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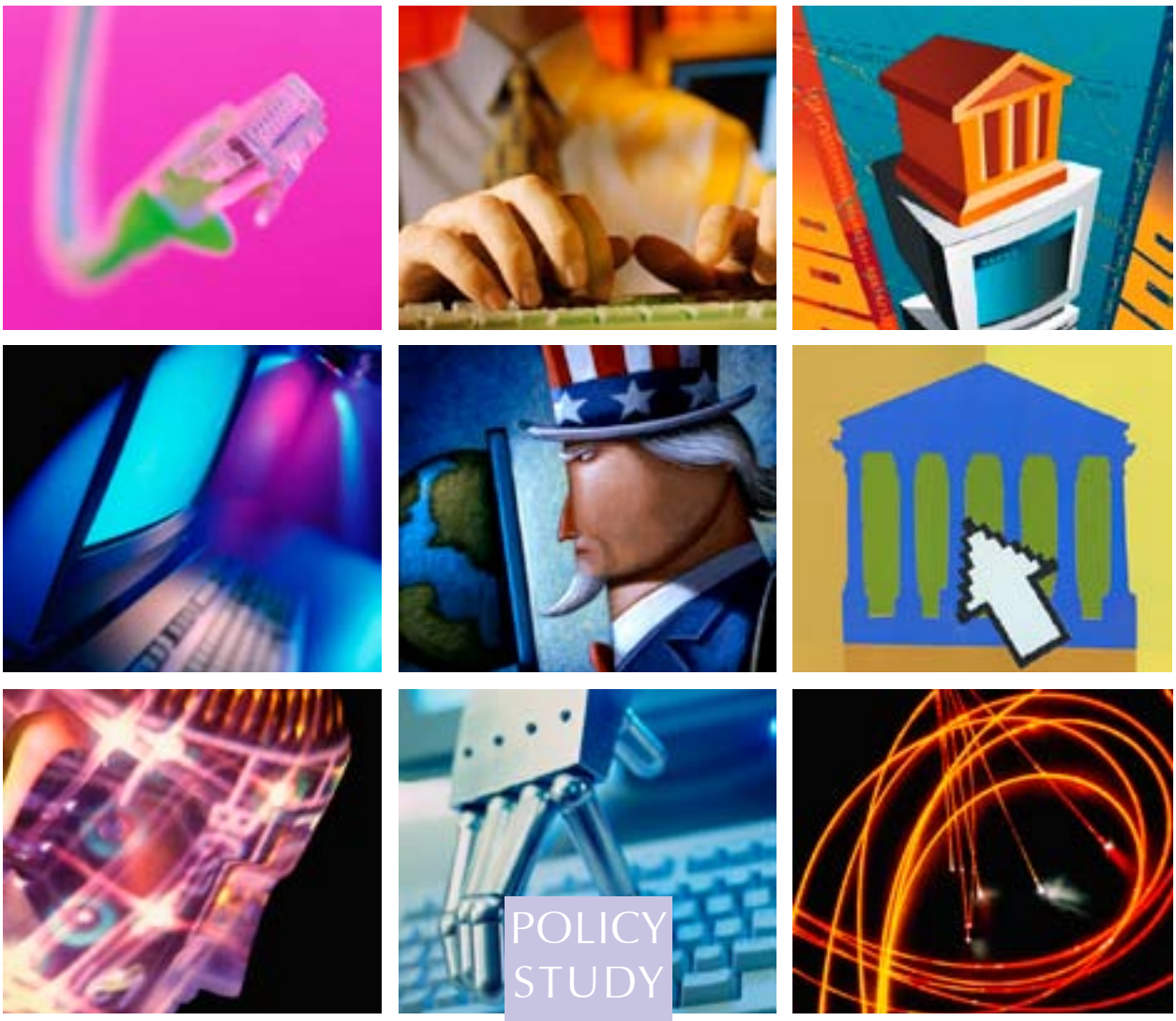
A Dynamic Perspective on Government Broadband Initiatives

By Jerry Ellig
Project Director: Adrian T. Moore



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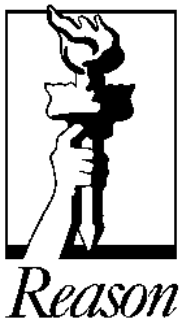

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Executive Summary

Debate over government provision of broadband has generated many of the usual arguments over the pros and cons of government service provision. On the one hand, such initiatives might make broadband more affordable and hasten its adoption. On the other hand, they could also generate significant costs for taxpayers and stunt incentives for cost containment. Such arguments commonly occur when governments consider direct provision of electricity, gas, water, roads, and many other services that tend to be provided by monopolies that invest in long-lived assets. Less extensively discussed, however, are some unique challenges that arise because broadband is anew, fast-changing technology available from competing suppliers. Policymakers need to consider some unique problems when a government enterprise enters a dynamic market such as the provision of Internet services.

Traditionally, infrastructure like water systems, gas distribution and electric distribution has involved a fixed investment that was very large compared to the ongoing operating cost. The technology of the infrastructure itself changed relatively slowly. As a result, local governments could usually invest in what appeared to be the best technology at the time without having to worry much about whether they chose the right technology. Pricing and selling the service was relatively easy. Most people need water, heat and electricity, and the service providers usually had a monopoly. Long asset lives and slow technological change made long depreciation schedules possible. Service providers could be reasonably confident of recovering their capital costs over a long time period.

However, these static monopolies differ significantly from services like Internet provision, which are dynamic due to their fast-changing technology and variety of services. Unlike heat, water and electricity, high-speed Internet service is not viewed as a need by many people. Companies continually change their offerings and prices to appeal to a variety of consumer desires. This dynamic competition upsets the tranquil conditions that make government provision of a service easier.

Scholarship on dynamic competition suggests seven new issues that are likely to be significant in municipal provision of Internet service:

- Competition: Unlike a monopolist, an enterprise that faces competition cannot count on a captive market. The only exceptions might be small communities serviced only by expensive alternatives, or municipalities willing to commit to very large subsidies for their broadband systems.

- Performance Competition: Competitive businesses seek to continually improve performance—or even develop new aspects of performance that were not previously thought capable of improvement. Comparing prices and services offered by government-sponsored Internet provision to those in the private sector, the prices and performance of existing government systems are often inferior to those of existing private systems.

- Continuous Improvement: One indicator of the extent of change is the pace at which prices of goods and services fall as technology improves, costs fall, or competition intensifies. Unlike in state-owned utilities, this has occurred frequently in the market for Internet service, as well as in related or analogous markets such as wireless communications, telephone equipment, and telecommunications services.

- Technological Change and Lock-In: "Lock-in" occurs when an initial decision gives one technology a slight edge, then sets in motion a process which leads that technology to dominate the market. The market can get locked in to an inferior technology due to the decisions of the early adopters, and subsidies may prompt early adopters to choose an inferior technology. Government broadband plans should squarely address the potential for lock-in and explicitly evaluate whether subsidies would give an inferior technology an artificial boost.

- Obsolescence: Wireless technology improves rapidly, and as a result capital investment becomes obsolete more quickly. Business plans for government broadband enterprises need to assume faster depreciation rates, and concomitantly higher prices, than have traditionally been used for government utilities. For example, a workable plan for municipal Wi-Fi needs to assume that revenues will not just cover operating costs plus interest, but also recover the initial capital outlay in three to five years.

- Risk: Financially, investment in a dynamic field such as Internet provision is less of a "sure thing" than a conventional government monopoly such as electricity, gas or water provision.

Decision-makers must ensure that governments do not finance broadband as if it were a traditional low-risk investment in infrastructure, as some have done, so that spending decisions are weighed appropriately.

- Uncertainty: The fact that uncertainty affects private business shareholders' financial fortunes gives them strong incentives to seek out management that will exercise sound judgment. For government broadband enterprises, taxpayers bear the uncertainty in their role as the ultimate owners. At a minimum, therefore, effective accountability requires that government broadband initiatives should have accountability and transparency for taxpayers at least as good as that which publicly held companies must have for their shareholders.

While many broadband initiatives require some type of public sponsorship or investment—either by government or by government-owned entities—a recent twist appears to offer the public a much better deal. In some cities, such as Philadelphia and San Francisco, private firms have proposed to build Wi-Fi networks at no cost to taxpayers. There is nothing inherently wrong with proposals for free or privately subsidized Wi-Fi. However, governments need to realize that rights-of-way and light poles are valuable assets, and access to these assets would bestow a significant competitive advantage on any firm selected to use them.

Any local government that grants one Wi-Fi provider an exclusive right to use right-of-way and poles risks distorting competition in whatever markets are generating the revenue stream that will subsidize the Wi-Fi service. A monopoly that gives away Wi-Fi to build demand for other services it might sell to Wi-Fi users might be able to charge a higher price for these other services than it would in the presence of other Wi-Fi competitors. For this reason, local governments should beware of granting one Wi-Fi provider exclusive access to public assets, even if the Wi-Fi service itself is free of charge to users. At a minimum, decision-makers should assess whether exclusive access would distort competition in the markets for other goods and services sold by the Wi-Fi company.

The factors outlined above need not imply that government-provided broadband is a bad idea. However, no plan for government-sponsored broadband should be considered complete or responsible unless it addresses many factors. Government faces the daunting challenge of entering a market where technological change is swift, the future is uncertain, and competitors' actions are unpredictable—a playing field fundamentally different from the stable, predictable utility markets that have traditionally attracted public investment.

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Part 1

Introduction

Proposals for government provision of broadband Internet service have generated significant debate in many localities. Such proposals come in many forms. Philadelphia plans to have Earthlink build a wireless (Wi-Fi) network that would offer service for about $20 per month, or $10 for low-income users.[1] In June 2005, voters in Lafayette, Louisiana approved a bond issue to build a fiber network.[2] In November 2005, voters in 17 Iowa cities voted in favor of creating telecommunications utilities that could offer phone and Internet service.[3] A 2004 survey found that 621 public power systems supply broadband services. About 23 municipalities offer fiber optic service to the public.[4] News reports claim that "hundreds of cities" are considering some type of municipal Wi-Fi.[5] San Francisco Mayor Gavin Newsome even declared free or low-cost wireless Internet access a "fundamental right."[6] Google then grabbed headlines by proposing to turn San Francisco into a Wi-Fi hotspot at no cost to the city. Media reports state that "many cities are approaching Wi-Fi as fundamental infrastructure akin to electricity and water."[7]

Debate over government provision of broadband has generated many of the usual arguments over the pros and cons of government service provision. On the one hand, such initiatives might make broadband more affordable and hasten its adoption. On the other hand, they could also generate significant costs for taxpayers and stunt incentives for cost containment. Such arguments commonly occur when governments consider direct provision of electricity, gas, water, roads, and many other services that tend to be provided by monopolies that invest in long-lived assets.

