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"Universal Service" Policies and the Diffusion of Broadband

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Throughout the 20th century, telecommunications policies in most advanced economies promoted "unversal service" for traditional telephony. It was widely believed that many households, particularly those in rural areas, would not have the opportunity or the means to have a telephone without some form of subsidy. Therefore, implicit or explicit subsidies were provided to these potentially underserved groups. In practice, such subsidies generally took the form of geographically-uniform prices for a service whose cost varied substantially and inversely with population density, but over time both explicit and implicit subsidies became more complicated and difficult to eliminate.

There is remarkably little evidence on the effectiveness of these universal service policies. Recent studies of the United States policies are not encouraging, for they find little impact on subscriptions or prices despite the great cost of these programs. Despite this lack of evidence and even adverse evidence on the effect of traditional universal service policies, there has been a groundswell of support for a new universal service policy directed at broadband services.[2] The advocates of such policies generally rely on the older populist notions of providing everyone with equal-priced access to a valuable new service, even if they have little evidence that such policies have worked in earlier, simpler times.

The political demand for universal-service subsidies for broadband is generally based on simple notions that broadband facilities are a form of essential infrastructure that promotes economic growth. Because broadband deployment is more expensive per subscriber in less dense rural areas, many believe that government must develop a new universal service policy for

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[2] For a useful, if somewhat dated list of statements supporting universal service policies for broadband, see Benton Foundation, "Benton Comments to Federal-State Joint Board on Universal Service," July 2007, available at http://www.benton.org/?q=node/6450.

accelerating broadband deployment in these high-cost rural areas. In addition, most proponents also support various forms of assistance to low-income households that lack the means or modern technology skills to subscribe to and use broadband services.[3] But is there any *a priori* reason for believing that an unsubsidized, private market is likely to underprovide broadband services? Are there major externalities that private market actors cannot capture, and if so what are these externalities? In this paper, I review these problems from largely a U.S. perspective, but this perspective surely applies to other developed countries, such as New Zealand, where broadband deployment has apparently become a major political issue.

I. The Traditional Case for Universal Service Policy

The *political* argument for universal service policies is largely based on income redistribution. It is generally argued that rural residents and/or poor households should not be denied a fundamental service because of its cost. Subsidies for electricity, roadways, water, and even health care have been driven at least in part by a similar redistribution argument. Unfortunately, broadband does not have the same political appeal as these necessities in most countries. Absence of a high-speed connection in a home is not the same as absence of water, electricity, or fundamental health care.

By contrast, the *economic* argument for universal service policies for broadband is based on alleged market failure, and the principal source of such failure derives from externalities in consumption. There is little doubt that traditional telephony generates substantial externalities. But have universal service policies addressed these externalities effectively and efficiently?

A. Universal Service and Traditional Telephony

The accepted economic rationale for universal service subsidies in telephony centers on call externalities. The benefits of another subscriber enrolling in and using the network exceed the value to that subscriber because others on the network benefit from being able to call or to be

[3] The United Kingdom, in particular, has promoted the idea that lack of broadband perpetuates low-income households' economic disadvantages. See H.M. Government, An assessment and practical guidance on next generation access (NGA) risk in the UK: Final report, March 2010.

called by this subscriber, but these benefits do not accrue to the subscriber herself.[4] As a result, some households may not subscribe to telephone service even though the total benefits (to it and others) exceed the cost of the service, and even if they do subscribe they may initiate far too few calls. However, once a very large share of households is connected to the network, the importance of these externalities diminishes. Indeed, it is likely that very little subsidy is required to encourage virtually universal subscriptions to telephone services in most modern economies. The best empirical evidence for such a proposition may be found in mobile penetration rates; virtually everyone has a mobile phone in advanced economies today even without universal service subsidies.[5]

The United States has had one of the most aggressive universal service policies for traditional telephone service for decades. While most other OECD countries simply require their national carrier of last resort to offer local telephone connections at the same prices for urban and rural areas, the United States has allowed states to require that rural rates be even lower than urban rates in many cases.[6] Moreover, U.S. federal government policies involving long-distance interconnection have generally required long-distance rates to cross-subsidize local rates, particularly the local rates in rural areas. Finally, as competition was introduced in local and long-distance services, these subsidy policies were replaced by direct subsidies to small (and even larger) rural carriers. These direct subsidies totaled more than $4 billion in 2009. In addition to direct carrier subsidies, the U.S. provides low-income subsidies for telephone subscriptions in the form of reduced installation and monthly service charges. These subsidies totaled more than $900 million in 2009.[7]

