HOUSTONKEMP
Economists

Response to Spark New Zealand's *Attachment D: Illustrative estimate of social cost of high price*

A Report for Chorus

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Executive Summary

Chorus engaged HoustonKemp to review Attachment D of Spark New Zealand's (Spark's) submission to the Commerce Commission (the Commission), entitled: *Illustrative estimate of social cost of high price*.

Spark received advice that a plausible competitive aggregate price for unbundled copper local loop (UCLL) and unbundled bitstream access (UBA) services (hereafter referred to jointly as 'the price of UBA services') is $24.47. The purpose of Spark's Attachment D was to estimate the impact on gross domestic product (GDP) of setting the price of UBA services at this level rather than at $38.39, which was proposed in the Commission's draft decision. Spark has used GDP as its measure of the social benefits of higher broadband uptake.

We have not reviewed, and so are not in a position to comment on, the validity of Spark's estimate of the efficient price. However, leaving this issue aside, we question Spark's results, in particular:

- the estimate that a further 21.6 per cent of New Zealand businesses and households would take up broadband appears implausibly high given that only 22 per cent of households are currently estimated to be without access;[1] and
- the estimated impact on GDP of between $128 and $214 million appears high given the likely nature of businesses and households that are currently choosing not to purchase broadband access.

Our review of Spark's analysis demonstrates that it suffers from a number of shortcomings, including that:

- it does not take sufficient account of the benefits of migrating to the fibre network;
- Spark's calculation of the percentage change in retail broadband prices ignores the fact that wholesale rates make up less than half of retail prices;
- the demand elasticity assumption is not consistent with the current high levels of broadband uptake in New Zealand; and
- similarly, the assumed relationship between broadband uptake and real GDP growth is inconsistent with current levels of broadband uptake in New Zealand.

In contrast to Spark's estimation, we find that:

- the increase in broadband uptake from the proposed price reduction is more likely to be between 2.1 and 6.2 percentage points, rather than the 21.6 percentage points estimated by Spark. This lower estimate takes account of:
  - the fact that wholesale UBA prices account for less than half the retail prices faced by consumers;
  - a demand elasticity that is more applicable to New Zealand's high levels of broadband penetration;
  - elasticities can be used to calculate percentage changes in demand, rather than percentage point changes; and
- the sensitivity of GDP to broadband uptake rates is likely to be considerably lower than that proposed by Spark.

As a result we conclude that Spark's Appendix D provides no reliable evidence to suggest that GDP would be increased as a result of lowering the UBA prices from the proposed $38.39 to $24.47.

[1] Statistics New Zealand, *2013 Census Data Transport and Communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

1. Introduction

1.1 Purpose of this report

HoustonKemp has been engaged by Chorus to review Attachment D of Spark New Zealand's (Spark's) submission to the Commerce Commission (the Commission), entitled: *Illustrative estimate of social cost of high price*. This submission was provided by Spark in response to the Commission's draft decision on the price for the monthly rental of the unbundled copper local loop (UCLL) and unbundled bitstream access (UBA).

1.2 Context

Chorus provides UCLL and UBA services to retailers of broadband internet services. The UCLL service provides access to Chorus's copper local loop while the UBA service provides access to Chorus's electronic equipment and software.[2] The prices of these services are regulated by the Commission under the Telecommunication Act 2001.

Although the Commission sets the prices of UCLL and UBA services separately, UBA access seekers necessarily require UCLL services and so, from herein, we refer to the sum of the price of UCLL and UBA services as 'the price of UBA services'.

In determining the price of UBA services the Commission is required to:

> … promote competition in telecommunications markets for the long-term benefit of end-users of telecommunications services within New Zealand.[3]

In determining whether, or the extent to which, its decision promotes competition for the long-term benefit of end-users, the factors the Commission must consider include:

- the efficiencies that result from its decision;[4] and
- 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. [5]

The Commission's draft determinations for UCLL and UBA services propose to increase the price of UBA services from $34.44[6] to $38.39 per month, which is expected to provide incentives for existing users of broadband services to switch to ultra-fast broadband.

The Ultra-Fast Broadband Initiative is a public private partnership that aims to provide 75% of New Zealand's population with an optical fibre connection by 2019. The ultra-fast broadband initiative will deliver download speeds of at least 100 megabytes per second (Mbps), which will provide an unprecedented increase in

[2] Specifically, UBA services provide access to enables access to, and interconnection with, that part of Chorus' fixed Public Data Network (PDN) that connects the End User's building to Chorus' first data switch (or equivalent facility), other than a DSLAM.

[3] The Telecommunications Act 2001, Part 2, Section 18(1).

