The Impact of Broadband Speed and Price on Small Business

by

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1. Executive Summary

1.1. Purpose

The purpose of this study is to explore the ways in which small businesses access and use high-speed Internet services, and to evaluate the importance of broadband speed and price for small businesses. The U.S. Small Business Administration's (SBA) Office of Advocacy (Advocacy) is required to conduct this study under Public Law 110-385, Sec.105.[1] Advocacy selected a small business that specializes in this field—Columbia Telecommunications Corporation (CTC)—to conduct this research.[2]

CTC conducted a nationwide survey of small businesses in April 2010 to solicit information about their Internet use and the impact of the Internet on their business. Survey responses were separated into metropolitan-area (metro) and rural segments to evaluate differences in Internet access, use, and value among businesses located in different areas. Survey results were also compared to information collected in an Advocacy survey conducted in fall 2003.[3]

To supplement the survey results, CTC conducted secondary research on the broadband markets in the United States, Europe, and Asia.

1.2. Key Observations Regarding the U.S. Internet Market

The Internet has transformed the way small businesses operate, communicate with employees, and interact with customers. Survey respondents indicate Internet service is an important tool for achieving strategic goals, improving competitiveness and efficiency, reaching customers, and interacting with vendors. Respondents indicate that high-speed (broadband) Internet access is as essential to their business as other utilities such as water, sewer, or electricity.

- The percentage of businesses using the Internet is considerably higher than the percentage of residential users. The small business broadband adoption rate has increased to 90% as of the date of this survey (April 2010), compared to 74% of adults with broadband access in their homes and just 65% of adults who use their home broadband connections, according to a 2010 Federal Communications Commission (FCC) report.[4]
- Excluding small businesses that do not have any computers, the level of broadband adoption jumps to 95%.
- Although there is not a significant difference between metro and rural markets in terms of businesses' need for broadband, there are significant differences between metro and rural areas with respect to the availability, performance, and price of high-speed broadband options.

[1] *Broadband Data Improvement Act*, Public Law 110-385, *U.S. Statutes at Large* 122 (2008): 105.
[2] CTC contracted with Clearspring Energy Advisors, based in Madison, Wisconsin, to assist with the market research; Dr. Robert Feinberg of American University to assist with the general and competitive analysis; and Dr. Ayman Tarabishy of George Washington University to assist with the entrepreneurial orientation analysis.
[3] U.S. Small Business Administration, "Study of the Impact of Broadband Speed and Price on Small Business," Contract SBAHQ-09-C-0050, awarded September 25, 2009.
[4] Horrigan, "Broadband Adoption and Use," 3.

- Almost one-third of businesses indicate a need for broadband speeds that require greater-capacity networks than currently exist in many locations in the United States. (And where this high-capacity access is available, it is extremely expensive—typically more than $1,000 per month.)
- The existing broadband infrastructures (cable modem, wireless, and DSL, respectively) have significant limitations when compared to fiber-to-the-premises (FTTP), which reaches only a small fraction of the United States. The cable, wireless, and DSL networks will require extensive upgrades, such as the construction of fiber optics closer to the premises, in order to provide businesses the capacity many currently need and most will eventually need.
- Defining broadband on speed alone is challenging and inadequate. The number of applications that businesses need to run over their data and Internet connections continues to increase. The speed required to support these applications is also increasing. Therefore, what appears to be an adequate broadband speed today will appear to be as slow as dial-up tomorrow.

Small businesses want both competition and choice (of providers and services) in broadband, and are dissatisfied with the choices they currently have available. The survey data demonstrate that the small business Internet market does not provide this competition or choice to small businesses from a performance perspective and, in some cases, from a price perspective.[5] Of the options presented in the survey, for example, respondents stated that the most important feature of Internet service is the ability to choose from more providers, followed closely by the option to purchase faster bandwidth.

- The survey data also point to a need for more choice among broadband service providers for many small businesses. When asked to compare what is important to them in terms of their Internet service, and how satisfied they are with those elements of their service, the largest gap—meaning the areas of greatest need for small businesses—is in their ability to choose among providers. In other words, in order to meet their price, customer service, and performance needs, small businesses want more choice among providers.
- Almost half (48%) of rural respondents and more than one-third (37%) of metro respondents report that they are not satisfied with their Internet speed.
- Rural respondents with either satellite or dial-up Internet connections—generally the two slowest options among broadband technologies—are the least satisfied with their connection speed. This may relate to rural businesses' lack of choice among providers and services; if they have no other options, then they are forced to use a low-speed service or go without any connection.
- In metro areas, in contrast, there are typically a number of service options available to small businesses, so those that are dissatisfied with their connection speeds can choose a faster service if they are able to pay for it.