B. The Effectiveness and Efficiency of Universal Service Policies

Although the case for universal service subsidies is well understood, the implementation of these programs is far from optimal. In general, universal service policies have been directed at monthly subscription rates and supported by excessive calling rates despite the fact that the price

[4] See Rohlfs (1974) for the classic exposition of this theory.
[5] See the discussion of this point below.
[6] See Crandall and Waverman (2000).
[7] For details, consult the Federal Communication Commission's annual Monitoring Reports, available at http://www.fcc.gov/wcb/iatd/monitor.html.

elasticity of demand for the latter exceeds the demand elasticity of the former. Crandall and Waverman (2000) found that this pricing policy cost U.S. consumers $4 billion to $7 billion per year. A subsidy directed at calling prices would be more efficient, and a broad-based general tax to support it would be far more efficient than a tax on some subset of telecommunications services. But since privatization, OECD countries do not use a general revenue tax as the major source of support for universal service, and most have traditionally relied on per-minute charges in excess of long-run marginal cost to fund low monthly subscription rates for rural subscribers.

Despite the scale and longevity of universal-service programs in the United States, there is very little evidence that these programs have had any effect on subscriber penetration or rural rates. The most optimistic estimate of the effect of these policies is a 2008 study of the effect of federal low-income subsidies, which finds that these programs cost nearly $900 per year per additional subscriber.[8] But this cost does not include the welfare cost of the tax on long-distance services used to pay for the subsidy, which could easily add another 50 percent to the cost. Thus, the best of the universal service policies in the United States costs more than $100 per month to deliver a service for which the typical household pays about $26 per month.

There is no evidence of which I am aware that the high-cost universal service programs in the U.S. increase telephone penetration. A recent study by Rosston, Savage and Wimmer finds that high-cost subsidies paid to the larger U.S. incumbent local carriers for their rural operations have no effect on rural rates, but rather are associated with lower *urban* business rates.[9] I examined the rates charged by subsidized and unsubsidized rural carriers in Iowa and found that there was very little difference between them despite very large high-cost subsidies paid to the former group.[10]

There is a modicum of good news, however, particularly for advocates of broadband subsidies. In a recent paper, David Gabel found that high-cost universal subsidies to large incumbent carriers are not associated with an increase in the availability of DSL services, but that the smaller carriers' *participation* in the inefficient high-cost subsidy program based on embedded costs is positively associated with the roll-out of DSL broadband services.[11] However,

[8] Ackerberg, Riordan, Rosston and Wimmer (2008). See also, Garbacz and Thompson (2009).
[9] Wimmer, Savage, and Rosston (2007).
[10] Crandall (2008).
[11] Gabel, (2007).

Gabel does not investigate whether the availability of such DSL services increases with the *amount* of these high-cost subsidies, which have been growing dramatically in recent years, or whether the gains in broadband subscriptions are sufficient to offset the costs of the subsidies.

The conclusion that emerges from the U.S. evidence is that despite the expenditure of more than $5 billion per year in universal service subsidies for traditional telephony (and much greater social costs due to the effect of the tax that supports them and the distortions in regulated access and calling prices), there is little effect on rural telephone subscriptions. Moreover, it is likely that with the widespread deployment of wireless services and the very high levels of personal income in the U.S., no such subsidies are necessary in the 21st century to assure the universality of ordinary telephone service.

II. Extending Universal Service Policy to Broadband Services

Traditional telephony, augmented by wireless services, is now universally available in most OECD countries. Indeed, universal service policies may well be redundant for such services, given the widespread availability and take-up of wireless services. Fixed-wire broadband is a newer service, generally subscribed to by about two-thirds of households in advanced OECD countries.[12] Could broadband offer any new external benefits that are not captured by the user himself or herself and that would justify subsidy policies designed to raise broadband penetration to 90 or 95 percent of all households?

Surprisingly, there is little evidence that such externalities are generated by broadband. Most advocates of government support of broadband, whether in the form of universal service subsidies or some other direct support, offer surprisingly vague notions of the externalities generated by broadband. For instance, Robert Atkinson of the Information Technology and Innovation Foundation is a major U.S. advocate of an aggressive government broadband policy. I quote him because his views seem to be very much a reflection the current policy wisdom in this area:

[12] See OECD, Households with Broadband Access, Broadband Portal, available at http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_37441,00.html.

