Current academic thinking about how best to implement TSLRIC in pricing telecommunications network services and the implications for pricing UCLL in New Zealand

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November 25, 2014

1. Executive summary

1. In the current New Zealand context the TSLRIC concept is applied to wholesale charges for bottleneck access to unbundled local loops (UCLL) and unbundled bitstream access (UBA).[1] The wholesale access seekers combine these wholesale services with other network inputs (from the core and concentration networks) and retail services.

1.1. Academic thinking about the classical TSLRIC concept

2. The classical concept of TSLRIC as the subject of this section has been developed for growing markets. TSLRIC is an average cost concept, as it should be in order to be compatible with cost coverage for the regulated firm. At the same time it represents efficient costs, thus assuring that consumers get the best possible deal among all average cost concepts. Because TSLRIC are independent of the regulated firm's actual costs the resulting regulated prices provide the strongest possible cost-reducing incentives for the regulated firm, stronger than price caps, which usually are adjusted after a few years to the firm's actual costs.

3. TSLRIC are consistent with competition *in* the market and *for* the market and, if correctly calculated, provide sufficient investment incentives for incumbents, for potential access seekers (both downstream and for make or buy) and for intermodal competitors. The competitive and investment incentives as well as allocative efficiency properties of TSLRIC have to be seen against the constraint of an average cost concept that is kept constant for some length of time and that is averaged geographically. Such concept cannot deliver all the advantages of fully flexible pricing in unregulated competitive markets. Thus, TSLRIC cannot be as allocatively efficient as marginal cost prices (which in the network setting would not cover costs) or as Ramsey prices (which are politically unpopular and unachievable by regulators).

4. Investment incentives are usually associated with the prospect of higher profits, but they also include predictability for investment planning. While predictability may not have been one of the initial objectives of the TSLRIC method, it has turned out to be one of its major properties. The prospect of higher profits induces firms to take on risks, while predictability may incentivize

[1] In the following the "UBA increment" means the differential, while the "UBA price" means the sum of the UCLL price and the UBA increment.

investment by reducing the risk itself. Incentivizing investments via the prospect of higher profits involves trade-offs between supply and demand constraints on investment and between more investment and higher prices under the LTBEU. In contrast, predictability involves trade-offs with the flexibility necessary to adapt to new situations. Thus, predictability can lead to higher or lower prices than under more flexibility. Rather than in the outcome the predictability of TSLRIC lies in the consistent application of the method itself. As long as TSLRIC provides the legal basis for wholesale input prices and as long as there is a common understanding of the TSLRIC concept, this predictability is assured. In principle, for a given TSLRIC outcome these properties should enhance investment incentives for all parties involved. In that sense enhancing predictability may be a less ambiguous policy approach than raising prices.

5. What makes TSLRIC predictable as a method? Besides peer pressure on the development of the method it is its ability to cope with new technology developments that is part of the notion of efficient and long-run costs.

6. Some economists, such as Alfred Kahn, have been critical of the high efficiency standard under TSLRIC. According to this view, TSLRIC prices subsidize access seekers and thereby hinder bypass competition. This view is not shared among regulators. There simply exists no "inefficient standard" to replace the efficient one. However, the difference between "efficient on the drawing board" and "actually achievable in reality" could matter. This could be taken care of through regulatory discretion about certain parameters that have to be estimated for TSLRIC measurement. Regulators are usually aware that certain parameter decisions increase or decrease the measured costs against the achievable costs, and they have to use their judgment in balancing those effects, most notably about WACC uplifts, if any.

7. The ladder-of-investment approach is not compatible with a strict TSLRIC standard. However, it could be compatible with some interpretation of relativity in association with s18.

8. A proportional common cost mark-up is usually justified, because in the TSLRIC context common costs are usually small and, in addition, tend to overestimate true common costs. Some direct costs are hard to measure and are therefore placed in the common cost category.

9. The only prominent study on the performance of TSLRIC against other wholesale pricing options is a simulation by Nitsche and Wiethaus (2011). It gives TSLRIC a poor ranking, but needs to be taken with a grain of salt, because of a questionable definition of TSLRIC. Virtually all empirical studies are about wholesale access regulation in general and not about the method of calculating the wholesale access charge. It is thus hard to draw any conclusions about the investment incentives of TSLRIC-based wholesale access charges. What the tone of the literature suggests is that the main influence of wholesale access regulation comes from the height of the regulated access charge rather than from the regulation per se. However, except for some U.S. studies on UNE-P there appear to exist no empirical studies relating investment outcomes to the height of the access charge and therefore to TSLRIC.

1.2. Challenges to the classical TSLRIC concept from declining copper demand and the rise of UFB

10. Challenges to classical TSLRIC have arisen from the rise of UFB, because the relevant markets for copper-based services have been shrinking. TSLRIC is conceptually based on an expanding market, where additional capacity is being installed. Since a large portion of the copper-related costs are sunk and some overcapacities develop, true forward-looking costs will therefore be much lower than TSLRIC as traditionally calculated by regulators. Also in this stage of the market an operator in a competitive environment would wish to take advantage of wholesale demand to defend its position against competing technologies. But if TSLRIC were still measured based on the old technology this would lead to price increases because of the smaller quantity base over which then fixed costs would have to be spread. Summing up, in the face of long-term declining demand relying on the TSLRIC standard for the old technology would induce unnecessary over-capacities and allocative inefficiencies in copper networks.

11. Predictability can be related to three potential consequences of a change in technical and market conditions, such as those caused by a decline in demand or the rise of a new technology, but also by a misjudgment of asset lives. The three consequences for the classical TSLRIC concept are (a) reinforcement of, (b) adaptation of and (c) break with the classical TSLRIC concept.

12. Using a brownfield approach could clearly be a possible adaptation of the classical TSLRIC concept, but it could also be a break with the concept. The reason to move from the modified greenfield approach to a brownfield approach has to do with the remaining life expectancy of certain assets, such as ducts, which is so high that it approaches the original life expectancy used in modified greenfield approaches. In other words, the regulated firms have over-collected in the past. Rather than starting from scratch the re-use of those civil works facilities for the new set of cables is usually the most efficient way to go forward. It also reduces the probability that the regulated firm is over-collecting.

13. While traditionally calculated TSLRIC-based wholesale charges become problematic in shrinking markets, such as that for copper-based UCLL and UBA, the function of TSLRIC can be fulfilled by modern equivalent assets (MEAs) to which the customers of the old services eventually migrate. The argument is that if both markets were competitive then the old assets have to be depreciated enough to be able to compete with the new assets. The value of the old assets after such depreciation is the value of the MEA. The MEA approach is therefore a natural part of TSLRIC and fully compatible with the classical TSLRIC approach.

14. The reason for the decline in market demand is usually that there is a new product that replaces the service with declining demand. The regulator then is usually (and should be) concerned with the efficient migration of services from the old to the new product. Based on Bourreau et al. (2012) a fairly high price could be optimal for inducing migration to the new technology. However, it has to be kept in mind that the objective of the Bourreau et al. (2012) article is neither total surplus nor the LTBEU but rather investment in and migration to the new technology. In particular, the outcome of a high-price policy may clash with the LTBEU.

15. In the U.K./EU a differentiation is now being made between replicable and non-replicable assets. Replicable assets, which can be provided in markets, are valued at their full replacement costs, while non-replicable assets are valued at the lower of replacement cost and an inflation-adjusted book value (which can be zero). This way, windfall gains or losses can be largely avoided. It is interesting to note that the EU approach does not seem to recognize the opportunity costs of such assets (for example, if they can be rented out for other uses or if there is not enough space for accommodating both, legacy uses and new uses). If one were to allow for re-use in a TSLRIC context one would have to calculate the remaining lifetime of such facilities and calculate the forward-looking costs based on a later replacement.

16. The European Commission (EC) quite clearly was driven by the main goals (a) of specific numerical outcomes of its new price setting method and (b) of cost coverage. With that in mind a break with the TSLRIC tradition is not really surprising but in line with the previous break, when the EU moved from classical TSLRIC to "pure LRIC" for call terminations, because the EC wanted to reduce termination charges.

17. While, in my opinion, the switch from replacement cost to inflation-adjusted historic cost in the case of non-replicable assets can be viewed as a break with the classical TSLRIC approach and can therefore be seen as interfering with predictability, a historic cost approach is generally (a) more predictable than a replacement cost approach and (b) more easily compatible with a commitment for cost coverage. Thus, there can be a trade-off between predictability of the TSLRIC approach and predictability of a different pricing method.

1.3. Specifics of UCLL implementation in New Zealand

18. In my view, the long-term perspective of the LTBEU does not mean that short-term benefits and costs should not be considered but rather that a discounted present value approach needs to be taken for such benefits and costs over the entire foreseeable future. A question is if spillovers and externality effects can be included as considerations under the LTBEU in s18. They are definitely not part of TSLRIC as correctly measured and would therefore have to be considered as consumer benefits. Such consideration as being in the LTBEU is fairly straightforward for benefits that directly accrue to consumers. It becomes somewhat of a stretch for spillovers to the economy in general, such as productivity effects from the Internet. Such spillovers should therefore be the concern of explicit subsidies or other policies than the TSLRIC determination.

19. A strict and consistent application of the TSLRIC methodology to both UCLL and UBA wholesale services leads to an outcome w.r.t. relativity such that the measured cost differences reflect the actual cost differences except for the common cost mark-up, which is usually done on the basis of proportionality and therefore will lead to some additional spread. Spreading the difference between the UCLL and the UBA price further could lead to extra unbundling investments with ambiguous effects for consumers. More likely, it will lead to no further unbundling and then to unambiguously higher prices for consumers. If different methods are used for measuring TSLRIC for UCLL than for UBA then consistency checks need to be undertaken to assure undistorted competition.

20. The NZCC must set a national average price cap for UCLL. Such geographic averaging of UCLL and UBA charges will influence build or buy incentives and arbitrage possibilities. Given that incentives will be very different in high density areas from low density areas the question is, how a TSLRIC estimate could minimise the risk of inefficient bypass. If under the conventional definition of inefficient bypass sunk costs do not count then there can probably be no efficient bypass of UCLL and most probably no efficient bypass of the incremental portion of UBA in New Zealand. The reason is that (a) the incumbent has to incur hardly any cost after the UCLL or UBA are sunk and (b) the incumbent can supply the whole market at those low costs. However, bypass can be efficient under a definition based on consumer welfare, because consumer welfare can be increased under the additional competition made possible by the bypass. This competition can be in the LTBEU even if the bypass is costly to the firms.

21. In my view, under geographic averaging, in dense areas there is little risk of UCLL bypass and UBA bypass (i.e., unbundling) investments in spite of a price above costs. Chorus' sunk costs provide for an entry barrier here, in particular, for a large unbundler. However, if the bypass risk is seen as significant then keeping both the TSLRIC estimate for UCLL and the spread between the UCLL and the UBA charge at the lower end of measurement would minimize the bypass risks.