In addition, the survey results indicate gaps between metro-area and rural businesses in terms of broadband availability, speed, and price—as well as how those businesses use the Internet. These

[5] The survey found that businesses are generally satisfied with pricing (except for satellite services and leased lines).

gaps indicate the potential for even greater broadband impact in rural areas if more robust and cost-effective broadband services were available. Stated otherwise, broadband providers are not fully supplying the demand of the rural small business consumer market.

- Only 1.8% of respondents indicate that no broadband option is available to them—but if satellite is excluded as a broadband option (as has been the assumption under the broadband stimulus programs), the percentage of small businesses reporting having no broadband option jumps to 7.7% for rural respondents and 3.5% for metro-area respondents.
- And while metro businesses pay more for Internet service, the data do not indicate that comparable services are priced higher in metro areas than in rural areas. The opposite may be true (i.e., that rural respondents are paying more for slower service.) Also, metro respondents are more likely to use leased-line service (the most expensive) and less likely to use dial-up service (the least expensive) than are rural respondents. Overall, respondents pay an average of $110 per month for Internet service, though most pay between $50 and $99 per month.
- Among businesses with Internet service, the share that still uses dial-up connections has decreased dramatically from 44% in 2003 to 6% in 2010. This transition from dial-up to broadband among small businesses is evident in both the metro and rural segments.

1.3. Policy Recommendations and Considerations

Based on the survey findings and supplemental research, we make the following policy recommendations and considerations (see Section 5.1 for more details):

- Stay the course on national broadband planning and implementation of the FCC's National Broadband Plan. The National Broadband Plan is an important first step in realizing the potential of ubiquitous broadband access and adoption, for small businesses as well as other sectors—but adequate follow-through with respect to regulatory goals and funding is essential to achieving the plan's goals.
- Encourage and enable small business broadband *providers* and other competitors by supporting their unfettered access to existing network infrastructure or otherwise lowering barriers to entry. Significant effort is necessary to open the broadband provider market to small businesses. One of the unfortunate byproducts of recent regulatory activity has been the exclusion of small businesses from the broadband provider/Internet Service Provider (ISP) market. While this outcome was likely unintended by regulators, thousands of existing U.S. small business ISPs were effectively removed from the market over the course of the past decade[6]—resulting in a far less robust competitive market and in the decimation of a small business economic sector.
- Define future broadband speeds to meet small business application needs. Broadband is a connection that is sufficient in speed and capacity such that it does not limit a user's required application. As users become more and more sophisticated, the speed and capacity

[6] Advocacy expressed its concern over the potential loss of ISPs due to rulings on Internet service classification and unbundling in letters submitted to the FCC in 2002 and 2003. See Sullivan, Menge, and Saade, 2002, and Sullivan, Menge, and Saade, 2003.

of a given connection will need to continually increase to be considered broadband. In addition, broadband needs to be available from a competitive marketplace.

- Provide small businesses accurate, actionable data to make broadband purchasing decisions. Standards do not exist for how broadband is advertised and, as a result, the information released by providers is frequently insufficient for small businesses to make "apple-to-apple" comparisons of services.[7] Small business consumers would be able to make informed purchasing decisions if they had accurate, understandable information about broadband attributes that affect performance, including actual (not theoretical) upload and download speeds, and upload and download oversubscription.[8]
- Protect small business consumers. As consumers of broadband services, small businesses often face a number of distinct disadvantages that limit their choices and use of broadband. First, they are often required to sign one-, three-, or even five-year service contracts with typically steep penalties for early termination. Second, they pay higher rates than do residential customers for comparable services.
- Consider creating federal broadband incentive programs that focus on small businesses. Given the demonstrated importance of broadband access to small businesses, and the economic engine that small businesses represent, creating an incentive that is focused on the infrastructure needs of small businesses could produce far-reaching benefits nationwide.
- Consider rural small business needs in Universal Service reform. The United States has invested to achieve telecommunications Universal Service for decades, with a set of priorities based on providing to all Americans adequate services over adequate facilities at reasonable cost. But the focus of the Universal Service programs has been on institutions (through the E-rate program for schools and libraries and the Rural Health Care pilot program for health care entities) and on residential service (through the High-Cost and Low Income programs).
- Consider efforts that expand small business broadband deployment and adoption. For example, broadband adoption could be increased through increased telecommuting, a use of the technology that is of great interest to both small businesses and their employees, and which offers a range of benefits. Increasing telecommuting could, in turn, lead to greater demand (i.e., a willing market) for broadband deployment, especially in rural and underserved areas.