Less extensively discussed, however, are some unique challenges that arise because broadband is a new, fast-changing technology available from competing suppliers. Dynamic competition is different from static monopoly. Policymakers need to consider some unique and different problems when a government enterprise enters a dynamic market. Dynamic competition could have a significant effect on the success or failure of a government broadband enterprise. The presence of dynamic competition raises a rather different series of questions that thoughtful decisionmakers should ask before launching government-sponsored broadband initiatives.

Several types of government-sponsored broadband initiatives have evoked discussion in recent years. Some municipal utilities offering cable service offer cable modems, just like private cable companies. The physical plant consists of coaxial cable or a combination of fiber optic and coaxial cable. Others offer fiber optic cable all the way to the home, much like some of the phone companies are starting to build. Some municipal electric utilities will no doubt seek to follow the

example of Manassas, Virginia, in providing broadband over power lines.[8] Most recent controversy has swirled around municipal proposals for "Wi-Fi." Wi-Fi operates much like a cordless telephone, providing computers with cordless Internet access at distances up to 300 feet from Wi-Fi transmitters. Like cordless telephones, Wi-Fi uses unlicensed radio spectrum. Some municipalities, such as Philadelphia and San Francisco, seek to blanket a large area with Wi-Fi transmitters to create a citywide Wi-Fi network. Finally, a longer-range wireless technology called "WiMAX" is frequently discussed but still under development. WiMAX might provide cordless Internet access up to 25 miles from transmitters.[9]

Part 2

What Is Dynamic Competition and Why Does It Matter?

Dynamic competition involves two factors: dynamism and competition. This may seem obvious, but it means that dynamically competitive markets are substantially different from the relatively static monopolies that characterize many government infrastructure investments.

Traditionally, infrastructure like water systems, gas distribution, and electric distribution has involved a fixed investment that was very large compared to the ongoing operating cost. The technology of the infrastructure itself changed relatively slowly. As a result, local governments could usually invest in what appeared to be the best technology at the time without having to worry much about whether they chose the right technology. Pricing and selling the service was relatively easy. Most people need water, heat, and electricity, and the service providers usually had a monopoly. Long asset lives and slow technological change made long depreciation schedules possible. Service providers could be reasonably confident of recovering their capital costs over a long time period. Pressures to replace the monopoly or allow competition were often minimal, because there were no radically new or different technologies out there that offered additional obvious and significant benefits. Government-owned utilities had a good shot at breaking even and providing at least an acceptable level of service, if that's what local officials wanted.[10]

Dynamic competition upsets this tranquil situation. By far the most prominent dynamic concept of competition is associated with economist Joseph Schumpeter. Schumpeter argued that the most significant advances in human wellbeing are triggered by "competition from the new commodity, the new technology, the new source of supply, the new type of organization—competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the output of existing firms, but at their foundations and their very lives."[11] Journalists observing the explosion of new information and communications technologies have explicitly noted Schumpeter, with headlines declaring that "Today's Hottest Economist Died 50 Years Ago."[12]

In addition to Schumpeter, a variety of other scholars have also developed dynamic theories of competition.[13] In "evolutionary" competition theories, a lot of things happen that most people would readily identify as realistic features of real-world competition. Different firms have

different abilities, novelty constantly arises, innovation occurs as firms learn, and there are limits to the amount of information decisionmakers can acquire and process. Competition is an open-ended process of innovation, experimentation, and feedback.[14] Some of Schumpeter's fellow "Austrian" economists developed complementary theories that emphasize competition as a process for the discovery of new knowledge. Real-world competition is a dynamic process of trial and error. The purpose of competition is to reveal what services, costs, and prices are possible. The firms that survive and grow are those that do a better job than others of anticipating what consumers want and finding the best way to produce it.[15] More recently, the interaction of competition and technological change has led scholars to examine whether small variations in initial conditions can lead to large and unpredictable changes in the market's evolution.[16]

Finally, strategic management scholars explicitly view competition as a continual striving to cost-effectively develop superior capabilities to serve consumers.[17] Strategic management emphasizes the importance of ensuring that a firm's capabilities are a good match to its environment. In a dynamically competitive market, some of the most important capabilities are the ability to innovate, to change business strategy rapidly, to drop and add services in response to customer needs, to upgrade products with new technology and features, and to change prices as market conditions change.

Dynamic competition is a powerful force in the marketplace that makes a substantial contribution to improvements in human wellbeing.

The U.S. experience with regulation and deregulation of infrastructure industries reveals substantial evidence that dynamic competition is a powerful force in the marketplace that makes a substantial contribution to improvements in human wellbeing.

Empirical studies of deregulated industries consistently find that competition generates more consumer benefits than economists predicted based on pre-deregulation costs and market conditions:[18]

- Airline deregulation led to more frequent flights, more nonstop flights, and more possible connections on heavily traveled routes. One of the most authoritative studies pegged the value of increased flight frequency at $10.3 billion annually in 1993 dollars.[19] Spurred largely by the hub-and-spoke route system, the increase in flight frequency was a surprise; prior to deregulation, researchers predicted that airlines would cut costs by reducing flight frequency.[20]
- Another substantial innovation in the airline industry came from the low-cost carriers, such as Southwest. Low-cost airlines cut back on frills, make more efficient use of labor, and avoid unnecessary expenses. Southwest, originally an intrastate carrier in Texas, could not compete with the established national airlines prior to deregulation, because the federal government refused to approve any new airlines during the 40 years prior to 1978.[21]

- AT&T lagged in introducing fiber optic cable and digital switching until it faced substantial competition from MCI and Sprint. In 1985, for example, MCI and Sprint combined had 1.5 times the fiber mileage of AT&T; by 1994, AT&T had 1.3 times more fiber than MCI and Sprint combined.[22]
- Under traditional monopoly regulation, residential gas customers bear the risk of fluctuations in natural gas prices. In states that permit consumers to choose their gas supplier, consumers can reduce this risk if they choose a supplier who offers a fixed-price contract.[23] Suppliers usually hedge this risk in gas futures markets, thus passing it on to speculators.
- Increased competition resulting from trucking deregulation spurred innovation by creating pressure to reduce costs and increase the reliability of service. Carriers can now monitor vehicle temperatures, security, and weight through remote communications technologies. For less-than-truckload shipments, freight forwarders provide customers with a more precise matching of transportation services with their needs. Within five years of interstate trucking deregulation in 1980, shippers saved nearly $6-10 billion annually in lower rates and $1 billion annually due to more rapid and reliable service.[24]
- Actual rate and cost reductions resulting from railroad deregulation were two or three times the size that economists predicted prior to deregulation. In addition, deregulation led to significant improvements in service quality that no one predicted beforehand. Researchers at the Interstate Commerce Commission and Federal Trade Commission estimated that more reliable rail service reduced manufacturers' inventory costs by $5-10 billion annually in 1987.[25] A Brookings Institution study estimated that speedier rail service made shippers better off by $2 to $6 billion in 1977 dollars.[26]

If even "low-tech" industries like railroads experience significant effects from dynamic competition, it surely deserves attention when policymakers consider investing tax dollars in fast-changing communications technology.

Part 3

New Issues for Decisionmakers

Dynamic competition complicates the assessment of government-sponsored broadband enterprises. Scholarship on dynamic competition suggests seven new issues that are unlikely to be significant under static monopoly: Competition, Performance Competition, Continuous Improvement, Technological Change and Lock-in, Obsolescence, Risk, and Uncertainty. There is substantial evidence from broadband, telecommunications, and other network industries that these dynamic issues are not just theoretical possibilities, but real concerns that could have a substantial effect on the success of a government broadband provider.

A. Competition

Unlike a monopolist, an enterprise that faces competition cannot count on a captive market. In many cases, government-sponsored broadband will have to compete with incumbent firms, such as cable, telephone, and wireless companies that already have a substantial head start. Judging from the money, time, and effort these firms have spent fighting government-sponsored broadband, they clearly view it as a competitor. Because broadband providers rarely have a captive market, the "penetration rates" and profit margins for a government-sponsored broadband service will likely be lower than for a municipal electric or water company.

The penetration rate is the percentage of eligible or targeted customers who actually choose to subscribe to the service. It is different from market share, which is the percentage of customers using the service who get it from a particular provider. In 2005, broadband was available to more than 90 percent of U.S. households, yet only about 32 percent subscribed.[27]

Nevertheless, government broadband initiatives often assume relatively high penetration rates and market shares. A 14-city fiber network planned in Utah, for example, assumes a 50 percent penetration rate after five years and a 55 percent penetration rate after 10 years, despite the presence of competitors.[28] The plan for Lafayette, Louisiana's fiber network assumes residential cable TV penetration of 50 percent after 2008 and residential Internet penetration of 27 percent by 2009, rising to 37 percent in 2027. It also assumes that margins (earnings before interest, taxes, depreciation and amortization) will exceed 50 percent over the long term—a highly unlikely assumption for a capital-intensive system that faces competition from similar competitors.[29] The

financial assumptions underlying Philadelphia's proposed wireless network imply a residential penetration rate of 13 percent in the first year, rising to 22 percent in year five. Though apparently more modest than the assumptions in other cities' fiber optic plans, this figure still implies that the city's wireless network would acquire all new broadband customers in the city during its first year, plus take 5.5 percent of the market from Verizon and Comcast, the incumbents already serving Philadelphia. Despite the presence of well-funded competitors, the Philadelphia wireless plan assumes margins of 30-42 percent.[30]

