incumbent. However, setting a high price in order to promote/protect duplication of the local loop may not be efficient if such duplication is costly. The argument does not take account of the trade-offs i.e., a higher price may well encourage infrastructure-based competition, but at the same time if the price is too high this will harm consumers. Because it is so self-serving the competition argument is suspicious when coming from the incumbent and would carry much more weight when coming from the competitors.

28. Chorus recommends following the European Commission's example of allowing for a WACC uplift for the FTTH MEA based on the higher risk of FTTH (but refrain from following the European Commission in other respects, which include that the EC did not recommend an uplift to the regulation of the pre-existing copper!). However, when using FTTH as the relevant MEA one is looking at the fixed network market in general, not at the UFB market. Thus, it is only the demand uncertainty for fixed network access that would matter.

29. Contrary to the Commission's claim Chorus argues that it is not compensated for the danger of asset stranding due to new technological and market developments, although the Commission uses Chorus' own estimate of expected asset lives. In my view, the Commission

has made a smart move in adopting Chorus' own estimates for expected asset lives. This puts the burden of proof on Chorus rather than on the Commission to show that they systematically overestimated the asset lives in light of potential new technological and market developments.

2.5 Spark's submission

30. Similar to my paper Spark also argues that the absence of reuse and performance adjustment lead to a higher price. In addition, Spark notes in stark contrast to Hausman, CEG and Chorus that the modeling decisions not treated in my paper (i.e., everything but the re-use decision and the lack of QoS adjustment for the MEA) "tend to result in higher rather than lower estimates" than the true costs. Spark further elaborates on this (backed by WIK and NSL), stating that the parameter values chosen by the Commission were overly generous to Chorus. The combination of these statements with those of Chorus and its advisors give me confidence that those of the Commission's estimates that I had not discussed in my paper were on balance neutral, if not conservative. Spark suggests that it would be best if the Commission tried to get each input (price or quantity) right, including the WACC.[1] This is a lofty goal but correct in principle. I do not see, however, how this can be done for all inputs so that there has to remain some room for the Commission's judgment.

31. Spark accuses me of neglecting the social costs of too high an FPP TSLRIC price. While I may not have explicitly addressed this issue in Vogelsang (2014b), it has been at the heart of several of my other papers for the Commission (e.g., Vogelsang, 2013a and 2014a). The main arguments here relate to (a) higher prices borne by a large number of consumers (whereas the benefits either are not for the LTBEU or only affect a small subset of consumers) for a long time and (b) competitive distortions between different modes and different types of competitors.

2.6 Vodafone's submission (B3.1-B3.16)

32. The comments in section B of Vodafone's submission refer to my statements in Vogelsang (2014a) on positive externalities potentially generated by increased migration from copper to UFB resulting from a higher UCLL/UBA price and to the consequences drawn by the Commission from this statement. This section of Vodafone' submission provides a particular interpretation of my paper and expresses the view that the Commission has misinterpreted my paper. I will try to address both.

33. My statements on externalities in this paper have been intentionally tentative, because I could not find any quantitative evidence but found the emergence of such externalities entirely plausible. I also noted that there could be negative network externalities on copper

[1] A similar position is taken by Dobbs (2015).

subscribers from migration away from copper but conjectured that they would be smaller than the positive externalities for UFB subscribers. While I made my statements more tentative in order to be on the safe side, Vodafone makes them look a lot more tentative than they were.

34. The Commission did not use my statements as the basis for a WACC or price uplift but rather only as the basis for an approach to the measurement of uncertain parameters. Vodafone seems to be (implicitly) suggesting that the Commission needs some stronger evidence on which to base its decisions on uplift. The Commission has meanwhile taken steps in this direction, for which I applaud them.

2.7 The CEG submission: Welfare effects of UCLL and UBA uplift

35. This CEG submission builds on Frontier's adaptation of the Dobbs (2011) model for last year's WACC proceeding for energy networks. In the following I provide some general critique of CEG's further adaptation and its suitability for the current FPP.

36. Unfortunately, the Frontier-Dobbs model has a major drawback for the telecommunications application that both Dobbs (2015) and CEG acknowledge. It is that the model addresses markets that have totally independent costs and demands. CEG tries to overcome the lack of cross-elasticities on the demand side by using more elastic own demands for the "new" product than for the old product, but does not solve the real problem, which is the resulting zero diversion ratio. While Dobbs (2015) suggests overcoming this issue by adding only the consumer surplus generated by the new service above the consumer surplus of the old service displaced, this does not address the negative innovation incentives generated by the cannibalizing issue.

37. CEG assumes that the incumbent operates in an old market with a large number of subscribers. This old market in the Frontier-Dobbs model is characterized by sunk costs and an effective obligation to serve at the regulated price. The firm can invest in a new product. It will do so only if the realized WACC is smaller or equal to the allowed WACC. CEG assumes a particular probability distribution for the WACC and then runs simulations to find the optimal allowed WACC (where "optimal" refers to either total surplus maximizing or consumer surplus maximizing).

38. In its base case CEG assumes the old product to be copper telephony/DSL and the new product to be UFB. CEG also runs (for reasons of sensitivity only) versions with VDSL etc. as the new product. It should be clear at the outset that any of such new products are not independent in demand from the old product. In particular, the incumbent can expect that subscribers will migrate from the old to the new product, which means that in general a subscriber for the new product will have terminated her subscription to the old product. This means that in general the diversion ratio will be (close to) one. In contrast, CEG assumes a diversion ratio of zero. This assumption totally distorts the incumbent's decision to innovate.

If we follow Dobbs' assumption that the costs of the old product are (largely) sunk, while the new product requires new investment, the innovation hurdle would indeed be high, because the profit contribution lost by switching to the new product is high. This means that an opportunity cost in the form of this lost profit contribution has to be added to the costs of the new product. Now the main issue at hand is whether an uplift of the allowed WACC will make the investment in the new product more profitable (or if it was not profitable before, make it profitable).

39. The way CEG models the two markets a WACC uplift will lead to the same price increase in both markets. Under the diversion ratio of zero assumed by CEG the profitability in both markets will be increased. This increases the probability that the investment in the new product will occur. It thus stimulates innovation. At the same time consumer surplus in the new market will be created and added to the consumer surplus of the old product. There will be some reduction in consumer surplus due to the price increases in both markets but that is small relative to the newly created consumer surplus. Thus, it becomes plausible why CEG finds that the optimal WACC even under a consumer welfare approach should be above the midpoint of the WACC distribution.

40. Contrast this with the case where diversion ratio is one. Now a WACC uplift no longer induces a greater incentive to invest in the new product. The profit contribution of the old product is increased by the same amount as the profit contribution of the new product. Thus, no shift in investment takes place. In this case there is a net consumer welfare loss because of the higher prices associated with the WACC uplift. For values of the diversion ratio significantly below one a WACC uplift may be improving consumer welfare but such a low diversion ratio appears unlikely.

41. CEG's base case model implementation is distorted by at least three factors. First, the demand assumptions make little economic sense. The new good should create higher not lower willingness-to-pay (but also higher cost) than the old good. Otherwise, nobody would buy it. Second, assuming 75% penetration for the new product targets UFB rather than the relevant very small percentage for copper-based new products. Third, by using total surplus as the yardstick CEG misses the LTBEU objective. In applying the Frontier-Dobbs model it directly estimates the consumer welfare uplift from new products being supplied (something which can usually be missed in a static analysis), but the total welfare estimates effectively ignore large transfers of wealth from consumers to producers – not something which usually fits with the long term benefit of end-users. CEG's justification of the total surplus objective with CEG's model results is more a critique of the model than of the consumer welfare objective. These three issues mean that CEG has taken as its base case one that is largely irrelevant to the current discussion. In contrast, CEG has relegated the really relevant cases to sensitivity runs and has not done (or not reported) the main relevant sensitivities for these runs.

2.8 CEG's cross-submission: Issues from submissions UCLL and UBA

42. CEG has in its cross-submission not directly commented on my November 25, 2014, paper but has raised a number of issues that allow me to clarify my own position.

43. CEG's paragraphs 10-36 are dedicated to WIK's argument that an ORC valuation leads to overvalued assets and that not taking care of reuse will be generous towards the incumbent. In contrast to WIK's position I had supported the Commission's decision on reused assets but nevertheless had called it generous towards the incumbent. My judgment has to be seen in the context of a potential uplift to the measured TSLRIC price. Such an uplift can be justified, for example, if the measured TSLRIC price is viewed as not fulfilling the s18 objectives. My argument was that by not lowering the price for reuse of assets the resulting TSLRIC price becomes sufficiently "profitable" for the incumbent not to jeopardize the s18 objectives.

44. CEG argues against WIK that the re-use approach of WIK, which mirrors that of the European Commission (EC), is inconsistent. However, the EC only applies a "brownfield" adjustment for so-called "non-replicable" assets. Those are assets that have a long remaining life and cannot be duplicated by others. For "replicable" assets an ORC valuation is used. The ownership of non-replicable (and presumably sunk) assets means that the incumbent is the only one who can effectively compete to provide the service. In that sense the incumbent can provide the service at lower cost than an entrant who would have to build such a network from scratch (and would incur TSLRIC to do so).