[7] The New America Foundation has called for "disclosure standards" for broadband providers. See Lennett et al., "Broadband Truth-in-Labeling."

[8] A network's oversubscription rate is the ratio of the sum of all subscribers' advertised bandwidth (e.g., one thousand subscribers who have been sold 1 Mbps service represent 1,000 Mbps in total subscribed bandwidth) to the capacity of the service provider's connection to the Internet. If the one thousand subscribers' provider has a 100 Mbps connection, then the oversubscription rate is 1,000 Mbps divided by 100 Mbps, or ten.

2. Report Definitions and Data Gathering

This section provides definitions of key terms used in the report and an overview of the survey process, survey return rates, and confidence level of the survey response groups.

The authorizing legislation required Advocacy to "conduct a study evaluating the impact of broadband speed and price on small businesses." The study was to include (1) a survey of broadband speeds available to small businesses; (2) a survey of the cost of broadband speeds available to small businesses; (3) a survey of the type of broadband technology used by small businesses; and (4) any policy recommendations that may improve small businesses access to comparable broadband services at comparable rates in all regions of the Nation."[9]

2.1. Defining Broadband

The definition of broadband is the subject of much debate among policymakers, consumer advocacy groups, incumbent providers, and other stakeholders, especially during the ongoing development and refinement of the Federal Communications Commission's (FCC) National Broadband Plan.

Definitions of broadband have also been an essential aspect of the implementation of the American Recovery and Reinvestment Act's two broadband initiatives. The Broadband Technology Opportunities Program (BTOP), administered by the U.S. Department of Commerce's National Telecommunications and Information Administration (NTIA), and the Broadband Initiatives Program (BIP), administered by the U.S. Department of Agriculture's Rural Utility Service (RUS), both define broadband, for example, as "providing two-way data transmission with advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users…."[10,11]

The FCC has recently redefined broadband by setting a universal benchmark for broadband speed of 4 Mbps downstream and 1 Mbps upstream (actual, not advertised, speed).[12] Significantly, the FCC also noted the importance of defining broadband in terms of actual speeds, not those that are advertised as "up to" speeds—meaning they are theoretically possible under optimal (but rare) circumstances.

For the purpose of this report, however, the survey avoided the debate over terminology and asked small businesses to report on their experience selecting and using "broadband" service. This is not to say that the definitions devised by various agencies and authorities are incorrect or correct—only that they will continue to evolve. And what is important for this report is finding an answer to a practical, present-day question: How are broadband availability, speed, and price affecting small businesses?

[9] *Broadband Data Improvement Act*, Public Law 110-385, *U.S. Statutes at Large* 122 (2008): 105.
[10] U.S. Department of Agriculture, "Notice of Funds Availability," 3824.
[11] U.S. Department of Commerce, "Notice of Funds Availability," 3797.
[12] Federal Communications Commission, "*Deployment of Advanced Telecommunications Capability,*" 4.

Viewed in this light, it is clear that the definition of broadband is going to be different for different businesses. Some businesses may be very well served by a cable modem service, while another business may need to run applications that a cable modem service cannot support. Thus, a more practical definition of broadband is one that looks at whether it enables a business to achieve its operational goals and supports related applications (see Section 3.2).

To that end, the survey of small businesses on which this report is based did not include a speed-based definition of broadband. Rather, respondents were asked to select from among a list of potential high-speed services—from satellite, DSL, and cable modem to high-capacity leased-lines—with the implication being that these services represented broadband access. By not attaching a speed-based definition to the term broadband, the survey also avoided another pitfall: namely, that small business' need for higher broadband speeds continues to grow—so presenting an absolute number is not likely to be accurate in the longer term. (See Section 4.2.1, for example, for an indication of the number of small businesses that want more speed than they can get.)

