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Has Local Loop Unbundling Increased New Zealand's Broadband Uptake?

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When the 2006 'Stocktake' and the subsequent Telecommunications Act amendments imposed full local loop unbundling[1] on New Zealand's incumbent operator Telecom New Zealand, one of the principal objectives was "*to ensure that the telecommunications sector becomes more competitive and that we achieve faster broadband uptake in line with our competitors*".[2] When the 2008 OECD Broadband uptake statistics were released in May 2009, New Zealand exhibited the third-highest increase in the number of subscribers per 100 in the OECD (after the Slovak Republic and Greece – Figure 5 below). This 'achievement' prompted some commentators to herald the efficacy of local loop unbundling policy. For example, the National Business Review's Chris Keall claimed "*the speed of broadband uptake in New Zealand last year was among the fastest in the OECD. Local loop unbundling really has made a difference*".[3]

Unfortunately, Mr Keall's conclusion that local loop unbundling is responsible for New Zealand's high ranking is flawed. Equally flawed is the Berkman Center's assertion that New Zealand's climb from 22nd to 18th in the rankings of connections per capita between 2006 and 2008 is a consequence of telecommunications access policy interventions[4] (if for no other reason than the first unbundled local loop was not retailed in New Zealand until March 2008). The explanations are flawed because New Zealand's performance, both in absolute and relative terms, is best explained by the dynamics of a standard diffusion process, given the initial conditions and inter-country differences observed across the OECD over time. This is supported by a growing body of econometric analyses on OECD data indicating little evidence of a material effect of unbundling on broadband uptake per capita.[5]

The 'trap' of using raw OECD rankings to inappropriately compare inter-country performance is common. However, it leads to flawed conclusions that all too easily can be used to drive not just the assessment of policy performance, but the very creation policies that can be either (or both of) very costly to the economies concerned, and impotent in addressing the underlying characteristics

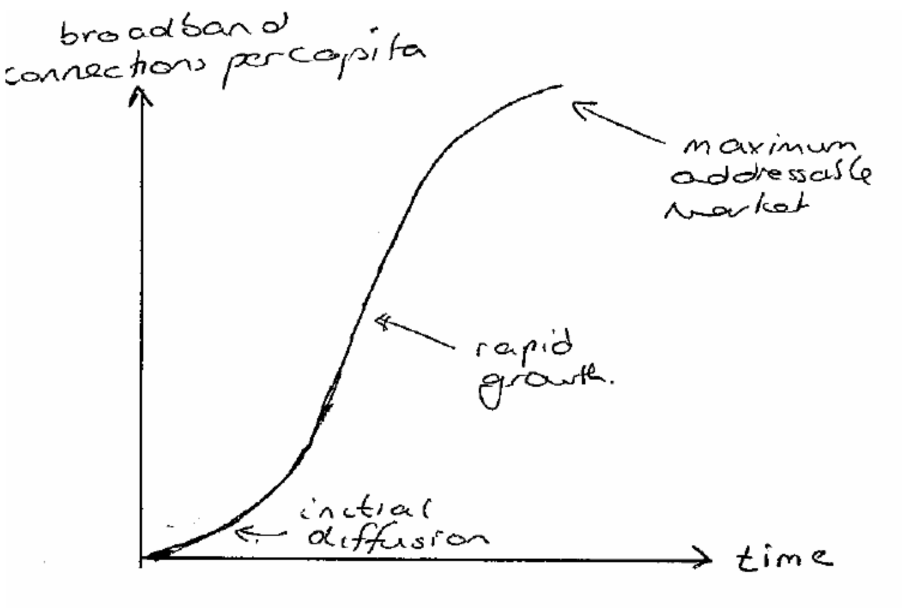
[1] Where the incumbent operator is required to enable competitors access to its exchanges to install their equipment that is then used to service retail customers over the incumbent' 'last mile' copper wires.
[2] Cartwright, S 2005, 'Speech from the throne', *New Zealand Gazette* Issue no. 187, November 9 2005, http://www.dia.govt.nz/Pubforms.nsf/NZGZT/Speech187Nov05.pdf/$file/Speech187Nov05.pdf
[3] Keall, C., 2009, NZ Worst-equal in capped broadband, May 25, 2009. http://www.nbr.co.nz/opinion/chris-keall/nz-worst-equal-capped-broadband
[4] The Berkman Center for Internet and Society at Harvard University, 2009, Next Generation Connectivity: a review of broadband internet transitions and policy from around the world. At p 109. October 2009. Available from http://cyber.law.harvard.edu/newsroom/broadband_review_draft
[5] Even those studies where a statistically significant effect is found indicate that the number of connections per 100 population due to unbundling is extremely small. For example, the Berkman Center's study shows a 1% per year effect from unbundling compared to between 7 and 12% from other factors. *Ibid*, p 117.