[4] The Telecommunications Act 2001, Part 2, Section 18(2).

[5] The Telecommunications Act 2001, Part 2, Section 18(2A).

[6] Calculated equal to the sum of the UCLL price of $23.52 and the price of UBA services only of $10.92, See: The Commission, Final determination on the benchmarking review for the unbundled copper local loop service, Decision No. NZCC 37, 2 December 2013, page 60; and The Commission, Unbundled Bitstream Access Service Price Review, Decision [2013] NZCC 20, 5 November 2013, page 8.

internet speeds in New Zealand, where average download speeds are currently between 7 megabytes per second (Mbps) and 14 Mbps.[7]

1.3 Spark's Submission

As we note above, the Commission's draft determinations propose to increase the prices of UBA services to $38.39. However, Spark's consultant advised that a plausible competitive price for UBA services is $24.47 and, on this basis, Spark contends that the price of UBA services in the draft decision:

> … exceeds a reasonable estimate of the competitive price.[8]

> … exceeds a reasonable estimate of the efficient price.[9]

Spark contends that the lower UBA price proposed by its consultant would allow currently non-adopting households, which are predominantly low-income households, to adopt broadband. Spark further postulates that the welfare gains associated with providing incentives for non-adopting households to adopt broadband services will outweigh the welfare gains associated with providing incentives for existing broadband users to switch to ultrafast broadband.[10]

While Spark does not consider in any detail the welfare gains associated with existing broadband users switching to ultra-fast broadband, it does undertake a high-level estimate of the effect on gross domestic product (GDP) of lowering the price of UBA services from $38.39 to $24.47. Spark implies that an increase in GDP can be used as a measure of the improvement in welfare.

Spark's analysis relies on the following assumptions:

- retailers would pass on 75 per cent of any reduction in the price of UBA services to consumers;
- the price elasticity of demand for broadband services is -0.951; and
- a 10 per cent increase in broadband penetration in New Zealand will increase the real GDP growth rate by between 0.9 per cent and 1.5 per cent.

On the basis of these assumptions, Spark estimates that a UBA price of $24.47, rather than $38.39, would increase the demand for broadband by 21.6 per cent. Using this estimate and the assumed relationship between GDP and broadband penetration, Spark estimates that real annual GDP would be $128 million to $214 Million higher each year if the price of UBA services was $24.47, rather than $38.39.

1.4 Key contentions with Spark's submission

Aside from concerns regarding Spark's down-playing of the benefits of migrating to the fibre network and the merits of its estimated efficient price of $24.47, the conclusions reached in Spark's submission do not appear to be well-founded. Specifically, it is difficult to accept that:

- the proposed price reduction would result in a 21.6 percentage point increase, given that only 22 per cent of households are currently without broadband access; and
- an increase in broadband access of this level would increase GDP by the extent suggested, given existing penetration rates and the nature of businesses and households currently choosing not to purchase broadband services.

Closer examination of Spark's analysis reveals the following critical flaws:

[7] http://www.stuff.co.nz/technology/64907944/nz-broadband-speeds-slowly-improving.

[8] Spark submission, *UBA and UCLL FPP pricing review draft decision*, Submission to the Commerce Commission, 20 February 2015, page 80.

[9] Spark submission, page 80 and 82.

[10] Spark, Submission, page 82.

- Spark's calculation of the change in retail broadband prices ignores the fact that the wholesale broadband price (the UBA price), makes up less than half of the retail broadband price;
- the demand elasticity assumed by Spark is not consistent with the current, high, levels of broadband uptake in New Zealand;
- Spark miscalculates the increase in the percentage of households who would purchase broadband by applying the estimated percentage increase in demand to the entire population rather than existing demand levels; and
- Spark assumes a relationship between broadband uptake and real GDP growth that is inconsistent with current levels of broadband uptake in New Zealand.

Adjusting Spark's analysis to take account of these flaws substantially reduces the estimated effect on broadband uptake and real GDP growth from a reduction in the UBA price. The remainder of this report sets out in detail the limitations of Spark's analysis and the implications of undertaking a similar quantitative exercise on the basis of more plausible assumptions.

1.5 Structure

Our review of Spark's submission is structured as follows:

- Section 2 comments briefly on the two high-level flaws in the premise of Spark's analysis, namely:
  - the dismissal of the benefits of migrating to the fibre-based network; and
  - the estimation of $24.47 as the efficient price;
- Section 3 considers the relationship between wholesale UBA prices and broadband uptake;
- Section 4 considers the relationship between broadband uptake and GDP; and
- Section 5 summarises the implications of adjusting Spark's analysis to incorporate more plausible assumptions regarding the key relationships.

