Report by Professor Jerry A. Hausman

Response to the Commerce Commission's Draft Determination on Uplift

I. Introduction

1. I am the MacDonald Professor of Economics at the Massachusetts Institute of Technology ("MIT") in Cambridge, Massachusetts. I graduated from Brown University in 1968. I received a D.Phil. (Ph.D.) in economics from Oxford University in 1973 where I was a Marshall Scholar. I have been at MIT since completing my D.Phil. My academic specialties are econometrics, the application of statistical methods to economic data, and applied microeconomics, the study of behavior by firms and by consumers.
2. In December 1985, I received the John Bates Clark Award of the American Economic Association, awarded every other year for the most "significant contributions to economics" by an economist under the age of 40. In 1980, I was awarded the Frisch Medal of the Econometric Society. In 2005 I received the Biennial Medal of the Modeling and Simulation Society of Australia and New Zealand. I have been a member of numerous government advisory committees for both the U.S. government and governments in many other countries. I have published over 170 academic research papers in leading economic journals including the *American Economic Review*, *Econometrica*, and the *Rand (Bell) Journal of Economics*. I have been an associate editor of *Econometrica*, the leading economics journal, and the *Rand (Bell)*

Journal of Economics, the leading journal of applied microeconomics. My curriculum vitae is attached as Appendix A.

3. I have extensive experience in telecommunication beginning in the late 1970s when I was an economic consultant to Bell Laboratories. I taught a course "Competition in Telecommunications" to graduate students at MIT for 25 years. I have provided testimony and consulted for governments and telecommunications firms in the US, Canada, the EU, Australia, and New Zealand as well as numerous other countries.
4. I have written many academic papers in telecommunications. The topics I have analyzed include: (1) Value to consumers of new goods and improved goods in telecommunications: Hausman (1996, 1999, 2002) (2) Regulation and economic efficiency: Hausman (1998, 2000), Hausman and Shelanski (1999) (3) TSLRIC, Real options and Investment Incentives: Hausman (1997, 1999), Hausman, Sidak, and Tardiff (2008), Hausman and Sidak (2014) (4) Internet competition: Hausman (2002), Hausman, Singer and Sidak (2001) (5) The Effect of Telecommunications Regulation on Consumer Welfare: Hausman (1997, 2003), Hausman and Sidak (1999, 2014), Hausman and Taylor (2012, 2013).

II. Purpose of Review and Conclusions

5. I have been asked by Chorus to consider the Commission's approach to the questions of whether to apply an uplift to the WACC and/or the price derived by applying TSLRIC, concentrating particularly on:

    i. the Commission's analysis of the asymmetric consequences of estimation error; and

ii. the conclusions reached by Prof Vogelsang on uplift, particularly the conclusions set out at ¶ 118 of his recent paper dated 25 November 2014 on the implementation of TSLRIC in pricing telecommunications.

6. I have come to the following conclusions:

i. Investment in telecommunications infrastructure leads to new services and improved quality in existing services. Academic research has found very large welfare gains to consumers and business end-users from new and improved telecommunications services.

ii. TSLRIC determined access prices can discourage investment since they lead to asymmetric returns. Good outcomes lead to access seekers buying access yet these access seekers have not taken the risk of an unsuccessful investment. Relaxation of TSLRIC regulation in the US in 2003 led to a significant increase in broadband investment which led to new and improved services. By utilizing an uplift for the WACC or an increase in the TSLRIC price the Commission would assist in mitigating the negative consequences on investment of applying TSLRIC.

iii. The consumer welfare standard of economists is very similar to the "long-term benefit of end-users" (LTBE) approach used in the NZ Telecommunications Act. The legislative purpose statement in Section 18(2A) of the Telecommunications Act requires the Commission to give consideration to the incentives to innovate and risks faced by investors in new telecommunication services which involve significant investment.

iv. The Commission's draft report does not take account of asymmetric risk arising from sunk and irreversible investments. Also, considerable risk arises from potential technological obsolescence of telecommunications infrastructure.

v. The Commission rationale for an uplift holds in the current situation since the costs of internet network outages and congestion to consumers of under-estimating the TSLRIC price or underestimating WACC are significantly greater than the costs to consumers of over-estimating WACC and having somewhat higher prices.

vi. The Commission decision to use FTTH rather than FTTN as the basis to determine the UCLL TSLRIC price will distort investment decisions by access seekers. If WACC or TSLRIC is underestimated, access seekers will find it in their economic interests to purchase the regulated access to legacy copper-based UCLL service instead of building an alternative fiber-based network. This distortion of the build or buy choice is inconsistent with the section 18 of the Telecommunications Act purpose statement of promoting investment in alternative infrastructure, and in turn promoting competition for the long-term benefit of end-users .

vii. Prof. Vogelsang has not taken into consideration significant academic thinking regarding TSLRIC on investment incentives.

III. Academic Research Has Found Very Large Welfare Gains to Consumers and Business End-Users from New and Improved Telecommunications Services

7. Investment in telecommunications infrastructure leads to new services and improved quality in existing services. Regulation can have significant effects on investment incentives and the introduction of new services and improvement in quality in existing services because it will affect the expected return to investment which firms decide to undertake or not undertake. Thus, if regulated prices are set too low or regulation does not correctly take into account the risk of investment in sunk cost infrastructure (as discussed below), regulation will decrease the incentives to invest in new and improved quality services below the level which maximizes consumer welfare. Academic research has found very large welfare gains to consumers and business end-users from new and improved telecommunications services. I have reviewed academic research which has measured the welfare gains from new and improved services in telecommunications. Regulation can have a significant effect on the introduction of new and improved goods as experience in the US and the EU has demonstrated. Under the "long-term benefit of end-users" standard of the NZ Telecommunications Act, gains in welfare should be among the important factors considered by the Commission.