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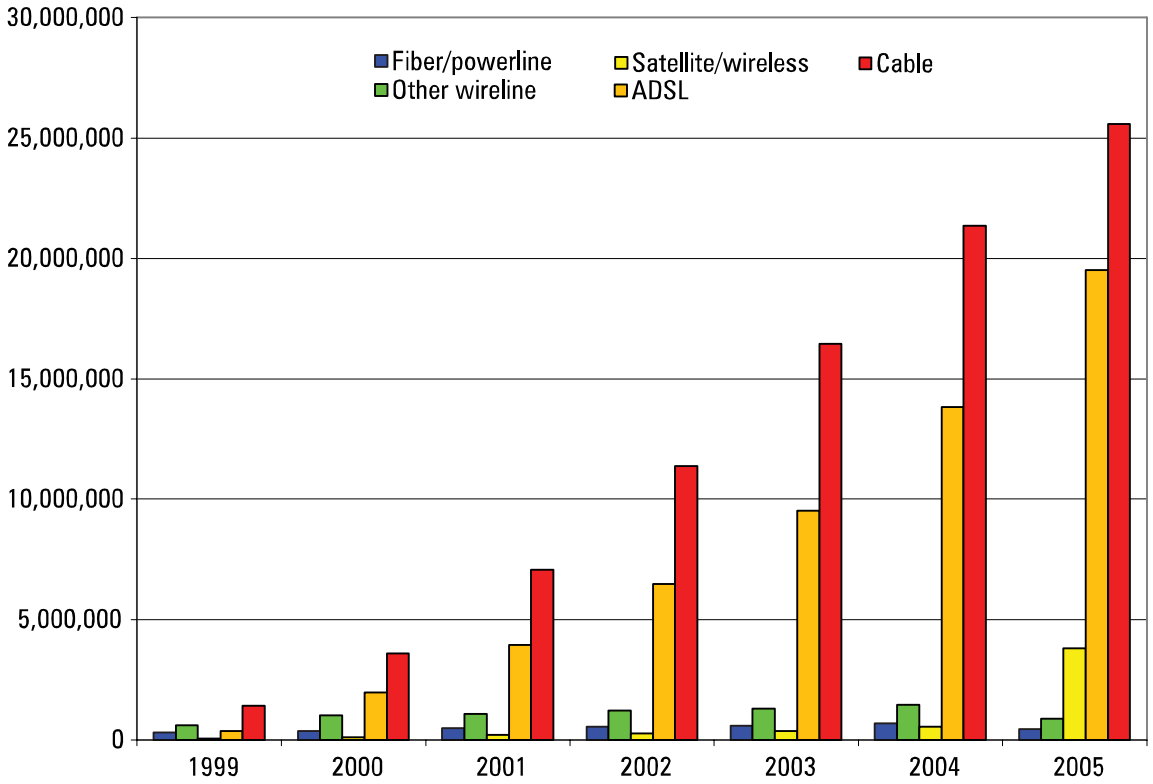
Are these kinds of penetration rates realistic? The evolution of broadband market shares over the past six years might shed some light on that question. The FCC collects data on residential and small business use of "high-speed" lines (capable of more than 200 kbps at least one-way). The accompanying figures and tables hold several lessons for any potential competitor.

Figure 1: Residential and Small Business High-Speed Lines



Source: FCC High-Speed Services Report (July 2006), Table 1.

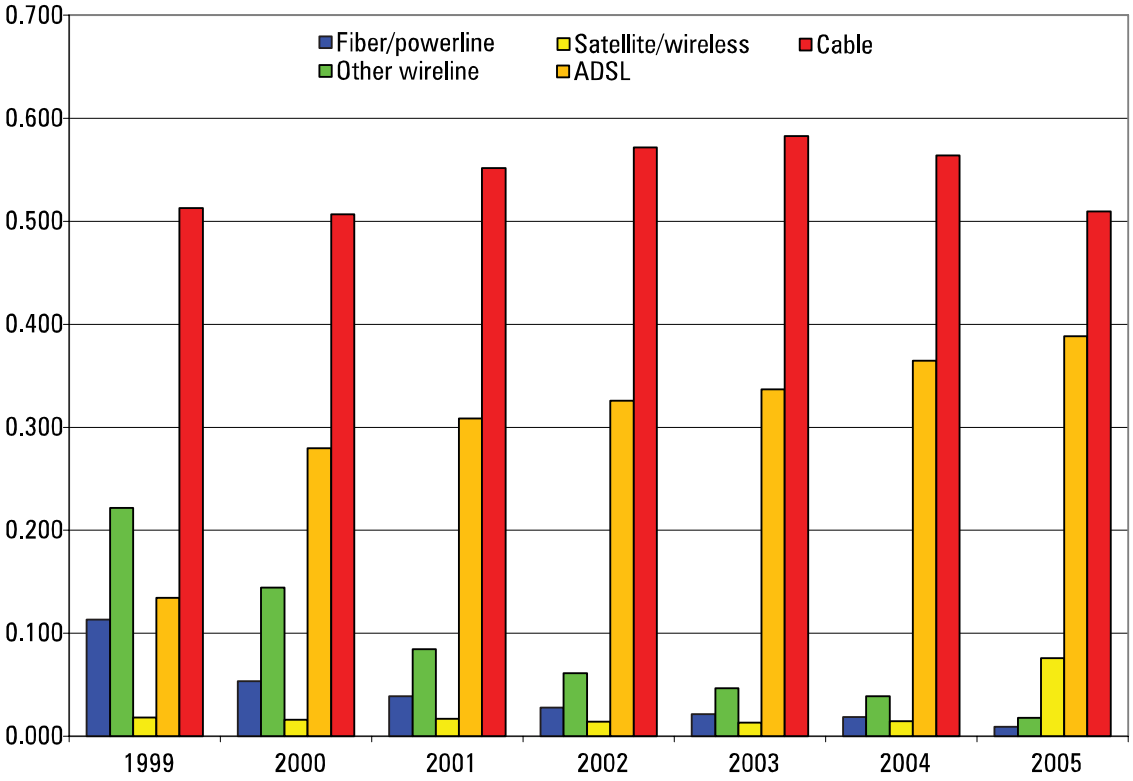
Table 1: Subscriptions to High-Speed Services (Year-End)							
	1999	2000	2001	2002	2003	2004	2005
Fiber/powerline	312,204	376,203	494,199	548,471	602,197	697,779	454,055
Other wireline	609,909	1,021,291	1,078,597	1,216,208	1,305,070	1,468,566	876,286
Satellite/wireless	50,404	112,405	212,610	276,067	367,118	549,621	3,809,247
DSL	369,792	1,977,101	3,947,808	6,471,716	9,509,442	13,817,280	19,514,318
Cable	1,411,977	3,582,874	7,059,598	11,369,087	16,446,322	21,357,400	25,583,233
Total subscriptions	**2,754,286**	**7,069,874**	**12,792,812**	**19,881,549**	**28,230,149**	**37,890,646**	**50,237,139**

Source: FCC High-Speed Services Report (July 2006), Table 1.

Table 2: Market Share for High-Speed Services (Year-End)								
	1999	2000	2001	2002	2003	2004	2005	Change in Market Share
Fiber or powerline	0.113	0.053	0.039	0.028	0.021	0.018	0.009	-0.104
Other wireline	0.221	0.144	0.084	0.061	0.046	0.039	0.017	-0.204
Satellite or wireless	0.018	0.016	0.017	0.014	0.013	0.015	0.076	0.058
DSL	0.134	0.280	0.309	0.326	0.337	0.365	0.388	0.254
Cable	0.513	0.507	0.552	0.572	0.583	0.564	0.509	-0.003

Source: FCC High-Speed Services Report (July 2006), Table 1.

Figure 2: Changing Market Shares



Source: FCC High-Speed Services Report (July 2006), Table 1.

In many cases, the first firms to offer high-speed lines were cable companies selling cable modem service. They initially acquired a very high market share, but this market share corresponded to a tiny penetration rate, as not many people subscribed. Cable modem's 60 percent market share at the end of 2004 corresponded to a penetration rate of only about 18 percent.[31] Thus, even if an area currently has no broadband service and the government broadband enterprise gets to be the first mover, it should not expect a high penetration rate over the long term**.**

Phone companies offering DSL service were usually the second or third market entrants, and they gradually built a respectable market share.[32] Although DSL is available at prices less than or equal to that of cable modem, the cable companies enjoyed a substantial lead over the phone companies due to uncertainty over the regulatory status of DSL service. Phone companies had much lower broadband market shares than the cable companies enjoyed in the early years. By 2004, DSL had an estimated broadband market share of 37 percent. But since many households do not use broadband, the penetration rate for DSL is only about 14 percent.[33] Analogously, a government broadband enterprise that becomes the second major competitor in a market should probably expect a penetration rate more modest than the first mover's. In 2005, new DSL subscriptions (5.7 million) exceeded new cable modem subscriptions (4.2 million) for the first time.[34] This was likely due to the substantial price reductions offered on DSL in 2005.

Wireless enjoyed substantial growth in 2005. The number of mobile wireless subscribers rose from 380,000 in June to 3.1 million by December.[35] The FCC did not report mobile wireless subscribership in previous years, but by way of comparison, total subscribers to all wireless and satellite numbered 550,000 in 2004. Mobile wireless had a market share of 6.2 percent at the end of 2005.

Other forms of high-speed service have much smaller market shares, corresponding to much smaller penetration rates. In some cases, such as fixed wireless and satellite, these may be the first or second competitor in rural areas that lack cable TV service or are too far from phone company switching offices to utilize DSL. Fiber optics to the home is just beginning to be deployed on a large scale, and broadband over powerlines has only recently become feasible. The FCC data suggest that, except in niche applications, alternatives other than cable modem or DSL will have to offer significant improvements in price or quality before they can gain significant market share. Verizon's pricing of its new fiber optic Internet service seems consistent with this point, as current prices significantly undercut the price of cable modem service at similar speeds.[36]

In some ways, the data organized by mode of service understate the effects of competition in many markets. DSL service, for example, can be offered by the incumbent telephone company or by a competitor who either builds all of its own facilities or leases the incumbent's phone line and installs its own switches and transport. As of December 2005, non-incumbents accounted for 3.7 percent of asymmetric DSL lines and 8.2 percent of high-speed connections using telephone lines.[37] Cable modem service is available from incumbent cable operators, but also from competitive "overbuilders" who have deployed a great deal of fiber and use coaxial cable only to connect individual homes to the neighborhood fiber node. Numerous studies find that direct cable

competition leads to lower cable rates.[38] Regulators do not systematically gather data on the price of broadband. A series of six case studies conducted by the U.S. Government Accountability Office, however, found that high-speed Internet service cost 20-38 percent less in three markets with competition from new "broadband service providers," and about the same in the other three.[39]

By the end of 2005, 67 percent of U.S. zip codes had at least four high-speed Internet providers. Ninety-three percent had two or more competitors, and only 1 percent had none.[40] The lesson for government systems should be clear: when competing against several established incumbents and possibly new entrants as well, it could end up with a tiny market share and penetration rate unless it offers a decisive cost or quality advantage.

There is evidence that municipal cable and Internet services can achieve high penetration rates if they're willing to lose a lot of money doing it. And this means taxpayer or ratepayer money. The communications utility operated by the Cedar Falls, Iowa, utility has video penetration of 47 percent and high-speed data penetration of 37 percent. Video service started in February 1996; data service started January 1997.[41] Lebanon, Ohio's municipal cable service achieved a penetration rate of 37 percent in its first year, despite competition from Time Warner. However, it has always shown substantial operating losses, and monthly rates are subsidized by at least $37 per household, which suggests the high penetration rate flows from below-cost pricing.[42] Similarly, Ashland Fiber Network in Ashland, Oregon had a 35 percent penetration rate for cable TV and a 40 percent penetration rate for Internet service as of December 2004. However, the system has posted an operating loss of about $1.5 million each year since 2002. In May 2005, the City Council voted to subsidize these services with revenues from the city's electric utility.[43] The 2004 operating loss implies a monthly subsidy of $17 for each cable and Internet subscriber, or $34 for a household that subscribes to both.[44]

Once customers are won, they can be expensive to keep. Providers of Internet and wireless services bear significant expenses to deal with "churn"—loss of customers to competitors.