> "Broadband exhibits several kinds of positive externalities, but perhaps the most important are network externalities…
>
> There are **two kinds of network externalities** from broadband, direct and indirect. ..
>
> **Direct externalities** relate to subscribership. Just as the fax system became more valuable when more people had faxes, broadband becomes more valuable when more people have broadband. Moreover, the more people have broadband, the more likely others are to subscribe. This is in part because the decision to purchase broadband is dependent in part of sufficient knowledge about it. … While dial-up connections also enable network externalities for applications like email, only broadband would generate them for more bandwidth intensive applications …
>
> **Indirect network externalities** from broadband relate to its effect on applications and content that requires broadband transport to work effectively…
>
> The **second major kind of broadband externality** relates to the fact that broadband enables consumers to become more efficient, thus in turn driving higher rates of productivity and economic growth…"[13] (emphasis supplied)

Thus, to Atkinson and many other proponents, the social imperative for universal broadband is seen to be driven by genuine direct externalities, network effects, and the contribution of broadband to economic growth. Given the lack of empirical evidence on the effect of universal broadband, I cannot cite to a related empirical literature review. The empirical literature focuses instead on the wholesale regulation of incumbent carriers' broadband services and access lines and its effect on broadband subscriptions and network investment. In the sections that follow, therefore, I examine only the *a priori* case for broadband subsidies outlined by Atkinson. I take up the three rationales advanced by Atkinson in reverse order: promoting economic growth, exploiting network effects, and accounting for direct consumer externalities.

A. Promoting Economic Growth

Perhaps the most frequent justification for any national broadband policy is that it "creates jobs," not simply during the construction phase of the broadband network, nor just in carrier operations, but through the effect on business development and general economic

[13] Robert D. Atkinson, *The Case for a National Broadband Policy*, Information Technology and Innovation Foundation, 2007, pp. 6-7, available at http://www.itif.org/files/CaseForNationalBroadbandPolicy.pdf.

growth.[14] Proponents of strong broadband policies or "national plans" generally cite the mounting evidence that economic growth in advanced countries, particularly the United States, is strongly related to investment in information and communications technology (ICT).[15] But such a relationship in the United States at least is the result of market signals which have impelled these investments, not government policies targeting investment in computer hardware, software, or communications technology.

Nor is broadband investment any more or less important to economic growth than many other forms of high-tech investment whose benefits are adequately internalized by market participants. Surely, the benefits of rolling out fiber to the home (FTTH) are largely reflected in the subscription decisions of the households passed by the fiber.

Nevertheless, the justification for government promotion of universal broadband is generally based on the notion that such networks promote economic growth. A good example is the recent National Broadband Plan released this year by the U.S. Federal Communications Commission in response to a Congressional mandate:

> "The benefits of broadband and its centrality to economic life make it an essential element of local and regional economic development in the 21st century. Broadband enables regions and industries to compete globally, from rural farmers marketing their products nationwide to start-up companies along Massachusetts's Route 128 corridor achieving dramatic breakthroughs in biotechnology that are attracting global attention. Looking ahead, communities without broadband infrastructure will find it more difficult to attract investment and IT-intensive jobs, particularly because they face growing national and international competition."[16]

Given the political salience of the connection between broadband and growth, it is not surprising that there is a burgeoning, but somewhat superficial, literature on the impact of broadband on growth. Several empirical analyses have found a correlation between broadband

[14] Indeed, this appears to be the principal rationale advanced by New Zealand Ministry of Economic Development in advancing its plan for government spending of NZ$1.5 billion to build a Next Generation Network in New Zealand.
[15] See, for example, Jorgenson (2005) and Jorgenson, Ho, Samuels, and Stiroh (2008).
[16] FCC, *National Broadband Plan*, March 2010, p. 273.

availability and the growth in employment and output, but these studies may simply be demonstrating that there is greater demand for broadband in high-growth areas, not that the availability of broadband is crucial to growth.[17]

This is not to say that the availability of modern communications services is not important for economic development. The availability of very high-speed services may be important in the efficient delivery of medical services, in videoconferencing for many business operations, or in remote sensing and monitoring. But entities engaging in these activities are able to convey their demands for them through normal market processes; there are no obvious externalities involved in most of these uses and therefore little need for government to promote, subsidize, or build such networks to accelerate universal service.

B. Network Effects

Network externalities of the "chicken-egg" variety often cited by proponents of government support of broadband are generally solved by market participants without the spur of government. There is no doubt that such effects, including the "bandwagon" effects described by Rohlfs, are important.[18] But it is unlikely that government investment in related technologies is required to assist Apple in developing the i-Phone platform – or more recently the iPad – to insure that there are sufficient software applications to justify investment in the platform, or *vice versa.* In earlier examples, television broadcasters did not have to wait for programming to develop in the 1940s and 1950s before investing in transmission facilities; they simply developed their own programming. And early PC makers did not have to wait for software to develop; market participants such as Microsoft and Novell were more than willing to provide software, often under contract to the PC manufacturers.[19] It seems unlikely that today's broadband networks are being delayed because of a paucity of broadband applications or that the

[17] Examples include Crandall, Jackson, and Singer (2003); Ford and Koutsky (2005); Lehr, Gillett and Sirbu (2006); and Crandall, Lehr, and Litan (2007). A more recent paper by Greenstein and McDevitt (2009) concludes that broadband accounted for just $28 billion of U.S. GDP in 2006, and the upgrade from dial-up to broadband created no more than $10.6 billion in "new" GDP. They do not, however, attempt to estimate the impact of broadband on productivity or output in other sectors of the economy.