22. Since only Chorus is (or has been) investing in the UCLL product, it will under cost averaging have less of an investment incentive in copper loops in rural areas and more of an investment incentive in urban areas than in a de-averaged state. That may be counter-productive given that Chorus will continue to keep copper loops only in rural areas. However, the existing loops in rural areas are probably just as sunk as those in urban areas, so that the high costs of low-density loops will only matter for replacement loops (which probably should only be built as fibre loops or should be replaced by wireless).

23. Three particular issues need to be addressed beyond the usual TSLRIC measurement of the MEA.

a) The first issue is that of the relevant output quantity and coverage. Since the MEA is both an actual replacement of the copper lines and the hypothetical replacement, the relevant state of demand is that for retail copper access before its decline in demand. This holds to the extent that former copper access subscribers have not vanished but have migrated or are migrating to either mobile or UFB services. Thus, the FTTH access network is the MEA already now even if it has not yet been (fully) built.

b) The second MEA issue concerns the valuation of re-used facilities. In a forward-looking sense certain existing facilities of the old copper network, such as ducts, can be re-used for FTTH networks. The NZCC has, however, proposed to value ducts etc. at their full replacement value instead of assuming that the current ducts can be re-used for the MEA. This is in contrast to the practice in a number of other countries, such as the U.K., which broke with the classical TSLRIC tradition of only using full replacement costs, because they observed windfall gains from the revaluation of assets under the TSLRIC approach. That argument does not hold in New Zealand. When using new assets throughout

it is important, however, that the assumed asset lives are sufficiently long. Nevertheless, a re-use would likely reduce the forward-looking costs of the FTTH network as the relevant MEA.

c) Third, since the FTTH wholesale access services (and the implied retail services) are no perfect substitute for the copper access services they replace, FTTH wholesale access (and mobile wholesale access) is no perfect MEA. There are distinct quality differences that may have to be taken into consideration. While the NZCC is in good company for proposing not to consider such quality adjustments, few people doubt that FTTH provides for higher-quality services than copper-based services. The use of FTTH as the relevant MEA for copper without quality adjustment would therefore tend to over-estimate the TSLRIC of the "true" MEA. This should be taken into consideration when making decisions about potential errors in measurement and their consequences.

24. From an actual cost perspective the TSLRIC method currently proposed by the NZCC is likely to be substantially more than needed by Chorus for covering the cost of its copper access network. Thus, the copper access network is likely to remain highly profitable. This bodes well for Chorus' decisions regarding copper upgrades and copper investments in maintenance in those areas, where Chorus is not the UFB provider. However, due to national averaging, there is the chance that the UCLL and UBA TSLRIC may not be sufficient to cover investment in new UCLL and UBA services. This could hold, although on average they will cover more than the costs to be incurred by Chorus for these investments. This problem can always occur under national averaging, because costs in some regions are just too high. However, that raises the question if further investments in copper access are justified. I therefore recommend against any WACC uplift or other uplift based on this argument.

25. The effects of UCLL and UBA pricing on other investments concern in particular Chorus' UFB investments, the UFB investments of the LFC, and investments by cable TV and LTE networks. The Chorus and LFC investments are contractual and therefore should not materially depend on the UCLL and UBA prices. However, the investment success could depend on those prices, because they will affect the speed of migration from copper-based to UFB services. This migration could be associated with both positive and negative externalities and spill-over effects. While my personal expectation is that the net migration effects will be positive, the question is if migration is already incentivized enough through the investment subsidies and by not adjusting the relevant MEA for the performance difference between the copper-based and the UFB services.[2] While the subsidy argument does not hold for cable TV and LTE, the performance argument also holds here. I therefore again see no reason for any uplift for incentivizing investment.

26. In my view, the EU approach represents a break with the classical TSLRIC concept even if the EC does not see it that way. It may nevertheless be the right choice in solving the copper access problems in the EU. The situation in New Zealand, however, is different so that the question needs to be answered if New Zealand should follow the European model.

[2] See Vogelsang (2013a, paragraphs 5 and 56, and 2014, paragraphs 26-28).

27. The relevant differences between EU and New Zealand are the following.

- First, New Zealand has no history of applying TSLRIC to copper wholesale access. As a result, in contrast to the EU there is no reason in New Zealand to correct for windfall gains that resulted from too short asset lives assumed in EU countries under TSLRIC for civil engineering infrastructure.

- Second, New Zealand does not have the same investment problem for UFB as the EU. In New Zealand UFB investment is assured by contract and subsidies received by UFB investors, while in the EU investment in UFB is incentivized but not assured.

- Third, in contrast to the EU, UFB wholesale access is strictly price regulated in New Zealand. In the EU access seekers have a right to UFB wholesale access but the incumbent's pricing freedom is restricted only by a price-squeeze prohibition.

- Fourth, the wholesale access provider for both copper and UFB access in New Zealand is vertically separated from the retail business. In the EU almost all countries (except the UK) have vertically integrated incumbents. Thus, in contrast to the EU New Zealand does not face a price-squeeze problem.

- Last, TSLRIC provides a wholesale price cap so that Chorus can price lower if deemed more profitable. Thus, if under inter-modal competition the TSLRIC price in New Zealand turns out to be too high Chorus can adjust it downwards without having to go through the whole regulatory process. This can reduce damages from too high a price but that is not assured.

28. Taken together the differences between New Zealand and the EC on balance argue against abandoning the classical TSLRIC approach in favor of the EU modifications. However, a condition that the comparable copper access charge does not exceed the UFB access charge may be used as a compatibility test. This could also be used instead of a quality adjustment for the MEA.

29. We have emphasized above that the predictability of TSLRIC-based pricing lies in the method and not necessarily in its outcome. A deviation from the classical approach could jeopardize this predictability if the expectation was that the NZCC would not deviate. It could also reemphasize predictability if the expectation was that the NZCC would follow international trends. For this expectation the NZCC's 2004 statement may be relevant. Additional aspects relevant for predictability concern (a) the term set for the validity of the current TSLRIC measurement and (b) the compatibility of prices under the FPP with those currently in place or those found under the IPP.

    a) In choosing the term for TSLRIC, predictability of the outcome may make one lean towards an upper limit, while predictability of the method may make one lean toward a lower limit.

    b) Predictability relative to the current UCLL and UBA prices should, in my view, be of little concern. Rather, the concern should be with the correct measurement of TSLRIC and with the

fulfilment of s18 objectives but not with whether the FPP deviates from the status quo or from the IPP results.

30. The trade-offs w.r.t. predictability from following the classical approach rather than the U.K./EU modifications primarily concern investment and migration incentives and the LTBEU. For simplicity we may assume that the main wholesale price effects of sticking with the classical approach rather than follow the EU modifications leads to a significantly higher UCLL price, while the UBA increment will only increase slightly. Predictability would likely increase for the current proceeding, even though there could result better predictability from historic costs for civil engineering works. Both the increase in price and the increase in predictability could have positive effects on certain investments and on UFB and other away-from-copper migration. Any beneficial effects from such migration and from investments will have to be traded off against the reduction in LTBEU from price increases of copper-based and other services.

31. My main conclusion is that, in order to fulfil s18 objectives or to achieve predictability the Commission should stay with the classical TSLRIC concept but should not err towards over-estimating TSLRIC.

2. Background

32. The New Zealand Commerce Commission (in the following: NZCC or Commission) has asked me to provide a report on the current academic thinking about how best to implement TSLRIC in pricing telecommunications network services and the implications for pricing UCLL in New Zealand

33. In the current New Zealand context the TSLRIC concept is applied to wholesale charges for bottleneck access to unbundled local loops (UCLL) and unbundled bitstream access (UBA). The wholesale access seekers combine these wholesale services with other network inputs (from the core and concentration networks) and retail services. Compared to purchasing UBA the purchasing of UCLL requires additional network services to be provided by the access seeker. These additional network services are costly and are associated with economies of scale and density so that they will most likely be self-provided only in denser areas and with the prospect of a sufficiently large market share (which also could come from selling the incremental UBA portion to other access seekers).

34. The assessment of "how best to implement TSLRIC" needs to take into consideration the interrelationships between TSLRIC and s18 at paragraph 107 of the TPRC consultation paper of July 9, 2014, which says,

35. "….section 18 informs the TSLRIC objectives that we should seek to achieve in determining the UBA and UCLL FPP prices. We therefore prefer a view that section 18 should be considered throughout, but cannot override a specific task or direction – for instance, we do not intend to disregard TSLRIC objectives purely on the basis that they do not appear in section 18."

36. While my report will in its application be restricted to UCLL, there will also be some reference to the parallel UBA pricing because of the importance of relativity under s18.

3. Academic thinking about the classical TSLRIC concept

3.1. Characterization of TSLRIC

37. The classical concept of TSLRIC as the subject of this section has been developed for growing markets. Section 4 will then deal with challenges to the classical concept if demand declines and if substitute services arise.

38. TSLRIC stands for total service long-run incremental cost. Like economic costs in general TSLRIC are viewed as forward-looking. „Long-Run" means that the time span of new investments is included in the cost consideration. It also means that all inputs are generally considered as variable. The long-run nature of costs is justified by the infrequency of regulatory price changes (FCC, 2008) and, at least implicitly, by the difficulty regulators face in determining correct short-run costs, both in cases when these are to reflect short-run bottlenecks (risk of exploitation) or temporary low demand (risk of margin squeeze if the access provider is vertically integrated into retail).[3]

39. TSLRIC as a long-run measure aims at the costs of efficient production of units where those variable and fixed costs are included which are essential for the output of a whole service among all the services that the company may offer. Consequently, outdated technologies and inefficiently incurred costs like redundant manpower are not reflected. However, the fixed costs of setting up a service are included. While common costs with other services are not part of a pure TSLRIC concept, they are usually included for practical reasons.

40. In the forward-looking approach only the actual (forecasted) costs are considered, hence the equipment is assessed at the replacement value[4] and over-capacities are usually not taken into account.[5] The costs also include a reasonable profit depending on the risk of the investment. In order to calculate the *average* incremental costs per loop (or per minute in the case of usage), the sum of the costs considered are divided by the (actual or forecasted) number of loops. From an economic perspective, TSLRIC usually results in wholesale access charges above short-run marginal cost (which are near zero for variations occurring between services within capacity constraints), since adequate fixed and common costs of production are also included. Overhead costs at the enterprise level are not considered as part of the LRIC of a particular service but a mark-up for them is usually added on the grounds that operators also need to recover overheads in order to continue staying in business.

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[3] A large part of the literature on TSLRIC is concerned with vertically-integrated incumbents that compete downstream with access seekers. Since (at least for UCLL) that does not hold for Chorus, we will skip most of this literature.

[4] Under the new EU approach for re-used facilities discussed below in Section 4 the depreciated historic value is used for certain assets.

[5] See Evans and Guthrie (2005) for the inclusion of optimally planned excess capacity under the heading of "optimized deprival value". Mandy and Sharkey (2003) calculate the effect of lumpiness on TSLRIC.