Once customers are won, they can be expensive to keep. Providers of Internet and wireless services bear significant expenses to deal with "churn"—loss of customers to competitors. Internet providers might expect a customer churn rate of 2.5−3 percent per month. That implies a firm can expect to lose about a quarter of its customers each year![45] In some sense, these costs are unavoidable. The firm can either try to reduce churn through attractive pricing and promotion to current customers, or try to replace lost customers with aggressive pricing and marketing to new customers. Either way, churn imposes a cost that municipalities should recognize when assessing the feasibility of broadband networks.

After reviewing many cities' actual experience with cable and broadband enterprises, Balhoff and Rowe suggest that a municipal fiber enterprise in a larger, competitive market is unlikely to gain

more than 35 percent of residential subscribers, or about 10 percent of households. A fiber enterprise that is the "first mover" in a smaller community with less competition might do somewhat better.[46] A wireless system might expect to serve about 25 percent of the residential market and 10-20 percent of the business market.[47]

In light of this experience, an assumed penetration rate for a municipal system of more than 10 percent in the first year, or 20-50 percent in subsequent years, appears highly unrealistic in most cases. The only exceptions might be small communities serviced only by expensive alternatives, or municipalities willing to commit to very large subsidies for their broadband systems.

B. Performance Competition

Dynamic competition is not just about price, and in some cases price may be a much less important factor than various aspects of quality or performance. Competitive businesses seek to continually improve performance—or even develop new aspects of performance that were not previously thought capable of improvement. Wireless phone service provides a case in point. Since the early 1990s, wireless has been less regulated and more competitive than wireline phone service. In addition to portable phone service, wireless phone companies have offered a continual stream of new features, including free long-distance service, ringtones, camera phones, video downloads, connectivity for PDAs, and wireless Internet access.

For government-provided broadband, performance competition means that price is not the only factor consumers will consider in evaluating whether to take the service. Cheap, or even free, service may not be a good deal if performance is inferior to alternatives that either exist now or may develop in the near future. For broadband, performance includes factors like:

- How fast is it?
- Do speeds slow if more users are on the system?
- How safe is my computer from intrusions by other network users?
- Can communications be intercepted?
- How effective are parental controls or other technologies customers might use to limit access?
- Does the presence of parental controls or filtering for other customers inhibit my ability to access what I want?
- Does the system have any features that protect copyrighted material?
- How good is the tech support, and what form does it take (phone, e-mail, Web, Internet chat, 24/7)?
- Is it wired or wireless?
- If wireless, can I receive the signal everywhere I want to use it, in all kinds of weather?
- Is the quality good enough to support voice?

Speed is perhaps the most measurable aspect of performance. The Appendix to this study compares the prices and speeds offered by about 60 government systems with the prices and speeds offered by many of the leading private DSL, cable modem, satellite, and wireless Internet providers. The list of 60 government systems is not comprehensive, but it includes all those for which it was possible to find price and speed data on Web sites or from other readily available sources in January 2006. In many cases, it appears that the prices and performance of existing government systems are inferior to those of existing private systems.

The large phone companies make DSL available at prices ranging from $14.95 to $49.99 per month, depending on the download speed. All of the "majors" sell a download speed of at least 1.5 mb for below $35. Only one government provider can beat this price for a speed of 1.5 mb or better: Spencer, Iowa, which sells a 6 mb speed for $34.95. Several others (Harlan, Iowa; Easton, Maryland; Tacoma, Washington; Bristol, Virginia; and Richmond, Indiana) come within a few dollars for 3 or 5 mb. Only 10 out of 60 government services sell 1 mb or more for less than $35. For half of these services, the price is within $6 of $35. None beats the offer of 1.5 mb for $14.99 available from SBC. Even if one assumes the phone companies will abandon their current promotional prices and revert to their 2004 prices in the $30-40 range for 1.5 mb, they are still attractively priced compared to most of the government systems.

Most private cable modem service costs at least $50-60 per month. Cable modem usually offers faster download speeds than DSL—typically 3-5 mb minimum, and sometimes as much as 30 mb. Only half of the government-sponsored cable modem systems offer a speed of 3 mb or higher, and only eight (25 percent) offer a speed of 5 mb or higher. About one-third of all the government systems offer a speed of 3 mb or more at a price below $60, which would make them competitive with the private cable companies. Sixty dollars may, however, may be an artificially high benchmark, as the phone companies recently made speeds of 3 mb or more available via DSL at substantially lower prices. Clearly, some government systems offer speeds and prices comparable to the private systems, but the majority do not.

Another way of quantifying the price/performance relationship is to examine the monthly price per kilobit of download speed. Except for the relatively slow "entry level" DSL offerings, the phone companies' DSL costs 1 or 2 cents per kilobit. Cable modem costs the same or less, and Verizon's fiber optic service costs tenths of a cent per kilobit. About one-third of the government services offer an option that costs less than 2 cents per kilobit. Most of the wireless services cost between 5 and 15 cents per kilobit. On a per-kilobit basis, the private providers have an edge over the government services.

Of course, one might imagine that a large number of broadband customers merely want something somewhat faster than dialup. For those consumers, what really matters is the price of the "entry level" offerings that are several times the speed of dialup. However, the government services somewhat faster than dialup (128-256 kb) cost about the same as DSL or the "slow" cable modem option offered by RCN, a competitive broadband service provider. The slower speeds give the government no price advantage. The principal government services that could be regarded as

exceptions would be the wireless services in Buffalo, MN ($9.99 for 192 kb) and Chaska, MN ($16 for 1 mb), and the fiber service in Kutztown, PA ($15 for 1 mb).

Many of the slower government systems appear to be in rural areas. If these areas lack DSL and cable, then the relevant competitors would be satellite and, in some cases, wireless. The government systems are generally less expensive than satellite, and often less expensive than private wireless. Therefore, they may offer a good alternative in some rural areas.

Many of the current government offerings appear to suffer significant handicaps compared to private DSL, cable modem, and fiber. Unless the mobility of a government wireless system provides significant value that most customers are willing to pay extra for, government systems that currently compete with these technologies will likely need to upgrade their speeds or cut their prices if they expect to retain customers. *New* government systems will have to offer higher speeds or lower prices than most of the existing government systems currently offer if they want to compete successfully with private DSL, cable modem, and fiber.

An effective government-owned competitor must be prepared to offer a price/performance combination that a significant number of consumers will prefer to those offered by competitors.

An effective government-owned competitor must be prepared to offer a price/performance combination that a significant number of consumers will prefer to those offered by competitors. If government ignores performance competition, it could end up offering a fairly plain service appealing only to customers who want relatively slow broadband speeds—and may not be willing to pay much for it. In effect, government would be seeking an unattractive market niche similar to the one now occupied by the dialup Internet access firms. While such an approach might be attractive as social policy, it is unlikely to pay for itself over the long term and would likely require ongoing subsidies.

This discussion has focused on speed to illustrate the point about performance competition, but similar reasoning applies to other aspects of broadband performance that customers think are important. A successful competitor need not be better than the competition on all quality attributes. At a minimum, though, a government broadband enterprise needs to carefully consider how the major quality attributes of its service compare to the alternatives that are either available in the market today or are likely to materialize in the future.

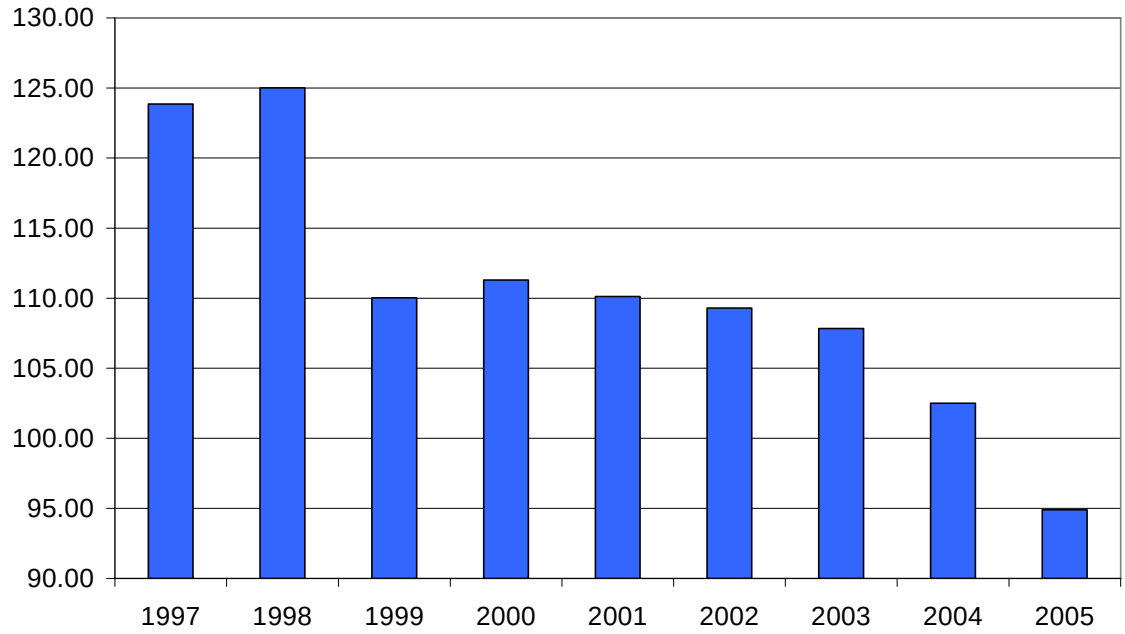
C. Continuous Improvement

Dynamism means change. In a dynamic market, business must continually improve in order to retain customers. Firms that fail to stay abreast of technological improvements tend to lose ground to those that do.