2.2. Survey Development, Distribution, and Analysis

In April 2010, surveys were mailed to nearly ten thousand businesses nationwide soliciting information about their use of the Internet and the impact of various Internet aspects on their business. The Office of Management and Budget (OMB) approved the survey under the requirements of the Paperwork Reduction Act of 1995, and assigned it OMB Control Number: 3245-0371. (Copies of the survey instrument and cover letter are included in Appendix A.) The survey sample was purchased from infoUSA.com and consisted of two subsamples of approximately five thousand each:

- Metro (metropolitan area): Businesses located in an area that is designated a "city" delivery route by the United States Postal Service (USPS)
- Rural: Businesses located in an area that is designated a "rural" delivery route by the USPS

The USPS delivery route designations are based on definitions established by the U.S. Department of Agriculture (USDA) Office of Rural Development, which typically[13] defines rural and rural area as any area other than (1) a city or town that has a population of greater than fifty thousand inhabitants, and (2) the urbanized areas contiguous and adjacent to such a city or town.[14] While it is possible that some businesses in the "metro" footprint are in relatively rural locations, and some businesses in the "rural" footprint are in medium-sized cities that resemble a more urban setting, these definitions provide a consistent distinction between two segments for analytic and summary purposes.

A total of 425 valid responses[15] were received over the course of a response time of approximately five weeks, yielding a net response rate of 4.52%. Of the initial sample of ten thousand,

[13] The USPS will take exceptions to the definition at times and apply different rules, such as the rural-urban continuum codes, urban influence codes, and rural county typology codes developed by USDA's Economic Research Service (ERS).
[14] *Farm Security and Rural Investment Act of 2002*, Public Law 107-171, *U.S. Statutes at Large* 116 (2002): 6020.
[15] Four unusable surveys were received and an additional six surveys were received after the cut-off date.

forty-eight were excluded in the initial address screening and 561 were undeliverable. The net response rate of 4.52% represents the 425 received out of the 9,391 that were delivered. (Full summary tables are included in Appendix B.) Of those responses, 249 were received from rural businesses and 176 were received from metro businesses.

The survey response rate was lower than anticipated and lower than the response rate realized in similar surveys conducted for specific cities or localities. In previous years, more than 10% of businesses responded to surveys regarding their use of broadband. The low response rate may reflect the nature of the survey (nationwide and from a federal government entity), recipients' time available for survey completion (economic conditions), or other factors. In addition as indicated above, 561 surveys were undeliverable—potentially because those businesses have closed during the current recession. Nonetheless, as noted below, response rates represent a sampling of metro and rural users and are statistically significant at a reasonable confidence level. ("Statistically significant" as used in this report does not mean or imply that a finding is important; rather, it means that a finding is statistically reliable.)

The confidence levels of aggregate, rural, and metro segment responses—based on the number of surveys received and the corresponding populations from the infoUSA.com database from which they were drawn—are as follows:

Table 1: Confidence Levels of Survey Responses

Sample	Surveys	Population	Confidence [a]
Rural	249	1,716,622	±6.2%
Metro	176	4,695,232	±7.4%
Total	425	6,411,854	±4.8%

Source: Analysis of survey results conducted by CTC.
[a] Confidence interval at the 95% probability level.