Common cost assignment

41. As just explained TSLRIC usually contain a proportional mark-up for common costs.[6] A mark-up is necessary in order to allow for full compensation of the incumbent, who may provide other services that otherwise would be burdened with more than their share of common costs. Using Ramsey mark-ups instead of proportional mark-up would be more efficient but, as explained below in paragraph 53 and footnote 12, is impractical. Furthermore, in the TSLRIC context common costs are usually small and, in addition, tend to overestimate true common costs. Some direct costs are hard to measure and are therefore placed in the common cost category (Burton, Kaserman, and Mayo, 2009).

42. The European Commission (EC, 2013) has applied a TSLRIC concept without common cost mark-up, called "pure LRIC", to wholesale call termination charges. This approach is restricted to those types of charges and does not extend to the TSLRIC of UCLL and UBA. It is based on the argument that terminations are typically reciprocal so that each firm can be asked to carry the burden of its own common costs. This argument is dangerous, however, because the termination charges influence the price-relevant costs so that in spite of reciprocity pure LRIC leads to a lower level of calling charges than TSLRIC with a common cost mark-up.[7]

3.2. Development of the academic thinking about TSLRIC

43. The TSLRIC concept appears to have originated in research in the 1970s and 1980s that developed multi-product cost concepts and that was synthesized in Baumol, Panzar and Willig (1982). These authors needed various cost concepts for characterizing contestable market situations in multi-product settings. The LRIC concept was then incorporated in the first analytic cost models developed by Mitchell (1990) at RAND and by Gabel and Kennet (1991, LECOM model for NRRI). The concept of TSLRIC was then discussed in the mid-1990s for purposes of regulation in the U.S. and Europe. The WIK/EAC (1994) report to the EC suggested pricing based on LRIC with proportional mark-ups for common costs. In the U.S. the Telecommunications Act of 1996 opened the door for TSLRIC, which was decreed in the FCC's Local Competition Order (FCC, 1996) under the acronym TELRIC (because there it was applied to network elements rather than to services).

44. While until then the academic discussion of TSLRIC had emphasized its competitive and efficiency-enhancing properties, more critical articles on the classical TSLRIC concept started to appear in Hausman (1999), Kahn, Tardiff and Weisman (1999), and Mandy and Sharkey (2003). These anticipated but were before the emphasis of telecommunications regulation changed from (static) efficiency to investment and innovation. This change in policy objectives brought with it a similar

[6] Some regulators also use a Shapley value approach to cost assignment. While this has certain axiomatic properties, it is complicated and does not have economically appealing efficiency values. I have no strong views on its use instead of a proportional mark-up.

[7] Personally I have less quarrels with the specific pure LRIC application to termination charges because I have favored a bill-and-keep approach based on the internalization of call externalities.

change in academic focus on investment and innovation. The arguments came largely from Schumpeterian approaches to dynamic competition that emphasized that investments and innovations required an expectation of enhanced profits as compensation for entrepreneurship and risk taking. There was no new theoretical research directly related to TSLRIC. However, a number of theoretical models tackled issues of wholesale price regulation with indirect relevance for TSLRIC. Furthermore, a number of empirical papers tried to assess the performance of regulatory interventions, again mostly with indirect relevance for the TSLRIC concept.

3.3. Objectives of classical TSLRIC in academic thinking

45. The following arguments brought forward in academic thinking about TSLRIC do not in general reflect specific academic work but are my own reading of the literature over the last twenty years. These arguments for and against TSLRIC concern competition *in* and *for* the market, static allocative and productive efficiency, dynamic efficiency w.r.t. (innovative) investments by incumbent, by potential access seekers (downstream and bypass investments), and by alternative competitors, and specific issues, such as dealing with geographic variation, with asset valuation, and with common costs. We will take up the challenges of declining markets and migration to new technologies in Section 4.

3.3.1. Competition *in* the market

46. TSLRIC-based wholesale charges shall provide a competitive cost standard, answering the question: What price would be obtained in a competitive market? However, in contrast to end-user regulation that tries to prevent exploitation of consumers and shall lead to competitive prices bottleneck regulation tries to benefit consumers through enhanced competition.

47. It is well-known that, in a perfectly competitive market, prices equal short-run marginal costs and, in the long-run, prices equal long-run average costs and long-run marginal costs. These conditions are generally not feasible in markets with extensive economies of scale and scope. Nevertheless, achieving the next best to the perfectly competitive standard would be desirable. Markets characterized by scale and scope economies would yield long-run competitive prices between long-run incremental costs and long-run stand-alone costs (SAC) (Baumol and Sidak, 1994).[8] TSLRIC always fulfil this condition and in growing markets are therefore always compatible with this competitive standard.[9]

48. At the same time competitive pricing usually requires the flexibility to adapt prices to changing cost and demand conditions. Competitive market prices follow short-run (marginal) costs, particularly in capital-intensive industries. Prices at TSLRIC will not usually reflect such short-run considerations.

[8] Stand-alone costs are the costs incurred by a firm producing only the single service in question (therefore not benefiting from economies of scope/synergies if any).

[9] Without a common cost mark-up TSLRIC equal the lower bound. With a common cost mark-up they are below the upper bound.

The long-term averaging implied by regulated wholesale charges lacks this flexibility.[10] This will lead to some allocative distortions by missing out on market opportunities (e.g., for higher capacity utilization in times of temporarily low demand). It will then lead to inter-modal distortions in competition. It may be no consolation for a competitor (or the incumbent) that TSLRIC wholesale charges are correct on average if the current market conditions would warrant much lower (or higher) prices. This, however, is a problem of regulated prices that is thought to be more than compensated under regulation by the avoidance of strategic price setting.

49. A particularly relevant aspect of wholesale access pricing is competitive neutrality between alternative technologies for the same or related (competing) services. If both services are expanding, competitive neutrality is usually achievable if both technologies have comparable bottlenecks that are provided at TSLRIC prices. If one service has such bottlenecks while the other does not then competitive neutrality may not be assured, because the service without bottlenecks can respond more flexibly to market opportunities. This inflexibility of TSLRIC therefore becomes more problematic under a certain degree of inter-modal competition if the other mode (e.g., cable TV or LTE) is not subject to the same kind of wholesale regulation. Since deregulating the bottleneck is not the option, some flexibility in setting access charges (or some form of non-linear pricing) might thus be appropriate even when applying the TSLRIC cost standard.

3. 3.2. Competition *for* the market

50. Since market entry requires a long-run perspective and since entrants have to expect covering their costs, TSLRIC (without common cost mark-up) will provide the lowest price, under which an entrant (with a multi-product approach) would enter an expanding market, i.e., bypass the bottleneck. The corresponding upper limit under competition would be SAC, under which entry would be possible for single-product firms only offering the bottleneck. SAC include all common costs that would be incurred by a multi-product firm. TSLRIC, as calculated in practice, include some common costs and therefore lie in the efficient range between theoretically pure TSLRIC and SAC. Without being perfect this will therefore likely lead to reasonably efficient entry and reasonably efficient competition for end-users.

51. The efficiency condition that wholesale access charges induce enough competition downstream cannot always be fulfilled because there may exist downstream economies of scale that severely limit the number of entrants. This can hold, for example, in rural markets. In this case, it is not only the wholesale access charge that matters but also the scope of the access product, which may have to be adjusted to assure enough downstream competition (like UCLL vs. UBA).[11]

[10] As explained below in paragraph 99 a similar tension regarding averaging also holds for geographic cost averaging.

[11] For the scope of the access product see Bourreau et al. (2014).

3.3.3. Static efficiency

Allocative efficiency

52. Allocative efficiency usually means that deadweight losses from pricing are minimized, but it may include an emphasis on low and affordable end-user charges (LTBEU) and adequate quality of service (QoS).

53. TSLRIC are reasonable average prices, but usually overestimate short-run marginal costs relevant for allocative efficiency. The reason for this is twofold. First, due to economies of scale and sunk assets marginal costs tend to be lower than average costs. Second, TSLRIC usually contain a proportional mark-up for common costs. However, provided TSLRIC wholesale prices are able to induce sufficient competition by wholesale access seekers and other entrants (such as cable TV) end-users will enjoy low prices and desirable qualities. In that case the level of wholesale charges will assure that the incumbent is charging adequately at the wholesale level and the competition will assure that downstream mark-ups are competitive. If the downstream market becomes sufficiently contestable consumer surplus will be close to the maximum without the incumbent or entrants incurring losses. It only comes close to the maximum because TSLRIC access charges typically use mark-ups for fixed and common costs that are not differentiated by demand elasticities for the services. This is in contrast to Ramsey access prices which would allow for mark-ups reflecting such demand elasticities. Because of insurmountable information requirements and because of the political unpopularity of high prices in demand-inelastic markets, Ramsey prices are, however, not used by regulators and will therefore not be considered here any further.[12]

Productive efficiency

54. TSLRIC prices are (almost) independent of the firm's own costs, because they are based on a cost model. They therefore provide a high power of incentives (in the sense of Laffont and Tirole, 1993). The power of incentives is quite separate from the tightness of regulation (which is more related to the participation constraint for the firm).[13] Tightness refers to the (economic or excess) profit rate

[12] The idea of Ramsey access pricing is to allow the regulated firm to recover fixed and common costs in such a way that overall welfare is maximized. In doing this, regulators would have to determine simultaneously optimal mark-ups for access and retail prices. In their construction, Ramsey prices refer to both cost and demand characteristics by which informational requirements become very high; regulators not only have to be informed about cost conditions but they are also supposed to estimate interrelated demand (super-) elasticities. Since regulators generally fail to calculate Ramsey prices directly, price-cap mechanisms – which delegate the pricing decision to the typically much better informed firm – have been initially developed to solve the Ramsey pricing problem. However, if price caps are targeted only towards specific wholesale access products, the regulated firm loses the flexibility to rebalance all its prices according to the required Ramsey mark-ups. Since Ramsey prices are too hard for regulators to determine, the goal of setting regulated Ramsey prices is an unachievable standard. The distortion created by not achieving Ramsey prices is small if common costs are only a small fraction of total costs but could become substantial if most costs are common.

[13] These arguments are taken from Vogelsang (2012). Since the tightness of regulation affects investments and investments affect productive efficiency, tightness can have a separate effect on productive efficiency.

that the regulator concedes to the firm in case normal expectations are fulfilled. Tight regulation refers to a low or zero expected profit rate and usually a low regulated price. Conversely, soft regulation refers to a high expected profit rate and usually a high regulated price. Since TSLRIC is generally not depending on the firm's actual costs, there will also be no Averch-Johnson effect of over-capitalization even with a WACC uplift that gives the firm an allowed rate of return above the cost of capital.

55. Because TSLRIC even after a few years typically are not adjusted to the regulated firm's actual costs the resulting regulated prices provide stronger cost-reducing incentives for the regulated firm than price caps, which usually are adjusted after a few years to the firm's actual costs.