Price Improvement

One indicator of the extent of change is the pace at which prices fall as technology improves, costs fall, or competition intensifies. This has occurred frequently in the market for Internet service, as well as in related or analogous markets such as wireless communications, telephone equipment, and telecommunications services. As Figure 3 shows, the real consumer price index for Internet services has fallen by 23 percent since the Bureau of Labor Statistics started tracking this series in 1997. Real consumer price indices for wireless, telephone equipment, and long-distance service have fallen even faster—by 45-65 percent.[48]

Figure 3: Real Consumer Price Index, Internet Services



Source: Bureau of Labor Statistics

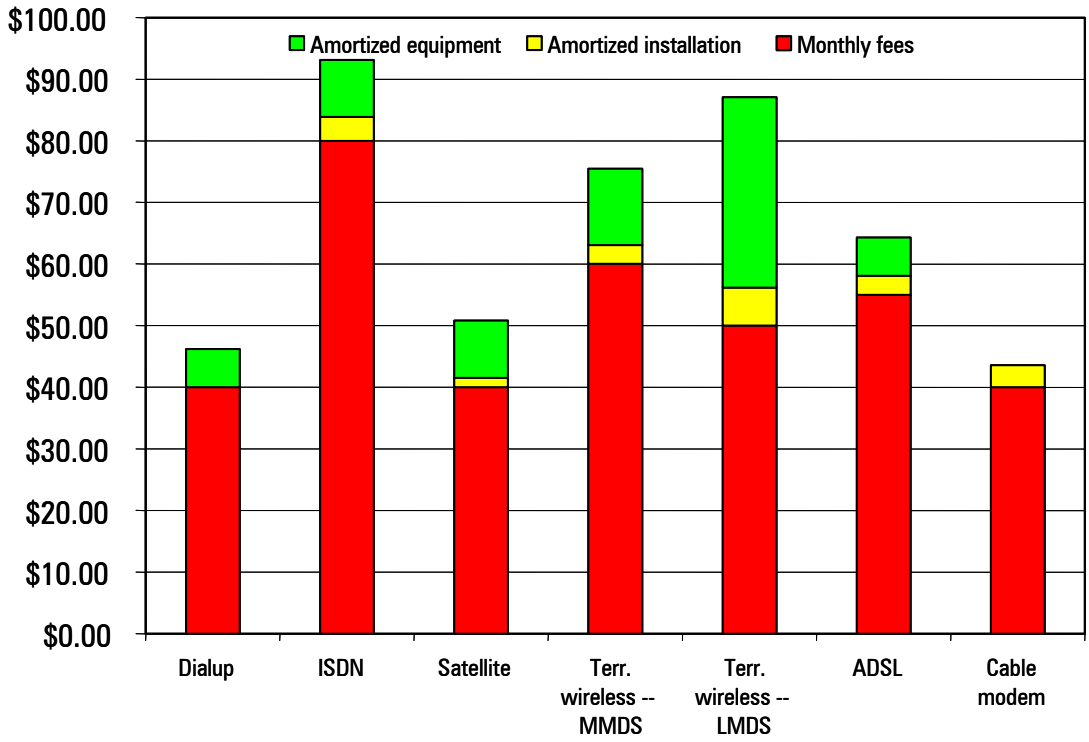
A more direct measure of the speed of progress in broadband can be found in substantial price reductions that have occurred in recent years. Between 2004 and 2005, Bellsouth cut the monthly price of 1.5 mb DSL from $39.95 to $32.95, a 17 percent drop. Qwest dropped its promotional price from $26.99 to $19.99, and extended the term from three months to a year. SBC cut its promotional price, good for a year, from $26.95 to $14.95.[49] Verizon Wireless reduced the

monthly fee for wireless broadband service using a PC card by 25 percent, from $79.99 to $59.99.[50]

Performance Improvement

Continuous improvement may also be important in performance as well as price. One indicator that performance competition matters in broadband is the rate at which maximum speeds have increased. In its first report on the extent of broadband deployment, the FCC chose to define "high speed" service as Internet service capable of at least 200 kbps one-way. "Advanced services" lines are defined as connections capable of at least 200 kbps both ways. The FCC has continued to employ those definitions to ensure data comparability in subsequent years.

Figure 4: Monthly Consumer Cost of Internet Access, 1998

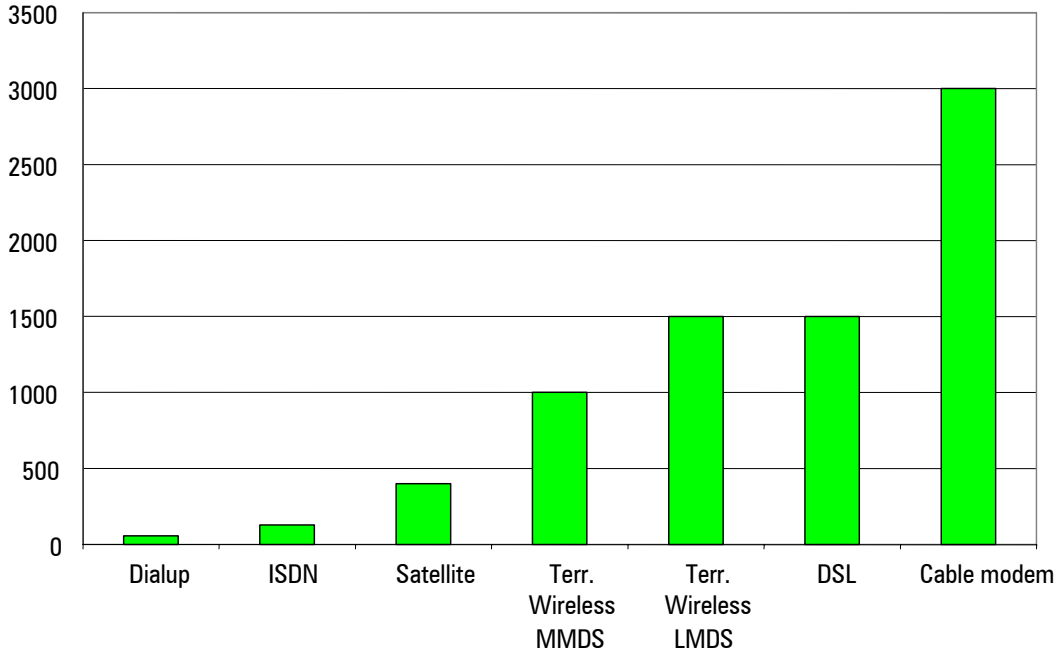


Source Author's calculations based on data in FCC, Broadband Report 1999, CC Docket No. 98-146 (January 28, 1999).

Many forms of broadband service available today, however, are much faster than that, and speeds have improved rapidly. Between 2004 and 2005, a number of major broadband providers increased the speed of their service. SBC increased the upload speed of its DSL service threefold, from 128k to 384k. Cablevision increased its download speed from 5 mb to as much as 10 mb. Comcast increased its download speed from 3 mb to 4 mb and its upload speed from 256k to 384k. Time Warner increased download speed from 3 mb to as much as 8 mb.[51] These changes represent

performance improvements of between 25 percent and 200 percent—in one year. In January 2006, Web pages indicated further improvement in maximum speeds. Comcast offered a maximum download speed of 6 mb, Cox offered 15 mb, and Cablevision offered 30 mb.[52]

Figure 5: Residential Internet Speeds Available in 1998 (kilobytes per second)



Source: FCC, *Broadband Report 1999*, CC Docket No. 98-146 (January 28, 1999).

If recent experience is a guide, government broadband operations will need to be prepared to continually improve in the future if they want to keep pace with private sector competitors.

Government broadband operations will need to be prepared to continually improve in the future if they want to keep pace with private sector competitors.

D. Technological Change and Lock-In

A vigorous scholarly debate rages over whether private firms make avoidable choices that "lock in" inferior technologies. "Lock-in" occurs when an initial decision gives one technology a slight edge, then sets in motion a process which leads that technology to dominate the market. If the technology that gets locked in is truly the superior technology, then there's no harm done. But if an inferior technology gains a temporary edge in market share, some scholars argue that it might remain dominant even though it is inferior. The head start could allow an inferior technology to

dominate because costs fall as the number of users increases ("increasing returns") or because the value of the technology to each user increases as more people use it ("network effects.")[53]

Discussions of lock-in often focus on numerical examples in which the early adopters of technologies choose the technology that creates the biggest payoff in the short term. An alternative technology, however, creates greater value over the longer term, when there is a larger number of adopters. The market gets locked in to the inferior technology due to the decisions of the early adopters. Lock-in arguments thus assume that the first decisionmakers cannot find a way to profit from forgoing the immediate short-term benefits of selecting the inferior technology so that they can reap the larger, longer-term benefits of the superior technology.[54]

Such lock-in may or may not be plausible in private markets. However, it is quite possible in government enterprises, because a wide variety of barriers reduce decisionmakers' ability and incentives to select the technology that is superior over the long term. Even those who are skeptical about lock-in allegations in private market settings admit that public policy can involve various forms of lock-in. Potential sources of sub-optimal initial decisions include the influence of concentrated interest groups, short political time horizons due to election cycles, less intense competitive pressures because voters must select from among candidates offering bundles of positions on different issues, and limitations on government decisionmakers' ability to profit personally from making decisions that most benefit the public.[55]

If policymakers choose the "wrong" technology, however, increasing returns or network effects may prevent or delay adoption of better or less expensive technologies that might otherwise come sooner.

Public policies run a significant risk of locking in technologies that quickly become outdated. In the mid-1990s, for example, public utility commissions and consumer groups sought mandates to ensure that telephone companies would hasten the rollout of the only "high-speed" Internet technology believed to be feasible anytime soon: ISDN. "As it turned out," note Scott Wallstein, "ISDN was a fairly short-lived technology that was expensive and relatively slow, supporting speeds only up to 128 Kbps, or about three times as fast as a dialup modem."[56] By 1998, survey data gathered by the FCC revealed that ISDN was the most expensive and second-slowest form of Internet access. Broadband subscriptions took off shortly thereafter, rising from 1.8 million in 1999 to 50 million in 2005.[57]

Governments that want to get into the broadband business already face several technology choices. Municipal cable operators can easily offer cable modem service. For new builds, the two most commonly discussed options are fiber optic and Wi-Fi. If policymakers choose the "wrong" technology, however, increasing returns or network effects may prevent or delay adoption of better or less expensive technologies that might otherwise come sooner. Of course, it is difficult to predict in advance what some of those advances might be, but several plausible options include:

- Further advancements to boost speed and reduce congestion in cable modem service
- Further advancements to boost speed of DSL service
- Full or partial deployment of fiber optic service by cable or phone companies
- "Evolution Data Optimized" technology that allows wireless phone companies to offer wireless broadband at speeds of 400-800 kb.[58]
- Broadband over powerlines
- Improvements to reduce the cost of satellite broadband
- WiMAX, a more powerful wireless option

Subsidies could exacerbate lock-in. Public subsidies for broadband could be funded by taxes or by excessive charges on monopolized services provided by the government enterprise. In addition, a government broadband enterprise could receive an implicit subsidy in the form of costless, below-cost, or perhaps even exclusive access to the public rights-of-way.