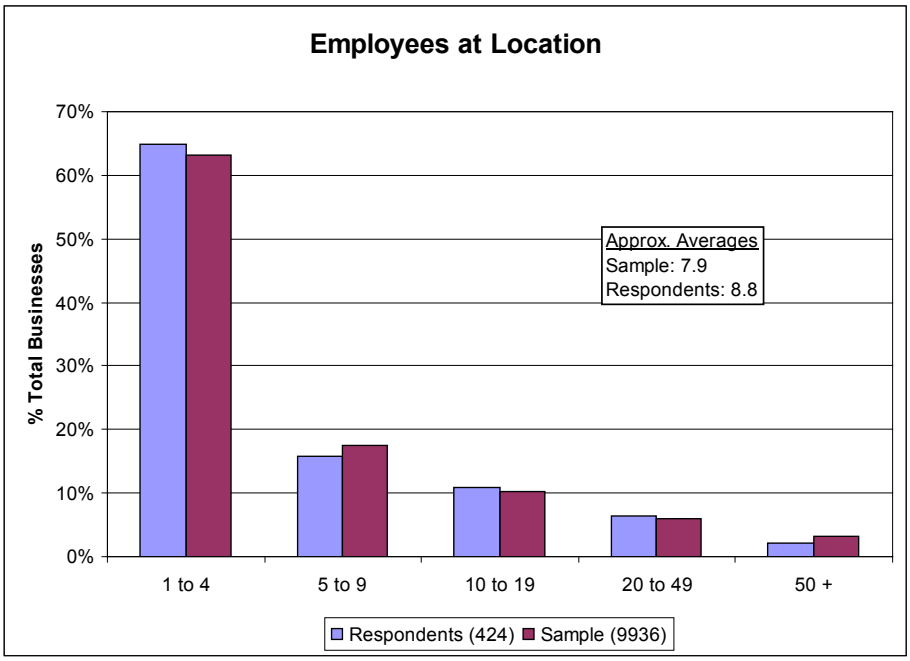
At the aggregate level, survey responses are statistically significant at the 95% probability level with an uncertainty of less than 5.0%. The metro and rural segments have slightly broader confidence levels, but still provide a sufficient number to make some valid comparisons between the segments. Further breakdowns into smaller categories such as the number of employees will have greater uncertainties and make statistically valid comparisons more difficult. To obtain statistically significant analysis for smaller sub-groups, a better survey response rate is required.

Statistical tests were run on each question to determine where differences in responses between the groups are statistically significant. This report discusses where differences are statistically significant or not.

The surveys were analyzed using SPSS software. Tabular results were exported to Microsoft Excel for further analysis and graphing. Aggregate survey results were weighted to capture the different number of responses received and the different populations of the two subsamples. The summary results within each segment are not impacted by the weighting.

Because employment size is a key variable, the survey results were analyzed to check for bias between the total sample and the respondents in terms of the number of employees reported. The data in both cases is from the same source (infoUSA.com). As shown in Figure 1, the number of employees at the business location surveyed is very nearly the same for the 424 respondents with data available as it is for the total sample of 9,936 businesses with data available. This analysis indicates no significant sample bias in relationship to employment size.

Figure 1: Number of Employees, Survey Respondents vs. Total Sample[16]



Although this report refers to businesses in general, all of the respondents had fewer than five hundred employees at the location surveyed, and only thirteen respondents had more than one hundred employees at all locations. For these reasons, the sample of respondents can be assumed to represent "small businesses," a term generally referring to businesses with five hundred or fewer employees.

[16] The source for Figure 1 through Figure 70 and Figure 72 through Figure 78 is data derived from the April 2010 survey of small businesses conducted by CTC.

3. Understanding the U.S. Broadband Market Today

As of June 2010, the worldwide estimated population of business and residential Internet users is 1.97 billion,[17] an amazing adoption rate considering that the commercialization of the Internet has not reached its twentieth year. It is no exaggeration to say that the Internet has changed the way many Americans work, communicate, and live their lives. E-mail alone would likely earn the same distinction, and "google" has become a verb because of its ubiquitous place in the lives of many Internet users. Well-known examples of other game-changing Internet offerings run the gamut of experience:

- Amazon.com and other successful online retailers changed the way Americans buy everything from books to groceries. Consumers often get better deals than in the past, too; easy comparison shopping means online and bricks-and-mortar stores face real price competition every day.
- eBay and other auction sites didn't just give people an alternative to setting up a yard sale—they gave entrepreneurs a platform for creating viable businesses out of their homes.
- Monster.com, USAJOBS, and similar sites gave job seekers instant access to employment listings, worldwide and at every level. Looking for work no longer means waiting for the Sunday newspaper to hit the doorstep.
- Craigslist has further eroded the importance of that local newspaper, too, by offering free "classified ads" for any item or service you wish to sell—or give away.
- YouTube has given everyone with a video-enabled cell phone the ability to post and play videos, instantly, from anywhere.
- Skype made a traditional landline phone superfluous for anyone with a computer and high-speed Internet access.

In fact, look at any residential or business consumer relationship—banking, trading stocks, shopping, taking orders, watching video of the latest news—and the Internet has changed it. The Internet has enabled the creation of applications and services that, as recently as ten or fifteen years ago, were impossible for most people to imagine.