[18] See Rohlfs (2003).

[19] For a brief review of the decision of IBM to contract with Microsoft to develop MS-DOS, see http://inventors.about.com/library/weekly/aa033099.htm.

development of such applications is inhibited because of the absence of ubiquitous, high-speed broadband.[20]

C. Direct Externalities

The economic case for a universal broadband policy, then, must be based on the direct externalities such as those that Atkinson lists: the "…sharing of digital photos and video telephony." This is a very short list to justify the policy that Atkinson (and others) advocates! Moreover, even this list may not stand up to closer scrutiny.

No one doubts that interactive communications services are subject to substantial network external effects. The traditional telephone calling externality described above is an obvious example. More modern examples involve social networking sites, like Facebook or Twitter. The value of these sites to you depends on their being available to perhaps hundreds or thousands of others. But what does "available" mean? Must everyone be connected at a speed of 512Kbs, 1 Mbs, or 100 Mbs? If, for example, 1 Mbs is sufficient to engage in these interactive applications, should this 1 Mbs be delivered by fixed-wire or wireless services? These are important questions that must be answered before policymakers rush into a program of subsidizing higher-speed connections for underserved areas.

D. Universal Broadband or Universal Fiber?

The current focus of policymakers seeking to provide ubiquitous ultra-high-speed broadband is on direct fiber to the subscriber. In many cases, government intervention to accelerate fiber roll-out is justified simply by the observation that incumbent telecommunications companies have been slow to deploy fiber, in part because these companies face insufficient competition. But there may be other reasons for the apparently slow deployment of fiber, such as technological uncertainty and related government regulation.

Deploying fiber to the premises necessarily involves large, sunk investments and thus substantial risk if subsequent technological change reduces their appeal to consumers. For this reason alone, many incumbents may be reluctant to embark on large investment programs to deploy fiber to the premises. There are only three major incumbent communications carriers who have invested large amounts in fiber to the subscriber: NTT, Korea Telecom, and Verizon.

[20] For a somewhat contrary view, see Brennan (2010).

Verizon and NTT have found the financial markets skeptical of their investments in fiber because of the substantial expense and presumably limited revenue potential of such investments. In both cases, much of the value proposition derives from distributive video services, which are not sources of consumer externalities. Most other incumbent telecommunications companies are content to deploy fiber to the curb so as to be able to offer advanced IPTV services over much shorter copper loops. This strategy allows them to avoid the risk of premature obsolescence of the sunk fiber link to the subscriber while still offering video services, including high-definition video.[21]

III. Broadband Usage and the Need for Higher Speeds

One cannot easily predict how extremely fast broadband might be used when it is universally deployed in one or more large OECD countries. But the evidence on existing uses does not suggest that direct network externalities loom large. As part of its analysis for a National Broadband Plan, the U.S. FCC commissioned a study on consumer usage of Internet services –bioth by dial-up and broadband subscribers under current (2009) conditions. The results are shown in Table 1.

Note that a larger percentage of broadband subscribers utilize the Internet for all of the services listed than do their counterparts still using dial-up services. But most of these uses do not involve direct consumption externalities. Downloading news, videos or music; applying for a job; banking online; or submitting a product or service review do not require the participation of others online. The only activities listed with externalities are playing video games and use of a social network site. It seems doubtful that these activities generate sufficient external benefits to justify a large government universal service subsidy program or large-scale government investment even though some may provide greater consumer satisfaction with the development of ever faster broadband speeds.

Currently, however, there are simply very few interactive services that require 50 Mbs or 100 Mbs, with the exception of complex real-time video games. Thus, "universal broadband" delivered over fiber to the home depends heavily on the degree to which consumers

[21] I am indebted to Stanford Levin for alerting me to this strategy.