56. It is not always assured that prices based on TSLRIC provide enough incentives for QoS. The reason is that TSLRIC prices are usually not profit maximizing. As a result, a reduction in QoS that leads to a reduction in the firm's actual costs will often be profitable, even if it leads to some reduction in quantity sold. Thus, regulators may have to supervise and define QoS independently of setting price.

3.3.4. Investment incentives and dynamic efficiency

57. In the last decade a major influence on the academic thinking about TSLRIC has come from a shift in policy emphasis from allocative efficiency and cost reduction incentives to investment incentives as the regulatory objective. As Vogelsang (2013b) put it, "starting with Röller and Waverman (2001) and so far culminating in Czernich et al. (2011) the empirical literature has demonstrated the benefits of telecommunications investments in general and broadband investments in particular for the economy as a whole beyond the telecommunications sector. While therefore a case for furthering investment and for overcoming any barriers to investment can be made, finding the right policies remains difficult. A policy of over-emphasizing investments can lead to stranding as exemplified by the telecom industry downfall in 2000. Also, the costs of duplication may not be worth the benefits (Höffler, 2007). Policies favoring infrastructure competition should therefore be balanced against other policy objectives." Although investments are an input, not an output of economic activity, the economics literature has been largely uncritical of this approach, which to some extent has tarnished the very positive reputation TSLRIC had enjoyed until then. TSLRIC was under this new emphasis often viewed as providing insufficient investment incentives for incumbents. This is surprising in so far as the classical TSLRIC concept is clearly geared at including all relevant costs and the investment costs in particular. We will look at some of the potential reasons for insufficient investment incentives below when discussing specific types of investment. In any case, the critique has induced legislators and regulators to specifically include investment incentives in the TSLRIC measurement.

58. Investment incentives are usually associated with the prospect of higher profits, but they also include predictability for investment planning.[14]

Incentivizing investments with higher prices

59. A prospect of higher profits is not necessarily associated with TSLRIC, because in principle the concept only covers efficient costs. While some additional profit may be attainable through the common cost assignment, regulators if deemed necessary add as an investment incentive an uplift to the applicable WACC, which is one of the largest cost components of TSLRIC for local telecommunications networks. Regulators may also use a tilted annuity approach that is front-loaded in order to reduce the risk over the time horizon of the investment. Such investment-friendly policies can spur investments by incumbents and by facilities-based competitors (including bypass investments) but, because of their price-increasing effects, may hinder downstream investments by access seekers. Attempting to spur investments via higher prices carries at least two ambiguities. The first is that investments can be supply constrained or demand constrained. At low prices they are supply constrained, because the investing firm may be unable to cover its costs. At high prices they are demand constrained, because consumer will buy less of the output produced with the investments. Thus, price increases for incentivizing investments need to be carefully balanced. The second ambiguity is that the resulting price increase burdens consumers so that the investment incentive needs to be balanced to fulfil the LTBEU.

Incentivizing investment through predictability

60. While predictability may not have been one of the initial objectives of the TSLRIC method, it has turned out to be one of its major properties. Predictability can be associated with the outcome of TSLRIC measurement but it need not be. If no TSLRIC measurement has yet been made the outcome may be predictable only within limits. Also, TSLRIC measurements may change over time, due to the emergence of new technologies or due to changes in relevant input prices, such as the WACC or the copper price (for copper loops). Rather than in the outcome the predictability of TSLRIC lies in the consistent application of the method itself. Because TSLRIC is applied in many countries the methods of TSLRIC measurement are subject to international scrutiny. Knowledgeable people can predict (again, within limits) the outcome of the TSLRIC measurements and of changes in the measurement outcomes over time. As long as TSLRIC provides the legal basis for wholesale input prices and as long as there is a common understanding of the TSLRIC concept this predictability is assured. In principle, these properties should enhance investment incentives for all parties involved. While enhancing the regulated firm's profits can induce it to overcome the investment risk, enhancing predictability can actually reduce this risk and provide investment incentives that way. In that sense enhancing predictability may be a less ambiguous policy approach. However, predictability can reduce the flexibility necessary to cope with new situations. Thus, predictability

[14] Guthrie, Small, and Wright (2006) make the case for historic costing as a way to incentivize investments. This does not appear to be an option for UCLL and UBA pricing under the New Zealand legal system, but it is part of the EU concept discussed in Section 4 below.

can lead to higher or lower prices than under more flexibility. However, the predictability included in the TSLRIC method may be just balancing the flexibility necessary under technical market changes. Whether the recent changes for asset valuation by the U.K. and the European Union (EU) are in line with this view will be discussed in Section 4 below.

61. In my opinion, at least conceptually, though probably not quantitatively, the benefits of predictability could be calculated. The main benefit of predictability is that it reduces the relevant investment risk. In addition it improves the forecast of market outcomes. Thus, in principle an increase in predictability should reduce the relevant WACC. This could be calculated if market observations were concurrently available. A second issue is that the improved forecasting information made possible by predictability puts investments on a better footing. In case of sunk investments this reduces the value of the real option to wait. This real option is currently not included in the TSLRIC calculations anywhere, but that is only justified if the option to wait is sufficiently low in value. The predictability inherent in the TSLRIC process may therefore help justify not considering effects of real options on the firm's cost of capital.

62. What are the intrinsic benefits of predictability in a regulatory setting? Predictability is closely related to commitment and dynamic consistency. Dynamic consistency (i.e., no change in preferences over time) means that the regulator decrees a path of action over time such that he/she wants to continue on that same path at any point in the future. Such dynamic consistency may not be achievable. In contrast, commitment means that the regulator decrees a path of action over time and is obligated to stick to it at any point on that path (even if he/she would like to deviate). Predictability means that others can know the path that the regulator will actually follow. That could happen under dynamic consistency even without commitment. However, it usually requires commitment in the absence of dynamic consistency. Predictability can require the observer to have expertise to be able to foresee the consequences of the method the regulator is using.

63. What makes TSLRIC predictable as a method? Besides the arguments about peer pressure on the development of the method it is its ability to cope with new technology developments that is part of the notion of efficient and long-run costs. As seen in Section 4, this notion has, however, been severely challenged by the decline in copper-based access services and the rise of fibre-based access.

Incumbent's investments

64. The main argument about investment incentives is that access prices (and prices for unbundled network elements) that do not cover all costs of investment would stifle investments. Proponents of the TSLRIC approach argue that by definition this cost concept includes all costs of expansion investments in new infrastructure. Thus, any shortfall in (expected) coverage of investment costs would have to come from cost measurement errors or from mistakes in the underlying models. Potential errors could come (a) from measurement of the required capacities under lumpiness paired with growing, uncertain or fluctuating demand and (b) from measurement of the weighted average cost of capital (WACC) under sunkness. Opponents of the TSLRIC approach here argue that

the regulators systematically err by not including enough reserve capacities and by making no WACC adjustments for real options.[15] Regarding the former critique Mandy and Sharkey (2003) provide correction factors for lumpiness and for the use of current equipment values when TSLRIC are recomputed at shorter intervals than investment lives. The latter critique has been particularly pronounced by Hausman (1999) and Pindyck (2007). According to Hausman's calculations TSLRIC would have to be increased by as much as 50%-100% to take care of real options associated with sunk costs and with the lack of commitment by access seekers to buy access if there is a lack of end-user demand. Pindyck adds that even tradable assets may involve sunk costs if they lose value over time. While these issues have been discussed by regulators in various proceedings, to the best of my knowledge no regulator has made adjustments for lumpiness or for real options. The main reasons seem to be that lumpiness is not such a big issue in telecommunications and that regulators discount or cannot assess the risk of loss of sunk assets and that they positively count the option of having assets in place when they are needed.[16]

65. TSLRIC will generally cover all costs that are expected over the lifetime of the assets and add mark-ups for common costs. Wholesale charges at TSLRIC levels will then provide correct expansion and replacement investment incentives for bottleneck assets of the incumbent. Higher than cost-covering charges would lead to less investment because of the reduction in downstream demand associated with higher downstream prices that especially competitors would have to charge. Lower charges would lead to lower investments on the part of the bottleneck provider because of insufficient cost coverage. Under cost and/or demand uncertainty a buffer above expected costs may be necessary to cover for estimation risks. It has usually been assumed, however, that investment risks of the incumbent are correctly covered in the WACC used for the TSLRIC calculation.[17] Today, however, an error analysis may be undertaken in order to assess the potential costs of mistakes.

66. Incumbents often claim that TSLRIC are insufficient for providing investment incentives. TSLRIC are usually below profit-maximizing prices. To that extent the complaint by incumbents is self-serving. Because TSLRIC are efficient costs and are tightly measured they may, however, be below a firm's actual expected costs and to that extent insufficient. This could not only happen, because TSLRIC in practice do not include adjustments for real options and lumpy investments but also because firms are less efficient than in an idealized setting. Some economists, such as Alfred Kahn, have been critical of this high efficiency standard. Referring to a paper by Kahn, Tardiff, and Weisman (1999), Joskow and Noll (2013) remark, "Fred [Kahn] believed that TELRIC was a terrible idea because the

[15] Another issue is that WACC measurement is usually done on a company basis, while for TSLRIC it would need to be done on an investment-specific basis.

[16] Recently, Guthrie (2012) has proposed simplified methods for estimating the real options effects on regulated costs.

[17] We are here only assessing the appropriate level of a regulated wholesale access charge that is levied on a wholesale access service on a pay-as-you-go basis. Alternative access arrangement, such as investment sharing may or may not provide better investment incentives. See, for example, Nitsche and Wiethaus (2010).

concept of a "blank slate" local network – one that was designed from scratch using the best available technology for the local market as it exists at this moment – is unrealistic and impractical, and that attempting to require that prices satisfy this standard inevitably will lead to an implicit subsidy for competitive entrants" [i.e., access seekers]. Kahn, however, did not convince many regulators or economists of this position. My explanation for this lack of influence is that there simply exists no adequate "inefficient" cost standard that could be used. Using an efficient cost standard would improve efficiency, while using the firm's actual costs would have the opposite effect. However, the difference between "efficient on the drawing board" and "actually achievable in reality" could matter. This could be taken care of through regulatory discretion about certain parameters that have to be estimated for TSLRIC measurement. Regulators are usually aware that certain parameter decisions increase or decrease the measured costs against the achievable costs, and they have to use their judgment in balancing those effects, most notably about WACC uplifts, if any.

Investments by alternative competitors

67. The main investor types are the dominant incumbent and the access-dependent entrants and other alternative competitors. To the extent that competition-enhancing regulation is successful it may increase investment by alternative competitors at the expense of the incumbent. Total investment may thereby diminish or increase depending on which effect is larger.

68. There are two types of investment by access-dependent entrants. They are bypass investments and downstream investments.