45. CEG tries to refute WIK's allegation that the technology risk in telecommunications is reflected in the relevant Beta and therefore does not require an additional risk-related compensation. CEG asserts that the technology risk is fully diversifiable and compares it to coin tossing. CEG's criticism is certainly correct in that the technology risk is not fully reflected in the asset Beta. However, the situation is not as simple as CEG makes it. The relevant asset Beta is the result of the firm's overall real business (as opposed to its financial side), which comes from its demand and supply situation. Technology is certainly one of the main contributors and is correlated with all of the firm's other activities. In that sense, the technology cannot be "uncorrelated" with the market if the firm's returns in general are correlated with it. It is, however, unclear how strong the correlation is and therefore how large the effect on the Beta is.

2.9 Network Strategies' (NSL's) cross-submission

46. I again selectively comment on NSL' cross-submission, concentrating on parts of section 6. In particular, NSL attacks Prof. Hausman's assertion that the Commission's TSLRIC estimates would undermine Chorus innovation/investment incentives. Complementing my arguments above against Hausman's claims is NSL's observation that Prof. Hausman totally misses the New Zealand institutional and economic environment. NSL observes that Chorus'

innovation/investment incentives are bent against copper-based services because of its obligation to invest fully in its UFB network. At the same time, according to NSL, Chorus has every incentive to maximize its return from copper-based services because of cost overruns for its UFB network. As explained in my review of the Hausman arguments above Chorus does not need UFB cost overruns as an incentive to maximize copper returns. The copper network is the ideal cash cow and innovations/investment in copper services will only be undertaken if they increase the net amount of that cash.

47. Furthermore, NSL tries to refute Prof. Hausman's arguments about the risks assumed by the original investors in Chorus' sunk network assets. NSL points out that the original investors were the New Zealand taxpayers and that Chorus took over the assets with a full understanding that TSLRIC would be applied for UCLL/UBA starting end of 2014 and that Chorus itself had publicly pointed out the risk of ensuing price reductions. NSL also alerts to the fact that Chorus has collected very high net revenues under the retail-minus regime until end of 2014. In my view, this could contradict Prof. Hausman's and CEG's assertion that Chorus has not over-recovered in the past.

48. NSL counters CEG's argument on the benefits of a UCLL/UBA price uplift in fostering migration from copper to UFB. In NSL' view an increase in the price of copper services will hinder overall broadband growth in New Zealand, because this growth is viewed as limited by affordability. Thus, NSL sees an increase in the price for entry-level broadband services as hindering the move to UFB.

2.10 WIK consult's cross-submission

49. While WIK touches upon many of the issues raised in my November 25, 2014, paper and in my reply to submissions above, there is little that I have not yet addressed in this reply.

50. WIK criticizes uplift proposals in general as distortive and points out that the "orthodox" approach of regulators around the world is to use the midpoint WACC for TSLRIC purposes. Any uplift would therefore require specific justification given that TSLRIC is the legal basis and that UFB investments are already incentivized via subsidies. These subsidies only refer to the building of the UFB network and not to incentives for migration. However, the subsidies lower the price of UFB relative to the cost of copper networks and therefore implicitly incentivize migration to UFB. A second factor discussed by WIK is the lack of a performance adjustment for copper relative to FTTH. WIK points out that the performance delta between copper and fibre would be $17.60 per month if one follows Prof. Hausman's numbers. Even if it were less it would indicate an advantage of fibre over copper at the same price. This definitely should generate migration incentives.

51. WIK points out the high price that New Zealanders already pay for copper access relative to the benchmark countries used for the UCLL IPP. WIK makes this a recurring theme, which is that the benefit to end-users may be jeopardized by such high prices. WIK also alludes to

distortions in inter-platform competition in favor of cable and mobile and to broadband penetration overall that WIK sees suffering from high charges for copper-based services. In addition, WIK alludes to distortions of access seekers' investment incentives downstream.

2.11 Conclusions

52. I have learned a lot from these submissions and cross-submissions, in particular from those that I do not agree with. They have helped me sharpen my focus and hopefully help me explain my views more succinctly. Compared to my November 25, 2014, paper my views have not changed in any major way, though. I still agree with the Commission's Draft Determination's conclusions on the lack of a case for an uplift on the UCLL/UBA price, as long as the main parameters are selected in a neutral way, re-use of assets is not given special credit and there is no performance adjustment for the QoS difference between UFB and copper access.

53. In particular, I see few or no innovation incentives arising from a UCLL/UBA price uplift. Furthermore, migration incentives from copper to UFB are already built into the UFB subsidies, which are reflected in the UFB price, and in the lack of a performance adjustment for the QoS difference.

3. Prof. Hausman's report "Response to the Commerce Commission's Draft Determination on Uplift"

54. Prof. Hausman makes two very general points, from which he derives the conclusion that the Commission should apply an uplift to the WACC and/or price derived by applying TSLRIC. The first argument in brief states that the value of innovations to consumers resulting from such an uplift vastly exceeds the burden from the resulting price increases. The second argument is that the sunk costs for access networks require an uplift for the real option foregone by facilities investment, given that future demand for the facilities is uncertain.

3.1. Prof. Hausman's contention on innovation effects

55. Prof. Hausman is very unspecific about the concrete innovation effects that he sees resulting from an uplift to the WACC and/or price derived by applying TSLRIC to the copper UCLL/UBA. Rather, he refers to the high value attached by consumers to an increase in broadband speed. His numbers here are taken from a paper by Nevo et al. (2013), but with some twisting. Prof. Hausman states (paragraph 11) that "Nevo et al. (2013) estimated that consumers' willingness to pay in the US for a 10 megabit increase in internet speed averages US$17.60 per month." However, in the mentioned paper Nevo et al. refer to an increase in internet speed of 1 megabit per second. They also make it clear that the increase in willingness to pay is non-linear.[2] The willingness to pay increase is therefore strongly depending on the starting speed and on the amount of speed increase. Also, the main focus of the Nevo et al. exercise was to identify differences in willingness to pay between consumer types. Nevo et al. found large differences in willingness to pay and a highly skewed distribution of types. Thus, the median willingness to pay for a 1 megabit increase is US$0.87 rather than the average US$1.76, from which Hausman extrapolated his estimate. Under Prof. Hausman's interpretation of the Nevo et al. data the New Zealand customers should switch to UFB in droves under the currently proposed TSLRIC rates for UCLL and UBA.

56. Prof. Hausman is totally unclear about the way in which a WACC uplift/price increase for UCLL/UBA will result in increased innovations. One interpretation could be the deep-pocket argument that a firm with higher profits is more likely to innovate. However, the firm could easily use the higher profits for something else, such as increased dividends to shareholders. Rather, there has to be a possibility for higher profits through innovation that is triggered by the WACC uplift/price increase (which in itself provides for a higher profit without any

[2] Given that Nevo et al. also talk about speeds of 10, 100 and 1000 megabits a linear increase would indeed look strange.

innovation). What innovation incentives could derive from an uplift to the WACC and/or price for UCLL/UBA? Hausman seems to suggest that the benefits from the deployment of high-speed broadband (such as the UFB) are at stake; but irrespective of what the Commission decides on the uplift question, the UFB is largely committed and hence the benefits from UFB will most likely emerge anyway. What is relevant are the innovation effects that could be attributed to the uplift, not the aggregate innovation effects that would occur anyway. In the following I will therefore concentrate on potential innovations by Chorus in its copper network, such as VDSL with or without vectoring,[3] and in footnote 6 briefly treat potential innovations by others, such as DOCSIS 3.0 for cable.[4] The main issue for Chorus' innovation incentives is how the profitability of potential innovations compares to the profitability of UCLL/UBA.[5] Without an uplift/price increase UCLL/UBA generates only competitive returns in the hypothetical TSLRIC world. However, there will be large profit contributions in the actual forward-looking sense, given that a large part of the loops are sunk and only require maintenance and other operating costs; very rarely will they require replacement. I conjecture that UCLL/UBA wholesale services are also quite profitable in a historic cost world with actual bookkeeping depreciations. Adding an uplift/price increase will increase this profitability. The main question on innovation incentives in Chorus' copper network, however, is, how the profitability of such innovations compares to the profitability of business as usual, i.e., to the sale of copper UCLL/UBA. We are looking only at product innovations.[6] Innovations could either be regulated or not. We will consider both cases.

57. For simplicity we currently assume that the new products replace the old UCLL/UBA offerings one-by-one (diversion ratio = 1). This means that the firm offers a new product in addition to or instead of the old product and that for any unit sold of the new product the firm loses the sale of a unit of the old product. Assuming now that the innovations are not regulated an uplift/price increase for UCLL/UBA would raise the opportunity costs of innovations for Chorus and in that sense would reduce the innovation incentives. In simple words, by innovating in new products Chorus would lose the profit contribution from UCLL/UBA and would have to gain a higher profit contribution from the new products.[7]

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3 See Vogelsang (2014a) for Chorus' UFB innovations. The somewhat related copper to UFB migration aspects are treated below in my discussion of the CEG February 2015 submission.

4 It is clear that some innovation incentives will derive from an uplift in WACC and/or price for UCLL/UBA for the providers of potential substitutes to UCLL/UBA. However, these incentives will be weak in UFB regions because of the investment contracts cum subsidies for UFB, which will handicap innovations by others.

5 Bourreau et al. (2012) call this the wholesale revenue effect. Going against this is the business migration effect, which calls for higher prices of the old relative to the new product in order to induce subscribers to switch. If the new product price is unregulated the firm will choose the price of the new product so as to balance these two effects. If the price is regulated there can be a conflict between the two effects.

6 Process innovations reduce the firm's costs. Under TSLRIC such innovations are particularly likely. Under the famous Arrow argument the incentives for such innovations should be higher at lower output prices, because the innovation applies to a larger output.