that the statistics are reflecting. Glenn Boyle and I highlighted the dangers in 'Ranking the Unrankable: How Useful are the OECD League Tables' (*Competition and Regulation Times* 35 March 2008 http://www.iscr.org.nz/newsletters). Using George Ford's example of broadband uptake 'nirvana' where every household and business in every OECD country has a broadband connection, we demonstrate that rather than New Zealand ranking first equal with all other 29 OECD countries, at best a rank of 16 could be achieved simply because the metric compared – broadband uptake per capita – will differ across countries even at full penetration of a technology simply because the average household and business size differs in each country. Under these circumstances, to increase ranking in 'broadband nirvana', New Zealand would have to adopt policies that reduced household size or prevented businesses and residences sharing the broadband connection (a common feature, given New Zealand's large number of small businesses, many of which are run from home).

So what do the 2008 OECD figures tell us about New Zealand's broadband performance? It is true that as of December 2008, New Zealand did rank highly (3rd in the OECD, behind the Slovak Republic and Greece) in the net increase of broadband connections per hundred population (3.8, compared to an OECD average of 2.6). This translates to an annual growth rate (measured as the increase in the number of subscribers in a given year as a proportion of subscribers at the beginning of the year – the classic economic way of measuring growth) of 7.3% (OECD average 6.2%). On this basis, New Zealand's broadband growth rate ranks 6th in the OECD – a high ranking, but not unusual given the historical context. In quarter 2, 2002, New Zealand's annualised broadband connection per capita growth rate, at 47.4% - nearly eight times the current growth rate - (OECD average 26.7%), ranked 15th in the OECD. In quarter 4, 2005 (the data available when the MED 'Stocktake' analysis recommending that local loop unbundling be mandated in New Zealand), the growth rate was 31% (OECD average 14.7%) and the rank was likewise 6th. Despite ranking only 13th, the number of connections per 100 population added in New Zealand in 2005 was 4.4 – larger than that recorded in 2008 when local loop unbundling was in place.

Can New Zealand's current high ranking be interpreted as a 'good' outcome driven by unbundling policy? Clearly, New Zealand's ordinal ranking in growth rates has changed little, yet the ranking in the number of new connections has increased, even though in cardinal terms the actual number of connections added per year is decreasing. Furthermore, the growth rate has fallen to less than a quarter of that prevailing prior to the Stocktake that resulted in the implementation of full local loop unbundling[6]. An uninformed commentator might actually conclude from these statistics that unbundling has been detrimental to New Zealand's broadband uptake growth! But to yield to that temptation would be to succumb to the fallacy that unbundling policy actually has a material effect upon the level of broadband uptake per capita relative to all of the other factors influencing the broadband per capita level and growth rate. A full interpretation requires an understanding of technology diffusion patterns and the factors that influence uptake in different countries.

Figure 1: Diffusion Curve



When a new technology comes to market, it diffuses through a population over time in a classic 'S' curve pattern (Figure 1). In the initial stages of diffusion, few people buy in any given time period, resulting in the flat 'bottom curve' of the S. When more people become aware of the technology, new uses for it are discovered, and/or the price decreases because of competitive entry and innovation reducing the costs of production, and more people buy in each time period, resulting in the steep upward portion of the 'S'. However, there is a limit on the number of units that can be sold. As a greater proportion of the addressable market has bought the technology, the only potential customers remaining are 'laggards' who take a very long time to be convinced of the benefits (or value it so lowly that it has to become extremely cheap for them to make the