Table 1

Survey of Broadband Usage in the United States, 2009

Exhibit 3: Online Activities of American Adults (figures as a % of users in each group)

	All Internet users	Dial-up users	Broadband users
Buy a product online*	78	56	83
Get local or community news*	75	55	80
Visit local, state or federal government Web site*	75	53	79
Use a social networking site*	52	41	55
Submit a review for a product or service*	52	36	55
Download or stream music*	47	22	52
Upload or share content*	45	26	48
Play games online*	46	38	48
Get international or national news	73	54	77
Bank online	63	43	69
Get information about or apply for a job	57	39	60
Get advice from a government agency about a health or safety issue	50	39	54
Download or stream video	38	18	42
Post to own blog or group blog	23	7	26
Take a class online	22	8	24
Play complicated role-playing games online	14	9	14

Source: Federal Communications Commission survey of 5,005 adult Americans, October-November 2009. Draft final results. For broadband users, n=1,378 for activities marked by * and n=1,278 for other activities. For dial-up user, n=212 for activities marked by * and n=247 for other activities.

value more choice in video entertainment. U.S. regulators acknowledge the central role of video downloads in consumers' use of broadband. As recently as last month, the U.S. FCC decided that Americans now require at least 4 Mbs download speed on their broadband services and 1 Mbs upload speed primarily because of their penchant for downloading video:

> "Today, Americans increasingly are using their broadband connections to access high-quality video, and we anticipate that this demand will only continue to grow in the future. For example, many Americans now communicate with their families and friends through desktop videoconference calls. Many users also now post their own videos and view others' on such sites as YouTube and Hulu. Instead of reading articles online, Americans often watch videos of today's top stories. The growth and demand for high-quality videos by Americans is substantial, and this demand is expected to grow at over 40 percent and 120 percent per year, respectively, through 2013."[22]

Thus, distributive video, not interactive video services, is the current driver of network investment in broadband. And despite this more aggressive definition of acceptable broadband speed, the FCC concluded that only 4 to 8 percent of U.S. households do not currently have access to broadband of acceptable quality despite the absence of a U.S. universal-service policy

[22] U.S. Federal Communications Commission, *Sixth Broadband Deployment Report*, July 16, 2010, §10.

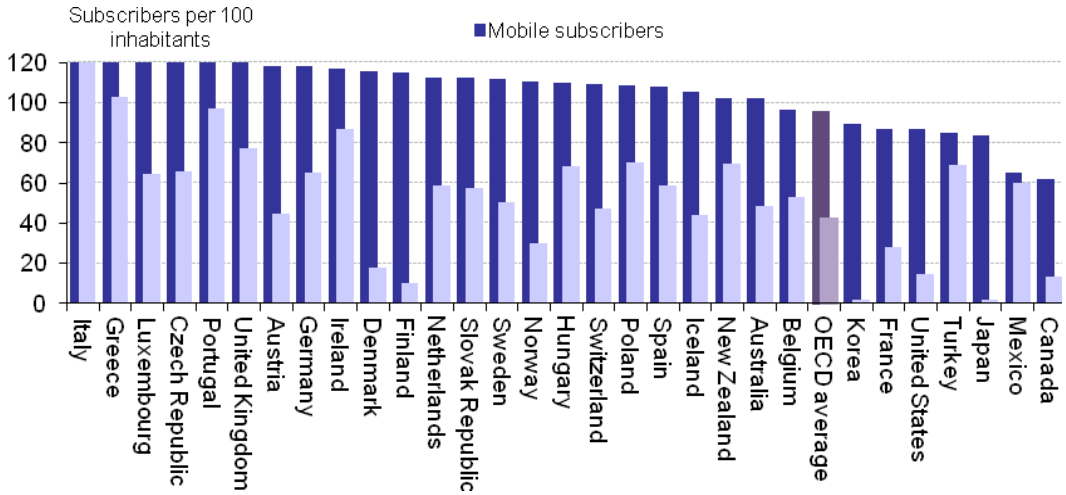
for broadband.[23] Indeed, the country is so well served by broadband carriers that the two U.S. government agencies entrusted with spending $7.2 billion in 2009 broadband "stimulus" funds in un-served and under-served areas have had difficulty spending this money because applicants for the funds are often been unable to demonstrate that areas are indeed under-served.[24]

IV. The Availability of High-Speed Services on Wireless Networks

It is far from clear that future broadband usage will be dominated by fixed wire services. The evolution of wireless services over the last twenty years has allowed subscribers to access the Internet at ever increasing speeds over a proliferation of new devices. Moreover, in most countries a substantial share of households relies solely on wireless for their telecommunications needs. Virtually everyone now has a wireless device (Figure 1).

Figure 1

Mobile Subscribers per 100 Persons, September 2009



Source: OECD

http://www.oecd.org/document/23/0,3343,en_2649_34449_33987543_1_1_1_37441,00.html.