2. High-level Shortcomings in Spark's Analysis

2.1 Overview

Spark estimates the effect on real GDP of reducing the UBA price from $38.39 to $24.47 using an empirical relationship between broadband uptake and the real GDP growth rate. Spark estimates that reducing the UBA price from $38.39 to $24.47 would increase real GDP in each year by between $128 and $214 million.[11]

Before delving into the detail of Spark's analysis, it is important to point out two fundamental shortcomings in Spark's framework, namely:

- Spark's estimation of the efficient price is at odds with the Commission's analysis and submissions put forward by Chorus and its advisors; and
- higher UBA prices will incentivise consumers to migrate to the fibre network at a higher rate, which can be expected to provide a number of benefits and improve welfare. By ignoring these benefits in its analysis, Spark overstates the net benefit of lower UBA prices.

We elaborate briefly on each of these points below.

2.2 The estimated efficient prices

Spark's advisors estimated that the efficient price for UBA services is $24.47 and Spark uses this estimate as the basis of its analysis.

Chorus' other advisors have considered the appropriate UBA price in detail and have concluded that the UBA price proposed in the Commission's draft determination is likely to underestimate the true TSLRIC-based price for UBA.

An analysis of the efficient, or total service long run Incremental cost (TSLRIC), estimate of the UBA price is beyond the scope of this report, and so we proceed on the basis that the UBA price proposed by the Commission is:

- higher than the 'optimal' price proposed by Spark; and
- lower than the 'optimal' price proposed by Chorus.

Any reduction in the difference between the Commission's proposed prices and the 'optimal' price proposed by Spark will reduce the scale of the estimated effect on GDP noted in Spark's submission.

For ease of comparison, in the following two sections, we use Spark's estimate of $24.47 to demonstrate that, even taking such an extreme assumption, Spark has provided no reliable evidence that the impact on GDP will be significant. However, this should in no way be interpreted as an acceptance on our part of the correctness of Spark's estimate of the optimal price.

2.3 The benefits of migrating to the fibre network

Spark postulates that the welfare gains associated with providing incentives for non-adopting households to adopt broadband services will outweigh the welfare gains associated with providing incentives for existing broadband users to switch to ultrafast broadband.[12] However, this conclusion appears to be unfounded as

[11] Spark, *UBA and UCLL FPP pricing review draft decision*, Submission to the Commerce Commission, 20 February 2015, page 85.

[12] Spark, *UBA and UCLL FPP pricing review draft decision, Submission to the Commerce Commission*, 20 February 2015, page 82.

Spark does not consider in any detail the gains associated with existing broadband users switching to ultra-fast broadband.

We briefly summarise the academic literature on the benefits associated with households switching to ultra-fast broadband below.

Estimating the welfare gains associated with households adopting ultra-fast broadband is an inherently difficult task, since ultra-fast broadband will improve internet speed on an unprecedented scale and most countries are yet to implement ultra-fast broadband on a large-scale. It follows that there is limited data available to quantify the welfare gains associated with households switching from broadband to ultra-fast broadband and, consequently, the literature focuses on qualitative analyses of the likely benefits. For example, Hätönen (2011) states that: [13]

> In spite of the extensive research on the socio-economic impact of Internet and broadband, there is practically no existing research on the socio-economic benefits of super-fast broadband.

However, we note that in 2012 the Commission engaged a consultant to undertake a study of consumers' willingness to pay for faster broadband in New Zealand. The study estimated that 56 per cent of consumers were willing to pay at least $5 extra per month for high-speed broadband.[14]

The economic literature explains that ultra-fast broadband can significantly improve four main functionalities of internet services, namely:

- faster file transfers;
- video streaming applications;
- high quality real-time communication; and
- users to use multiple applications at the same time.

Ezell et. al. (2009) explain that there will be productivity benefits associated with faster file transfers, which will enable, and improve the effectiveness of, cloud computing and information sharing.[15] By way of example, the benefits of cloud computing include improved access to information, more secure storage, reduced information technology costs for businesses, improved collaboration and more flexible work practices. Ezell et. al. (2009) also explain the ultra-fast broadband will enable users to use multiple applications at the same time and highlight the multitude of electronic devices that are simultaneously active in the home, for example, digital cameras, home video editing equipment, cell phones, PDAs, digital video recorders, televisions, laptop computers, home monitoring systems and smart appliances.[16]

Kongaut and Bohlin (2014) highlight that faster video streaming from ultra-fast broadband will improve the development of education and health information[17] and increase competition in the provision of television services.[18] Similarly, there are multiple benefits associated with high quality real-time communication, for example: [19]

[13] Hätönen, J. (2011). *The economic impact of fixed and mobile high-speed networks*. EIB Papers, 16(2), 30-59, page 49.