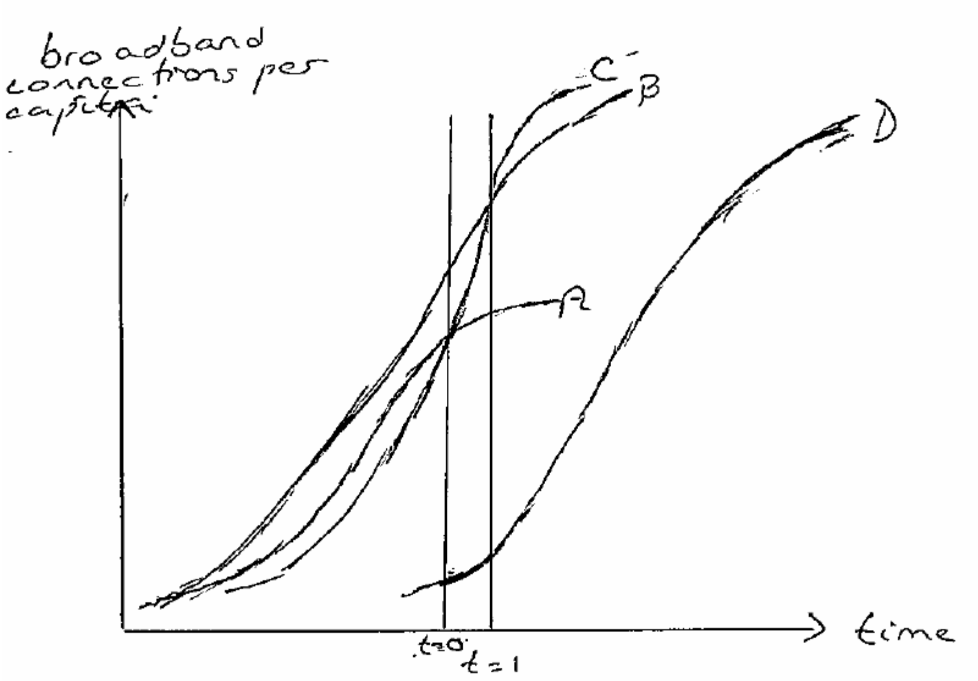
[6] Bitstream unbundling, a limited form of unbundling where an incumbent's local loops are leased entrants, but no equipment is installed in exchanges, was implemented in 2004.

decision to buy it). This leads to a flattening at the top of the 'S'. The time taken to reach full diffusion is important – the less time taken, the steeper the 'S'.

Compared to other technologies such as telephones and televisions, broadband has undergone a very rapid diffusion. The bottom of the 'S' has been very short and the upsweep very steep. However, the actual pattern has differed across countries due to differences in local circumstances. Some countries have had steeper upsweeps than others, as all else being equal, prices differ in different countries (e.g. due to costs of delivery being higher – such as occurs in areas with low population density or high costs of connection to the hub – both of which pertain to New Zealand). The total possible number of connections per capita (the maximum addressable market) also differs, due to demographic factors such as those identified in the 'broadband nirvana' example above, and the relative affordability of the technology compared to other calls on household budgets. Furthermore, as the technology is made available in different countries at different times, the diffusion curves will have different origins.

At any given point in time (such as the quarterly periods at which the OECD collects data), different countries will be at a different stage in the diffusion process. Common statistics collected across countries at a specific point in time are not directly comparable without first taking into account the underlying conditions giving rise to the observations. In the stylised example in Figure 2, at t=1, the technology is nearly fully diffused in country A, even though the connections per capita statistic is less than in country B, due to the smaller addressable market in country A (e.g. larger household size and hence fewer households for the same population). Furthermore, while countries B and C have the same connections per capita and the same addressable market, the technology is diffusing more rapidly in country C. Figure 2 also illustrates that the diffusion curves in countries B and D are identical in all respects, except that country D began diffusing later than country B. Moreover, the slope of the 'S' (represented by the identical number of connections sold in the period between t=0 and t=1 is the same for countries A and D, even though A is at the end of its diffusion cycle and D at the beginning.