If subsidies allow a government enterprise to offer broadband service at a price that fails to cover costs, then competitors face a higher bar to successful market entry, even if they have a better technology. Suppose, for example, the government offers 200 kilobyte Internet access for $10 per month, even though it costs $20 per month to produce. Suppose further that private competitors could offer 10 megabyte service for $40 per month. Many consumers might prefer the faster service at $40 to the slower service at $20, but they'll choose the slower service if it only costs $10. If the government service is subsidized, the competitor cannot afford to introduce its faster service until further technological progress either improves the quality or reduces the cost sufficiently to let it attract consumers away from the subsidized service. Until that happens, consumers have to content themselves with the slower, subsidized service.

The point here is not just that lock-in via subsidies wastes the public's money, but also that consumers have to wait longer to get a better service, because competitors are deterred by the subsidy. Consumers would be better off if the price of the government service were not subsidized, because competitors would provide the superior combination of service and price sooner.

Government broadband plans should squarely address the potential for lock-in and explicitly evaluate whether subsidies would give an inferior technology an artificial boost.

E. Obsolescence

Monopolized government enterprises (and traditional regulated, investor-owned utilities as well) can afford to stretch out the recovery of their capital costs over a long period of time. Their prices

are lower as a result. There are two reasons such enterprises can use long depreciation schedules: they are often monopolies, and technological progress is relatively slow in any event.

In a dynamically competitive market, networks become obsolete faster. Technology improves more rapidly, and competitors are not shy about introducing the newest technology if they feel it will give them a cost or quality edge over the competition. As a result, capital investment becomes obsolete more quickly. Accurate cost recovery requires higher prices in the early years than under static monopoly, so that the firm can recover its capital costs before competitors' improvements constrain its ability to do so.[59]

If capital becomes obsolete more rapidly, the firm must recover its capital costs over a shorter period of time. Business plans for government broadband enterprises need to assume faster depreciation rates, and concomitantly higher prices, than have traditionally been used for government utilities. Balhoff and Rowe, for example, argue that Wi-Fi will have to be depreciated over 3–5 years, versus 15 or more years for fiber.[60] Thus, a workable plan for municipal Wi-Fi needs to assume that revenues will not just cover operating costs plus interest, but also recover the initial capital outlay in 3–5 years.

F. Risk

Obsolescence is not just faster under dynamic competition; it is also less predictable. Financially, the investment is less of a "sure thing" than a conventional government monopoly. That means the cost of capital should carry a higher risk premium than normally considered appropriate for government enterprises. A higher cost of capital, in turn, implies that the price consumers pay should be higher if the enterprise is expected to cover its costs.

Are broadband enterprises riskier than other infrastructure investments that governments sometimes make? Assessing the inherent riskiness of government enterprises is notoriously difficult. Even assessments based on financial market evaluations (such as interest rates on bonds) may be misleading, because investors will regard explicit or implicit government guarantees or subsidies as factors that reduce risk. The underlying business might face substantial risks, yet financial markets might assign very little risk premium to bonds because guarantees or subsidies transfer the risks from investors to taxpayers or ratepayers of affiliated government enterprises.

However, one can gain some idea of the relative riskiness of various types of businesses by examining how financial markets evaluate the riskiness of private firms in different industry sectors. A common measure of risk is the "beta coefficient" calculated by financial analysts. The beta coefficient measures how risky a stock or industry sector is compared to the stock market as a whole. An industry with a beta of 1, for example, is neither more nor less risky than the overall stock market. A beta below 1 signifies relatively less risk than the market as a whole, and a beta exceeding 1 implies relatively more risk than the market as a whole.

Table 3 reports recent beta estimates for various industry sectors that are similar to different types of government infrastructure enterprises. All betas were calculated in January 2005 based on the previous five years of stock market data.[61]

Table 3: Utility Risk Levels

Low Risk	Average Beta	High Risk	Average Beta
Electric Utility	0.72-0.79	Cable TV	1.75
Gas Distribution	0.65	Telecom Services	1.32
Water Utility	0.60	Wireless Networking	2.38

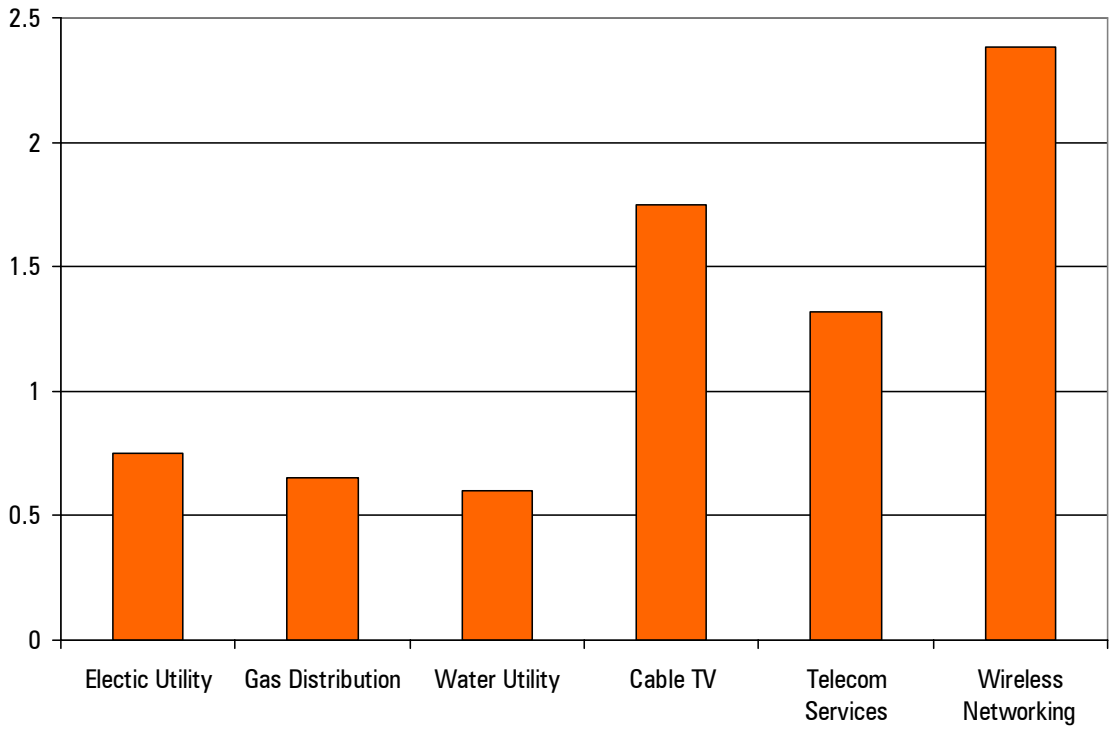
Source: Aswath Damodaran, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html

It is clear from this table that investments in electric, gas, and water utilities have involved much less risk than investments in firms that sell broadband or wireless data services. Electric, gas, and water are precisely the types of static, monopolized industries where governments have traditionally invested. In terms of risk, broadband is a whole new ballgame. Investing is broadband is much riskier than investing in the overall stock market.

Nevertheless, some governments have financed broadband initiatives as if they were traditional low-risk investments in infrastructure that provides necessities:

- Spencer, Iowa's Spencer Municipal Communications Utility has an $8 million loan from the city's electric utility at 4.5 percent, whereas the electric utility's revenue bonds have an interest rate of 5.75 percent.[62] This rate differential implies that the communications utility is less risky than the electric utility! The municipal utility also allocated $11.7 million worth of communications infrastructure costs to the electric utility, effectively financing them at 5.75 percent.[63] The utility offers cable, high-speed data, and telephone service in competition with Mediacom and Qwest.
- Cedar Falls Communications Utility pays 5 percent interest on a $6 million loan from an affiliated city utility.[64] It offers cable and high-speed data. Cedar Falls is regarded as one of the best-run municipal fiber operations with some of the best financial results.[65]
- Lebanon, Ohio financed construction of its hybrid-fiber-coax network with $5 million of 4-year revenue bonds at 5.26 percent, a $1 million 1-year note at 2.7 percent, and a $750,000 one-year note at 3 percent.[66]
- Bristol, Virginia financed its fiber optic system with a combination of $15 million in loans from the city electric utility at rates ranging from 3.77-5.99 percent; revenue bonds at rates between 2.0 and 5.35 percent; and a $2 million grant from the Virginia Tobacco Indemnification and Community Revitalization Commission.[67]
- The 14-city UTOPIA fiber project in Utah assumes it can finance the project at 6 percent over 20 years.[68]

Figure 6: Utility Risk Levels
(Beta Coefficients, Where Stock Market = 1)



Data Source: Aswath Damodaran, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/Betas.html

Many of these interest rates seem low when compared with analysts' estimates of the "true," risk-adjusted cost of financing government broadband initiatives. Balhoff and Rowe, for example, suggest that the true cost of capital for the Lafayette fiber project is likely 10-13 percent, given the risk involved.[69]

Another implication of high risk is that it takes a different kind of organization, with different strategies, to deal with the risk, especially when future events are difficult to predict. As Aaron Wildavsky pointed out, high risk makes a strategy of "resilience" more appropriate than a strategy of "anticipation." When technological risks are low, well-understood, and have known remedies, then decisionmakers can best deal with them by anticipating what will happen, taking preventive measures, and developing plans to cover every contingency. Expert knowledge and the ability to plan are key resources needed by organizations in this type of environment. When risks are large and remedies unknown, then organizations need to develop "resilience:"

> *A strategy of resilience … requires reliance on experience with adverse consequences once they occur in order to develop a capacity to learn from the harm and bounce back. Resilience, therefore, requires the accumulation of large amounts of generalizable resources, such as organizational capacity, knowledge, wealth, energy, and communication, that can be used to craft solutions to problems that the people involved did not know would occur. Thus, a*

> *strategy of resilience requires much less predictive capacity but much more growth, not only in wealth but also in knowledge. Hence it is not surprising that systems, like capitalism, based on incessant and decentralized trial and error accumulate the most resources.*[70]

An accurate cost of capital provides important discipline that is especially critical in a high-risk environment.

A traditional municipal utility is more likely to face a low-risk environment in which anticipation is a viable strategy. A broadband enterprise faces a high-risk environment that demands resilience. The cost of capital helps a private firm determine *how much* it should invest in developing the capabilities that produce resilience, and what kinds of investments to make. A government enterprise that faces an artificially low cost of capital is more likely to waste the public's money by "investing" in capabilities that produce little value for customers, or do so only after an excessively long time. An accurate cost of capital provides important discipline that is especially critical in a high-risk environment.