[23] *Id.*

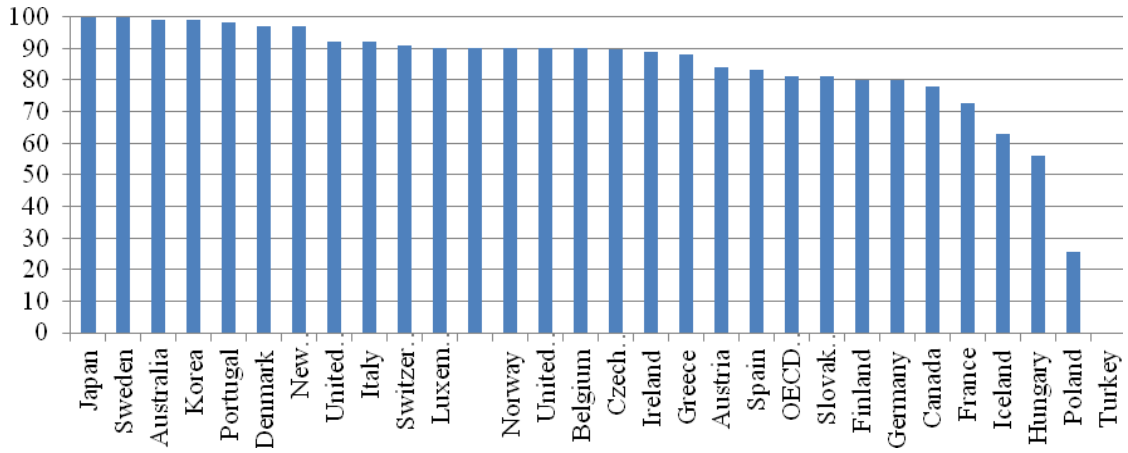
[24] See "Stimulus funds for high-speed Internet access tangled up, " *USA Today*, February 10, 2010, available at http://www.usatoday.com/tech/news/2010-02-09-broadband09_CV_N.htm.

Equally important for the purposes of the current discussion, virtually everyone in advanced OECD countries, including New Zealand, has *access* to high-speed 3G wireless services. (Figure 2) These services are growing rapidly, and new, even faster services on the horizon. Indeed, a recent report by the Australian Communications and Media Authority reported that the number of 3G subscriptions in Australia was 12.3 million in June 2009 while the number of fixed lines in the country had fallen to 10.7 million.[25]

Given the availability of 3G and the introduction of even faster 4G services on the immediate horizon, one has to question whether it makes sense to pursue universal fixed-wire broadband and, in particular, ubiquitous fiber to the premises. Are consumers likely to embrace new wireless devices, such as the iPad, and be emancipated from their erstwhile couch-potato status?

Figure 2

Wireless 3G Coverage by Country, 2009-10



Source: OECD http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_37441,00.html.

[25] Australian Communications and Media Authority, Communications Report, 2008-09, p. 51, available at http://www.acma.gov.au/webwr/_assets/main/lib311252/08-09_comms_report.pdf.

V. Universal Service Subsidies or Government Investment?

Despite the rather considerable discussion of the merits of universal broadband, there has been very little movement towards the establishment of universal service policies for broadband services in most advanced countries. Instead, the focus has been upon stimulating intra-platform competition through network unbundling or direct government investment, or both, in order to accelerate broadband take-up.

A. Network Unbundling

Much of the debate over broadband policy has centered on wholesale access to incumbent local telephone companies (ILECs) for new entrants into the provision of broadband services. This wholesale access is provided through the "unbundling" of network facilities – primarily, the local loop – so that the entrant can avoid the costly duplication of the subscriber line that extends from the incumbent's wire center or remote terminal to the subscriber's residence or business. In practice, the most common form of wholesale arrangement is a lease of the upper-frequencies of this local loop on a month-to-month basis, a service often called "line sharing" since it permits the incumbent to retain the lower frequencies that are used for the delivery of ordinary voice services. Although the wholesale rate for a shared line is generally supposed to be based on cost, there is no clearly-defined approach for establishing such costs given the preponderance of joint and common costs in providing a share of a local loop.

Although not generally a part of the regulator's universal service policy, network unbundling has been pursued as a strategy to encourage competition in broadband services and, therefore, lower broadband prices and greater broadband penetration. Unfortunately, the empirical evidence does not establish that these wholesale unbundling policies have led to increased broadband penetration. Moreover, there is evidence that they inhibit network investment by incumbents and entrants alike. In the United States, the first large developed country to utilize unbundling, the results have been particularly unsatisfactory. A very large percentage of firms that entered the local telecom market after the 1996 launch of the unbundling policy using unbundled or shared loops failed.[26] In 2003, the FCC was forced by the courts to abandon mandated line sharing because cable companies were a virtually ubiquitous competitive

[26] Crandall (2005)

presence and the courts accepted the argument that line sharing was therefore unnecessary and would suppress network investment.