8. Consumers and businesses achieve very high welfare gains from the introduction of new and improved telecommunications services. For a new service consumer welfare (consumer surplus) from the new product is the area under the (compensated) demand curve above the observed market price.[1] This "welfare triangle" is determined from

[1] See Hausman (2003), p. 27, for an explanation of this measurement. This estimate will typically provide a conservative (lower-bound) estimate. For a linear demand curve the virtual price equals $p^* = p(\alpha + 1)/\alpha$ where α is the absolute value of the price elasticity and p is the market price.

the market price, the market quantity, and the "virtual price" which would set demand to zero. For example, if a representative consumer pays $60 per month for mobile service of say 100 minutes of use and 1 GB of internet usage and the virtual price is $120 per month the average consumer welfare gain is approximately $30 per month.[2] Multiplying by the number of consumers who buy the service estimates the overall welfare gain. Since the virtual price typically exceeds the market price by a significant amount, a successful new product will yield a very large gain in consumer welfare.

9. J. Hausman (1997) found that regulatory delay in the introduction of mobile services in the US led to a large loss in consumer welfare. I estimated that the delay cost consumers $25 billion per year in lost consumer welfare of approximately or $100 per person in 1990s US$ or about $155 per person in current US$. Other research e.g. Goolsbee and Petrin (2004) find a very large consumer welfare gain from the introduction of satellite TV.

10. Quality improvement in a product also often leads to a large gain in consumer welfare. The demand curve will typically shift outwards for an improved product. The area between the old and new demand curve determines the gain in consumer welfare. It can be approximately estimated by 0.5 times the difference in the virtual price and the market price multiplied by the change in quantity of the improved product minus quantity of the original product (for a constant price).[3] So if the

[2] See e.g. Hausman (2003) for an explanation. The conservative estimate of amount of consumer welfare gain is $0.5(p^* - p)q$ where p^* in the virtual price and q is quantity demanded.

[3] See Hausman (2003), p. 31 and p. 42 for an explanation of the measurement of consumer welfare gain from improved products. If the price of the product remains constant the conservative welfare change estimate is $0.5(p^* - p)\ (q^2 - q^1)$ where q^2 is demand of the improved product and q^1 is demand for the original product. If price changes the change in consumer welfare is $0.5[(p^* - p)\ (q^2 - q^1) - (p^2\ q^2 - p^1\ q^1)]$.

difference between the virtual price and market price is $60 (as above) and quantity demand increases by 10 units, the representative consumer welfare gain is $300. Again the increase in consumer welfare is typically large if demand increases significantly for the improved quality product.

11. Recently, A. Nevo et. al. (2013) estimated that consumers' willingness to pay in the US for a 10 megabit increase in internet speed averages US$17.60 per month.[4] On a yearly basis this amount is US$212 per year. With approximately 84.3 million broadband internet users in the US the total amount is US$17.8 billion per year.[5] Almost all of this amount is a gain in consumer welfare.

12. In the past decade the EU has implemented a strict price based regulatory regime for both landline telecommunications and for termination charges for mobile telecommunications. This regulation has led to either no growth in revenues or revenue decreases and decreases in profits for most EU telecommunications companies.[6]

> "European regulators will adopt far-reaching legislation to boost investment in the beleaguered regional telecoms industry and slash mobile roaming charges for consumers across the region…. The proposals are designed not just to boost the struggling companies in the sector but to underpin the wider growth in digital services and industries that require fast internet access and cheap mobile communications. The European telecoms sector has been hamstrung by the large number of companies in highly competitive national markets and heavy regulations that have exacerbated a long term fall in revenues."

[4] Prof. Nevo is the former chief economist at US DOJ, the chief US antitrust agency, which is charge of antitrust or telecommunications. Note this estimate is based on actual market behavior, not the response to a survey about purchasing intentions.

[5] Data for users as of Q42013. http://www.leichtmanresearch.com/press/031714release.html

[6] See e.g. the article by Daniel Thomas from London Financial Times (Sept 11, 2013, http://www.ft.com/intl/cms/s/0/41958a7e-1aee-11e3-a605-00144feab7de.html#axzz3NIQpSDEQ)

A similar report is in the Economist, September 14, 2013.[7]

13. Recently the EU Commission has determined that EU telecommunications in both landline and mobile services has fallen significantly behind other countries which have less strict regulation, such as the US. As the above articles discuss, the EU Commission has proposed decreased regulation and consolidation among service providers so that firms will have increased incentive to invest in fast internet access and 4G mobile services. The EU Commission has created a "Digital Agenda" to encourage investment in the digital infrastructure. Among the changes is a reform of the regulatory framework to encourage investment: "Create a new and stable broadband regulatory environment."[8] The goal is to improve internet speeds in the EU:

> "New services such as high definition television or videoconferencing need much faster internet access than generally available in Europe. To match world leaders like South Korea and Japan, Europe needs download rates of 30 Mbps for all of its citizens and at least 50% of European households subscribing to internet connections above 100 Mbps by 2020. The Digital Agenda aims to turn this ambition into reality by stimulating investments and proposing a comprehensive radio spectrum plan."[9]

Thus, the EU Commission has recognized that insufficient investment in telecommunications infrastructure has created an economic problem which requires increased investment in broadband infrastructure and mobile technology.