69. Bypass investment

    a) Bypass investment means that a potential access seeker decides to invest in the bottleneck itself. Bypass investment is efficient if an alternative competitor can offer the relevant bottleneck more cheaply to itself than the incumbent can. Conventional wisdom is that a wholesale access charge provides efficient bypass incentives if it correctly reflects the incumbent's costs so that bypass investment would be triggered if and only if the potential access seeker has lower cost than the incumbent. This view has been challenged by Sappington (2005 and 2006), who shows in a theoretical model that the bypass incentive only depends on the bypass cost advantage or disadvantage of the potential access seeker against the incumbent and not on the access charge. The intuition behind this is that (in a setting of vertical integration) the fierceness of downstream competition is determined by the difference between the wholesale access charge and the incumbent's cost. Thus, for example, if the wholesale access charge is high relative to the incumbent's cost then downstream competition will be soft. Thus, the potential entrant is better off not doing bypass investment, unless its cost is lower than that of the incumbent, because bypass investment will make downstream competition fiercer. However, Mandy (2009) shows that this reasoning depends on the type of downstream competition so that, as a general matter, the bypass investment will be influenced by the wholesale access charge. In the New Zealand context the Sappington argument is partly

irrelevant because Chorus as the incumbent is not vertically integrated and therefore does not compete with the access seekers. It could, however, be relevant for the incremental UBA portion that Chorus sells in competition with unbundlers. In dense regions, in particular, UBA bypass could be invited under the higher TSLRIC average, but Chorus could price below the TSLRIC cap, and for that its actual costs would be relevant.

b) With this proviso TSLRIC can provide the correct incentives in expanding markets for bottleneck bypass investments of those alternative competitors that depend on bottleneck access. If wholesale charges are too high alternative competitors may invest in bypass even if their costs are higher than those of the incumbent. If wholesale charges are too low they are unlikely to invest in bypass even if their costs are lower than those of the incumbent. However, as argued below in paragraph 100, the incumbent's sunk costs may play a major role for the make or buy decision.

c) Another potential application to bypass comes from Bender and Götz (2011), who show in a theoretical model that higher wholesale access charges can increase facilities-based competition and thereby can lead to lower retail prices and higher coverage, provided there are uniform retail charges across regions with different population densities. It does not appear that this model applies to New Zealand, because facilities-based full-scale entry is unlikely, given the UFB subsidies and the large area of LFC commitments.

d) Alternative intermodal competitors (such as cable TV and FTTH), who are not dependent on bottleneck access, benefit from higher wholesale access charges imposed on access seekers because of less competition from entrants. Again, wholesale charges at TSLRIC on average provide competitive neutrality for intermodal carriers, but access seekers lack the pricing flexibility afforded to alternative intermodal competitors in competitive markets.

e) Many regulators have tried to follow the ladder-of-investment approach (for a history see Cave, 2014). This approach tries to systematically relate the rungs of the investment ladder to each other by changing the investment incentives for entrants with the level of access. Accordingly, efficient investment shall be incentivized by making the wholesale access conditions dependent on the strength of the bottleneck property. Thus, strict bottlenecks should be priced at cost, while weak bottlenecks with bypass opportunities should be priced above costs. This differentiated approach is not compatible with a strict TSLRIC standard. However, it could be compatible with some interpretation of relativity in association with s18. In that context it may be helpful to note the limited empirical evidence on the working of the ladder-of-investment approach. For a set of EU countries Bacache, Bourreau and Gaudin (2013) and for the UK Nardotto, Valletti and Verboven (2013) found support for a short ladder leading from resale and UBA access to UCLL-based competition, but not to broadband loop investments by entrants.[18]

[18] In particular, Nardotto, Valletti and Verboven (2013) find for the UK that, relative to bitstream access, unbundling does not increase broadband penetration but increases the QoS.

While this could suggest that some spread beyond the pure cost difference between UCLL and UBA charge could be justified, nothing in these two papers suggests that such an additional spread was actually used by the regulators in their samples.

70. Downstream investments

    a) Turning to downstream investments, because of demand effects alternative competitors depending on bottleneck access would invest too little downstream (i.e., in concentration and core networks) if bottleneck access charges were too high and would invest too much downstream if those charges were too low. Charges at TSLRIC should balance these tendencies.

    b) The most relevant downstream investments by potential access seekers in New Zealand would be incurred for unbundling in order to bypass the incremental UBA portion and for migration to UFB. In addition there are downstream investments in UBA access network facilities and in the copper-based retail service business, but I assume that these assets are already sunk and therefore immaterial for the future.[19]

3. 4. Empirical and simulation studies about the effects of TSLRIC

71. TSLRIC has been practiced by regulators for almost 20 years. There should therefore exist ample evidence about its effects on sectoral performance. However, very little is available as quantitative evidence or even in the form of simulation studies.

72. The only study in this latter category that appears to be directly relevant for the TSLRIC application is Nitsche and Wiethaus (2011). The article considers four access regulation regimes and simulates their effects on investment in a new technology, on competitive intensity and on consumer welfare. The alternative regimes are named LRIC, fully distributed cost regulation, risk-sharing (i.e., infrastructure sharing), and regulatory holiday. As TERA (2014) describes in their literature review, Nitsche and Wiethaus in their simulations find (TS)LRIC to provide less investment incentives than the other wholesale pricing approaches, is also comparatively low on consumer surplus, but ranks second in terms of competitive intensity. Thus, in comparison to the other schemes TSLRIC performs poorly. However, Nitsche and Wiethaus use an unconventional definition of (TS)LRIC: According to them “the incumbent may recoup investment costs through the access price if the investment reflects the most efficient means of providing certain services.” Within their framework this means if the investment is “successful, the incumbent may pass on the investment costs to the entrant via the access price”, while if it is not successful the access price is assumed to be zero. This assumption is not further explained in their paper. In general one would assume that if the investment were not successful there would either be no access seekers so that there would be no revenues under any of the schemes; or, the old technology would persist with the old access prices. These could be lower (but also higher) than those under the new technology. If they were assumed lower the zero access charge under TSLRIC could be seen as a normalization that does not affect the qualitative results.

[19] This assumes that there will be no new entrants for copper-based services.

However, it would affect the simulations and the rankings. Thus, I am inclined to take the Nitsche and Wiethaus rankings with a grain of salt.

73. All empirical studies with relevance for the TSLRIC application are about unbundling and wholesale access in general, independent of the way these products are priced. In the U.S. context there have been some early studies that consider TSLRIC but those are not compared to other pricing methods and they are restricted to a particular and much criticized unbundled product called "UNE-P" that is much broader than UCLL. On the most general level Grajek and Röller (2012) find that wholesale access regulation reduces incentives for the regulated firm and for individual access seekers to invest. Their results suggest that regulators have a commitment problem in that regulatory intensity is increased if the incumbent's stock of infrastructure is high (which would associate high regulation intensity with high investment). In contrast and more specific Gruber and Koutroumpis (2013) show that wholesale access regulation increases DSL investment. Other studies, like Bouckaert, Van Dijk, and Verboven (2010) suggest the opposite result. Thus, it is unclear if wholesale access regulation increases or decreases investment. Crandall et al. (2013) note that unbundling regulation has reduced DSL prices but hinders NGA investment. Consistent with that finding Briglauer et al. (2012) show that service-based competition at the DSL level (measured by entrants' market shares) may have a negative impact on NGA investment.[20] Since all these studies are about wholesale access regulation in general and not about the method of calculating the wholesale access charge, it is hard to draw any conclusions about the investment incentives of TSLRIC-based wholesale access charges. What the tone of the literature suggests is that the main influence of wholesale access regulation comes from the height of the regulated access charge rather than from the regulation per se. However, there appear to exist no empirical studies relating investment outcomes to the height of the access charge and therefore to TSLRIC.

4. Recent challenges to the classical TSLRIC approach from declining copper demand and the rise of UFB

74. The classic approach to TSLRIC worked well for some time. There were challenges from critics, such as the real option challenge and the lumpiness challenge but these issues were rejected by regulators, because TSLRIC worked in a satisfactory manner. It was clear that costs were covered without these proposed and not easily implementable adjustments. New challenges, however, arose from fixed-to-mobile substitution and from UFB, which both challenged the assumption that the relevant market for copper-based services was increasing. Thus, the fiction that firms needed to invest in the newest technology for all assets required to perform the service was no longer tenable. The firms did not do these investments. Concurrent and at least lightly associated with this has been

[20] Cave (2014), however, raises the issue of the relevant counterfactual. If only one infrastructure exist, the relevant counterfactual is unregulated monopoly, while in the presence of two or more competing infrastructures it is unregulated competition.

the issue of windfall gains under classical TSLRIC. These gains also resulted from longer than assumed lives of some assets under TSLRIC measurement. As a result the wholesale access services became highly profitable under TSLRIC, in spite of the assumption of efficient costs. Last, declining demand for copper-based services went along with the rise of UFB posing the problem how to link these two fixed network access technologies.

4.1. General remarks based on academic thinking

75. When considering expansion and contraction in demand the use of TSLRIC has certain limitations. As Vogelsang (2013a, paragraph 25) explains, "first and foremost, it is a long-run cost standard that can deviate from that applicable to real life decisions on expanding, contracting or building new facilities or on setting prices in a competitive context. An incumbent with a large portion of sunk costs will keep the network running even if TSLRIC are not fully covered. On the other hand he will invest in new capacity only if TSLRIC are fully covered, and that can include an allowance for the real option to wait that is extinguished by the investment."

76. TSLRIC as a forward-looking cost standard breaks down, if demand for the bottleneck service, for which it is to be applied, steadily and structurally decreases so that overcapacities develop. In this case no new investments and few replacement investments take place so that the current prices of the resources used to construct the bottleneck facilities lose their function as a normative yardstick.

77. The efficiency objectives in case of declining demand concentrate on (a) the optimal use of the old technology and (b) the optimal migration to the new technology.[21] In addition there is (c) the issue of commitment to a potentially inefficient, but potentially equitable pricing policy for the future in order to honour promises that were made originally in order to induce investments.

Optimal use of old technology

78. TSLRIC is conceptually based on an expanding market, where additional capacity is being installed. The market for copper-based access, however, is shrinking and appears to continue to shrink, due to substitution from cable TV and, more recently, fibre. Since a large portion of the copper-related costs are sunk and some overcapacities develop, true forward-looking costs will therefore be much lower than TSLRIC as traditionally calculated by regulators.

79. Decreasing end-user demand leads to excess capacities. In competitive markets this would lead to price reductions which should not only hold at the retail level but also at the wholesale level, because wholesale demand is a derived demand. Also in this stage of the market an operator in a competitive environment would wish to take advantage of wholesale demand to defend its position against competing technologies. But if TSLRIC were still measured based on the old technology this

[21] In the following we will not refer to the optimal shut-down decision, which will be affected by political considerations as much as by pricing.

would lead to price increases because of the smaller quantity base over which then fixed costs would have to be spread.

80. Summing up, in the face of long-term declining demand relying on the TSLRIC standard for the old technology would induce unnecessary over-capacities and allocative inefficiencies in copper networks.