Recent studies find little direct relationship between network unbundling policies and broadband penetration.[27] However, there is a growing literature that provides support for the hypothesis that network unbundling reduces the incentive for incumbents and entrants to invest in their networks, including the facilities required to deliver higher and higher speed broadband services.[28] It is noteworthy that when the U.S. FCC commissioned a large study of broadband policies by the Berkman Center at Harvard University during its preparation of a National Broadband Plan, it chose to ignore the study's recommendations because the study strongly advocated network unbundling in the face of all of this adverse empirical evidence.[29]

B. **Government Investment**

Most OECD countries have privatized their national telecommunications carrier and have thus not invested directly in telecommunications facilities in recent years. The major exception has been Sweden, whose municipalities apparently have invested substantial amounts in local fiber-to-the-home (FTTH) networks. Other countries, such as Korea and Japan, have provided favorable tax treatment of broadband investment, but their governments have not invested directly in mass-market broadband facilities. These three countries have the largest share of direct fiber connections of all OECD countries.

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[27] These studies include Aron & Burnstein (2003), Bauer, Kim, & Wildman (2003), Denni & Gruber (2005), Distaso, Lupi & Mantenti (2005), Cava-Ferreruela & Albau-Munoz (2006), Wallsten (2006), Waverman Meschi, Reillier,and Dasgupta (2007), Boyle, Howell, and Zhang (2008), and Wallsten and Haulsaden (2009). Three others, including Garcia-Murillo (2005), Grosso (2006), and deRidder (2007), have found a positive association, but each one has a number of problems as explained by Crandall, Ehrlich, and Eisenach (2010). In particular, the deRidder study utilizes a variable for network unbundling – the number of years unbundling has been in place in a country – which is collinear with the number of years that broadband has been available. Therefore, deRidder's unbundling variable serves as proxy for the diffusion or "S" curve. See Crandall, Ehrlich, and Eisenach (2010) and Boyle, Howell, and Zhang (2008).

[28] See the recent survey of this literature by Cambini and Young (2010), which lists a number of studies that address the effect of regulatory policies on investment, including Waverman and Dasgupta (2006), Friederiszick, Grajek, and Roller (2008), and Wallsten and Hausladen (2009).

[29] See *Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World*, October 2009 (Draft) (available at http://www.fcc.gov/stage/pdf/Berkman_Center_Broadband_Study_13Oct09.pdf) and the criticism of the report provided by Crandall, Ehrlich, and Eisenach (2010).

C. Private Investment in Fiber to the Home

Before turning to the recent policy direction in Australia in New Zealand, which reflects a desire to accelerate the deployment of fiber-based broadband networks, it is useful to note the general paucity of such network investment across the OECD. Incumbent telephone companies in the major OECD countries have been very slow to deploy such networks. Among these companies, only Verizon (U.S), NTT (Japan) and perhaps KT (Korea) are committed to a major roll-out of fiber throughout their operating territories. In the EU, for example, most of the investment in direct fiber connections is being undertaken by non-incumbents. The European Competitive Telecommunications Association (ECTA) reports that as of the 3rd quarter of 2009, there were only 373,000 direct fiber connections to incumbents' networks, and 1,669,000 connections to entrants' facilities (including connections to Sweden's municipal fiber networks) **o**ut of a total of nearly 122 million broadband connections. Thus, despite repeated optimistic pronouncements concerning fiber roll-out, most carriers remain very reluctant to undertake this expensive, irreversible (sunk) investment.

Both Verizon and NTT encountered substantial resistance from the financial markets when they began to launch their expensive fiber networks. Despite an appreciation of the yen by about 25 percent against the U.S. dollar since NTT began deploying fiber to the home in 2001, NTT's common equity price has languished badly. Indeed, the yen's appreciation since the end of 2005 has also been about 25 percent, but the dollar price of NTT stock is currently below its December 2005 level. Verizon's stock price also underperformed compared to other large U.S. carriers after it began to deploy fiber in 2004-05, but its stock has actually outperformed the broad market indexes since the end of 2005. It should be noted, however, that Verizon's deployment has been less aggressive than NTT's, and it now appears to be slowing its roll-out as it approaches 50 percent coverage of households in its service area.[30]

One must conclude that the deployment of fiber to the home, as limited as it has been, has not yet been shown to be a profitable strategy for incumbent companies. Between them, Verizon and NTT had nearly 21 million FTTH subscribers at the end of 2009. No other ILEC in the

[30] Broadband DSLReports.com, "So, Is This Where Verizon's FiOS Deployment Ends?" March 12, 2010, available at http://www.dslreports.com/shownews/So-Is-This-Where-Verizons-FiOS-Deployment-Ends-107342.