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[7] http://www.economist.com/news/business/21586321-digital-commissioner-proposes-single-market-speed-up-europe-kroes-control

[8] http://ec.europa.eu/digital-agenda/digital-agenda-europe

[9] http://ec.europa.eu/digital-agenda/en/our-goals/pillar-iv-fast-and-ultra-fast-internet-access

14. This policy shift in Europe arising from decreased investment is similar to the outcome in the US where TSLRIC (TELRIC) regulation led to decreased investment. When the FCC changed its policy to exempt new internet infrastructure from price regulation, Verizon built its FTTH (FiOS) network and AT&T built its FTTN (U-verse) network, which provide high speed internet service to residential customers.[10]

15. The effect of regulation on investment in the EU is discussed in a recent report.[11] The report finds that "American operators have invested almost twice as much per capita [in broadband] as their European counterparts in recent years." (p. 2) For example in 2004 US investment per capita was almost the same as EU investment per capita in broadband. The US decreased regulation for new investment and by 2013 investment per capita was approximately $230. EU investment per capita was approximately $120 in 2013. (Figure 1) This large "investment gap" was an outcome of EU regulation which the EU Commission has stated it will reform. Similarly, 4G mobile reaches only 26% of the European population while Verizon in the US reaches 97%, and AT&T, Sprint, and T-Mobile also have well-developed 4G networks. (p. 4 Table 1).

16. Economists have determined that consumer welfare should be the goal of regulation.[12] New and improved products become an important factor (perhaps the most important factor) in increased consumer welfare from telecommunications. Mobile telecommunications, the internet, and smartphones (3G and 4G) all provide

[10] For a discussion see e.g. Hausman and Taylor (2012 and 2013) and Hausman and Sidak (2014).
[11] R. Layton, "The European Union's Broadband Challenge", 2014. See Figure 1, p.3.
[12] See e.g. Hausman and Sidak (1999).

services which have led to significant gains in consumer welfare. Significant investment has been required to provide each of these new and improved services.

17. The consumer welfare standard of economists is very similar to the "long-term benefit of end-users" (LTBE) approach used in the NZ Telecommunications Act. The legislative purpose statement in Section 18(2A) of the Telecommunications Act requires the Commission to give consideration to the incentives to innovate and risks faced by investors in new telecommunication services which involve significant investment:

> *"…in determining whether or not, or the extent to which, competition in telecommunications markets for the long-term benefit of end-users of telecommunication services within NZ is promoted, consideration must be given to the incentives to innovate that exist for, and the risks faced by, investors in new telecommunications services that involve significant capital investment and that offer capabilities not available from established services."*

18. Above I discussed the large gains in consumer welfare from new services and quality-improved services in telecommunications. These welfare gains are among the most important factors in the LTBE. For quality improvement for the internet, faster speeds are a focus of investment. However, a reduction in congestion and a reduction in internet outages are also important factors in quality. Consumers, businesses, and government agencies all rely on the internet for email, downloads for work and entertainment, e-services, and many other uses. Network outages and congestion significantly degrade internet performance. While the consumer value of less congestion has not been quantified, less congestion of the internet is highly valued by

consumers as the recent experience in the US over network congestion and the performance of Netflix has demonstrated.[13]

19. These concerns relating to congestion and quality-improved services are important for UBA and similar services provided at the wholesale level since the wholesale level service will typically be the primary determinant of service quality for final consumers. I conclude that the costs of network congestion and degraded quality of service to consumers as a result of under-estimating WACC or the TSLRIC price are significantly greater than the costs to consumers of over-estimating WACC or the TSLRIC price and having somewhat higher prices, as I demonstrate below.
20. Given the high value that consumers, business and government place on internet usage, regulatory policy that creates investment incentives to provide improved quality (speed) internet, decreased congestion, and decreased outages on the legacy copper network will lead to significant gains in economic welfare. Thus, any estimation error for TSLRIC which creates investment disincentives will harm the LTBE. Given the inherent uncertainty in TSLRIC estimation, an uplift to WACC and to the TSLRIC price will guard against the potential welfare-decreasing effect of TSLRIC estimation error.
21. While the regulatory-determined TSLRIC is based on a hypothetical operator, Chorus will still have increased investment incentives if the Commission provides an uplift to WACC or the TSLRIC price. If Chorus invests in new services or higher quality services, the prices of these new services will be "anchored" by the TSLRIC price of regulated services so higher regulated prices increases the incentive to invest in new

[13] Netflix is estimated to provide 35% of peak-time internet traffic in the US. See e.g. http://time.com/98987/netflix-streaming-traffic/

services. Likewise, if Chorus invests in new services, there is a risk that these services become subject to regulation and that TSLRIC will be applied to set the price so that investment incentives are again affected by the regulated price. Since TSLRIC prices do not take account of asymmetric risk, as I now discuss and the Commission has previously recognized, the use of TSLRIC prices will distort investment incentives by Chorus. An uplift to WACC or TSLRIC will decrease the effect of the distortion in investment incentives.

IV. The Commission Draft Report Fails to Take Account of Asymmetric Risk Arising from Sunk and Irreversible Investments

22. TSLRIC regulation creates asymmetric risk for investment returns because it truncates return from favorable outcomes. This situation has been recognized by regulators. I discuss this potential problem and why it should lead to an increase in WACC and TSLRIC price in regulatory decisions.