[14] The Commission, *High speed broadband services demand side study*, June 2012, page 36.

[15] Ezell, S. J., Atkinson, R. D., Castro, D., & Ou, G. *The need for speed: The importance of next-generation broadband networks*, 2009, page 5.

[16] Ezell, S. J., Atkinson, R. D., Castro, D., & Ou, G. *The need for speed: The importance of next-generation broadband networks*, 2009, page 6 and 7.

[17] Kongaut, C.; Bohlin, E. Impact of broadband speed on economic outputs: An empirical study of OECD countries, 25th European Regional Conference of the International Telecommunications Society (ITS), Brussels, Belgium, June 2014, section 2.1.

[18] Ezell, S. J., Atkinson, R. D., Castro, D., & Ou, G. *The need for speed: The importance of next-generation broadband networks*, 2009, page 13.

[19] Ezell, S. J., Atkinson, R. D., Castro, D., & Ou, G. *The need for speed: The importance of next-generation broadband networks*, 2009, page 6, 8 and 15.

- improved collaboration and so innovation;
- remote diagnosis; and
- more flexible work practices.

These studies strongly suggest there are numerous benefits likely to arise from households and businesses switching from broadband to ultra-fast broadband that will likely have positive implications for economic growth and welfare. Further, with reference to the revolutionary nature of ultra-fast broadband, there are likely to be a number of unforseen benefits that will be developed once the requisite infrastructure is in place to enable them.[20]

Higher UBA prices will encourage consumers to migrate more rapidly to the fibre network, with the resulting increases in welfare described above. Lower UBA prices may be viewed as a useful short-term socio-economic objective for preventing digital divide by allowing low income households to access basic broadband services over the existing copper network. However, such an objective may not be in the long-term interest of end-users if it disincentivises investment in, and uptake of, the new and enhanced services that fibre is capable of providing. Spark has not considered these benefits to end-users (which would be reduced if UBA prices fall) in its analysis, thereby failing to properly consider the *net* benefits that would arise from reducing UBA prices.

[20] Hätönen, J. (2011). The economic impact of fixed and mobile high-speed networks. EIB Papers, 16(2), 30-59, page 52.

3. The Relationship Between Prices and Uptake

3.1 Overview

Spark purports that a UBA price of $24.47 will result in a 21.6 per cent increase in demand for broadband services, as compared with a hypothesised level of demand that would arise if the UBA price was $38.39.[21]

Spark estimates the per cent change in demand resulting from a change in price using an estimate of the price elasticity of demand. The price elasticity of demand is a measure of the responsiveness of demand to a change in price and is calculated as set out below:

$$Price\ elasticity\ of\ demand = \frac{per\ cent\ change\ in\ quantity\ demanded}{per\ cent\ change\ in\ price}$$

It follows that the above formula can be arranged such that the per cent change in demand that arises by consequence of a change in price can be estimated by multiplying the per cent change in price by an estimate of the price elasticity of demand.

While the economic basis of such a calculation is sound, Spark's implementation of this approach contains a three significant errors, specifically:

- Spark overestimates the effect on the *retail* price of broadband of a change in the *wholesale* price of broadband, ie, the UBA price;
- Spark uses an estimate of the price elasticity of demand that is likely to overestimate the effect on demand of a price change; and
- Spark overestimates the effect on broadband uptake of an increase in demand for broadband.

3.2 Failure to account for non-wholesale components of retail prices

Spark assumes that retailers will pass on 75 per cent of any change in the UBA price to end-users and calculates the percentage change in retail prices as 75 per cent of the percentage change in wholesale prices. This methodology does not take account of the fact that the UBA price is only one component of the retail price. We understand from Chorus that the UBA price makes up approximately 45 per cent of the monthly retail broadband price, where the remainder comprises the retail providers costs and profit margin as well as goods and services tax.[22]

Therefore, the relative change in the retail broadband price will be significantly less than the relative change in the UBA price, taking account of pass-through. Specifically, the relative change in the retail broadband price will be equal to the product of:

- the change in the UBA price;
- the pass through rate; and
- the share of the UBA price in retail broadband prices.

[21] It is not evident how Spark reached an estimate of 21.6 per cent, as this is inconsistent with its estimated percentage fall in prices of 27.1 per cent and price elasticity of -0.951.

[22] This estimate is based on the retail prices observed in March 2015.