Commitment and equity

81. If the network is not expanded or replaced at all then TSLRIC would be applied to investments that were exclusively made in the past. In addition to being an efficiency issue, it is primarily one of equity between incumbents and entrants. Given the long lives of the copper access network and given that pricing in the past has only relatively lately started to be determined according to appropriate cost standards, this could mean that the incumbent has already been fully compensated or even been overcompensated for the actually incurred cost. This would come in addition to the fact that entrants would overpay for access to a network that is not being expanded and was acquired at the lower costs in the past.

82. Under commitment past investments have been made under the expectation that TSLRIC will be applied over the lifetime of the investment then it may be a breach of commitment to switch to some short-run cost standard that does not compensate for prudently incurred past investment. This should, however, in my view, not shield the regulated firm from all the vagaries of technical change and market developments.

Migration to the new technology

83. The reason for the decline in market demand is usually that there is a new product that replaces the service with declining demand. The regulator then is usually (and should be) concerned with the efficient migration of services from the old to the new product. In the case of copper-based wholesale access this new product is fibre-based wholesale access. Thus, a relationship needs to be established between the copper-based and the fibre-based wholesale products. The most prominent academic work on this issue is Bourreau et al. (2012), who distinguish between three effects of wholesale pricing of the old technology on the deployment of the new technology by an integrated incumbent. As noted in Vogelsang (2013a),

    - "the *wholesale revenue effect* reduces the incentives to invest in the new technology because such investment cannibalizes profits. This effect calls for low wholesale charges for the old technology in order to make the old technology less attractive than the new technology. This effect should be less relevant for Chorus because of the incumbent's commitment to invest in UFB. The wholesale revenue effect is only important to the extent that Chorus can renege on their investment commitment. However, … a similar effect should be relevant for the RSPs' decisions to switch from DSL to UFB.

- The *replacement effect* induces alternative investors (the RSPs) to invest in the new technology. This calls for high wholesale charges as an umbrella for such investments. Again, this effect is less important for New Zealand, because such alternative investments are handicapped by the UFB subsidies. Any replacement effect would be very local. The replacement effect could have some relevance for cable in its restricted area.

- Last, the *business migration effect* captures the effect of wholesale charges on consumer prices and their willingness to switch to the new technology. In New Zealand the business migration effect appears to be the most important one."

84. Thus, based on Bourreau et al. (2012) a fairly high price could be optimal for inducing migration to the new technology. However, it has to be kept in mind that the objective of the Bourreau et al. (2012) article is neither total surplus nor the LTBEU but rather investment in and migration to the new technology. In particular, the outcome of a high-price policy may clash with the LTBEU.

Predictability

85. Predictability can be related to three potential consequences of a change in technical and market conditions, such as those caused by a decline in demand or the rise of a new technology, but also by a misjudgment of asset lives. The three consequences for the classical TSLRIC concept are (a) reinforcement of, (b) adaptation of and (c) break with the classical TSLRIC concept.

    a) Under reinforcement the classical TSLRIC concept survives unscathed. That would, for example, be the case if a perfect MEA were to replace the declining market. In that case predictability of TSLRIC as a method would be perfect, although the outcome may be very different from that "predicted" before the decline and the emergence of the MEA.

    b) The second potential consequence is that the classical TSLRIC concept is adapted in the most efficient way so that the main properties of TSLRIC survive. This could hold for the case of an imperfect MEA such that there are QoS differences or such that the old services cannot fully be mapped into the MEA. In this case a new TSLRIC concept may replace the classical TSLRIC, because it can no longer be fully applied. Predictability in this case will be less than perfect, because there usually is not only one way to adapt the TSLRIC concept. In this case there will usually emerge a dominant concept that will take the place of the classical concept. If no such dominant concept has emerged predictability considerations may make one want to use the concept that is closest to the classical concept.

    c) The third potential consequence is that in a similar situation as the previous one some regulators choose a solution to the new problems that is no longer compatible with main properties of the TSLRIC concept. This could be a good and/or efficient solution for those regulators' problems but it should no longer be called TSLRIC. Examples could include moves to stand-alone costs, to short-run marginal costs or to average historic costs. Such a move could undermine predictability, in particular, if TSLRIC is the legal standard.

86. The conventional approach to TSLRIC measurement has been to interpret “long-term” to mean that all costs are variable so that the costs measured are those of a hypothetical firm that starts from scratch. The only concession made early on (e.g., in FCC, 1996) was to base the network architecture on a scorched node approach (also called “modified greenfield approach”) rather than a scorched earth approach (or “greenfield approach”). This concession could be viewed as either reinforcement or adaptation of the classical TSLRIC concept. It was made for practicality both of the cost measurement and of the service definition, which was associated with the real existing network. For example, the resulting UCLL or UBA under a scorched earth approach may have little to do with the UCLL and UBA the access seekers would actually be purchasing. In the last few years the modified greenfield approach has been replaced in several countries by a so-called “brownfield approach” that looks at the regulated firm more as a going concern with path dependent investments. Thus, the existing network and not just its architecture is taken as the starting point of the cost measurement. This is a possible interpretation of the TSLRIC concept, but it is not the only one. So this could still be adaption of but it could also be a break with the classical TSLRIC concept. The reason to move from the modified greenfield approach to a brownfield approach has to do with the remaining life expectancy of certain assets, such as ducts, which is so high that it approaches the original life expectancy used in modified greenfield approaches. In other words, the regulated firms have over-collected in the past. Rather than starting from scratch the re-use of those civil works facilities for the new set of cables is usually the most efficient way to go forward. It also reduces the probability that the regulated firm is over-collecting.

Expansion vs. contraction in demand: The issue of a MEA

87. Viewed in isolation declining demand in regulated industries usually means a loss in economies of scale. As a result, TSLRIC would tend to increase, as demand declines. This may have to be accepted for isolated declining industries. However, if the decline of one industry is the result of the growth of a competing industry one has to look at the interactions between the two. In fact, very often the growing industry provides for a (almost) perfect substitute of the declining industry. In that case the investments in the growing industry create MEAs for the assets of the old industry. The argument is that if both markets were competitive then the old assets have to be depreciated enough to be able to compete with the new assets. The value of the old assets after such depreciation is the value of the MEA. The MEA approach is therefore a natural part of and reinforces classical TSLRIC. “Generally, a MEA should be applied instead of the technology currently in use if (in the particular geographical area) no one would rationally invest in the old technology but rather only in the new technology.” (Vogelsang, 2013a, paragraph 29) It is a common view today that FTTH and wireless access services serve as MEAs for copper-based UCLL and UBA.

88. The classic TSLRIC approach is highly adaptable to new technologies, because it always reflects the newest dominating technology available. This also means that it is naturally compatible with a MEA approach. The newest technology provides the MEA for the old technology in place. This only becomes problematic if (a) the MEA does not provide the same services but, for example, better and more services and if (b) the market for the old services is shrinking. There are two fairly straightforward solutions with good economic interpretation. One is to treat the old technology as

dying and refrain from a MEA and treat the new technology as a new, growing market that may or may not have to be regulated. This may be a logical and perfectly good approach but would not, in my view, be compatible with classical TSLRIC. The other is to consider the new technology as simply replacing the old one. This yields the new technology as providing the MEA and essentially assumes both to be under the same regulation. Thus, the classical TSLRIC approach would be applied. No country seems to have followed either of these "pure" approaches. Rather, hybrids have been pursued.

4.2. Practical consequences taken by regulators in the U.K. and the EU

89. Since the early 1990s the U.K. public utility regulators have been plagued with the issue of "windfall profits", first arising under price caps in the electric utility industry. Excessive profits at the time led to political tensions that resulted in adjustments of the price cap regulation. Similar issues arose in the telecommunications industry around 2005, when copper networks had been mostly depreciated and produced excessive profits under TSLRIC-based regulation. In other regulated industries, in order to avoid windfall gains and losses the U.K. regulators had moved away from using full replacement costs for certain assets. For example, in the water industry an assumption was made that the pipes were kept in shape, but not extended, so that normalized annual maintenance and current replacement expenses were used ("infrastructure renewals accounting"). In telecommunications a differentiation was made between replicable and non-replicable assets. Replicable assets, which could be provided in markets, were valued at their full replacement costs, while non-replicable assets were valued at the lower of replacement cost and book value. This way, windfall gains or losses could be largely avoided.

90. Like the U.K., for non-replicable assets the EC (2013) sees no necessity to price them at full replacement costs. Rather, there should be a dual valuation approach, where replicable assets are valued at their replacement costs, while non-replicable assets are valued either at their book value indexed by inflation or at zero (if fully depreciated). As expressed by the EC (2013, paragraph 37), "Therefore, the initial RAB corresponding to the reusable legacy civil engineering assets would be set at the regulatory accounting value, net of the accumulated depreciation at the time of calculation and indexed by an appropriate price index, such as the retail price index." The initial RAB would be locked in for the future and would be changed only for depreciation and for new investments in civil infrastructure. This also has the effect that fully depreciated assets would no longer be valued. It is interesting to note that the EU approach does not seem to recognize the opportunity costs of such assets (for example, if they can be rented out for other uses or if there is not enough space for accommodating both, legacy uses and new uses).

91. While the main concern of the EC (2013) seems to have been to avoid the over-recovery of costs, in my view, it is a somewhat strange justification to view it "as the proper and appropriate implementation of TSLRIC in the specific circumstances of the migration to NGA". I find this strange because the same reasoning would hold for a continuation of the old service as for a migration to the new service. In both cases the non-replicable infrastructure is "re-used" in the future, in one case for the old service in the other for the new one. Why should assets like ducts receive a lower

value for purposes of TSLRIC measurement, when they are used for the MEA rather than for the copper lines? If one were to allow for re-use in a TSLRIC context one would have to calculate the remaining lifetime of such facilities and calculate the forward-looking costs based on a later replacement.[22]

92. The new U.K./EU approach to TSLRIC measurement for civil works can conceptually be broken down into two issues in potential conflict with the classical TSLRIC concept. The first is the switch from replacement costs to inflation-adjusted historic costs for asset valuation.[23] The second is to move from full replacement costs to the costs of re-used facilities, which have a number of years of potential use in them but which have already served for a number of years. The second move solves the problem of an underestimation of the asset lives, when the past TSLRIC measurements were made. Thus, prices were deemed too high in the past. If an adjustment to the now justified asset lives were made that would solve the asset valuation problem for the future but the regulated firms would keep the past windfall profit. By adjusting the value of the assets to a "re-use" value the windfall profits could be fully eliminated, because not only the depreciation rate but also the asset base would be adjusted. To get this exact result a historic costing approach is needed. In contrast, under TSLRIC the value for such an adjustment would be the "depreciated replacement value". Thus, if the current historic book value after 20 years were just zero but the asset still had 30 years in it the depreciated replacement cost value would be 60% of the current full replacement cost (assuming linear depreciation). That, however, would not eliminate the windfall gain fully. In contrast, because of the use of the historic value the EU approach will value the asset at zero and that would fully eliminate the windfall gain. However, in my view, one needs to distinguish a past mistake (the misjudgement of asset lives) from a systematic property of TSLRIC (the change in replacement cost and the forward-looking feature of TSLRIC cost accounting).