23. The Commission's draft proposal does not take account of asymmetric risk arising from sunk and irreversible investments. Also, considerable risk arises from potential technological obsolescence of telecommunications infrastructure. I discuss academic research which demonstrates that the "free option" given to access seekers under TSLRIC regulation distorts investment incentives and leads to reduced investment by the regulated firm. That is, the free option which access seekers receives allows them to free ride off of investments by the wholesale fixed network provider regulated firm. If outcomes turn out to be good the access seeker buys the service at a cost-based regulated price. If outcomes turn out to be bad, the access seeker has not

invested and is not required to help pay for unsuccessful investment. Thus, the access seeker receives an option for free on the investment outcomes financed by the regulated firm. This asymmetric return situation caused by the truncation of the upper end of the distribution of returns leads to a distortion in investment incentives for the regulated firm.

24. The commission states: "We are required to set forward-looking cost-based access prices for UCLL and UBA using a total service long run incremental cost (TSLRIC) methodology" (¶ 2) I note the term "forward-looking" which is consistent with application of TSLRIC worldwide. However, application of TSLRIC to investment creates asymmetric risk because it truncates returns at the top end of the distribution of investment returns because regulation gives an access seeker a "free option" to buy access at cost-based prices if the investment is successful but take no risk for sunk investments which are not successful. I have analyzed this problem in my academic research, Hausman (1997, 1999, 2014) and G. Guthrie (2006) and R. Pindyck (2007) have also analyzed this problem. I first testified to this problem before the Commission in 2003, and it has been widely recognized as creating regulatory disincentives to new investment. The academic research finds that asymmetric risk will lead to distorted investment incentives which leads to insufficient investment, compared to the (imperfectly) competitive situation. The conclusion from the academic research is that regulation should adjust the WACC to take account of this distortion.

25. It has been widely recognized that most of the investment in a landline telecommunications network is sunk and irreversible investment, i.e. it has small or

negligible value in another use. Economic analysis demonstrates that the investment hurdle rate and thus the WACC is sensitive to the situation where new investment is sunk and irreversible. Generally the hurdle rate is significantly higher in this situation.

26. In the telecommunications situation academic papers by Hausman (1997, 1999), Hausman and Sidak, (1999, 2014), Guthrie (2006), and Pindyck (2007) demonstrate that not taking account of sunk and potentially stranded investment leads to a significant downward bias in the calculation of the cost of capital. Thus, increasing the WACC uplift would help to mitigate this problem.

27. An example from the US is Verizon (VZ) which in much of its landline residential network has invested in FiOS in much of its service area, a fiber based network (FTTP) which allows for fast internet and VOIP telephone service. The use of its residential copper based network has decreased significantly. Similarly, AT&T has invested in a fiber to the node residential network so the copper-based feeder network is no longer used. AT&T recently took a multi-billion write-off for its copper-based network as much it has become stranded investment, replaced by its U-verse FTTN network.[14] AT&T invested in its FTTN network which is not price regulated and truncation of returns cannot occur. To the contrary the legacy copper network is price regulated by TELRIC, and neither AT&T nor VZ invested to upgrade DSL on their copper networks. Indeed, some commentators have claimed that TELRIC regulation of the copper network removed the incentive for upgrades to the copper network so

[14] http://www.telecomlead.com/telecom-services/att-take-10-bn-hit-q4-abandon-copper-networks-55481.

that slow DSL speeds occur over the copper network where VZ and AT&T fiber networks do not exist.[15]

28. Both VZ and AT&T have petitioned US regulators to be allowed to abandon service on their respective copper networks.[16] The old copper networks are then "stranded assets" a term commonly used in telecommunications, because they no longer earn sufficient revenues to help fund the investment the companies undertook.

29. In the US when the vast majority of the copper-based investment was originally made, price regulation was done under the "used and useful" standard. That is, once the investment entered the regulatory capital base (i.e. it was used and useful) the regulatory guaranteed it would not become stranded. Even if the asset were no longer used, the regulated company was supposed to receive a return on its investment until it became fully depreciated. Thus, investment did not become "stranded" under this regulatory framework.[17]

30. In the 1990s the regulatory framework changed in the US and cost of service regulation was no longer used for the large telecom companies. However, typically the starting point for regulated prices under a price cap system was current prices so historical undepreciated investment was contained in the regulated prices. See e.g. Hausman and Taylor (2012, 2013) for a discussion.

31. However, forward looking (new) investment does not have this regulatory provision. If for example, mobile telecommunications continues to advance and as predicted

[15] See e.g. http://www.progressivepolicy.org/wp-content/uploads/2014/03/2014.03-Ehrlich_A-Brief-History-of-Internet-Regulation1.pdf, p. 9 and p. 16.

[16] http://www.businessweek.com/news/2014-02-28/at-and-t-proposes-alabama-florida-for-digital-tests-to-lose-rules

[17] See e.g., e.g. Kahn (1988) and Guthrie (2006).

download speeds reach 100 Mbs in the next 5 years, demand for landline internet service may well decrease markedly. Investment in residential fiber based networks may not earn an economic return. Indeed, VZ has not invested in extension of its FiOS network in the past few years.

32. The Commission recognizes that it previously has used the term "asymmetric risk" in respect to asset stranding and the risk that truncates a firm's distribution or returns at the one extreme, without an offsetting truncation at the other end. (¶ 214) This outcome arises from sunk and irreversible investment which I explained in my academic research (1997, 1999) and in my previous testimony to the Commission. The conclusion of academic research is that TSLRIC needs to increase WACC to cause it to approximate the higher hurdle rate that occurs because of sunk and irreversible investment.[18] An uplift in the WACC and the TSLRIC price would mitigate the problem created by TSLRIC in the presence of sunk and irreversible investment.