7 Note that this cannibalization argument does not hold for Chorus' infrastructure competitors. They would not lose the profit contributions from UCLL/UBA. However, since Chorus' price increase benefits both the old and the

This statement would hold as long as the price of the new product is independent of the price of the old product. A violation of this condition could arise from demand relationships that link the willingness to pay for the new product to the price of the old product. This could mean that the uplift/price increase of UCLL/UBA would have no effect on Chorus' innovation incentives. To conclude, without regulation of new products Chorus' innovation incentives from a WACC uplift/price increase for UCLL/UBA are likely to be negative or at best neutral for new services that replace the old services one-by-one.

58. Without regulation the price of the new services will likely be anchored by the price of the old services. Chorus would then choose a price of the new services that is based on the perceived differential in willingness to pay and on the marginal cost differences. Under regulation of the new service the price of the new product will most likely be determined by cost differences only. The question here is how the WACC uplift/price increase for UCLL/UBA affects the regulated price difference to the new product. If both prices are the same there will be no innovation effect from the uplift/price increase. If prices are proportional to costs and the new product has higher (lower) costs then the difference will be increased (decreased), resulting in additional (reduced) innovation incentives. Note, however, that these incentives are only on the cost differential, not on the total costs.

59. I conjecture that the innovation incentives are strongly depending on the geographic region, specifically (a) the Chorus UFB region, (b) the LFC regions, (c) the cable TV regions, (d) the non-UFB Chorus DSL regions, (e) the non-DSL regions. We therefore turn to specifics of the various regions with a view to the validity of the one-by-one replacement assumed above. The diversion ratio is likely to vary between types of regions and will generally differ from one.[8] When using Prof. Hausman's innovation arguments the Commission should keep in mind (a) the differential probability and scope of such innovations in terms of the regions covered by them, (b) the likely differential uptake by consumers of such innovations, and (c) the UCLL/UBA price increase affecting all consumers taking the UCLL/UFB services. The attribute "differential" here refers to the difference in innovations with or without the WACC uplift/price increase for UCLL/UBA services.

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new products of those competitors, their innovation incentives are not clear cut. Their profit contributions from their old products would increase on account of the market price increase and this raises the bar for the profit contribution from any innovative product they would venture into.

8 The results derived for a diversion ratio equal to one could still hold for smaller diversion ratios, as long as the relevant comparison is incentives to innovate with and without uplift, for a given diversion ratio. A smaller diversion ratio means that the amount sold of the new product is going to be larger than the amount lost for the old product, reducing the opportunity cost of the new product. This opportunity cost is increased by the WACC uplift but the increase is smaller in absolute terms than the increase of the price of the new product, which therefore becomes more profitable. I would, however, argue that the most relevant cases at hand show a diversion ratio at or close to one. As explained in footnote 19 below a diversion ratio of one over a range of price changes and quantity distributions between the old and the new product is not compatible with fixed own and cross-elasticities of demand.

a. The Chorus UFB region: Although Chorus could here invest in enhanced copper access (VDSL), this would be strongly cannibalizing both with UFB and with copper DSL. Since Chorus is investing in UFB anyhow (which implies virtually zero forward-looking costs), there would be hardly any business case for other innovations. If a WACC uplift/price increase in UCLL/UBA were to increase the remaining innovation incentives this would be counter-productive.

b. The non-Chorus UFB regions: The only cannibalization argument valid here is the one w.r.t. UCLL/UBA mentioned in paragraph 57 above. Chorus could here invest in innovative services, such as VDSL, in order to meet competition from the UFB providers. Such incentive could be strong, because copper access will be on its way out, unless it can compete with UFB. Chorus' calculation for innovation investments here will be the differential in profit contributions between UCLL/UBA and the new products, weighted by the differential probability of losing lines to the UFB providers. Generally, the probability of losing DSL customers to UFB providers will increase with a WACC uplift/price increase for UCLL/UBA. However, the same holds for VDSL customers if they experience a similar price increase. If the VDSL customers do not experience the same price increase the innovation incentive over DSL becomes weaker. Thus, in LFC regions the incentives for Chorus to switch to VDSL from a WACC uplift/price increase in UCLL/UBA are ambivalent.

c. Cable TV regions: High-speed cable is likely a very close substitute for VDSL and superior to DSL. Chorus will therefore have strong incentives to install VDSL wherever possible in cable TV regions,[9] in particular in an area like Christchurch that is served by another UFB provider.[10] Chorus will also likely be price constrained here by competition so that a WACC uplift/price increase in UCLL/UBA is unlikely to have any major effect on product innovations in cable TV areas.

d. Non-UFB regions with DSL: In these regions the main calculation for innovation would follow the one described in paragraph 57 above. However, here competition from LTE could factor in, leading to a calculation similar to the one in LFC regions.

e. Non-DSL regions: Here the WACC uplift/price increase for UCLL/UBA would play little or no role for innovation incentives.

60. My conclusion is that there are likely to be very few if any innovation incentives for Chorus from a WACC uplift/price increase in UCLL/UBA. Innovation incentives for other competitors could be higher in the sense that these competitors are likely to increase their

[9] Chorus, however, could also play "puppy dog" and concentrate on the low-quality copper services.

[10] Cable TV is currently limited to Wellington, Christchurch and Kapiti.

market-share against Chorus and would also be more profitable than before.[11] This could hold specifically for cable TV networks and mobile operators.

3.2. The issue of asymmetric risk, sunk costs and real options

61. Prof. Hausman has a history of being adamantly opposed to the TSLRIC concept, because it does not, in his view, adequately address the issue of real options in view of sunk investments (e.g., in Hausman, 1997 and 1999). It is therefore no surprise that he again raises this issue for the current FPP proceeding.

62. According to Prof. Hausman it is widely recognized in academic writing that asymmetric risk creates an investment disincentive and that the "conclusion from the academic research is that regulation should adjust the WACC to take account of this distortion" (paragraph 24). He also notes that Ofcom has recognized this (paragraph 55 and footnote 23). However, there is a difference between acknowledging the issue of asymmetric risk and allowing for an actual uplift based on this acknowledgement. Thus, while Ofcom in 2005 has stated its intention to include consideration of a real-option uplift in the future, it did not do so in the 2005 proceeding cited by Prof. Hausman and, to the best of my knowledge, has not done so since.

63. Prof. Hausman particularly links the asymmetric risk to the issue of stranded assets because of technical or market changes. He mentions AT&T's recent write-down of its copper network (paragraph 27) and the potential write-downs arising from a shutdown in the US of the copper networks altogether (paragraph 28). Changes such as these may caution a regulator when setting lifetimes for network assets. They can certainly affect copper lines and to a lesser extent ducts (which can be used for copper and fibre). There are two potential consequences. The first is for the regulator to shorten the relevant assumed asset lives from the beginning in response to general or specific knowledge about potential technical or market obsolescence of specific assets. The second is to make midstream corrections for asset lives if large unforeseen circumstances arise that particularly affect certain important assets. The latter could, of course, also go in the other direction if technological change unexpectedly increases the lives of assets like ducts or copper lines.

3.3. Other remarks by Prof. Hausman not specifically related to the Vogelsang report

64. Prof. Hausman draws lessons on TSLRIC particularly from the US and the EU. These lessons, in my view, are quite misleading and do not apply to the New Zealand context.

[11] Bourreau et al. (2012) call this the replacement effect. See Cambini (2015).

a. Prof. Hausman (paragraph 6.ii.) claims that "Relaxation of TSLRIC regulation in the US in 2003 led to a significant increase in broadband investment which led to new and improved services" (see also paragraph 14). In the 2003/2005 timespan there were in particular two decisions that can be said to have triggered those improvements. One is that the FCC reduced the scope of regulation by abolishing the UNE-P, which was a very broad wholesale product that allowed entrants to act as a network provider without any network investment. This product had in fact undermined investment incentives both of incumbents and entrants. The other development was that the FCC decided to refrain from regulation of new fibre-based services. Thus, it was not TSLRIC regulation per se but rather all price regulation of these new services that was abandoned. Abolishment of the UNE-P product made the remaining UCLL regulation almost irrelevant, because it essentially bankrupted the two largest wholesale UCLL users, (the old) AT&T and MCI, both of which were swallowed up by incumbent local exchange carriers.

b. Prof. Hausman's assessment of the EU situation relative to New Zealand is also misleading. The European telecommunications incumbents are indeed not as profitable as their main US counterparts. However, that is largely due to bad investments rather than to low wholesale access charges. Examples include Deutsche Telecom's investment in T-Mobile USA or Telefonica's investment in the German mobile sector. The main difference between the US and the EU in terms of the telecommunications infrastructure is that the EU has a much smaller percentage of high-speed cable TV coverage. As a result, the relevant counter-factual to UCLL/UFB wholesale regulation in the EU would be unregulated monopoly, while it would be unregulated duopoly in the US (Cave, 2014). A deregulation policy like in the US therefore was at no point in time a politically viable alternative for the EU, while it was for the US. Contrary to New Zealand the EU has refrained from a concerted effort to reach UFB build-out via contracts cum subsidies. Thus, the EU has to depend on investment incentives from soft regulation (Vogelsang, 2015). In paragraph 15, Prof. Hausman's reference to the EU's low 4G coverage is also misleading, because it refers to the mobile sector and is mostly due to delayed spectrum assignments, having nothing to do with TSLRIC.