By not taking account of the share of the UBA price in the retail broadband prices Spark overestimate the change in retail prices. Spark calculate that, with a pass-through rate of 75 per cent, a 36 per cent decrease in the UBA price will decrease the retail price by 27.1 per cent.[23]

However, on the basis that the UBA price comprises approximately 45 per cent of retail broadband prices, in these circumstances the actual decrease in the retail broadband price would be only 12.2 per cent.[24]

3.3 The price elasticity of demand

Spark estimates the relative change in demand that would result from a change in the retail broadband price using an estimate of the price elasticity of demand for broadband services of -0.951, which was estimated using data from 2000 to 2008. In our opinion, a price elasticity of demand for broadband services equal to -0.951 may not be appropriate when contemplating a reduction in the price of broadband in the present day.

First, this estimate was derived using data from 2000 to 2008, when broadband was in the initial stages of penetration. Specifically, broadband was introduced in many OECD countries around 2000[25] and a study cited by Spark shows that, in 2008, the average broadband penetration in 20 OECD countries was only 26.1 per cent, and 21.9 per cent in New Zealand. In contrast, broadband penetration in New Zealand was approximately 78 per cent in 2013.[26]

It is highly likely that the price elasticity of demand for broadband has changed materially since the 2000 to 2008 period. Indeed, a footnote in Spark's submission recognises a report that considers the applicability of the abovementioned study relied on by Spark and notes that:[27]

> The main question, however, is to what extent these model results travel from the 2000-2008 OECD countries to 2016-2024 New Zealand. One main obvious difference is that during the period analyzed in the Shinohara et al. study DSL was starting at low penetration levels and continued to grow in most countries. In contrast, New Zealand in 2016 will have reached a level of saturation at which total broadband subscription demand may be almost totally inelastic w.r.t. price.

Indeed, a 2009 study using American data estimates that the price elasticity of demand for broadband services is decreasing through time, ie, it estimates that the price elasticity of demand for broadband services was:

- -1.53 in 2005;
- -1.17 in 2006;
- -0.88 in 2007; and
- -0.69 in 2008.

In light of these results, the study goes on to state that:[28]

> … broadband is progressively being perceived by those who are using it as a household necessity. Moreover, the perceived value of broadband to households is rising, and therefore they are increasingly less willing to alter their broadband purchases in response to a change in price.

[23] Calculated equal to 36.26% x 75% = 27.1%, see Spark submission, *UBA and UCLL FPP pricing review draft decision*, 20 February 2015, page 83.

[24] Calculated equal to 36.26% x 75% x 45% = 12.2%.

[25] Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L., *Broadband Infrastructure and Economic Growth*, CESIFO working paper, No. 2861, December, 2009, page 9.

[26] We use internet access as a proxy for broadband access, we note that Spark appear to have adopted an equivalent assumption. See: Statistics New Zealand, *2013 Census QuickStats about transport and communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

[27] Ingo Vogelsang,

[28] Dutz, M., Orszag, J. and Willig, R., *The substantial consumer benefits of broadband connectivity for US Households*, July 2009, page 25.

> Indeed, a recent survey of what Americans consider as a "necessity" or a "luxury" finds that 31 percent of Americans consider broadband Internet a "necessity".

Similarly, a World Bank study summarises the abovementioned study and states that:[29]

> …. at higher penetration levels, price elasticity coefficients start to diminish. In their study of price elasticity in the United States between 2005 and 2008, Dutz et al. (2009) observed that coefficients declined from -1.53 in 2005 to -0.69 in 2008. Coincidently, Cadman and Dineen (2008) estimated elasticity coefficients for OECD countries in 2007 to be -0.43. This could be due to a shift in consumers perceptions as to the value of broadband (and consequently willingness to pay) from "luxury" to "necessity". On the other hand, because of diminishing importance in the affordability barrier to adoption, as reviewed in the survey data above, structural factors related to limited digital literacy and cultural relevance take precedence.

On the basis that the price elasticity of demand for broadband services is likely to have become relatively less elastic as broadband uptake has increased, the estimate used by Spark is likely to overestimate the effect on demand of a price change.

Further, Spark also contends that:[30]

> … the own price elasticity of demand for a sample based on the one-third of lower income households with less than 50% broadband access would be more elastic.

However, a recent study of households in the US that have not adopted broadband finds that:[31]

> A very large proportion – about two thirds – of the households surveyed reported that they would not consider subscribing to broadband at any price.

The study also finds that the remaining third of non-adopting households, being those that would adopt broadband at some price, have a relatively inelastic demand for broadband:[32]

> … the price elasticity of demand for broadband using the bias-corrected willingness to pay values is equal to -0.62.

Therefore, this study finds evidence that the price elasticity of demand for the non-adopting households is relatively less elastic, as compared with the estimate used by Spark.