33. The economic literature which I have discussed emphasizes and measures the effect of new telecommunications service and improved quality on consumers. The academic literature also discussed why TSLRIC does not achieve it because it gives a "free option" to access seekers and therefore gets the WACC incorrect. An uplift to WACC and the TSLRIC price would counteract the effect of the free option for access seekers and the distortion on investment incentives that it creates.

[18] The effect of sunk and irreversible investment is demonstrated by the copper network which becomes a stranded investment when new fiber based networks are constructed, as has occurred in the U.S. with Verizon and AT&T. Stranded investment occurs because the network cannot be used for other economic purposes; hence the investment is sunk and irreversible.

V. The Commission Rationale for an Uplift Holds in the Current Situation

34. The Commission rationale for an uplift holds in the current situation. Since the costs of internet network outages and congestion to consumers of under-estimating WACC are significantly greater than the costs to consumers of over-estimating WACC and having somewhat higher prices the Commission should provide an uplift to provide investment incentives.

35. In the UCLL Draft Determination (¶¶ 138-143) the Commission explains how it considers that a TSLRIC-based price should promote efficient investment. The Commission states that its approach to TSLRIC:

> "*…emphasises the use of forward-looking costs, resulting in a price that reflects the efficient costs of building an equivalent service today. The intention is that an* ***access seeker will build an alternative rather than purchase the regulated access only where building is more efficient*** *and therefore is in the long-term best interest of end-users*." [¶ 139, emphasis added]

36. In ¶ 142 the Commission states that:

> "*…incentivising efficient build or buy choices is consistent with the section 18 purpose statement, by* ***promoting investment in alternative infrastructure****, and in turn promoting competition for the long-term benefit of end-users*." [emphasis added]

In addition, in paragraph 143, the Commission states that:

> "*…separate from incentivising build or buy choices, a TSLRIC-based price rewards efficient investment. The TSLRIC price is independent from actual costs, and so provide* ***incentives for Chorus to operate efficiently*** *and*

consequently, adopt the most efficient mix of capital expenditure (capex) and operating expenditure given its actual network." [emphasis added]

These Commission goals need to be analyzed in light of the consequences of possible estimation error and the asymmetric effect on investment incentives which arise with TSLRIC regulation.

37. It is important to note that even the European Commission has recommended (NGA Recommendation) applying a risk premium on the cost of capital, after taking into account different factors of uncertainty.[19] In accordance with the NGA Recommendation, a number of regulators in Europe have added a risk premium to the cost of capital for FTTH-based local loop prices acknowledging the higher risk associated with an FTTH investment. The Commission, on the other hand, has chosen not to apply an uplift (risk premium) although it has modelled FTTH-based TSLRIC price for UCLL. Therefore, it has created negative investment incentives for any current or future FTTH investment.[20]

38. Under-estimating WACC or TSLRIC will lead to a distortion in investment incentives by access seekers as discussed by Hausman and Sidak (1999, pp. 458-464 and 2014). Access seekers will decide to purchase regulated access to legacy copper-based UCLL service instead of building an alternative FTTH-based local loop, for which the Commission has modelled the costs. This distortion of the build or buy choice would therefore be inconsistent with the section 18 purpose statement of

[19] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1422024847937&uri=CELEX:32010H0572

[20] While much of the FTTH build is under contract, if the investment incentives are distorted, further improvement in speed or capacity of the FTTH infrastructure will not be undertaken. In the US Verizon has upgraded it FTTH network in terms of both speed and capacity due to increased consumer demand and the growth in demand for streaming video, e.g. Netflix.

promoting investment in alternative infrastructure, and in turn promoting competition for the long-term benefit of end-users as I discuss above in ¶ 35.

39. The Commission reports that it uses an uplift in WACC for price-quality regulation because "we expect the costs to consumers of under-estimating WACC to be greater than the costs of consumer of over-estimating WACC" (¶ 204).

40. The Commission explains that it applied the uplift because it feared that the risk of under-investment in network reliability could lead to "major supply outages". (¶ 207) It stated that for UCLL and UBA the effect of competition, migration to fiber-based services, and investment from access seekers are more relevant factors. However, I find that the Commission has not taken into account consumer valuation of higher speed internet service over the copper network as well as other improvements in quality such as fewer outages and decreased congestion, all of which I discussed above.

41. The Commission's draft report has not recognized that the first two factors, the effect of competition and especially the second factor, the migration to fiber-based networks will lead to the copper network becoming stranded assets. Thus, in a forward-looking application of TSLRIC investment which is sunk and irreversible has a significant probability of becoming obsolete in the near future, which would lead to a higher WACC.

42. The Commission recognizes that the copper network will be replaced in the near future. (¶ 223) But, the Commission has not recognized that new investment or investment in improved quality typically leads to a much greater gain in consumer

surplus than the consumer loss from prices which are only too high by a small amount.

43. Indeed, the well-known envelope principle of economic analysis demonstrates that for only a marginal increase in price, change in consumer welfare is very small. For small price increases the change in consumer welfare is approximately linear in the price increase. Thus, for a price increase of say 5% the approximate change in consumer welfare from consuming the product would be approximately minus 5%.