65. Prof. Hausman (paragraphs 18 and 19) refers to congestion reduction and reduction of internet outages as sources of consumer gains. However, he does not relate those effects to UCLL/UBA products. While the internet depends on local access, internet quality of service (QoS) depends just as much or more on the core or backbone network. It does not become clear what specific local internet QoS issues are present in New Zealand that could be related to TSLRIC. My conjecture is that Prof. Hausman refers to internet connection speed and local network upkeep. The former would relate to the Nevo et al. (2013) paper, which is about congestion effects. The latter is not really treated by Prof. Hausman. There is some possibility that a higher UCLL/UBA price could induce incumbents to do more network upkeep and maintain higher connection speed, but that would have to come from higher

profits from the additional sales made possible by such speed/upkeep. Thus, higher QoS would have to shift the demand (or supply) outward. In order to undertake the QoS improvement the firm must make more profit on the additional sales than the cost of the QoS improvement (presumably on all output). The WACC uplift/price increase for UCLL/UBA will increase this profit per unit but the higher price will reduce the output increase. The net outcome remains unclear.[12]

66. Prof. Hausman (paragraph 27) claims that, because copper UCLL in the US is still regulated under TELRIC[13], neither (the new) AT&T nor Verizon have invested to upgrade DSL on their copper networks. I doubt this explanation. As explained above, in the US UCLL with TELRIC has ceased to play any significant role since 2003/05. Prof. Hausman's contention also obviously does not hold for AT&T's extensive VDSL network.

67. In paragraph 43 Prof. Hausman claims, "the well-known envelope principle of economic analysis demonstrates that for only a marginal increase in price, change in consumer welfare is very small. For small price increases the change in consumer welfare is approximately linear in the price increase. Thus, for a price increase of say 5% the approximate change in consumer welfare from consuming the product would be approximately minus 5%." In my view, this application of the envelope theorem is incorrect. It appears that Prof. Hausman refers to Roy's identity, which – for Marshallian demand curves – states that for small price changes the consumer welfare change equals minus the price change times the consumption quantity. If the consumption is "access" then the consumption quantity equals the number of subscribers (in the absence of multi-homing). Thus, the welfare effect per consumer equals the price change. But that does not mean that a 5% price increase reduces consumer welfare by 5% (as claimed by Prof. Hausman). Rather, both the absolute price increase and the percentage consumer welfare effect depend on the initial price level. For example, assume a linear demand curve with a choke price of 100 and an initial price of 95. Then a 5% price increase will eliminate all consumer welfare. Prof. Hausman's contention would in this example hold only in the range of an initial price of 33. Thus, Prof. Hausman seems to be appealing to the envelope theorem to produce a seemingly irrefutable result, which is not the case. Rather, it depends on the concrete circumstances.

68. Prof. Hausman's contention (paragraphs 8 and 44) that the consumer welfare from a new product or service equals the area under the demand curve above the price is also a misleading application. In his 2003 article[14], on which this exposition is based, he notes in a

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12 In Vogelsang (2014a, paragraphs 2 and 18) I have argued that there could be a QoS increase for legacy copper services from a UCLL price increase on account of the fact that the resulting out-migration from copper would leave higher-quality RSPs, who have done unbundling investments and provide the UBA portion themselves.

13 The FCC uses the concept of total element long-run incremental costs, which is closely related to TSLRIC.

14 There are two 2003 articles cited in his bibliography. This refers to the one in the Journal of Economic Perspectives.

footnote that vanishing products/services have to be treated symmetrically to new products but that they have little importance. In the current report he has omitted this footnote. In fact if a new product/service has a close substitute then the consumer surplus of the new product/service has to be reduced by the reduction in consumer surplus for the old substitute product. This factor could be quite important for telecommunications access products. Innovations here are often closely related to quality improvements but they also contain product differentiation effects. The most drastic example would be the old copper telephone network, which clearly is being viewed as obsolete. However, there is substantial opposition against shutting it down and replacing it by modern IP networks based on fibre or fixed wireless. This shows that it must still be valued enough by some consumers. More subtle examples refer to the replacement of regular DSL by VDSL and by VDSL with vectoring. In the case of New Zealand migration occurs from copper to UFB products. Clearly, the consumer surplus lost by a consumer moving from copper to fibre is not trivial relative to the consumer surplus gained. For the marginal migrating consumer it will be almost the same. Thus, the innovation effects for consumers are anything but straightforward.

3.4. Prof. Hausman's critique of the Vogelsang paper

69. Prof. Hausman raises a number of critical points about my paper, which I will allude to further down, but will first concentrate on two general points (made, e.g., in paragraph 47). The first is Hausman's accusation that I made no empirical estimates to justify my position, which he calls "hand waving". The second is the accusation that I only consider one side of the issue and therefore do not arrive at a balanced view.

70. It is true that I have not made any empirical estimates to justify my position. This is in fact not much different from Prof. Hausman's approach. While he produces several numbers, they do not refer to the New Zealand context and only pretend precision where there is none. The latter pretence definitely does not hold for my advice to the Commission. It is openly based on my own judgment, not on numbers that may apply to the US but not New Zealand. To give an example, Prof. Hausman asserts a valuation of NZ$285 per year for 10 megabit faster internet speed and asserts that this would be significantly greater than the adjustment for civil works that I claim. There are at least two flaws in this argument. The first is that the willingness to pay numbers only hold for a certain range and only for a subset of the population (way less than 50%, as shown by the median valuation, which is only half the amount claimed by Prof. Hausman). The second flaw is that the assumed 10 megabit increase in speed is not paid for by the higher UCLL/UBA price only but rather by additional investments required but not counted by Prof. Hausman.

71. Regarding the second accusation I admit that my balancing looks different from Prof. Hausman's. He puts almost all the emphasis on sunk investments and the value of foregone innovations and quality improvements and very little on consumer price increases, while I doubt the severity of the sunkness issue and the extent of additional innovations that would

result from a WACC uplift/price increase for UCLL/UBA. As I have shown above, the innovation incentives from a WACC uplift/price increase in the UCLL/UBA cut both ways and are likely to be small. Furthermore, I have remarked in the conclusions of Vogelsang (2014b) that the Commission has been generous in its choices w.r.t. re-use of assets and the MEA and have no reason to believe that the Commission has erred in the other direction on the other parameters. Thus, the two main issues raised by Prof. Hausman carry much less weight than he claims. This is also demonstrated by the range of submissions in this proceeding.

72. Prof. Hausman states that I have neglected "significant academic thinking regarding TSLRIC on investment incentives" (paragraph 6.vii.). He refers, in particular, to Hausman (1997, 1999), Guthrie (2006) and Pindyck (2007) (paragraph 55, also 60). As paragraph 64 of my paper shows, I have included Pindyck (2007) and Guthrie (2012) as well as Hausman (1999) explicitly in my paper. Guthrie (2006) and Hausman (1997), both of which I have known for a long time, might have added some weight but would not have changed the content of my statements.

73. Prof. Hausman finds my "emphasis on the economic lives of ducts incorrect" (paragraph 56). He has a point in noticing that wireless substitution may reduce the total number of fixed lines depending on ducts (both copper and fibre). However, mobile substitution may well use small cells that depend on fixed backhaul, which uses ducts. In any case, an estimation of the economic lives of ducts should be left to the Commission.

74. Prof. Hausman (paragraph 57) emphasizes quality improvements of the copper network in rural areas (also raised more generally in his paragraphs 59 and 64). Maintaining a high level of QoS is an intrinsic problem both of price-cap regulation and TSLRIC pricing, both of which are independent of the regulated firm's actual costs. It is widely accepted that therefore QoS regulation may have to supplement price regulation. A WACC uplift/price increase for UCLL/UBA will likely reduce the QoS issue by increasing the profit from continued service but it is anybody's guess by how much.

75. In paragraph 58 (and again in 62) Prof. Hausman questions my view that the relevant quantity for the TSLRIC estimation should be the quantity sold before the demand decrease. I agree with Prof. Hausman that quantities lost to wireless providers (except in areas where wireless is the relevant MEA) should not necessarily be counted for the TSLRIC estimation. However, as discussed in NSL's cross-submission, demand may also increase due to infill housing. Thus, to the extent that the fixed network overall loses or gains customers a case can be made for adjusting the customer base looking forward.

76. In paragraph 63 Prof. Hausman criticizes my view (in my paragraph 100) that the copper network will be highly profitable. As explained above, this statement does not refer to profits in the TSLRIC world but in a world of actual forward-looking costs. This view should be

fully compatible with Prof. Hausman's assertion that most of the costs in an access network are sunk. I conjecture that it also holds for actual historic costs. Prof. Hausman is correct that the historic cost perspective could have looked differently if the demand reduction for copper had occurred earlier (e.g., without the development of DSL). However, TSLRIC regulation is meant to yield results similar to competition. In a competitive environment demand losses to substitutes usually lead to price reductions rather than price increases. The question therefore is if price regulation should shield incumbents from the downsides of the market (as a compensation for not allowing the firm to benefit from all the upsides). In fact, in a competitive environment the actual UCLL/UBA prices should be lower that the FTTH TSLRIC level because FTTH is a superior product. According to Prof. Hausman's own statements about consumer valuations such a product would command a substantial price premium over copper access. That is the essence of the performance adjustment alluded to in paragraph 108 of my paper. It means at the very least that using the FTTH MEA without performance adjustment is treating UCLL/UBA access very generously. From a competitive equivalence perspective the UCLL/UBA access charges should be substantially below the UFB access charges but according to the current preliminary TSLRIC estimates they are not.