93. The EC quite clearly was driven by the main goals (a) of specific numerical outcomes of its new price setting method and (b) of cost coverage. With that in mind a break with the TSLRIC tradition is not really surprising but in line with the previous break, when the EU moved from classical TSLRIC to "pure LRIC" for call terminations, because the EC wanted to reduce termination charges (as discussed in paragraph 42 above).

94. While, in my opinion, the switch from replacement cost to historic cost in the case of non-replicable assets can be viewed as a break with the classical TSLRIC approach and can therefore be seen as interfering with predictability, a historic cost approach is generally (a) more predictable than a replacement cost approach and (b) more easily compatible with a commitment for cost coverage. Thus, there can be a trade-off between predictability of the TSLRIC approach and predictability of a different pricing method.

[22] Calculations of cost savings from re-using existing facilities (called a „brownfield" approach) and of cost increases due to gradual build-out for FTTH networks have been done by WIK (2010 and 2011).

[23] Historic costing could also be efficient. See, for example, Guthrie et al. (2006).

5. Specifics of UCLL implementation in New Zealand

95. In the following I will only pick up a limited set of issues that are relevant for the TSLRIC implementation for UCLL in New Zealand and that relate to the arguments brought forward in sections 3 and 4 above.

5.1. Relevant TSLRIC objective (s18)

96. My views on the relevant s18 interpretation can be found in Vogelsang (2013a), paragraphs 18-21. In particular, any effects of the TSLRIC measurement on changes in competition, investment and innovation incentives have to be measured against the yardstick of the LTBEU. In my view, the long-term perspective of the LTBEU does not mean that short-term benefits and costs should not be considered but rather that a discounted present value approach needs to be taken for such benefits and costs over the entire foreseeable future. A question is if spillovers and externality effects can be included as considerations under the LTBEU in s18. They are definitely not part of TSLRIC as correctly measured and would therefore have to be considered as consumer benefits. Such consideration is fairly straightforward for benefits that directly accrue to the users of the services in question. It becomes less so for related services consumed by other consumers. It becomes somewhat of a stretch for spillovers to the economy in general, such as productivity effects from the Internet.

5.2. Relativity

97. A strict and consistent application of the TSLRIC methodology to both UCLL and UBA wholesale services leads to an outcome w.r.t. relativity such that the measured cost differences reflect the actual cost differences except for the common cost mark-up, which is usually done on the basis of proportionality. Thus, since UCLL has lower TSLRIC than UBA, the cost difference is enhanced through the proportional common cost mark-up. To this extent, the difference between UCLL and UBA pricing would follow the ladder-of-investment approach. In Vogelsang (2013a) I have expressed skepticism about the applicability of the ladder-of-investment approach in the New Zealand context. It almost certainly does not apply to the last potential rung from UBA bypass to UCLL bypass. There may be a case for incentivizing unbundling investment to enable UBA bypass, but that would face tradeoffs between the cost of the extra (duplicative) investment and the potential consumer benefits reaped. Spreading the difference between the UCLL and the UBA price further could lead to extra unbundling investments but even then would have ambiguous effects for consumers. More likely, it will lead to no further unbundling and then to unambiguously higher prices for consumers. If different methods are used for measuring TSLRIC for UCLL than for UBA then consistency checks need to be undertaken anyhow to assure undistorted competition.

98. Relativity also relates to geographic cost averaging. According to conventional wisdom the economies of density are stronger for UCLL than for the incremental UBA part of the UBA cost. Thus, in principle, investment incentives for UCLL bypass would be more strongly affected by geographic averaging than the unbundling incentives for bypass of the incremental UBA portion. This

difference, however, has only limited effects for the current proceeding, because very little UCLL bypass can be expected. Additional unbundling investments for UBA bypass are also in doubt.

5.3. Geographic averaging: Arbitrage issue

99. Geographic averaging of UCLL and UBA charges will influence build or buy incentives and arbitrage possibilities. The NZCC must set a national average price cap for UCLL. Given that incentives will be very different in high density areas from low density areas the question is, how a TSLRIC estimate could minimise the risk of inefficient bypass. Inefficient bypass could have three meanings. Under the first and conventional meaning inefficient bypass occurs if an entrant bypasses the incumbent's bottleneck, although the incumbent's costs are lower. This was the meaning used in paragraph 70 above. Under the second meaning bypass is inefficient if it leads to higher cost in supplying a given market output (i.e., duplication under natural monopoly). Under the third meaning bypass is inefficient if it leads to lower (consumer) welfare than without the bypass. If under the first and the second meaning sunk costs do not count there can probably be no efficient bypass of UCLL and most probably no efficient bypass of the incremental portion of UBA in New Zealand. The reason is that (a) the incumbent has to incur hardly any cost after the UCLL or UBA are sunk and (b) the incumbent can supply the whole market at those low costs. However, bypass can be efficient under the third meaning because consumer welfare can be increased under the additional competition made possible by the bypass. This competition can be in the LTBEU even if the bypass is costly to the firms. This will hold, because the bypass investments are also sunk and therefore are available in the long run. Furthermore, under the LTBEU it does not matter if the firm's profits are reduced, unless that profit reduction prevents them from doing other things that are in the LTBEU.

100. Based on my arguments in Vogelsang (2013a, paragraph 6) I conjecture that UCLL and UBA charges at the geographically averaged TSLRIC will be significantly above the weighted average of true costs (including sunk costs) in areas where Chorus invests in UFB, will be close to the weighted average of true cost in LFC areas and will be below average true cost in rural areas without UFB. As a result, geographic averaging of TSLRIC costs will already achieve some compromise between setting prices above true costs (including sunk costs) in order to incentivize innovations and reduce investment risks and keeping prices low and thereby acting in the LTBEU in areas that will not be served by UFB. In my view, in dense areas there is little risk of UCLL bypass and UBA bypass (i.e., unbundling) investments in spite of a price above costs. Chorus' sunk costs provide for an entry barrier here, particularly for a large "entrant" (such as Telecom). However, if the bypass risk is seen as significant then keeping both the TSLRIC estimate for UCLL and the spread between the UCLL and the UBA charge at the lower end of measurement would minimize the bypass risks.

101. As Vogelsang (2013a, paragraph 58a) points out, "while both, the UBA costs and the UCLL costs appear to depend on network density it seems clear that the UCLL costs are more sensitive to density than the (incremental) UBA costs." This could increase the bypass incentives for UCLL relative to UBA if the average spread between the two reflects the relevant cost difference. However, the bypass risk for UCLL is minimal to start with, in particular, because of Chorus' subsidized UFB investment. The risk of unbundling investment for bypass of the UBA increment is

also small. Since only Chorus is (or has been) investing in the UCLL product, it will under cost averaging have less of an investment incentive in copper loops in rural areas and more of an investment incentive in urban areas than in a de-averaged state. That may be counter-productive given that Chorus will continue to keep copper loops only in rural areas. However, the existing loops in rural areas are probably just as sunk as those in urban areas, so that the high costs of low-density loops will only matter for replacement loops (which probably should only be built as fibre loops or be replaced by wireless).

102. On a forward-looking basis Chorus' actual (as opposed to TSLRIC) UCLL and UBA costs are going to be low even in areas, where Chorus is not the UFB provider. Hence, to the extent that replacements are not required Chorus may have incentives to price UCLL and UBA below the TSLRIC cap in order to gain or keep market share.

5.4. Declining demand requires use of a MEA

5.4.1. Applicability of the EU approach under consideration of the specific situation in New Zealand

103. In my view, the EU approach represents a break with the classical TSLRIC concept even if the EC does not see it that way. It may nevertheless be the right choice in solving the copper access problems in the EU. The situation in New Zealand, however, is different so that the question needs to be answered if New Zealand should follow the European model. There could be two reasons (not) to follow the EU model: (a) because it is (not) the adequate TSLRIC approach or (b) because it makes wholesale access pricing in New Zealand more (less) predictable. If the assessment of (a) and (b) go in opposite directions, an assessment of weights would need to be made.

104. The relevant differences between EU and New Zealand are the following.

- First, New Zealand has no history of applying TSLRIC to copper wholesale access. As a result there are no windfall gains that accrued under this method. Rather, as far as TSLRIC for wholesale copper access is concerned, New Zealand starts from scratch. It may nevertheless be that Chorus (or its predecessor) has accumulated gains from wholesale access that may justify a downward adjustment based on current depreciated values for non-replicable assets, but that is not a TSLRIC issue.

- Second, New Zealand does not have the same investment problem for UFB as the EU. In New Zealand UFB investment is assured by contract and subsidies received by UFB investors, while in the EU investment in UFB is incentivized but not assured. Thus, for New Zealand incentivizing UFB investment via copper access charges is not the issue. New Zealand may have similar issues, though, with migrating subscribers to the finished UFB network. In further contrast to the EU, New Zealand does not have the issue that civil engineering infrastructure shall be shared with potential competitors.

- Third, in contrast to the EU, UFB wholesale access is strictly price regulated in New Zealand. Thus, copper access regulation is not used as a constraint on UFB pricing. In the EU access

seekers have a right to UFB wholesale access but the incumbent's pricing freedom is restricted only by a price-squeeze prohibition. However, compatibility between the copper-based wholesale access charges and the UFB wholesale access charges may be an issue for New Zealand. Thus, a condition that the comparable copper access charge does not exceed the UFB access charge may be used as a compatibility test. This could also be used instead of a QoS adjustment for the MEA.

- Fourth, the wholesale access provider for both copper and UFB access in New Zealand is vertically separated from the retail business. To the best of my knowledge, in the EU such vertical separation only holds for the U.K. So, there can be no or little (for UBA bypass) price-squeeze issues in New Zealand. Furthermore, the issue of relativity between UCLL and UBA prices is not much affected by the re-use issue because the UBA increment contains relatively less civil engineering infrastructure than the UCLL part.

- Last, TSLRIC provides a wholesale price cap so that Chorus can price lower if deemed more profitable. Thus, if under inter-modal competition the TSLRIC price in New Zealand turns out to be too high Chorus can adjust it downwards without having to go through the whole regulatory process. This can reduce damages from too high a price but that is not assured. Strangely, this pricing freedom may be used by Chorus precisely in those areas where Chorus' copper network faces competition from others and where Chorus may be expected still to re-invest in copper.

105. Taken together the differences between New Zealand and the EC on balance argue against abandoning the classical TSLRIC approach in favor of the EU modifications.