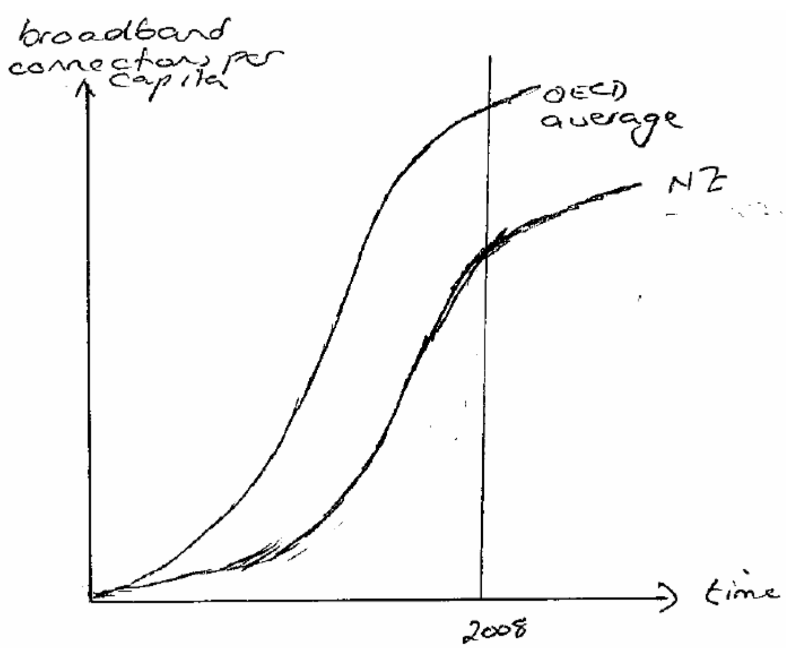
Figure 2: Comparative Broadband Diffusion Rates



Broadband per capita rankings and connections added at t=1 tell us very little on their own. By broadband per capita the rankings are B and C 1st, A 2nd and D 3rd at t=1. By connections added in period from t=0, C is 1st, B 2nd, A and D 3rd equal. Country B is certainly not 'outperforming' country A, despite 'outranking' it in both statistics. This is where growth levels come into play. Assume at the beginning of a diffusion process, after the first unit is sold one unit is sold each period. After one period, the growth rate is 100% (1/1); two periods 50% (1/2), three periods 33.3% (1/3) etc. If two units are sold in period 4 and 5, the growth rates are 50% (2/4) and 33.3% (2/6) respectively. Returning to Figure 2, assume both countries A and D recorded one unit sold in the period preceding t=1. If at t=0 100 units had been sold in country A and country D 1 unit, the growth rate for A is 1% and D 100%. This is consistent with the technology being nearly fully diffused in country A but just beginning to diffuse in country D. That country C's growth rate is twice that of country B is also consistent with a later start to diffusion in country C. However, even growth rate information is insufficient to identify that the whole curve is steeper for country C relative to country D. We need to know much more to determine what is really occurring – for example, when diffusion began, the likely extent of the addressable market and how the patterns have evolved over time

The patterns in Figure 2 are recognisable in many of the OECD countries. Canada, for example, was one of the first countries to have broadband available, largely due to a widespread cable broadband market. Canada was also an early leader in the uptake of broadband connections (as per country B) – 2nd in 2002 - but has recently fallen down the rankings. However, in the United Kingdom (country C), diffusion started substantially later and was initially more slower than in Canada. However, the United Kingdom experienced a more rapid upsweep, and in the latest data (Figure 4) has nearly overtaken Canada. Consistent with this analysis, the United Kingdom's growth rate in 2008 substantially exceeded Canada's. Japan, on the other hand, despite having the technology available for the same length of time as the United Kingdom, exhibits one of the lowest growth rates in 2008, despite being only a mid-table performer in penetration (just one place above New Zealand), suggesting a similarity to country A – that is, a smaller addressable population than either Canada or the United Kingdom (perhaps as a consequence of an older average population – age has been shown to have an influence on the likelihood of an individual purchasing the technology). By contrast, the Slovak Republic was a very late starter in terms of availability (like country D), but is growing rapidly, so exhibits a low penetration per 100 population in 2008 despite a very high growth rate.