77. In paragraph 67 Prof. Hausman comes back to the "hand waving" argument. He claims that I have identified only two factors against the "efficiency argument (Alfred Kahn), investment risk or lumpiness" and that I provided no empirical analysis. Unfortunately, none of these factors lend themselves to valid empirical statements, at least without substantive quantitative analyses that would easily pass for a doctoral dissertation. I do not pretend having done such an analysis, while Prof. Hausman does.

78. As an overall summary Prof. Hausman has not shown how an increase in the UCLL/UBA price or allowed WACC would lead to more innovations and has overstated the benefits of such innovations to consumers and understated the costs of innovations.

4. The CEG submission: Uplift asymmetries in the TSLRIC price (emphasis on section 5)

79. CEG (in paragraph 11) considers the question of a WACC or price uplift to UCLL/UBA requiring an analysis "grounded in real world outcomes and not the world of the Commission's HEO" (meaning the "hypothetical efficient operator" of the TSLRIC model). I agree that the differences between the real world outcomes and the HEO are relevant for this question, but that is precisely why some of CEG's and Chorus' statements about my observations on the Commission's generosity towards Chorus are misplaced. See, in particular, CEG's section 5.1.2 discussed below in paragraph 94.

80. In paragraph 16 CEG alerts to an absurdity of the HEO world under uncertainty in that using the midpoint WACC would lead to no investment at all 50% of the time. I cannot follow this

interpretation. The HEO is a concept for cost measurement. Rather, the interpretation should be that 50% of the time the costs of the HEO are lower or higher than at the median WACC.

81. In sections 3 and 4 CEG treats asymmetric costs and asymmetric risks as the basis for a WACC uplift/price increase for UCLL/UBA. According to CEG asymmetric costs specifically refer to weak incentives to maintain and invest in Chorus' copper network in the long run. They are deemed to impede migration from copper to UFB and to reduce incentives for Chorus and LFCs to invest in UFB.

82. CEG is correct that over-investment in copper is unlikely under a too high price for UCLL/UBA. There will rather be less investment because of faster migration to UFB and to other competitors. TSLRIC simply does not generate an Averch-Johnson effect, because it is based on the HEO and not the RAB. Even without an Averch-Johnson effect there is, however, still the negative effect of higher prices on consumers. Under-investment is also less of a problem than in an Averch-Johnson world because the firm is not rewarded with a lower rate base. However, some under-investment and insufficient maintenance could occur under a lower price. This will even be a problem under a higher price as long as revenues do not suffer from the lack of upkeep. There simply is a case to be made for QoS regulation under TSLRIC.

83. In paragraph 35 CEG asserts that an innovative new product would be affected ("anchored") by the regulated price of the old product even if the new product were not regulated. While I agree, this does not necessarily affect the innovation incentives, which depend much more on the relative prices than on the absolute prices of the old and new products (as long as the incumbent can finance the innovations). Chorus' argument in paragraph 36 that the Commission does not have other tools at hand for incentivizing innovations than TSLRIC does not change any of this.

84. In section 3.1.2 CEG addresses competition issues and asserts that regulation should be softer in the face of competition in order to shield competitors and encourage build decisions. I allude to this claim below in the context of the Chorus submission. In paragraph 46 CEG asserts that by using the FTTH MEA the Commission is biasing the build or buy decision against build by entrants. However, the build of the MEA is meant to be the efficient choice, not the build of a new copper network.

85. In section 3.2 CEG considers effects of a higher UCLL/UBA price on migration. I have dealt with these effects at length in Vogelsang (2014a). A new aspect added by CEG (in paragraph 47) is that increased migration to UFB could accelerate the date that the copper access network can be shut down, thus reducing the discounted costs of carrying duplicate networks. However, as argued in Vogelsang (2014a, paragraph 35), the shutdown may also be delayed, because the remaining copper customers are more profitable under a higher UCLL/UBA

price. Given the different direction of these effects it is difficult to determine which effect dominates.

86. CEG argues (in paragraph 48) that the net cost to consumers of overestimating TSLRIC may be negative. I doubt that, because the current UFB price is already subsidized. Thus, an overestimated TSLRIC price for copper would increase this imbalance, which is evident from the fact that under current TSLRIC estimates the UCLL/UBA prices for copper exceed those for UFB (acknowledged by CEG in paragraphs 50/51 with reference to the Commission). CEG's statement that a price for fibre higher than the price for copper would be more of a concern than a copper price higher than the fibre price is without any foundation or justification provided.[15]

87. CEG's large section 4 on asymmetric risks addresses a number of issues, to which I have very little to add. This concerns, in particular, CEG's treatment of catastrophic risk and the question to what extent such risks are covered by insurance and Chorus' expenditures on risk management. I will address some issues on regulatory and technological/competitive stranding to the extent that they are not covered in Chorus' submission treated below.

88. CEG (paragraph 70) sees regulatory stranding arise mainly from the emergence of new low cost technologies that replace the old ones and as a consequence immediately lead to a new lower TSLRIC price. This observation is essentially correct and corresponds to the notion that TSLRIC should emulate the effects of competitive markets. If in fact new technologies emerge in competitive markets the market price will reflect these new technologies leading to a write-down of the assets of the old technologies. In real life a question would be how quickly the new technologies spread. They would not be there in the spur of a moment but would take some time for deployment. However, usually a new MEA and the accompanying TSLRIC calculation also take some time. FTTH has been deployed in Japan for about 15 years now. So, the switch to the new MEA is not going to be immediate. As noted above the effect of a new technology on the old technology in a competitive market is a write-down of the asset. Thus, the way to treat this type of "regulatory stranding" is via the required depreciation/asset life. This is, what the Commission has done.

89. CEG goes through some hypothetical examples of different technologies and the regulatory responses to them (paragraphs 81ff) as if the regulator could anticipate such technological changes with precision. However, costs and deployment dates and success of new technologies are usually not known. Thus, the regulator has to use depreciation rates to capture the effects of yet unknown technological changes. This would in effect mean the third of CEG's options to overcome stranding (paragraph 85), but it would not use a WACC uplift.

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15 On the other hand, a higher price for copper than for fibre access can be expected, given that FTTH is the MEA for most of the population and given that UFB in New Zealand is subsidized.

90. In the area of technological stranding CEG (paragraphs 88 and 99ff) adds to Chorus' submission discussed below that technological changes reduce the incumbent's demand through the offerings of new competitors and that this would justify higher UCLL/UBA charges. CEG here essentially says that the incumbent should be allowed to counter the new competition with a regulated price increase. Again, I see the possibility for asset write-downs leading to shorter expected asset lives. I expect both the expectation of technological change and increased competition to be partially reflected in the firm's Beta for the WACC calculation.

91. A potentially relevant contribution by CEG (section 4.3.3, based on Salinger, 1998) is that the expected value of different annuities for different asset lives is above the value of an annuity for the expected asset life. Without concrete data it is hard to assess the size of this effect, but it is worth looking into.

92. CEG's section 5 is largely devoted to my judgment that cost increases from not allowing the re-use of assets and from not making a performance adjustment would fully compensate (a) unrealistic efficiency requirements under TSLRIC, (b) network externalities from migration to UFB, and (c) cost under-estimates. CEG disagrees on three key points (paragraph 112). First, in their view, re-use of assets does not reduce cost measurements. Second, a performance adjustment would require quid-pro-quo modelling of very high entry costs for the new technology. Third, the Commission's other modelling choices (in particular on the relevant demand and on asymmetric risk) cannot be called generous.

93. In section 5.1.1 CEG essentially reinterprets the re-use of assets as a basis for valuation that does not change anything. While I had suggested that (sunk) re-used assets should be valued at their opportunity cost (which means in their best alternative use), CEG wants that such re-used assets yield "the same revenue stream as calculating a tilted annuity form of depreciation to an optimised replacement cost" (paragraph 117). This is not, however, how the re-used asset approach has been applied in practice. Proponents of the re-used asset approach see the difference as follows: Under the replacement asset approach the starting point is a new MEA built from scratch and then depreciated over time and converted into an annuity. Under the re-used asset approach an old (presumably sunk) asset is used at its depreciated value (which can be zero) and assessed with its remaining life. It will then only be replaced with a new asset after that. This then reduces the discounted value of all costs that would be relevant for creating an annuity. In contrast, CEG wants the reused asset evaluated based on the price of a new replacement asset evaluated with its remaining expected life. While this is a possible interpretation of the valuation of re-used assets, it is not what the proponents of this approach have in mind.

94. In section 5.1.2 CEG uses the Commission's statement about performance adjustments (i.e., that they would be difficult to implement and would create uncertainty) as a reason to dismiss such adjustments. However, performance differences are a matter of **reality** (in

CEG's dichotomy between real life and HEO). Thus, according to CEG it should be legitimate to use them as factors for the assessment of a potential price increase in UCLL/UBA. Neumann and Vogelsang (2013) provide a method how this could be done, based on the increased willingness to pay for the superior product. Prof. Hausman has provided the number of NZ$285 per year increase in willingness to pay per 10 megabit speed increase. A similar adjustment can be made between copper and UFB.