44. The increase in consumer welfare from a new product is the entire area under the demand curve an above the price, e.g. Hausman (1997, 2003). In my analysis of numerous new products and service in telecommunication I have typically found the consumer surplus is approximately two times the revenue from the product or service, e.g. Hausman (2002). Thus, the consumer welfare increase is approximately 20 times the potential consumer welfare decrease. Taking the inherent uncertainty of cost estimation into account for TSLRIC, the LTBE standard of consumer welfare yields the result that investment in new and improved telecommunications services should be favored. And as I discussed above, an uplift in WACC and an increase in regulated TSLRIC prices increase the incentive to invest in new and improved services because these new and improved service prices will be affected by regulation.

45. For improvement in quality the approximate gain in consumer surplus is the area between the old demand curve and the new demand curve, e.g. Hausman (2003). For example, if the improved quality lead to a 20% increase in demand the change in consumer welfare is approximately 20% compared to the potential 5% loss. Thus, the

risk of under-investment in either new products or improved quality is typically much greater than the downside risk of too high a price. Again the LTBE standard would favor investment incentive to improve quality.

46. The Commission has proposed to alter its previous approach of providing an uplift, relying in part on the recommendation of Prof. Vogelsang that the Commission failure to consider the re-use of civil works results in a price which is sufficient so that uplift is unnecessary. However, valuing re-useable assets at historic cost is not consistent with forward-looking pricing and TSLRIC. The economic value of these assets will change and, indeed, the efficient design of these assets will likely change when the network is fiber based rather than copper (coax) based.[21] Thus an economic study of the optimal design and economic cost in a forward looking study would be required before this factor could be included correctly in TSLRIC estimation.

47. I note that Prof. Vogelsang has made no empirical estimate which justifies his position. He points to a single factor and states that since, in his opinion, it has been omitted, the asymmetric risk is taken care of.[22] To properly consider this argument, one would need to make an estimate of how much price would be inflated by this factor and compare it estimates in the academic literature of consumer welfare gains from new or quality improved services. As I discussed above, the academic literature finds significant gains in consumer welfare from improved internet service. In the US context I find an increase of approximately US$211 per year or NZ$285 per year for

[21] For example, given the much higher capacity of fiber compared to coax copper, the design of ducts would likely be quite different.

[22] Prof. Vogelsang identifies a second factor, the lack of a "performance adjustment". However, this factor does not properly belong in a TSLRIC study which is based on cost. A "performance adjustment" instead involves consumer valuation of different services and thus is based on demand factors. To include relative consumer valuations, demand studies and estimation would be required as well as an equilibrium study of market outcomes. These models would go far beyond the cost based requirements of TSLRIC estimation.

10 megabit faster internet speed. This empirical estimates would be significant greater than the economic effect of including an adjustment for civil works which is the factor that Prof. Vogelsang discusses. Prof. Vogelsang's opinion is based on "hand waving" rather any an empirical estimate of the tradeoffs involved in setting an appropriate WACC.

48. The academic literature shows the potential gain from faster UBA access is significant as I discussed above and is likely to far exceed the single factor which Prof. Vogelsang identifies. Also, decreased network congestion is another factor which the Commission should take into account when considering consumer welfare and the effect of TSLRIC regulation.

49. Further, the commission decision has made modelling assumptions which may well lead to an underestimate of TSLRIC. Examples include:

    i. 50% discount on Chorus operational expenditure

    ii. 50% reduction in aerial deployment costs on the basis that the hypothetical efficient operator shares poles with electricity distribution businesses at no cost

    iii. Exclusion of a substantial proportion of the rural network on the basis that the hypothetical operator would receive capital contributions to connect such premises.

    iv. Assumption that demand is constant for the duration of the regulatory period. Thus, no allowance for decreasing usage and increasing unit cost on the legacy copper network as users migrate to fiber.

50. Thus, economic factors can lead to estimated TSLRIC prices being either too low or too high. Prof. Vogelsang only considers economic factors which he believes cause TSLRIC to be too high. He has ignored other economic factors which can cause estimated TSLRIC to be too low.

51. The Commission has recognized the uncertainty in estimating TSLRIC. It has also recognized the asymmetric risk to consumer welfare of too low regulated prices because consumer gains of new and improved quality services are typically much higher than potential losses from too high prices. The change in Commission policy regarding an uplift based on the single factor identified by Prof. Vogelsang yields a significant likelihood that consumer welfare in New Zealand will be harmed.

52. The Commission "protection" of access seekers investment is misplaced (¶ 229, p. 52) because access seekers investment will not lead to quality improvement (e.g. higher speeds for broadband internet or reduced network congestion) for consumers. Thus, the Commission is "protecting access seekers" and is failing to take into account the interests of consumers under the LTBE standard. As I discussed above, the commission is required under s 18(2A) of the Act to consider the LTBE under a consumer welfare approach and not the economic welfare of access seekers. Consumers receive significantly more benefit from new and improved services than from slightly lower prices when TSLRIC is underestimated.

VI. Prof. Vogelsang Disregards Academic Analysis of TSLRIC and Investment Incentives

53. Academic analysis has demonstrated that TSLRIC regulation distorts investment incentive and leads to too little investment. Prof. Vogelsang ignores experience in the

US where removal of TSLRIC regulation on new investment led to both Verizon and AT&T building multi-billion dollar fiber-based networks to replace their copper networks. Prof. Vogelsang fails to consider the economic interaction of regulation of the old networks and competition from the new networks.

54. In ¶ 10 Prof. Vogelsang considers the effect of decreasing demand on TSLRIC calculation. However, he fails to note that most regulators require regulated companies to continue to provide the service, e.g. "provider of last resort" even when demand decreases.