5.4.2. Specific issues for MEA implementation that challenge the classical TSLRIC measurement

106. The first specific issue for the MEA replacement of copper is that of the relevant output quantity and coverage. Since the MEA is both an actual replacement of the copper lines and the hypothetical replacement, the relevant state of demand is that for retail copper access before its decline in demand. This holds to the extent that former copper access subscribers have not vanished but have migrated or are migrating to either mobile or UFB services. Thus, neither a reduction for incomplete actual FTTH access networks nor for under-utilization of the old copper access network should be taken into consideration. The reason is that the TSLRIC price provides for the upkeep of the service.[24] This is because the replacement of the facilities should employ the MEA technology and is fully in line with the classical TSLRIC approach. Thus, the FTTH access network is the MEA already now even if it has not yet been (fully) built. The TSLRIC of FTTH as the MEA for copper access also need not be the same as the TSLRIC of FTTH for UFB access. There could be differences due to different dimensioning necessary for the high speed required for UFB versus copper-based services and due to differences between the UFB rollout and the coverage of FTTH as the MEA (although in areas, where FTTH is too expensive, mobile or fixed wireless access services may represent the

[24] A question to be decided by the regulator is if provisions should be included for running a duplicate network before migration to the MEA is concluded.

relevant MEA). There could also be cost differences w.r.t. the relevant WACC. Building a new UFB network may be more risky, because it is based on uncertain demand projections. In contrast, the FTTH access network as the relevant MEA is based on the total ongoing demand for fixed network access (which may still be affected by fixed-to-mobile substitution in the FTTH areas). Economies of scale and assumed 100% market share for the MEA calculation handicap the make decision against the buy decision. This should not be a major issue for UCLL, because bypass by access seekers is not contemplated and because that bypass decision is already influenced by the UFB subsidies afforded to Chorus.

107. The second issue concerns the valuation of re-used facilities. In a forward-looking sense certain existing facilities of the old copper network, such as ducts, can be re-used for FTTH networks. The NZCC has, however, proposed to value ducts etc. at their replacement value instead of assuming that the current ducts can be re-used for the MEA. This is in contrast to the practice in a number of other countries, such as the U.K. In my view, the NZCC decision is compatible with the classical approach of TSLRIC. Countries like the U.K. broke with this tradition, because they observed windfall gains from the revaluation of assets under the TSLRIC approach. Since the New Zealand legal context interprets TSLRIC as forward-looking, it is unclear if the valuation of re-used assets would be covered by the law. The reason for the alleged windfall gains in countries like the U.K. has been that the life of ducts has proven to be much longer than originally anticipated and longer than anticipated under the cost models used for TSLRIC. Since the current UCLL and UBA prices have not been based on TSLRIC modeling, there have not been pent-up windfalls based on this method.[25] When using new assets throughout it is important, however, that the assumed asset lives are sufficiently long. Nevertheless, a re-use would likely reduce the forward-looking costs of the FTTH network as the relevant MEA relative to the classical approach.

108. Third, since the FTTH wholesale access services (and the implied retail services) are no perfect substitute for the copper access services they replace, FTTH wholesale access (and mobile wholesale access) is no perfect MEA. There are distinct quality differences that may have to be taken into consideration. To the best of my knowledge this issue has been addressed extensively in English only by Neumann and Vogelsang (2013). They suggest a method for making quality adjustments based on the resulting market prices for the copper-based and fibre-based retail products. To the extent that such market prices do not exist or are viewed as distorted the practicability of such a method could be questioned. The NZCC is therefore in good company for proposing not to consider such quality adjustments.[26] However, since few people doubt that FTTH provides for higher-quality services than copper-based services, the use of FTTH as the relevant MEA for copper without quality adjustment would tend to over-estimate the TSLRIC of the "true" MEA. This should therefore be taken into

[25] This does not mean that there have not been similarly large windfalls from other methods.

[26] Other types of quality adjustments, such as by line speed, make little sense. However, it may be advisable to choose the cheapest MEA, such as GPON, over a more expensive one with higher QoS, such as P2P. While GPON in its conventional form may only be available for UBA and not for UCLL, GPON can be combined with P2P in an inexpensive way, allowing for both UCLL and UBA services. See WIK (2010).

consideration when making decisions about potential errors in measurement and their consequences. As suggested above in paragraph 104, third bullet point, it may therefore be appropriate to check the measured TSLRIC for copper UCLL and UBA against the regulated UFB wholesale access charge. If the copper TSLRIC is higher than UFB wholesale access charge then a quality adjustment would be needed.

109. The MEA approach described in the Commission's consulting paper of July 9, 2014, is a hybrid but leaning towards the second option described above in paragraph 89. By assuming a customer base of all fixed-network subscribers it does away with the notion that the market for copper-based services is shrinking, and by assuming UFB as the MEA it links copper access with the UFB market. UFB as a MEA is assumed to be in a steady state. Yet, UFB access itself is regulated under a different regime. The EU in contrast assumes that the MEA is built using the assets of the copper regime and that these assets still have some (though not the whole) life in them. While this is realistic, it breaks with the TSLRIC assumption that the MEA network is built from scratch. Inconsistently in my view, the EU does not provide for a ramp-up phase for the MEA. Instead, a full set of subscribers is assumed so that there is full continuity in subscribership.

110. By using a classical TSLRIC approach with no quality adjustment for the UFB MEA, from an actual cost perspective the TSLRIC method currently proposed by the NZCC is likely to be substantially more than needed by Chorus for covering the cost of its copper access network. Thus, the copper access network is likely to remain highly profitable. This bodes well for Chorus' decisions regarding copper upgrades and copper investments in maintenance in those areas, where Chorus is not the UFB provider.

5.6. Risk, investment and new services

111. Incentivizing risky investment has, as alluded to above in paragraph 59, been often pursued via an uplift on expected costs, in particular on the WACC. Is such an uplift warranted in the current context of the FPP for UCLL and UBA? The answer draws on the riskiness of the investments associated with UCLL and UBA and on the relationship between the TSLRIC measurement and the costs of the relevant UCLL and UBA related investments. The answer further draws upon on any effects of UCLL and UBA pricing on other investments.

112. UCLL and UBA related investments for copper-based services are only required for keeping up the services in Chorus' UFB regions until they are replaced by UFB and in other regions for the times that copper-related services are still competitive in an inter-modal setting. The problem for the latter is that, due to national averaging, there is the chance the UCLL and UBA TSLRIC may not be sufficient to cover copper replacement investment. This could hold, although on average they will cover more than the costs to be incurred by Chorus for these investments. This problem can always occur under national averaging, because costs in some regions are just too high. However, as suggested above in paragraph 101, such high costs raise the question if further investments in copper access are justified. I therefore recommend against any WACC uplift or other uplift based on this argument.

113. The effects of UCLL and UBA pricing on other investments concern in particular Chorus' UFB investments, the UFB investments of the LFC, and investments by cable TV and LTE networks. The Chorus and LFC investments are contractual and therefore should not materially depend on the UCLL and UBA prices.[27] However, the investment success could depend on those prices, because they will affect the speed of migration from copper-based to UFB services. This migration could be associated with both positive and negative externalities and spill-over effects. While my personal expectation is that the net migration effects will be positive,[28] the question is if migration is already incentivized enough through the investment subsidies and by not adjusting the relevant MEA for the performance difference between the copper-based and the UFB services. While the subsidy argument does not hold for cable TV and LTE, the performance argument also holds here. I therefore again see no reason for any uplift for incentivizing investment.

5.7. Predictability

114. We have emphasized in paragraph 60 that the predictability of TSLRIC-based pricing at least for the classical TSLRIC approach lies in the method and not necessarily in its outcome. A deviation from the classical approach could jeopardize this predictability if the expectation was that the NZCC would not deviate. It could also reemphasize predictability if the expectation was that the NZCC would follow international trends. For this expectation the NZCC's 2004 statement may be relevant. Additional aspects relevant for predictability and not covered so far concern the term set for the validity of the current TSLRIC measurement and the compatibility of prices found under the FPP with those currently in place or those found under the IPP.

115. The term set for the validity of the current TSLRIC measurement has two natural limits. It cannot be too short, because TSLRIC measurement is costly and time consuming. In my view, a reasonable lower limit would be 1-2 years. The term also cannot be too long, because costs change and become out of date. A simple inflation adjustment is unlikely to do the job, because the TSLRIC are not well linked with inflation. For example, the relevant WACC may follow quite a different path than inflation. Because of rapid technical and market changes in the telecommunications sector I would consider 5-10 years to be a reasonable upper limit. The question then is, where in this range should the chosen term lie? Here predictability of the outcome may make one lean towards the upper limit, while predictability of the method may make one lean toward the lower limit.

116. Predictability relative to the current UCLL and UBA prices should, in my view, be of little concern. The IPP already brought a substantial change that some had predicted, others not. If the FPP brings another change that will justify those, who put in motion the FPP process. But some of those parties did this in the expectation that prices would be higher under the FPP, while others wanted it because they thought prices would be lower. Thus, the concern should be with the correct

[27] The UCLL and UBA prices will affect Chorus' finances. However, under the classical TSLRIC approach the prices will lead to substantial profits for Chorus.

[28] See, for example, Vogelsang (2014, paragraphs 26-28).

measurement of TSLRIC and with the fulfilment of s18 objectives but not with whether the FPP deviates from the status quo or from the IPP results. However, it may be worth the effort to check the TSLRIC methods used by the benchmark countries of the IPP determinations against the method to be used in the current proceeding.

117. The trade-offs w.r.t. predictability from following the classical approach rather than the U.K./EU modifications primarily concern investment and migration incentives and the LTBEU. For simplicity we may assume that the main wholesale price effects of sticking with the classical approach rather than follow the EU modifications leads to a significantly higher UCLL price, while the UBA increment will only increase slightly. Predictability would likely increase for the current proceeding, even though there could result better predictability from historic costs for civil engineering works. Both the increase in price and the increase in predictability could have positive effects on UFB investment (not so important because it is contractual), Chorus' copper investments (not so important because price cap will not be binding), probably not on UBA bypass (with a small increase in UCLL/UBA spread plus more migration away from copper), potentially significant investment effects on cable TV/LTE. There will be important positive effects on UFB and other away-from-copper migration. Any beneficial effects from such migration and from investments will have to be traded off against the reduction in LTBEU from price increases of copper-based and other services (Vogelsang, 2014).

6. Conclusions

118. My main conclusion is that, in order to fulfil s18 objectives or to achieve predictability the Commission should not err towards over-estimating TSLRIC. If the Commission sticks to its preliminary decisions to stay with the classical TSLRIC approach and therefore not to consider re-use of civil works and not to make a performance adjustment for the FTTH MEA, then as compared to application of the modified TSLRiC methodology being advocated by the EU the NZCC classical application results in a higher price. This would likely offset any efficiency argument (Alfred Kahn), investment risk or lumpiness that would go against the classical TSLRIC. It would also take care of any net positive externalities from incentivizing migration to UFB. Thus, there would, in my view, be no case to be made for an uplift to the WACC or for a generous approach to any other cost components. However, even if the Commission were to reverse its stand on the re-use of civil works would Chorus be able to generate substantial profits from its UCLL and UBA offerings.

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