95. CEG's section 5.2 deals with efficiency factors, investment risks and lumpiness. In my paper (Vogelsang, 2014b) I have indicated that efficiency is never perfect, even in TSLRIC modelling. CEG nags on the issue of instantaneous deployment of new technologies, which I have rejected above. In this context CEG cites a 2003 FCC decision that even an efficient network reflects a mix of old and new technologies. This is perfectly fine and correct. However, under economic depreciation the costs under all technologies are the same for the same purpose. Also, to the best of my knowledge neither the FCC nor currently the Commission use a scorched earth approach. Rather, the TSLRIC network is customarily based on the current network topology.[16]

96. I agree with CEG (section 5.3) that the Commission's demand assumption based on my advice may be demanding for the incumbents. In my view, adjustments could be considered based on expected demand reductions from fixed-to-mobile substitution but also based on demand increases from more households.

97. My only comment on CEG's section 6, which covers a suggested empirical approach via Monte Carlo simulations, is that it appears to be totally unworkable in the current proceeding. It would require probability assessments for various parameters that are not available at all.

5. Chorus' submission (paragraphs 285-291 and 642-687)

98. Chorus' main critique of my paper is that I state as factors of regulatory generosity towards the incumbent some items that follow naturally from the New Zealand statutes on the pricing principles. I agree that that this "generosity" only flows from the statute. As comes out from my paper TSLRIC is by no means a static concept but rather one that develops with the state of the art. Whether the EU/UK decisions to accept the re-use of assets or the Swiss regulator's decision to allow for a performance adjustment are still within the limits of the TSLRIC concept, is a question of debate. The European Commission at least has stated that their approach is the natural one under TSLRIC with new technological developments. In light of these developments I have argued for a more conservative approach, which happens to be generous for the incumbent relative to these new developments abroad. I cannot judge

[16] This bewilderment about CEG's view that the Commission is using a greenfield approach is shared in NSL's cross-submission, p. 64.

if these new developments would have been compatible with the New Zealand statutes. Nevertheless, the conservative approach is generous relative to an alternative standard, under which prices would result that reflect re-use of equipment and would reflect performance adjustments. This is relevant, when it comes to the question of a WACC uplift/price increase for UCLL/UBA. For example, a UCLL/UBA price without performance adjustment distorts the resulting copper-based prices relative to UFB and will lead to faster migration. If one put a WACC uplift on top of that the distortion will be enhanced.

99. Chorus (paragraph 649) notes that modifying the TSLRIC method to take account of re-use of assets would be "in direct contradiction with the build or buy principles and promotion of efficient investment" and would "bias an RSP's build or buy decision towards purchasing regulated access at odds with the section 18 purpose". While I agree that taking account of re-use would be wrong in the New Zealand context,[17] the bias that Chorus asserts is less than obvious. If the incumbent can lower its costs relative to the RSPs by re-using assets then it would be more efficient that the incumbent builds rather than the RSP. Chorus (paragraph 650) falsely asserts that I have overlooked this key build or buy efficient investment principle. It has been the subject of another paper of mine for the Commission (Vogelsang, 2014a). In it, however, I do caution against incentivizing copper investment in UFB regions at this time.

100. In paragraph 653 Chorus notes (with reference to Analysys Mason) that a TSLRIC with performance adjustment would not cover replacement cost. That is true w.r.t. a copper network. This would, however, provide the right build or buy decision to rather invest in an FTTH and not in a copper network.[18]

101. In paragraphs 654ff Chorus (based partially on the Hausman and CEG submissions) claims that major supply outages of its network could cause severe social damages similar to electricity. Chorus' obvious conclusion is that if electricity receives a WACC uplift based on this argument so should Chorus. There do not appear to exist similarly good numbers backing this contention as there are for the electricity context. This most probably already hints at the conjecture that the public is not viewing this problem as seriously. Rather, this is more viewed as a national (or local) security problem that needs to be resolved outside the TSLRIC proceeding. Chorus (in footnote 152) provides anecdotal examples of network failures, but it remains unclear how they are investment-related.

102. Chorus (in paragraph 658) is correct that copper investments in rural, non-UFB areas may be worth encouragement. But, in my view, this is quite limited. Most of the action w.r.t.

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17 The main reason is that in New Zealand there have been no windfall gains from past TSLRIC application. The re-use approach would also hurt predictability of the TSLRIC concept.

18 I cannot judge the difference between TSLRIC costs for FTTH vs. FTTN, as suggested by Prof. Hausman in his submission. It appears that FTTN is an interim technology with less of the long-term future than FTTH but it may have a future in less densely populated areas.

high-speed internet here will instead come from the mobile carriers (4G and higher) and from fixed wireless (under the rural broadband initiative providing fixed wireless broadband to around 90% of homes outside of the UFB area).. I conjecture that a large fraction of the remaining rural areas in New Zealand are without DSL and therefore do not fall under the current proceeding. This leaves a small number of loops that would be affected by this proceeding. These loops are largely in place so that the main investments would be in maintenance, possibly in upgrade to DSL. Given the small percentage of loops affected in rural areas even without a WACC uplift/price increase Chorus should be generating ample profit contributions to incentivize the upkeep and upgrades. It is not clear why the whole copper-dependent New Zealand population should have to pay for that.

103. In paragraph 664 Chorus (based on the CEG submission) makes the case for a higher price for UCLL/UBA based on the competition argument. Accordingly, competition is claimed to suffer from too low prices by the incumbent. This argument has been used before in the price-cap context (e.g., by Abel, 2000). It basically says that a higher regulated price will encourage infrastructure-based competition, while a lower regulated price will reduce such competition. At the same time, competition protects consumers against exploitation by the dominant firm. However, setting a high regulated price in order to promote/protect duplication of the local loop may not be efficient if such duplication is costly. The argument does not take account of the trade-offs i.e., a higher price may well encourage infrastructure-based competition, but at the same time if the price is too high this will harm consumers. Absent quality improvements, such competition accompanied by higher prices will not be in the long-term benefit of end-users. Because it is so self-serving the competition argument is suspicious when coming from the incumbent and would carry much more weight when coming from the competitors.

104. In paragraph 668 Chorus recommends following the European Commission's example of allowing for a WACC uplift for the FTTH MEA based on the higher risk of FTTH (but refrain from following the European Commission in other respects!).[19] In paragraph 669 Chorus refers to five types of uncertainty it considers relevant. The question for any uncertainties relevant for a WACC uplift is always to what extent they are already captured in the (capital) market risk and the Beta relevant for calculating the WACC. For example, macroeconomic uncertainty should definitely have been captured in the market risk. The other four types of uncertainty mentioned by Chorus should at least partially be captured in the Beta. Furthermore, when using FTTH as the relevant MEA one is looking at the fixed network market in general, not at the UFB market. Thus, it is only the demand uncertainty for fixed network access that would matter.

19 NSL (pp. 69/70) and WIK (paragraph 73) in their cross-submissions point out that the EC used the uplift only for new FTTH networks, not for FTTH as the copper MEA.

105. In paragraphs 677ff Chorus deals with the danger of asset stranding due to new technological and market developments. Contrary to the Commission's claim Chorus argues that it is not compensated for these developments, although the Commission uses Chorus' own estimate of expected asset lives. In my view, the Commission has made a smart move in adopting Chorus' own estimates for expected asset lives. This puts the burden of proof on Chorus rather than on the Commission to show that they systematically overestimated the asset lives in light of potential new technological and market developments. Such proof probably takes more than the anecdotal and conjectured evidence provided by Chorus in these paragraphs.

106. Chorus' remarks on regulatory stranding (paragraphs 684ff) are, in my opinion, only an extension of the technological/market stranding discussion. It is clear that a potential change in the MEA (or in prices of inputs) should be anticipated in the TSLRIC calculation. Chorus thinks that these anticipated changes should be taken care of in an uplift to the WACC. However, systematically they are really related to asset values and therefore to depreciation and therefore to asset lives. If a new technological development leads to a new MEA this means that the old assets have to be revalued relative to their competitive value vis-à-vis the MEA.

6. Spark's submission

107. Similar to my paper Spark also argues that the absence of reuse and performance adjustment lead to a higher price. In addition, Spark (in paragraph 370) notes in stark contrast to Hausman, CEG and Chorus that the modeling decisions not treated in my paper (i.e., everything but the re-use decision and the lack of QoS adjustment for the MEA) "tend to result in higher rather than lower estimates" than the true costs. Spark further elaborates (backed by WIK and NSL), stating that the parameter values chosen by the Commission were overly generous to Chorus. The combination of these statements with those of Chorus and its advisors give me confidence that those of the Commission's estimates that I had not discussed in my paper were on balance neutral, if not conservative. Spark (in paragraphs 381 and 383) suggests that it would be best if the Commission tried to get each input (price or quantity) right, including the WACC.[20] This is a lofty goal but correct in principle. I do not see, however, how this can be done for all inputs so that there has to remain some room for the Commission's judgment.

[20] A similar position is taken by Dobbs (2015).

108. In paragraph 385 Spark accuses me of neglecting the other side, which is that of the social costs of too high an FPP TSLRIC price. While the other side comes out implicitly from many of my arguments against a WACC uplift/price increase, I may not have explicitly addressed this issue in my paper (Vogelsang, 2014b). It has been at the heart of several of my other papers for the Commission (e.g., Vogelsang, 2013a and 2014a). The main arguments here relate to (a) higher prices borne by a large number of consumers (whereas the benefits either are not for the LTBEU or only affect a small subset of consumers) for a long time and (b) competitive distortions between different modes and different types of competitors. Probably not relevant in the context of TSLRIC are over-investments by the incumbent.