55. An unregulated company might well replace the copper network with a fiber network and abandon the old copper network, as VZ and AT&T are attempting to do in the US. The regulatory requirement of maintaining the copper network e.g. for access seekers use, creates an option for the access seekers. This option has positive value and is not reflected in the TSLRIC price. The importance of option value for access seekers in telecommunications has been emphasized by Hausman (1997, 1999), Guthrie (2006) and Pindyck (2007) and has been recognized by regulators such as Ofcom and the Commission.[23] Thus, a downward bias exists in the TSLRIC estimate. Prof. Vogelsang ignores this potential important economic factor.

56. Prof. Vogelsang's emphasis on the economic lives of ducts is incorrect. (¶ 12) The demand for ducts in the future is uncertain as the mobile internet may overtake landline internet for many consumers. This outcome is currently occurring in the US where a significant percentage, about 34% in a survey in early 2014, mostly use only

[23] Ofcom states: "Section 9 of this document provides a summary of these responses. In the light of these responses Ofcom concludes that, going forward, its analysis should take account of the value of real options where appropriate." http://stakeholders.ofcom.org.uk/consultations/cost_capital2/statement/, "Ofcom's Approach to risk in the assessment of the cost of capital", 2005, ¶ 1.29.

their mobile phones to access the internet.[24] While I recognize the percentage would currently be lower in NZ, improvements in technology and networks upgrades are likely to continue the migration of many consumers to the mobile internet reducing landline internet demand. This uncertainty needs to be taken into account in considering economic lives.

57. Prof. Vogelsang recognizes that only Chorus is investing in the copper network. (¶ 22). Thus, quality improvements will arise from Chorus investment which may be especially important in rural areas. I understand that the FTTH network will extend to approximately 80% of the population, so the remaining 20% will depend on the copper network for internet access unless wireless (mobile) technology replaces the landline network. Prof. Vogelsang thus differs from the Commission's approach which effectively amounts to the protection of access seekers, placing all the risk on Chorus. (NZCC ¶229 and discussed above) However, Prof. Vogelsang fails to discuss the finding that the primary factor in consumer welfare gain in telecommunications is from new products and improvements in quality in existing services such as the internet and mobile.

58. Prof. Vogelsang claims (¶ 23) that the relevant quantity for TSLRIC estimation is the demand before it begins to decrease. I disagree because this approach will lead to lower prices than with the quantity being actually demanded, and a hypothetical company would not build the network at the regulated TSLRIC price which assumes higher demand. That is, when a company makes a decision whether to build a new network it must consider the economic returns over the entire lifetime of the network.

[24] http://www.pewinternet.org/fact-sheets/mobile-technology-fact-sheet/

If it forecasts that demand will decline over time, it may not build the network if regulated prices assume higher demand because it will not recover its investment unless the price is high enough when demand decreases. Looking at the demand over the lifetime of an asset has previously been recognized by regulators.[25] Since in the real world according to Prof. Vogelsang the price will be lower and quantity will also be lower Chorus would not cover its economic costs of the network.

59. Prof. Vogelsang argues against an uplift because he claims that the TSLRIC is "more than high enough". (¶ 24) This claim is based on no empirical analysis and is "hand waving". Investment incentives are unlikely to exist in quality improvement even though consumers place a high value of it, as discussed above. Especially as FTTH will not occur in rural areas, quality improvement for faster internet speeds and less congestion will increase consumer welfare.

60. Prof. Vogelsang gives only a partial view of the extensive economic literature which emphasizes and measures the effect of new telecommunications service and improved quality on consumers and why TSLRIC does not achieve it because it gives a "free option" to access seekers and there gets the WACC incorrect.

61. The free option arises because access seekers do not take the risk in investment but use the asset if the new or improved service is successful. Prof. Vogelsang fails to take account of this problem in his defense of TSLRIC. He recognizes its existence (¶ 64) but does not say how it should be implemented in TSLRIC prices.

62. In his discussion of decreasing demand (¶78ff) Prof. Vogelsang fails to recognize that the company with the decreasing asset base in a forward-looking world must make

[25] See e.g. Kahn (1988)

the decision whether to build it networks. Thus, under a TSLRIC approach a regulated company may decide not to build the network because it will not earn sufficient revenue when demand decreases. However, if regulated prices adjust when demand decreases so that the fixed costs of the network receive an economic return, the regulated company will find it economic to invest in the network.

63. Prof. Vogelsang claims that the copper network will be "highly profitable". (¶ 100) His claim is based on no empirical analysis and fails to take into account the expected migration away from landline to mobile services as their speeds increase (as discussed above). Thus, Prof. Vogelsang fails to recognize that the copper network might appear profitable in hindsight but that does not take into account the risk that the original investors took on when building the asset, that it would be stranded earlier by superior technologies as has occurred.[26]

64. In his analysis of investment incentives (¶ 111-112) Prof. Vogelsang assumes that no investment will be undertaken to lead to quality improvement of the copper network, e.g. faster speeds or reduced congestion or outages. Consumer welfare will decrease because consumers value higher speed and less congested broadband as discussed above.

65. Prof. Vogelsang in his conclusion (¶ 118) finds that TSLRIC will likely be overestimated because of the Commission's failure to consider re-use of civil works. I disagree. Prof. Vogelsang points to arguably one effect but fails to consider effects in the opposite direct of causing TSLRIC to be "too low" Above I discussed five

[26] Above I discuss the principle of "used and useful" in US regulation which, in principle, guaranteed an economic return to an investment even if it became a stranded asset. When the "used and useful" principle is not used, the risk of an investment becoming a stranded asset becomes an important factor in determining the riskiness of an investment.

such effects—assumptions made in the TSLRIC model and the failure to take account of real options. Thus, I find Prof. Vogelsang's claim that Chorus will gain "substantial profits" to be unsupported and not considered in the context of the effect on the LTBE.