Taken together, these studies strongly suggests that Spark has substantially overestimated the effect on uptake rates of a price change.

We have estimated a reasonable range for the price elasticity as follows:

- an 'upper-bound' of -0.65, which is based on the more recent studies but does not take account of the suggestion that around two thirds of households without broadband may not be willing to take it up at any price; and
- a 'lower-bound' of -0.22, which assumes that two thirds of households without broadband would not purchase broadband at any price and the remaining one third has an elasticity of -0.65.

[29] World Bank, *Broadband Strategies Toolkit*, Chapter 6.2.2.4, available at: http://broadbandtoolkit.org/6.2.

[30] Spark, UBA and UCLL FPP pricing review draft decision, Submission to the Commerce Commission, 20 February 2015, page 84.

[31] Carare, O., McGovern, C., Noriega, R., Schwarz, J., *The willingness to pay for broadband of non-adopters in the US: estimates from a multi-state survey*, November 2014, page 17.

[32] Carare, O., McGovern, C., Noriega, R., Schwarz, J., *The willingness to pay for broadband of non-adopters in the US: estimates from a multi-state survey*, November 2014, page 1.

This range suggests a reasonable impact on demand of between 2.7[33] and 8.0[34] per cent.

3.4 Estimating the effect on broadband uptake

Finally, Spark erroneously calculates the increase in broadband uptake on the basis of its estimate of the increase in demand for broadband. Spark's analysis implies that an increase in demand for broadband of 21.6 per cent will increase broadband penetration in New Zealand by 21.6 *percentage points*, rather than by 21.6 *percent*.

Elasticities of demand are more often applied to demand measured in quantity terms and can be used to estimate a percentage change in demand relative to a percentage change in price. When elasticities are applied to demand measured on the basis of the percentage uptake by a population, care must be taken. For example, if 50 per cent of a population are purchasing a product, a 50 per cent increase in demand will result in 75 per cent of the population purchasing that product. A 100 per cent increase in demand would be required for 100 per cent of the population to make a purchase. Thus a 50 percent increase in demand is quite different from a 50 percentage point increase in demand.

Spark has inadvertently interpreted a 21.6 per cent increase in demand as a 21.6 percentage point increase. For example, at the current estimated uptake rate of 78 per cent,[35] a 21.6 per cent increase in demand would increase the uptake rate by 16.9 percentage points.

3.5 Amended estimate of increase in broadband uptake

Amending Spark's analysis of the impact on the rate of broadband uptake associated with a reduction in the price of UBA services from $38.39 to $24.47 indicates that:

- taking account of the relationship between the UBA price and the retail broadband price, reduces the estimated reduction in the prices faced by consumers from 27.1 per cent to 12.2 per cent;[36]
- applying a reasonable range for the price elasticity of between 0.22 and 0.65 suggests that demand for broadband will increase by between 2.7[37] and 8.0[38] per cent; and
- assuming that broadband uptake in New Zealand is 78 per cent,[39] we estimate that a 2.7 to 8.0 per cent increase in demand will increase the broadband uptake rate by between 2.1[40] and 6.2[41] percentage points.

[33] Calculated equal to the 12.2 per cent retail price decrease multiplied by the weighted average of the price elasticity of demand elasticity of non-adopting households that would and would not adopt broadband at some price, ie, -12.24% x ((-0.65 x 1/3) + (0 x 2/3)) = 2.7%

[34] Calculated equal to -12.24% x -0.65 = 8.0%

[35] Statistics New Zealand, *2013 Census Data Transport and Communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

[36] Calculated equal to 36.26% x 75% x 45% = 12.2%.

[37] Calculated equal to the 12.2 per cent retail price decrease multiplied by the weighted average of the price elasticity of demand elasticity of non-adopting households that would and would not adopt broadband at some price, ie, -12.24% x ((-0.65 x 1/3) + (0 x 2/3)) = 2.7%

[38] Calculated equal to -12.24% x -0.65 = 8.0%

[39] Statistics New Zealand, *2013 Census Data Transport and Communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

[40] Calculated equal to 78% x 2.7% = 2.1 percentage points.

[41] Calculated equal to 78% x 8.0% = 6.2 percentage points.

4. Broadband Uptake and GDP Growth

4.1 Overview

Spark uses its estimate of the increase in the rate of broadband uptake to estimate the implications of the proposed price reduction on New Zealand's GDP, using an empirical relationship between the:

- penetration of broadband; and
- the growth rate in real GDP.

In our opinion, there are two shortcomings in the way in which Spark has undertaken its analysis, namely:

- it is unclear how Spark has arrived at its dollar value estimate of the impact on GDP, given the assumed relationships; and
- the relevance of the cited papers to an economy with a broadband penetration rate of almost 80 per cent is highly questionable.