7. Vodafone's submission (B3.1-B3.16)

109. The comments in section B of Vodafone's submission are not on my paper cited in the title of this reply but rather on Vogelsang (2014a). Vodafone refers to my statements there on positive externalities potentially generated by increased migration from copper to UFB resulting from a higher UCLL/UBA price and to the consequences drawn by the Commission from this statement. I have to admit that this section of Vodafone' submission reads more like a critique of the Commission rather than a critique of my paper. However, it provides a particular interpretation of my paper and expresses the view that the Commission has misinterpreted my paper. I will try to address both.

110. My statements on externalities in this paper have been intentionally tentative, because I could not find any quantitative evidence but found the emergence of such externalities entirely plausible. I also noted that there could be negative network externalities on copper subscribers from migration away from copper but conjectured that they would be smaller than the positive externalities for UFB subscribers. Vodafone seems to be saying that the Commission misinterpreted my statements by placing too much weight on them (when they were only tentative). While I made my statements more tentative in order to be on the safe side, Vodafone makes them look a lot more tentative than they were.

111. Did the Commission miss-interpret my statements? The Commission did not use my statements as the basis for a WACC or price uplift but rather only as the basis for an approach to the measurement of uncertain parameters. I can fully understand this consequence and could have come to a similar conclusion. Vodafone also seems to be (implicitly) suggesting that the Commission needs some stronger evidence on which to base its decisions on uplift. The Commission has meanwhile taken steps in this direction, for which I applaud them

8. The CEG submission: Welfare effects of UCLL and UBA uplift

112. This CEG submission builds on Frontier's adaptation of the Dobbs (2011) model for last year's WACC proceeding for energy networks. The submission is related to my November

25, 2014, paper only insofar as it addresses the uplift question prominently discussed in my paper. In the following I provide some general critique of CEG's further adaptation and its suitability for the current FPP.

113. As CEG remarks (paragraph 3), Dobbs (2014) had stated that his model was intended with a view of the telecommunications industry rather than energy markets. CEG jumps on this as a justification for using it in the current proceeding. Unfortunately, the Frontier-Dobbs model has a major drawback for the telecommunications application that both Dobbs (2015) and CEG (paragraph 14) acknowledge. It is that the model addresses three (in the current implementation two) markets that are completely separate. In the model they have totally independent costs and demands. CEG tries to overcome this lack of cross-elasticities on the demand side by using more elastic own demands for the "new" product than for the old product, but does not solve the real problem, which is the resulting zero diversion ratio.[21] Dobbs (2015), in my view, correctly addresses the measurement of consumer surplus in the presence of cross-elasticities but leaves out the negative effect of positive cross-elasticities on the firm's incentives to innovate as described in the following paragraph.

114. CEG assumes that the incumbent operates in an old market with a large number of subscribers. This old market in the Frontier-Dobbs model is characterized by sunk costs and an effective obligation to serve, which means that independent of the actual realization of the WACC relative to the allowed WACC the incumbent will serve all demand for this product (at the regulated price). The firm can invest in a new product. It will do so only if the realized WACC is smaller or equal to the allowed WACC. CEG assumes a particular probability distribution for the WACC and then runs simulations to find the optimal allowed WACC (where "optimal" refers to either total surplus maximizing or consumer surplus maximizing). In its base case CEG assumes the old product to be copper telephony/DSL and the new product to be UFB. CEG also runs (for reasons of sensitivity only) versions with VDSL etc. as the new product. It should be clear at the outset that any of such new products are not independent in demand from the old product. In particular, the incumbent can expect that subscribers will migrate from the old to the new product, which means that in general a subscriber for the new product will have terminated her subscription to the old product. This means that in general the diversion ratio will be (close to) one. In contrast, CEG assumes a

21 This follows directly from zero cross-elasticities. Formally the diversion ratio is defined as the ratio between the cross-elasticity of the new good w.r.t. the price of the old good and the own elasticity of the old good, multiplied by the quantity of the new good divided by the quantity of the old good. Thus, if the cross-elasticity is zero the diversion ratio is zero also. If, for example, the cross-elasticity is 1.2 and the own elasticity 0.4 and the quantity of the new good is 1% of the quantity of the old good, then the diversion ratio is 0.03. On the other hand, if for the same elasticities the quantity of the old good is 1% of the quantity of the new good the diversion ratio is 300. This little example shows that a diversion ratio of one can only be maintained if cross- and/or own elasticities change, as the market for the new product grows relative to the market of the old product. In the current example of fixed elasticities a diversion ratio of one can only be observed if the new product quantity is 1/3 of the old product quantity. A simple condition for the diversion ratio to be one is that the own and the cross derivatives are the same in absolute terms.

diversion ratio of zero. This assumption totally distorts the incumbent's decision to innovate. If we follow Dobbs' (2011) assumption that the costs of the old product are (largely) sunk, while the new product requires new investment, the innovation hurdle would indeed be high, because the profit contribution lost by switching to the new product is high. This means that an opportunity cost in the form of this lost profit contribution has to be added to the costs of the new product.[22] Now the main issue at hand is whether an uplift of the allowed WACC will make the investment in the new product more profitable (or if it was not profitable before, make it profitable).

115. The way CEG models the two markets the old and the new product have the same TSLRIC costs and prices. Thus, a WACC uplift will lead to the same price increase in both markets. Under the diversion ratio of zero assumed by CEG the profitability in both markets will be increased. This increases the probability that the investment in the new product will occur. The price increase thus stimulates innovation. At the same time consumer surplus in the new market will be created and added to the consumer surplus of the old product. There will be some reduction in consumer surplus due to the price increases in both markets but that is small relative to the newly created consumer surplus (unless one assumes an elastic linear demand curve for the new product). Thus, it becomes plausible why CEG finds that the optimal WACC even under a consumer welfare approach should be above the midpoint of the WACC distribution.

116. Contrast this with the case where diversion ratio is one. Now it is no longer the case that a WACC uplift induces a greater incentive to invest in the new product. The profit contribution of the old product is increased by the same amount as the profit contribution of the new product. Thus, no change in innovation takes place. In this case there is a net consumer welfare loss because of the higher prices associated with the WACC uplift. For values of the diversion ratio significantly below one a WACC uplift may be improving consumer welfare but such a low diversion ratio appears unlikely.[23]

117. I have several more specific issues with the CEG model implementation.

a. CEG's demand assumptions naturally translate into consumer surplus assumptions. As can be seen from CEG's Figure 2, the allowed WACC percentile has almost no effect on the consumer welfare of the old product. The reason is that this consumer surplus is so large that even a reduction by several billion NZ$ is hardly detectible on the graph. These are really big consumer surplus numbers. They derive from the assumption of a constant demand elasticity of 0.43 and a choke price of NZ$523. While there may exist people

[22] To be exact, the relevant opportunity cost is the profit contribution of the old product multiplied by the diversion ratio. For the logic behind this see DeGraba (2003).

[23] It may hold for higher values of the diversion ratio if without a commensurate increase in cost the consumer valuation of the new product is sufficiently higher than of the old product.

willing to pay NZ$523 per month for such a service, the question is how many. My conjecture is that the number of such people implied by the constant elasticity demand curve is substantially larger than those with an actual willingness to pay in that range. Overall, CEG's demand assumptions make little economic sense. The new good should create higher, not lower willingness-to-pay (but also higher cost) than the old good. Otherwise, nobody would buy it.

b. CEG builds a large straw-man by assuming for its base runs that the new product is subscribed by 75% of the New Zealand population, meaning that the new product is UFB, to which Chorus has committed without any WACC uplift for UCLL and UBA.

c. Even after the Commission has made a clear decision in favor of a consumer welfare approach in last year's WACC proceeding for energy networks, CEG cannot let go of its total surplus approach. In applying the Frontier-Dobbs model it directly estimates the consumer welfare uplift from new products being supplied (something which can usually be missed in a static analysis), but the total welfare estimates effectively ignore large transfers of wealth from consumers to producers – not something which usually fits with the long term benefit of end-users.[24] This distracts the reader from the potential contribution of the paper and relegates the main results to the status of sensitivity runs. CEG justifies its insistence on the total surplus approach by pointing out that the Dobbs/Frontier model for the old product alone only generates an "optimal" rate of return of 1%, which would "tend to result in expropriation of sunk investment". In my view, if anything this calls into question the appropriateness of the Frontier-Dobbs model in the current context. Generally, sunk costs have in this proceeding been treated similar to other costs and the old services have received a rate of return equal to the WACC.[25]

d. Without explicitly stating so CEG seems to assume that new services created by the incumbent will be regulated with probability one. Since, for example, VDSL services are currently not regulated this appears to be an unrealistic assumption. One can still argue (as I did above) that the unconstrained price of new services is anchored in the price of old regulated services, but that link is not straightforward.

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24 Dobbs (2015) presents a spirited defense of the total surplus approach based on the argument that the whole New Zealand population represent telecommunications end-users and thus all effects of regulated pricing accrue to those consumers (except for foreign shareholders and input suppliers of the regulated firms). However, this approach is not convincing in the current context. The legislator could have easily chosen the New Zealand "population" or "citizens" instead of "end-user". It is hard to believe that the wording has been random rather than being purposeful. Thus, being an "end-user" characterizes a person in her or his *role* as a consumer and not as a worker or investor. In the context of regulation (or competition policy) distinguishing consumers from producers makes a lot of sense, because consumers are viewed as the weaker parties that need protection. This does not mean that producers are neglected in the current context, because they will only invest and innovate (in the long run) if they can make sufficient profits. However, in terms of optimization those necessary profits need not be taken care of in the objective function but rather they constrain the set of relevant policies.