66. Since Prof. Vogelsang does no empirical analysis, his conclusion has no support. Instead, he has presented a view that only looks at one factor which might move TSLRIC in one direction while ignoring factors that would move it in the other direction. His claim of "substantial profits" is also unsupported

67. Lastly Prof. Vogelsang's claim that "This would likely offset any efficiency argument (Alfred Kahn), investment risk or lumpiness what would go again the classical TSLRIC" is again "hand waving" and is unsupported by any empirical analysis. I note that the Commission does not consider any of these issues which Prof. Vogelsang identifies at all. Instead the Commission accepts Prof. Vogelsang's assertion that his two "generous" points can balance out all of the factors going the other way. For example, Prof. Vogelsang admits that I found that the WACC needed to be significantly higher using investment riskiness, but he fails to do any tradeoff quantitatively with the civil works factor and FTTH MEA factor that he identifies. He also has not considered the inherent tradeoff that arises from the uncertainty in TSLRIC estimates. Thus, Prof. Vogelsang has done no balancing of the economics factors which need to be taken into account when evaluating the outcome of TSLRIC estimation.

68. I have discussed the significant increases in consumer welfare from new and improved quality telecommunications services which are consistent with the

Commission's LTBE standard. These consumer benefits should be considered with respect to the somewhat lower prices which may occur with lower TSLRIC estimates. I find that the tradeoff is in favor of new and improved quality services based on academic research. Prof. Vogelsang, to the contrary, has done no balancing analysis of the well-known distortions on investment created by TSLRIC which lead to insufficient investment versus the effect of TSLRIC on final prices to consumers.

69. Given the potentially large losses to consumers from insufficient investment in the internet arising from the uncertainty inherent in TSLRIC estimates and the asymmetry in returns introduced by the free option given to access seekers, an uplift to WACC and to the TSLRIC price will decrease the distortion to investment incentives. The outcome will be an expected increase in the LTBE.

References

Goolsbee A., and A. Petrin, "The Consumer Gains from Direct Broadcast Satellites and the Competition with Cable TV", *Econometrica*, 72, 351-381, 2004

Guthrie G., "Regulating Infrastructure: The Impact on Risk and Investment", *Journal of Economic Literature*, 44, 925-972, 2006.

Hausman J., "Valuation and the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity: Microeconomics*, 1-38, 1997

Hausman, J., "Taxation by Telecommunications Regulation," *Tax Policy and the Economy*, 12, 29-48. 1998.

Hausman, J., "Cellular Telephone, New Products and the CPI," *Journal of Business and Economics Statistics*, *17*, 188-194, 1999

Hausman, J., "The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds, The New Investment Theory of Real Options and its Implications for Telecommunications Economics, 1999.

Hausman, J. "Efficiency Effects on the U.S. Economy from Wireless Taxation", *National Tax Journal*, 53, 733-742. 2000.

Hausman, J., "Competition and Regulation for Internet-related Services: Results of Asymmetric Regulation", R. Crandall and J. Alleman ed., Broadband, Brookings, 2002

Hausman, J., "Mobile Telephone," in M. Cave et. al. eds, Handbook of Telecommunications Economics, North Holland, 2002.

Hausman, J., "Sources of Bias and Solutions to Bias in the CPI", *Journal of Economic Perspectives*, 17, 23-44. 2003

Hausman, J., "Regulated Costs and Prices in Telecommunications," in G. Madden ed. International Handbook of Telecommunications, 2003.

Hausman, J., and H. Shelanski, "Economic Welfare and Telecommunications Welfare: The E-Rate Policy for Universal Service Subsidies," *Yale Journal on Regulation*, 16, 1999

Hausman J. and J.G. Sidak, "A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks," *Yale Law Journal*, 109, 417-505. 1999

Hausman J. and J.G. Sidak, "Telecommunications Regulation: Current Approaches with the End in Sight," in N. Rose. ed., *Economic Regulation and Its Reform*, 2014.

Hausman, J., J.G. Sidak, and H. Singer, "Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers", *Yale Journal on Regulation*, 18, 129-173, 2001.

Hausman J., J.G. Sidak, and T. Tardiff, "Are Regulators Forward-Looking? Copper Prices and Telecommunications Networks," *FCC Communications Journal*, 61, 199-227, 2008

Hausman J. and W. Taylor, "Telecommunications Deregulation", *American Economic Review*, 2012

Hausman J. and W. Taylor, "Telecommunications in the US: From Regulation to Competition (Almost)", *Review of Industrial Organization*, 42, 2013

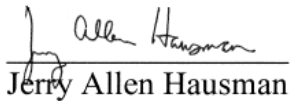
Kahn, A., The Economics of Regulation, (Cambridge MA, MIT Press), 1988

Layton, R., "The European Union's Broadband Challenge", www.aei.org, 2014

Nevo, A., J. Turner, and J. Williams, "Usage-Based Pricing and Demand for Residential Broadband", **http://ssrn.com/abstract=2330426,** 2013

Ofcom, "Ofcom's Approach to risk in the assessment of the cost of capital", 2005.

Pindyck, R. "Mandatory Unbundling and Irreversible Investment in Telecom Networks", *Review of Network Economics*, 6, pp. 274-298, 2007



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