4.2 Spark's estimate of the impact on GDP

Spark has calculated the impact of an increase in broadband uptake on the basis of the following:

- Qiang, Rossotto and Kimura (2009)'s estimate that a 10 percentage point increase in penetration increases the long run average rate of growth in GDP by 1.21 percentage points;[42] and
- Czernich, Falck, Kretschmer and Woessmann (2009)'s estimate that a 10 percentage point increase in broadband penetration rates increases GDP growth by between 0.9 and 1.5 percentage points.[43]

Using its estimated impact on the broadband penetration rate (21.6 per cent), Spark suggests that these studies indicate a resultant increase in the real growth rate of GDP of between 1.94 and 3.24 per cent. Spark then estimates the associated real increase in GDP per annum to be between $128 and $214 million.

Setting aside for a moment our concerns regarding the applicability of these studies to present-day New Zealand, Spark's dollar-value estimate is inconsistent with its estimate of the increase in growth and current GDP, which was around $230 billion in the year ended March 2014.[44] It is not, then, apparent how Spark has arrived at the estimates presented in its paper.

4.3 The relevance of the cited studies

As noted above, Spark cites two empirical studies on the relationship between broadband penetration and real GDP growth:

- Czernich et. al. (2009) use data on 25 OECD countries from 1996 to 2007 and estimate that a 10 percentage point increase in broadband penetration was associated with a 0.9 to 1.5 percentage point increase in annual per capita GDP growth;[45] and

[42] Zhen-Wei Qiang, C., Rossotto, C. M. and Kimura, K., *Economic Impacts of Broadband*, 2009, page 45.

[43] Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L., *Broadband Infrastructure and Economic Growth*, CESIFO working paper, No. 2861, December, 2009, page 1.

[44] Statistics New Zealand, http://www.stats.govt.nz/browse_for_stats/economic_indicators/GDP/GrossDomesticProduct_HOTPSep14qtr.aspx

[45] Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L., *Broadband Infrastructure and Economic Growth*, CESIFO working paper, No. 2861, December, 2009, page 1.

- Zhen-Wei Qiang et. al. (2009) use data from 1980 to 2006 and estimate that a 10 percentage point increase in broadband penetration in developed countries was associated with a 1.21 percentage point increase in per capita GDP growth.[46]

Interpreting the results of such empirical studies is inherently difficult. To provide reliable estimates of these relationships the analysis must take full account of other factors that may be influencing the results, such as the economic cycle, the introduction of other technologies and significant world events. In addition, it is difficult to ensure that the studies are measuring a causal relationship between broadband uptake and GDP and not merely a correlation. For example, especially in panel data, there are valid reasons for assuming that broadband uptake rates would, at least in part, be driven by GDP growth.

In addition to these concerns regarding the validity of the results, both studies use data from years when broadband was in the initial stages of penetration, for example:

- Zhen-Wei Qiang et. al. (2009) notes that broadband penetration in developed countries in the final year of the sample period, ie, 2006, was 18.6 per cent;[47] and
- Czernich et. al. (2009) presents data that shows broadband penetration in developed countries in the final year of the sample period, ie, 2008, was 26 per cent.[48]

By using the relationships developed in these studies, Spark's analysis implicitly assumes that the productivity gains achieved during the introduction and early years of adoption of broadband provide a good measure of productivity gains that could be achieved if broadband penetration increased from a level of 78 per cent.[49] In our opinion, this is unlikely to be the case.

During the period over which the studies were conducted, businesses were able to access for the first time services that had until then been unavailable and were of potentially enormous economic value to them. It is virtually tautological that the businesses adopting broadband in the initial years will be those for whom the potential productivity gains are most significant. In contrast it is very difficult to identify logical reasons for assuming that GDP would be significantly impacted by the remaining 23 per cent of households and businesses currently without broadband adopting these services, given that they already have the option to do so and chose not to.

The implausibility of these studies being applicable at relatively high broadband penetration rates can be illustrated by considering New Zealand's GDP growth rate given past rates of broadband uptake. For example, given New Zealand's existing broadband penetration rate of approximately 78 per cent,[50] the above studies would suggest that broadband access is contributing around 7.5 percent to GDP growth per annum. This seems unlikely in light of GDP growth rates of around 3 per cent.

In our opinion, the context within which these studies were undertaken is so far removed from the current conditions in New Zealand as to make their results irrelevant. Furthermore, our concerns regarding the likelihood that these studies have effectively adjusted for other factors and measured a purely causal relationship between broadband uptake rates and GDP, suggest these results may well have overstated the relationship even in the early years of broadband introduction.