Figure 3: NZ and OECD Average Broadband Diffusion



What does this mean in respect of New Zealand's performance? New Zealand was the 3rd country in the OECD to make ADSL broadband technology available. Thus, we know broadband started diffusing early. But penetration per capita has been historically lower than the OECD average – suggesting an overall flatter curve. The most likely explanation is that the maximum addressable market in New Zealand is smaller than the average OECD country – consistent with our low GDP per capita (OECD analysis – cited in Boyle and Howell (2008) above - indicates that 62% of the difference in broadband uptake rates between countries can be explained by differences in GDP per capita). We also know that New Zealand's early adoption rate measured as the number of connections sold per period was lower than the OECD average in early years when most commonly-used applications could be satisfactorily accessed on dial-up connections, because our very attractive dial-up internet access pricing slowed the rate of broadband diffusion relative to countries where dial-up access was much more expensive[7] (de Ridder, 2006). Hence, the OECD average diffusion curve had a much steeper initial phase than New Zealand's, leading to an earlier arrival at full diffusion despite the higher maximum addressable market. Consequently, the New Zealand diffusion curve has consistently lain below the OECD one (Figure 3). As the growth rates of both are now slowing and converging towards zero, both diffusion curves are likely entering the top flat part of the S, but with the New Zealand curve lagging, thereby currently exhibiting higher absolute numbers of additions in the last period observed (2007-8), but smaller than previous periods.

Thus, the New Zealand observations in the 2008 OECD statistics and rankings can be explained without any recourse to judgements of either 'good' or 'bad' performance or attribution to policy interventions such as local loop unbundling. Indeed, independent econometric analysis shows that of all the factors potentially influencing the level and rate of uptake of broadband connections across OECD countries, local loop unbundling is most likely insignificant both statistically and in its material effect. Boyle, Howell and Wang (2008)[8] show using OECD data that whilst there is a small positive correlation between unbundling policy and broadband uptake, it is statistically insignificant. Even if unbundling was statistically significant, the material effect would be very small relative to the number that could be expected to be added simply as a consequence of the natural diffusion process occurring. The model indicated that in 2005 New Zealand would have recorded only an additional 25,000 broadband connections (0.5 per 100 population) had unbundling been in place. Without unbundling, in 2005 the connections increased

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[7] De Ridder, J. (2007), Catching-up in broadband – what will it take? Available on http://deridder.com.au/files/Bband-Model-v9.pdf

[8] Boyle, G., Howell, B., & Wang, Z. (2008), Catching Up in Broadband Regressions: Does Local Loop Unbundling Really Lead to Material Increases in OECD Broadband Uptake? http://www.iscr.org.nz/f410,11598/11598_LLUBroadband01c_rev_300708.pdf

by 4.4 per 100 population, consistent with the hypothesis that the most important factor driving broadband uptake is the natural diffusion process, and that policies such as local loop unbundling are having negligible effect on the patterns of uptake observed.