G. Uncertainty

The term "risk" describes a situation in which the actual outcome in the future is unknown, but it is possible to quantify or estimate the possible outcomes and the probabilities that they will occur. In addition to risk, firms in dynamic markets face *uncertainty*—the possibility of unique but significant events that cannot easily be quantified.[71]

Development of WiMAX technology may be one example of uncertainty faced by government broadband projects. WiMAX seems to hold tremendous promise but has not yet been deployed anywhere in the United States. Indeed, the Institute of Electrical and Electronics Engineers has not yet settled on a WiMAX standard.[72]

Another significant uncertainty comes from wireless phone companies, who are launching wireless Internet service at speeds of 400-800 kb. This service uses a technology called Evolutionary Data Optimized, or EV-DO. Although one major wireless company markets this service as an alternative to Wi-Fi, at this point it is simply not clear whether such products are substitutes for or complements to Wi-Fi.[73]

The market potential of both WiMAX and EV-DO is unclear, yet both could be powerful competitors to Wi-Fi—perhaps even making Wi-Fi obsolete. The likely outcomes and probabilities may not be well-enough understood to consider these technologies a risk to Wi-Fi; they are more likely sources of uncertainty.

A private business firm's shareholders bear uncertainty as well as risk. The prospect of additional, higher returns entices them to bear that uncertainty. The fact that uncertainty affects shareholders' financial fortunes gives them strong incentives to seek out management that will exercise sound judgment.[74]

How to replicate these incentives, so that decisionmakers in government enterprises make sound judgments in the face of uncertainty, is a conundrum. The most likely method would be to organize the enterprise as a for-profit company, with explicit expectations from the owner (the government) that it be commercially successful. The government would have to commit to allowing the enterprise to operate in a commercial fashion—including, for example, permitting hiring and compensation policies similar to those found in the private sector. The most credible way governments make these types of commitments is by enacting a plan to privatize the enterprise. But in this context, a privatization plan would beg the question of why the government is getting into the broadband business to begin with! Thus, for broadband, government faces the fascinating challenge of committing to commercial operation without promising privatization.

For government broadband enterprises, taxpayers bear the uncertainty in their role as the ultimate owners. At a minimum, therefore, effective accountability requires that government broadband initiatives should have accountability and transparency for taxpayers at least as good as that which publicly held companies must have for their shareholders. Basic criteria for accountability include:

- Publicly available, audited financial statements prepared according to Generally Accepted Accounting Principles
- Transparent disclosure and quantification of any subsidies
- Clear articulation of public benefits that the government enterprise is supposed to produce, along with an assessment of the evidence that these benefits will occur
- Outcome-oriented performance measures that will reveal whether the government enterprise causes these benefits to occur
- Data on performance and public benefits that are as verifiable and valid as the financial data

These transparency measures may not be sufficient to make government managers as accountable to uncertainty-bearing taxpayers as corporate managers are to uncertainty-bearing owners. But it is difficult to see how accountability is possible without them.

Part 4

"Free" Networks: Beware of Geeks Bearing Gifts

Most of this study has focused on broadband initiatives that actually require some type of public sponsorship or investment—either by government or by government-owned entities. A recent twist, which appears to offer the public a much better deal, has arisen in several cities, where private firms have proposed to build Wi-Fi networks at no cost to taxpayers. Cities where such proposals have been mentioned include Philadephia, San Francisco, Milwaukee, Houston, and Mountain View, California, the home of Google and other high-tech firms.[75]

In Philadelphia, Earthlink won a high-profile contract to build a Wi-Fi network covering 135 square miles by placing transmitters on telephone poles. CNET News noted, "The City of Brotherly Love's plans differ from those of many other municipalities in one crucial way: EarthLink will own the hardware and take the financial risk associated with providing the service. If it flops, city taxpayers won't lose the money."[76] The goal (not guaranteed) is to offer Wi-Fi service for $20 per month, or $10 for low-income users.[77]

San Francisco solicited bids from private sector firms seeking to offer Wi-Fi service using the city's right-of-way and light poles. Google proposed to build a citywide Wi-Fi system at no charge to the city, plus offer "free," advertiser-supported Wi-Fi service at a speed of 300 kilobits per second.[78]

Houston Mayor Bill White announced in November 2005 that his city wants a piece of this action. Existing broadband competitors, he contends, have "no good reason to fight it unless we were going to try to finance the system with taxpayer dollars, which we're not proposing to do. We're not trying to compete with any private business, and we want to make this technology option available."[79]

It is unlikely that such firms are offering "free" (or below-cost) Wi-Fi out of charitable motives, or merely to build goodwill. Presumably they seek to offer Wi-Fi because they see a revenue stream somewhere, even if the users or the local government are not charged directly for Wi-Fi. This is just a larger-scale version of the business model followed by some hotels and retailers, who offer "free" Wi-Fi because they believe it will bring in more paying customers. Google's "free" Wi-Fi

would be supported by advertising, and perhaps other revenue streams that Google expects will increase as more people use its Wi-Fi service. As Google noted in its Mountain View proposal, "Google is in a unique position to offer free access to the Internet, since we have the ability to subsidize and earn revenue indirectly when these Wi-Fi users get on the Internet and access our and our partner sites."[80]

There is nothing inherently wrong with proposals for free or privately subsidized Wi-Fi. However, governments need to realize that rights-of-way and light poles are valuable assets, and access to these assets would bestow a significant competitive advantage on any firm selected to use them. Utility regulators have noted that access to rights-of-way is one of the most significant obstacles to broadband deployment. The California Public Utilities Commission noted in 2005, "The process for obtaining Right of Way permits for construction of broadband infrastructure in California is lengthy, expensive, inconsistent and is cited as one of the most significant barriers to broadband deployment."[81] An AEI-Brookings study by Scott Wallstein finds that states with laws that guarantee telecommunications companies access to right-of-way have broadband penetration that is about 10 percent higher than states which do not guarantee access. States that fail to extend this guarantee to cable companies have somewhat lower broadband penetration.[82]

Indeed, the ongoing Wi-Fi "gold rush" resembles the cable TV gold rush of the 1970s. Once the FCC stopped protecting broadcasting from cable competition, the race was on to wire America's homes. In most locations, cable companies competed for monopoly franchises by offering cities a variety of "free" or below-cost services, such as channels for public, educational, and government access; studios for creation of public access programming; and wiring of various public facilities. Consumers ultimately paid for these freebies via higher cable rates, which were only possible because local governments typically permitted only one cable company to use the public rights-of-way. Two decades of economic research have amply demonstrated that cable rates are significantly lower when more than one cable company competes for consumers' business.[83] Largely because of this evidence, the federal government now prohibits local governments from granting monopoly cable franchises or "unreasonably" refusing to grant a competitive franchise.[84]

Local governments should beware of granting one Wi-Fi provider exclusive access to public assets, even if the Wi-Fi service itself is free of charge to users.

In the Wi-Fi gold rush, government or private enterprises receive exclusive use of light poles and other city property for placement of transmitters. In exchange, the Wi-Fi provider often offers some kind of bargain service for local government and a free or low-cost entry-level service for citizens. Where the money comes from to pay for the Wi-Fi freebies remains to be seen.

Any local government that grants one Wi-Fi provider an *exclusive* right to use right-of-way and poles risks distorting competition in whatever markets are generating the revenue stream that will subsidize the Wi-Fi service. The only provider of advertiser-supported Wi-Fi allowed to use city

light poles, for example, could likely charge a higher price for advertising than if there were competing providers of advertiser-supported Wi-Fi. A monopoly that gives away Wi-Fi to build demand for other services it might sell to Wi-Fi users might be able to charge a higher price for these other services than it would in the presence of other Wi-Fi competitors.

For this reason, local governments should beware of granting one Wi-Fi provider exclusive access to public assets, even if the Wi-Fi service itself is free of charge to users. At a minimum, decisionmakers should assess whether exclusive access would distort competition in the markets for other goods and services sold by the Wi-Fi company. They should seek the assistance of the Federal Trade Commission or the Antitrust Division if they lack the capabilities to perform such an assessment.

This warning should not be controversial, as it is consistent with public policy on wired broadband provided by for-profit companies. Nowadays no one would seriously advocate that only the cable company or only the phone company should be permitted to use the public right-of-way to provide broadband service. Similarly, the Telecommunications Act of 1996 explicitly prohibits state and local governments from granting exclusive franchises for telecommunications service. National policy explicitly envisions competition in broadband, and the Federal Communications Commission is required by law to report annually on the state of broadband deployment and competition.[85] A 2006 Federal Trade Commission staff report likewise recommends that local governments providing Wi-Fi should ensure that they do not disadvantage or exclude private competitors.[86] Local governments should not let the sizzle of free Wi-Fi obscure the consumer's stake in competition.

Part 5

Conclusion

The factors outlined above need not imply that government-provided broadband is a bad idea. However, no plan for government-sponsored broadband should be considered complete or responsible unless it addresses the factors outlined in this report. More specifically, any plan that adequately takes dynamic competition into account should answer the following questions:

- Who are the competitors?
- Do the projected penetration rate and market share reflect realistic assumptions about current and potential competition?
- What cost or quality advantage will the government broadband service have over competitors?
- What performance attributes matter to customers?
- How will the government service compare to competitors on these performance attributes?
- How rapidly have broadband prices fallen in the market where the government enterprise will compete?
- How rapidly can prices be expected to fall in the future?
- How rapidly have performance attributes improved in the market where the government enterprise will compete?
- How rapidly can performance be expected to improve in the future?
- How will the government enterprise keep pace with competitors' price reductions and/or performance improvements?
- What safeguards are necessary to ensure that the government enterprise competes with the private sector strictly on the merits?
- What safeguards are necessary to ensure that any benefits the government enterprise receives due to its public nature do not distort competition in related markets?
- What safeguards are necessary to ensure that private broadband competitors obtain access to public rights-of-way on equal terms with the government entity?
- What safeguards are necessary to ensure that political considerations or subsidies do not let an inferior technology dominate the market by giving it a head start?

- What is the economically useful life of the capital deployed by the government enterprise and the appropriate depreciation rate?
- What cost of capital reflects a realistic depreciation rate on the assets?
- What cost of capital accurately reflects the risks that the government enterprise will face in a dynamically competitive market?
- How will the incentives of the enterprise and its employees be structured to foster sound judgment in the face of significant uncertainty about competition and future technological developments?
- How will any subsidies be quantified and transparently disclosed to the public?
- What public benefits is the enterprise intended to produce?
- How will these benefits be measured and communicated to the public?
- How will financial, performance, and public benefit data be gathered, verified and validated?

These questions may appear daunting. They are no less daunting than the challenge of actually entering a market where technological change is swift, the future is uncertain, and competitors' actions are unpredictable. Such is the nature of dynamic competition. If the questions seem unfamiliar to policymakers, that's one more bit of evidence that the nature of dynamic competition is fundamentally different from the stable, predictable utility markets that have traditionally attracted public investment.