OECD comes close to them, and the jury is still out on the profitability of their heavy investment in fiber.

D. Government Investment as a Substitute: Australia and New Zealand

In the face of this market evidence, Australia and New Zealand are proposing to launch very large government-supported investments in fiber. Australia began this process after several years of contentious negotiations with Telstra, the national incumbent telecom company. In 2009, the government announced that it would establish a new corporation to build a "superfast broadband network" with up to A$43 billion of government money.[31] Telstra appeared to be relegated to the sidelines because it had not cooperated with the government in moving to a regime of network sharing with some degree of structural separation, and its share price was severely depressed as a result. Recently, however, Telstra negotiated an A$11 billion deal with the National Broadband Network Co. to lease its facilities as NBN rolls out its fiber and to turn over its fixed-line customers to the NBN. But this agreement is apparently in limbo, pending the outcome of next month's national election.[32]

New Zealand launched its national broadband policy in 2009 after several years of similarly contentious relations with New Zealand Telecom. The government's policy objectives are surprisingly simple:

"The government's objective for the UFB Initiative … is: to accelerate the roll-out of ultra-fast broadband to 75 percent of New Zealanders over ten years, concentrating in the first six years on priority broadband users such as businesses, schools and health services, plus greenfield developments and certain tranches of residential areas."[33]

The justifications for the government's expenditure of up to NZ $1.5 billion are:

- "… making a significant contribution to economic growth;

[31] ACMA 2008-09 Report, p. 36. http://www.acma.gov.au/webwr/_assets/main/lib311252/08-09_comms_report.pdf.
[32] See "Telstra Shares Rise on NBN Deal," *Business Spectator*, 21 June, 2010, available at http://www.businessspectator.com.au/bs.nsf/Article/Telstra-shares-surge-on-NBN-deal-pd20100621-6M26S?OpenDocument.
[33] New Zealand Ministry of Economic Development, Ultra-Fast Broadband Investment Initiative, *Final Proposal Overview Document*, September 2009, available at http://www.med.govt.nz/templates/MultipageDocumentTOC____41865.aspx.

- neither discouraging, nor substituting for, private sector investment;
- avoiding entrenching the position, or 'lining the pockets', of existing broadband network to providers;
- avoiding excessive infrastructure duplication;
- focusing on building new infrastructure, and not unduly preserving the 'legacy assets' of the past; and
- ensuring affordable broadband services."[34]

On the one hand, the government wishes to be neutral towards private broadband investment. On the other hand, it does not want to allow existing providers (TNZ?) to "line their pockets" or preserve their "legacy assets." It is unlikely that it can accomplish the latter without "discouraging … private investment."

Indeed, the problem with both the Australian and New Zealand decisions to build a government-subsidized broadband network is that such projects cannot help but freeze private investment in fixed-wire networks. It surely would be unwise for either TNZ or Telstra to consider building out their own networks without some clear assurance that the government-funded NGN's would not offer their wholesale services to retail competitors at wholesale prices that are below cost. Yet, in both countries, the stated goal of the government is to assure consumers "affordable" broadband services –not services simply priced at their actual economic cost. Both countries therefore risk a return to the era of government-owned telecommunications fixed-wire infrastructure, which will induce private companies to focus their entrepreneurial energies on the unsubsidized wireless sector.

VI. Conclusions

A close examination of the potential rationale(s) for broadband universal service policies leads me to conclude that there is very little economic justification for such a policy. The ultimate rationale, then, is political: everyone deserves to have the latest high-tech infrastructure available at affordable prices no matter where he or she lives and regardless of his or her financial circumstances.

[34] *Id.*

Unfortunately, the history of traditional universal service policies in the United States does not provide much basis for optimism if such policies are extended to high-speed Internet services. There is very little evidence that these traditional universal service policies have increased rural telephone penetration in the United States, and there is even less evidence that such subsidies are needed for broadband, which is already available for all but a few percent of U.S. households. Indeed, the federal government is encountering problems in spending the $7.2 billion in broadband "stimulus" funds because applicants often cannot show that the areas they have targeted are un-served.

The United States has seen strong capital spending on broadband networks, including wireless and cable television, in recent years in large part because broadband has been freed from some of the onerous regulations imposed in the wake of the 1996 Telecommunications Act. Australia and New Zealand have chosen a different path after substantial regulatory battles with their incumbent carriers. If they go ahead with government-funded national fiber-optic networks, they may be able to accelerate the deployment of super-fast broadband to a large part of the population, but surely this will be achieved at the expense of private capital spending in telecommunications.

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