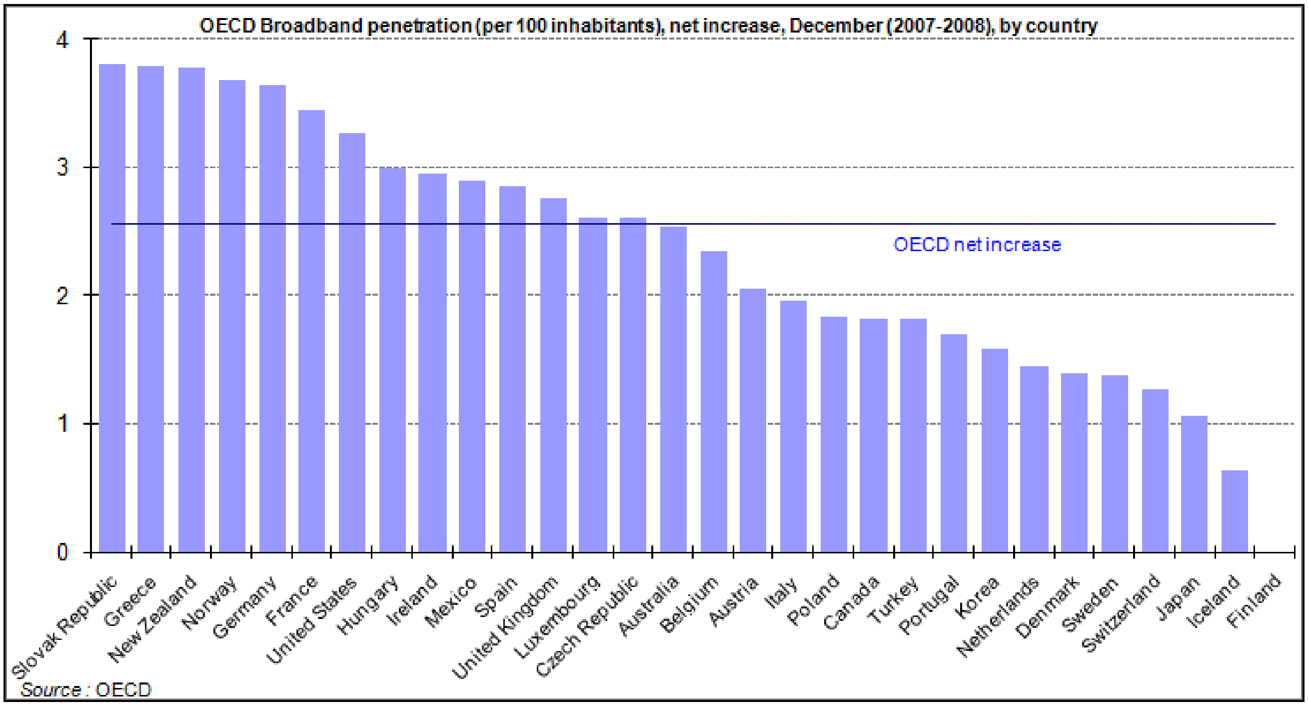
In summary, therefore, it would be constructive for the wider debate about telecommunications performance if commentators and policy-makers thoughtfully analysed ranking comparisons when the OECD publishes its data. National GDP per capita, population density, degree of population urbanisation, the size of the addressable market, the length of time the technology has been available, population age, the prices of legacy and broadband technologies and natural diffusion patterns all influence uptake. Compared to these, the effect of LLU policy is negligible.

Figure 4. OECD Broadband Penetration and GDP Per 100 Population, December 2008

	Broadband penetration (subscribers per 100)	GDP per capita (USD PPP, 2007)
Denmark	37.2	$36,208
Netherlands	35.8	$38,389
Norway	34.5	$54,298
Switzerland	33.5	$41,336
Iceland	32.8	$37,986
Korea	32.0	$24,750
Sweden	32.0	$37,171
Finland	30.7	$34,331
Luxembourg	30.0	$81,781
Canada	29.0	$36,610
United Kingdom	28.5	$33,925
Belgium	28.1	$34,603
France	28.0	$32,709
Germany	27.4	$33,470
United States	26.7	$45,489
Australia	25.4	$35,150
Japan	23.6	$33,111
New Zealand	**21.9**	**$25,927**
Austria	21.6	$37,437
Spain	20.8	$31,638
Ireland	20.6	$41,490
Italy	19.2	$29,754
Czech Republic	17.2	$21,933
Hungary	16.8	$18,702
Portugal	16.0	$21,918
Greece	13.5	$28,864
Slovak Republic	11.5	$17,875
Poland	10.5	$15,875
Turkey	7.8	$12,619
Mexico	7.2	$13,553

Source: OECD

Figure 5


OECD Broadband penetration (per 100 inhabitants), net increase, December (2007-2008), by country
4
3
2
1
0
OECD net increase
Slovak Republic
Greece
New Zealand
Norway
Germany
France
United States
Hungary
Ireland
Mexico
Spain
United Kingdom
Luxembourg
Czech Republic
Australia
Belgium
Austria
Italy
Poland
Canada
Turkey
Portugal
Korea
Netherlands
Denmark
Sweden
Switzerland
Japan
Iceland
Finland
Source : OECD