25 The debate about the valuation of reused assets can be interpreted as one about sunk assets, but the Commission has decided to treat re-used assets like any other assets.

118. These last issues mean that CEG has taken as its base case one that is largely irrelevant to the current discussion. In contrast, CEG has relegated the relevant cases to sensitivity runs and has not done (or not reported) the main relevant sensitivities for these runs.

119. In sections 4.5 and 5 CEG refers to the Oxera model prepared for the New Zealand Commerce Commission for last year's WACC proceeding for energy networks. Since Oxera has prepared a related analysis for the Commission in the current proceeding, I refrain here from discussing CEG's current contribution on the Oxera model.

120. My critique does not mean that the Frontier-Dobbs model is useless for the telecommunications sector. It just does not work in the current context. It might have worked for the situation when wireless was a new service. At that time it was not clear if wireless was a complement or substitute for fixed line services. Thus, the diversion ratio in that case would have been reasonably close to zero, but that certainly does not hold for the current situation in New Zealand.

9. CEG's cross-submission: Issues from submissions UCLL and UBA

121. CEG has in its cross-submission not directly commented on my November 25, 2014, paper but has raised a number of issues related to my paper. I will here selectively comment only on those issues.

122. CEG's paragraphs 10-36 are dedicated to WIK's argument that an ORC valuation leads to overvalued assets and that the reuse of assets should lead to lower prices, meaning that not taking care of reuse will be generous towards the incumbent. In contrast to WIK's position I had supported the Commission's decision on reused assets but nevertheless had called it generous towards the incumbent. This judgment has to be seen in the context of a potential uplift to the measured TSLRIC price. Such an uplift can be justified, for example, if the measured TSLRIC price is viewed as not fulfilling the s18 objectives. My argument was that by not lowering the price for reuse of assets the resulting TSLRIC price becomes sufficiently "profitable" for the incumbent not to jeopardize the s18 objectives. I added the lack of a performance adjustment to this and will come back to that below.

123. CEG argues that WIK's re-use approach, which mirrors that of the European Commission (EC), is inconsistent. However, the EC only applies a "brownfield" adjustment for so-called "non-replicable" assets (as also pointed out in NSL's cross-submission, p.66). Those are assets that have a long remaining life and cannot be duplicated by others. For "replicable" assets an ORC valuation is used. The ownership of non-replicable (and presumably sunk) assets means that the incumbent is the only one who can effectively compete to provide the service. In that sense the incumbent can provide the service at lower cost than an entrant who would have to build such a network from scratch (and incur TSLRIC to do so).

124. In section 3 CEG refers to technological risk, trying to refute WIK's allegation that the technology risk in telecommunications is reflected in the relevant Beta and therefore does not require an additional risk-related compensation. CEG rightly points out that the measured WACC that is based on the CAPM does not in and of itself compensate for diversifiable risk. At the same time, CEG asserts that the technology risk is fully diversifiable and compares it to coin tossing. CEG's criticism is certainly correct in that the technology risk is not fully reflected in the asset Beta. However, the situation is also not as simple as CEG makes it. The relevant asset Beta is the result of the firm's overall real business (as opposed to its financial side), which comes from its demand and supply situation. Technology is certainly one of the main contributors and is correlated with all of the firm's other activities. In that sense, the technology cannot be "uncorrelated" with the market if the firm's returns in general are correlated with it. It is, however, unclear how strong the correlation is and therefore how large the effect on the Beta is.

125. In paragraphs 57 and 58 CEG asserts an asymmetry in the Commission's treatment of asset valuation, stating that "when technological change is slower than expected, the HEO will recover exactly the efficient cost determined by the Commission, …but when technological change is faster than expected, the HEO will recover less than the efficient cost". …"This is because technical change will only ever lower costs." However, the cost reduction may be less or come later than assumed in the Commission's model.

126. In section 4 CEG addresses population growth and its potential effects on unit costs. In paragraph 65 CEG asserts that population growth in urban areas would reduce unit costs, while population growth in rural areas would raise unit costs across New Zealand. This assessment totally depends on the composition effect and ignores the scale effect. If population grows at the same rate in both areas costs unequivocally will be reduced, because in both areas the density, which is relevant for the unit costs, increases. Only if the population in rural areas increases relative to the population in urban areas can there be an overall increase in average unit costs but even that only happens if the composition effect trumps the scale effect.

127. I refrain from commenting on section 6 on WACC estimation.

10. Network Strategies' (NSL's) cross-submission

128. I will again selectively comment on NSL's cross-submission, leaving out sections 1-5.

129. In section 6.1 NSL in particular emphasizes why in their opinion the Commission may have overestimated the true TSLRIC of the UCLL and UBA services and why TSLRIC may lead to cost over-recovery rather than the under-recovery claimed by Prof. Hausman and CEG. In particular, they list seven points (p. 65) that provide some evidence that the Commission has not underestimated the TSLRIC.

130. In section 6.2 NSL attacks Prof. Hausman's assertion that the Commission's TSLRIC estimates would undermine Chorus innovation/investment incentives. Complementing my arguments above against Hausman's claims is NSL's observation that Prof. Hausman totally misses the New Zealand institutional and economic environment. NSL observes (p. 68) that Chorus' innovation/investment incentives are bent against copper-based services because of its obligation to invest fully in its UFB network. At the same time, according to NSL, Chorus has every incentive to maximize its return from copper-based services because of cost overruns for its UFB network. As explained in my review of the Hausman arguments above Chorus does not need UFB cost overruns as an incentive to maximize copper returns. The copper network is the ideal cash cow and innovations/investment in copper services will only be undertaken if they increase the net amount of that cash.

131. In section 6.3 NSL tries to refute Prof. Hausman's arguments about the risks assumed by the original investors in Chorus' sunk network assets. NSL (p. 70) points out that the original investors were the New Zealand taxpayers and that Chorus took over the assets with a full understanding that TSLRIC would be applied for UCLL/UBA starting end of 2014 and that Chorus itself had publicly pointed out the risk of ensuing price reductions (p. 71). NSL (pp. 71/72) also alert to the fact that Chorus has collected very high net revenues under the retail-minus regime until end of 2014.[26] In my view, this contradicts Prof. Hausman's and CEG's assertion that Chorus has not over-recovered in the past.

132. According to NSL (pp.71-74) Prof. Hausman also misses the New Zealand context in his criticism of TSLRIC in distorting the build or buy decision of access seekers because, in their view, the access seekers' incentives to build new networks is already eliminated by Chorus' subsidized UFB network.

133. In section 6.5 NSL counters CEG's argument on the benefits of a UCLL/UBA price uplift in fostering migration from copper to UFB. In NSL's view an increase in the price of copper services will hinder overall broadband growth in New Zealand, because this growth is viewed as limited by affordability. Thus, NSL sees an increase in the price for entry-level broadband services as hindering the move to UFB.

11. WIK consult's cross-submission

134. While WIK touches upon many of the issues raised in my November 25, 2014, paper and in my reply to submissions above, there is little that I have not yet addressed in this reply.

[26] See also section 2.6.1 of the WIK cross-submission and section 2.6.2, which makes the point that Chorus makes very little investment in its copper network, although it is compensated for investment that would maintain the network at its current level indefinitely.

135. WIK criticizes uplift proposals in general as distortive and points out (in paragraph 27) that the "orthodox" approach of regulators around the world is to use the midpoint WACC for TSLRIC purposes. I agree that any uplift would require specific justification given that TSLRIC is the legal basis and that UFB investments are already incentivized via subsidies. These subsidies only refer to the building of the UFB network and not to incentives for migration. However, the subsidies lower the price of UFB relative to the cost of copper networks and therefore implicitly incentivize migration to UFB. A second factor discussed by WIK in paragraph 44 and section 2.10 is the lack of a performance adjustment for copper relative to FTTH. WIK (paragraph 44) points out that the performance delta between copper and fibre would be $17.60 per month if one follows Prof. Hausman's numbers..[27] Even if it were less it would indicate an advantage of fibre over copper at the same price. This definitely should generate migration incentives.

136. WIK in section 2.2 points out the high price that New Zealanders already pay for copper access relative to the benchmark countries used for the UCLL IPP. WIK makes it a recurring theme that the benefit to end-users may be jeopardized by such high prices. WIK (paragraph 38) also alludes to distortions in inter-platform competition in favor of cable and mobile and to broadband penetration overall that WIK sees suffering from high charges for copper-based services (section 2.4 and paragraph 81). In addition, WIK alludes to distortions of access seekers' investment incentives downstream (paragraph 47).

12. Conclusions

137. I have learned a lot from these submissions and cross-submissions, in particular from those that I do not agree with. They have helped me sharpen my focus and hopefully help me explain my views more succinctly. Compared to my November 25, 2014, paper my views have not changed in any major way, though. I still agree with the Commission's Draft Determination's conclusions on the lack of a case for an uplift on the UCLL/UBA price, as long as the main parameters are selected in a neutral way, re-use of assets is not given special credit and there is no performance adjustment for the QoS difference between UFB and copper access.

138. In particular, I see few or no innovation incentives arising from a UCLL/UBA price uplift. Furthermore, migration incentives from copper to UFB are already built into the UFB subsidies, which are reflected in the UFB price, and in the lack of a performance adjustment for the QoS difference.

[27] In paragraph 75 WIK point out a contradiction in Prof. Hausman's submission. It is that he postulates UCLL/UBA uplifts based on on-cost arguments but rejects the performance adjustment argument because it is based on demand factors (Hausman, 2014, FN 22).

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