Appendix A

Private and Public Broadband Providers

Government Systems Location	Name	Monthly Fee	Download Speed (kilobits/sec.)	Price/ Kilobit
Wireless				
Cupertino, CA	MetroFi	$19.95	1000	$0.020
Rochelle, IL	Rochelle Muni. Utils.	$74.95	256	$0.293
		$94.95	512	$0.185
Richmond, IN	Richmond Pwr. & Lt.	$39.95	1000	$0.040
Scottsburg, IN	Scottsburg C3bb	$35.00	512	$0.068
		$70.00	1000	$0.070
Tell City, IN	Tell City Elec. Dept.	$29.95	384	$0.078
		$44.95	768	$0.059
		$84.95	1540	$0.055
Western Kansas	Wheatland Electric	$37.00	512	$0.072
		$87.00	1000	$0.087
Owensboro, KY	Owensboro Muni. Utils.	$29.99	512	$0.059
Vivian, LA, and	Fastline Internet	$10.00	64	$0.156
Linden, TX		$60.00	1000	$0.060
Alexandria, MN	Alex. Bd. of Pub. Wks.	$29.95	128	$0.234
		$39.95	512	$0.078
Buffalo, MN	Buffalo Muni. Util.	$9.99	192	$0.052
Chaska, MN	City-owned ISP	$16.00	1000	$0.016
Grand Haven, MI	Ottawa Wireless	$15.00	100	$0.150
		$45.00	512	$0.088
Carthage, MO	Ecarthage.com	$39.95	1000	$0.040
Marshall, MO	Marshall Muni. Utils.	$30.00	250	$0.120
		$70.00	500	$0.140
		$105.00	750	$0.140
Rio Rancho, NM	Azulstar	$20.00	256	$0.078
		$40.00	1500	$0.027
		$80.00	4000	$0.020
Floresville, TX	Floresville Elec. Lt. &	$49.95	128	$0.390
	Power	$59.95	256	$0.234
		$69.95	384	$0.182
		$89.95	512	$0.176

Government Systems Location	Name	Monthly Fee	Download Speed (kilobits/sec.)	Price/ Kilobit
		$105.95	768	$0.138
		$155.95	1024	$0.152
		$199.95	1536	$0.130
Benton County, WA	Maverick Wireless	$19.95	128	$0.156
		$34.95	512	$0.068
		$49.95	1000	$0.050
Southeast WA	Columbia Rural Electric	$40.00	256	$0.156
		$260.00	1500	$0.173
Sun Prairie, WI	Sun Prairie Wtr./Lt.	$35.00	768	$0.046
Cable Modem				
Opp, AL	Opp Cablevision	$24.95	256	$0.097
		$34.95	512	$0.068
		$44.95	1024	$0.044
Scottsboro, AL	Scottsboro Elec Pwr Bd	$31.00	512	$0.061
		$43.00	1500	$0.029
		$58.00	3000	$0.019
Ketchikan, AK	Ketchikan Pub Util	$47.95	512	$0.094
		$59.95	1000	$0.060
		$99.95	1500	$0.067
Conway, AR	Conway Corp.	$39.95	2048	$0.020
		$59.95	3084	$0.019
Paragould, AR	Parag. Lt., Wtr. & Cable	$25.95	NA	
		$39.95	NA	
		$59.95	NA	
Alameda, CA	Alameda Pwr & Teleco	$29.99	1000	$0.030
		$49.99	3000	$0.017
		$52.99	4000	$0.013
Elberton, GA	City	$50.00	500	$0.100
Monroe, GA	Monroe Utilities	$39.95	6000	$0.007
Algona, IA	Algona Muni. Utils.	$49.95	1000	$0.050
		$69.95	1500	$0.047
Alta, IA	City of Alta	$44.95	256	$0.176
		$54.95	512	$0.107
Cedar Falls, IA	Cedar Falls Utilities	$24.95	168	$0.149
		$40.00	3920	$0.010
Harlan, IA	Harlan Muni. Utils.	$37.50	1540	$0.024
Laurens, IA	Laurens Muni. Comm.	$49.95	1000	$0.050
Muscatine, IA	Muscatine Power	$21.95	128	$0.171
		$39.00	1000	$0.039
		$59.95	3000	$0.020
Orange City, IA	Orange City Communic.	$39.95	3000	$0.013
Osage, IA	Osage Muni. Utils.	$45.95	256	$0.179
		$59.95	512	$0.117

Government Systems	Name	Monthly Fee	Download Speed	Price/
Location			(kilobits/sec.)	Kilobit
		$79.95	768	$0.104
		$99.95	1000	$0.100
Spencer, IA	Spencer Muni. Utils.	$34.95	6000	$0.006
		$64.95	10000	$0.006
Sanborn, IA	The Community Agency	$26.95	128	$0.211
		$39.95	512	$0.078
		$69.95	1000	$0.070
Bardstown, KY	Bardstown Cable TV	$27.95	512	$0.055
		$32.95	1000	$0.033
		$42.95	3000	$0.014
		$52.95	6000	$0.009
Frankfort, KY	Frankfort Elec. & Water	$19.00	128	$0.148
		$23.00	256	$0.090
		$29.00	512	$0.057
Glasgow, KY	Glasgow Elec. Board	$25.95	1000	$0.026
Murray, KY	Murray Electric	$29.95	256	$0.117
		$40.95	500	$0.082
		$48.95	1000	$0.049
		$59.95	4000	$0.015
Easton, MD	Easton Utils. Comm.	$24.95	128	$0.195
		$39.95	5000	$0.008
Braintree, MA	Braintree Elec. Light	$39.00	5000	$0.008
Poplar Bluff, MO	City of Poplar Bluff	$29.95	256	$0.117
		$34.95	512	$0.068
Lebanon, OH	City/GO Concepts	$45.95	5000	$0.009
		$74.95	10000	$0.007
Wadsworth, OH	Elec. & Comm. Dept.	$22.45	128	$0.175
		$29.95	256	$0.117
Brookings, SD	Brookings Muni. Utils.	$34.95	512	$0.068
Columbia, TN	Columbia Pwr. & Water	$32.95	384	$0.086
		$41.95	640	$0.066
		$47.95	1500	$0.032
		$57.95	2000	$0.029
		$77.95	3000	$0.026
Fayetteville, TN	Fayetteville Electric	$44.95	256	$0.176
Greenville, TX	Greenville Elec. Util.	$37.95	6000	$0.006
Tacoma, WA	Click/Advanced Stream	$29.90	1000	$0.030
		$39.90	3000	$0.013
		$59.90	6000	$0.010
Fiber				
Sylacauga, AL	Sylacauga Util. Board	$120.00	1000	$0.120
Ashland, OR	Ashland Fiber Network	$44.00	5000	$0.009

Government Systems	Name	Monthly Fee	Download Speed	Price/
Location			(kilobits/sec.)	Kilobit
Bristol, VA	Bristol Virginia Utilities	$26.36	1000	$0.026
		$35.16	3000	$0.012
		$39.56	5000	$0.008
Sallisaw, OK	Sallisaw DiamondNet	$29.95	1000	$0.030
		$39.95	2000	$0.020
		$59.95	4000	$0.015
		$149.95	10000	$0.015
Kutztown, PA	Hometown Utilicom	$15.00	1000	$0.015
		$20.00	1000	$0.020
		$25.00	1000	$0.025
		$30.00	1000	$0.030
		$40.00	1000	$0.040
Reedsburg, WI	Reedsburg Util. Comm.	$24.95	128	$0.195
		$34.95	1000	$0.035
		$39.95	3000	$0.013
DSL/ISDN				
Gainesville, FL (ISDN)	GRUCom	$24.95	128	$0.195
Richmond, IN	Rich. Pwr. & Lt.	$39.95	3000	$0.013
Barnesville, MN	Barnesville Muni. Tel.	$41.90	128	$0.327
		$48.85	256	$0.191
		$57.85	384	$0.151
		$74.85	512	$0.146

Appendix B

Notes on Sources and Calculations

Most of the list of government Internet services was compiled by Steve Titch and the author from two sources:

1. American Public Power Association, *2004-05 Annual Directory and Statistical Report*.

2. FTTH Council, Fiber Optic Communities of the United States, and Telecommunications Industry Association, *U.S. Optical Fiber Communities 2005* (May 2005).

A few additional providers were not listed in these directories but have been mentioned in press reports or in Balhoff and Rowe (p. 27).

Price and speed data were acquired from the providers' Web pages in January 2006. Providers that did not post prices and speeds on their web pages are not included in this table. Data for some additional government wireless services are from table in Balhoff and Rowe (p. 27).

Data for private Internet services were acquired from the providers' Web pages in January 2006.

Prices are for unbundled high-speed Internet service and include charges for modem rental, where such information is available. Prices omit the effects of one to three month promotional pricing, but may include offers whose prices are good for one year.

About the Author

Jerry Ellig has been a senior research fellow at the Mercatus Center at George Mason University since 1996. Between August 2001 and August 2003, he served as deputy director and acting director of the Office of Policy Planning at the Federal Trade Commission while on a leave of absence from the Mercatus Center. Dr. Ellig has also served as a senior economist for the Joint Economic Committee of the U.S. Congress and as an assistant professor of economics at George Mason University.

Dr. Ellig has published numerous articles on government regulation and business management in both scholarly and popular periodicals, including the *Journal of Regulatory Economics, Managerial and Decision Economics, Business & Politics, Antitrust Bulletin, Contemporary Policy Issues, Competitive Intelligence Review, Journal of Private Enterprise, Texas Review of Law & Politics, The Wall Street Journal, New York Times, Barron's,* and the *Washington Post.* His co-authored/edited books include *Dynamic Competition and Public Policy* (Cambridge, 2001), *Economic Deregulation and Customer Choice* (Center for Market Processes, 1997, with Robert W. Crandall), *New Horizons in Natural Gas Deregulation* (Praeger, 1996, with Joseph Kalt) and *Municipal Entrepreneurship and Energy Policy* (Gordon & Breach, 1994, with Alison E. Woodward and Tom R. Burns).

Dr. Ellig received his Ph.D. and M.A. in economics from George Mason University in Fairfax, Virginia, and his B.A. in economics from Xavier University in Cincinnati, Ohio.

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Spinning its Wheels: What Other Cities Can Learn from iProvo's First 18 Months of Municipal Broadband, by Steven Titch, Reason Foundation Policy Study 348, August 2006, http://www.reason.org/ps348.pdf

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*Spectrum Privatization: Removing the Barriers to Telecommunications Competition***,** by David Colton, Reason Foundation Policy Study No. 208, July 1996, http://www.reason.org/ps208.html

*On the Frontier of Deregulation: New Zealand Telecommunications & the Problem of Interconnecting Competing Networks***,** by Milton Mueller, Reason Foundation Policy Study No. 177, May 1994, http://www.reason.org/ps177.html

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[31] Ibid., p. 22. Since the first quarter of 2003, the percentage of households using DSL more than doubled, from 6 percent to 13.8 percent. The percentage using cable modem increased from 10.5 percent to 18.3 percent.

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