We have been unable to source further studies of the relationship between broadband adoption rates and GDP in economies with higher penetration rates. However, it is our opinion that the impact on GDP from an

[46] Zhen-Wei Qiang, C., Rossotto, C. M. and Kimura, K., *Economic Impacts of Broadband*, 2009, page 43 and 45.

[47] <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

[48] Czernich, N., Falck, O., Kretschmer, T. and Woessmann, L., *Broadband Infrastructure and Economic Growth*, CESIFO working paper, No. 2861, December, 2009, page 9.

[49] Statistics New Zealand, *2013 Census Data Transport and Communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

[50] Statistics New Zealand, *2013 Census Data Transport and Communications*, Table 4, available at <http://www.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-transport-comms/access-telecomms.aspx>

increase in broadband demand, at New Zealand's current uptake rate, would be substantially below that suggested in the studies cited by Spark.

While the studies cited by Spark suggest that broadband deployment is a valuable investment for stimulating economic growth, Spark's argument that a reduction in wholesale UBA prices will increase economic growth goes beyond the scope of the studies. The findings of Czernich et. al. (2009) and Zhen-Wei Qiang et. al. (2009), could be interpreted as providing support for the proposition that the greatest productivity gains are achieved during the initial penetration of a revolutionary technology. This gives further weight to the conclusion that the benefits of households and businesses switching to ultra-fast broadband, and the associated unprecedented increase in internet speeds, are likely to be significant. Arguably, a reduction in the wholesale price of copper-based regulated services could reduce incentives to invest in fibre-based services, which in turn may have negative effects on growth. In other words, if a reduction in the UBA price is likely to slow the migration to the fibre network, it becomes difficult to conclude that such a price reduction would increase GDP.

5. Conclusions

The objective of Spark's 'Attachment D' was to estimate the effect on GDP of reducing the price of UBA services over the next regulatory period from the $38.39 proposed by the Commission to $24.47, which Spark's consultant has advised is a plausible competitive price. Spark estimated that such a price reduction would result in broadband penetration rates around 21.6 percentage points higher, with a resultant positive impact on GDP of between $128 and $214 million per annum.

We do not accept Spark's premise that a price of $24.47 is efficient, however, leaving this issue aside, Spark's results are surprising as:

- the estimate that a further 21.6 per cent of New Zealand businesses and households would take up broadband appears implausibly high given that only 22 per cent of households are currently estimated to be without access; and
- the estimated impact on GDP of between $128 and $214 million appears high given New Zealand's high rate of broadband uptake and the likely nature of businesses and households that currently choose not to purchase broadband services.

Our review of Spark's analysis suggests that Spark has overestimated the impact of such a price reduction on the rate of uptake of broadband services. We found that Spark's analysis:

- ignored the fact that wholesale rates make up less than half of retail prices when estimating the impact of a reduction in wholesale prices on retail prices;
- used a demand elasticity assumption that is not consistent with the current high levels of broadband uptake in New Zealand; and
- misinterpreted the relationship between prices and demand and interpreted a percentage increase in demand as a percentage point increase in broadband uptake rates.

Adjusting the assessment of the retail price impact to account for the proportion of retail prices not attributable to wholesale prices suggests that retail prices are likely to fall by around 12.2 per cent[51] rather than Spark's estimate of 27 per cent.[52]

We estimated that the price elasticity is more likely to lie between -0.22 and -0.65 rather than around the -0.951 estimate used by Spark. Combined with our estimate of the impact on retail prices, this suggests broadband demand is likely to increase by between 2.7 and by only 8.0 per cent. Given existing uptake rates, this suggest a percentage point increase in uptake rate of between 2.1 and 6.2 percentage points.

Spark used its estimated increase in the broadband uptake rate of 21.6 per cent to estimate the effect of a price reduction in UBA services on GDP. However, it is not evident that the studies Spark relied on to estimate the relationship between broadband uptake and GDP provide a useful indication of the extent to which GDP is driven by broadband uptake, rather than the two measures being correlated. In addition, these studies were undertaken during the introduction of broadband, when uptake would have had the most significant impact on an economy's productivity and growth. Such studies are not relevant in the current context.

Furthermore, Spark's analysis does not take account of the risk that lower UBA service prices may slow the rate of migration to the fibre network, which may reduce GDP. In sum, we conclude that Spark's Appendix D provides no reliable evidence to suggest that GDP would be increased as a result of lowering the UBA prices from the proposed $38.39 to $24.47.

[51] Calculated equal to 36.26% x 75% x 45% = 12.2%.

[52] See section 3.2.

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