Although Internet applications have flourished, and have enabled entrepreneurs to create many new businesses and services, the business of providing Internet access has not flourished. In the early 1990s there was an amazing growth of Internet service providers (ISPs). Across the country thousands of ISPs emerged to offer not only access to the Internet, but Internet protocol (IP) support and other related services. Those early ISPs had unrestricted access to the communications circuits used to connect to the Internet—consumers' telephone lines. These ISPs did not have to lease circuits from incumbent communication providers, nor did they have to undergo the time-consuming and expensive proposition of installing communication circuits to their customers. Consumers enjoyed a competitive market place.

As applications continued to evolve and as personal computers' processing speeds accelerated, dial-up services became too slow to meet expanding consumer expectations. Cable, wireless, and telephone companies responded to the need for increased speed by enabling their networks to

[17] Miniwatts Marketing Group, "World Internet Usage."

support cable modem, DSL, and other technologies. Many of the dial-up-based ISPs quickly adapted and began offering DSL-based ISP services over telephone lines. This situation was unfortunately short-lived for the ISPs, however. Through business practices and regulation, the upgraded cable and telephone network operators were able to restrict access to their infrastructure, rendering competitive ISPs unable to operate. As a result, the Internet market in the United States is not competitive and is not meeting the needs of the small business market.

Small businesses want both competition and choice (of providers and services) in broadband, and are dissatisfied with the choices currently available to them. The survey data demonstrate that the small business Internet market does not provide this competition or choice to small businesses from a performance perspective and, in some cases, from a price perspective.

Cable, wireless, and telephone companies will continue to advance the capabilities of their respective infrastructures, particularly in areas where revenues and return on investment are highest. However, it is not clear that they will expand their existing footprints to deploy new technologies in areas they do not currently serve. In addition, their existing infrastructures have significant limitations when compared to fiber-to-the-premises (FTTP), which reaches only a small fraction of the United States. The cable, wireless, and telephone company networks will require extensive upgrades, such as the construction of fiber optics closer to the premises, to provide businesses the capacity many currently need and most will eventually need.

3.1. Overview of Current Broadband Options

In examining existing broadband services for small businesses in the United States, CTC supplemented the data collected from the survey by reviewing public Web material and contacting service providers regarding their offerings. We sought a representative range of technologies, service areas, and offering types. For each service, we documented the downstream and upstream speed, cost, service area, required contract length, and other performance-related parameters related to the service (see Appendix E).

On a nationwide basis, CTC found a diverse range of offerings—dozens of companies providing hundreds of services, ranging from services barely superior to dial-up, to services with download speeds in excess of 100 Mbps (two thousand times the speed of dial-up, comparable to most internal home or business networks). However, most businesses seeking broadband will not have as wide a range of services available to them, because providers have limited service areas, and many providers have only a subset of services available at a given location. Put another way, in the broadband marketplace, your geography limits you to only one or a few providers, each with only a few service offerings.

Fortunate broadband customers are served by multiple companies, each with advanced offerings. Although there is some large-scale pattern in national providers' service levels—such as Verizon and Comcast both offering their highest speed services in the northeast metropolitan markets—whether or not a particular business gets a service may also depend on more granular issues. For example, does the cable provider serve shopping centers and office parks? How far is the customer from the DSL central office? Are the copper lines in the neighborhood DSL-ready? Does the fiber provider serve customers in multi-dwelling units? Does the fiber provider serve business customers?

Our analysis of existing broadband services found that costs for a small business connection range from $25 to $3,300 per month. Generally, higher-speed services cost more. Rural customers and customers in smaller markets pay a lower amount than businesses in larger cities and do not have access to the highest speed services available in metro areas. Rural customers generally pay more for less service than customers in metro markets.

In terms of service availability, generating and displaying an accurate and complete nationwide picture of broadband availability and quality with wireline broadband services is a complex undertaking. Unlike the wireless broadband world, in which service providers publish maps of their coverage areas, wireline broadband providers do not publish such details. Potential wireline broadband customers must enter street addresses into a database, sometimes on a service-by-service basis, to determine whether a location is served.

This supplemental study did not verify claims of service availability (i.e., it did not verify the accuracy of information posted by providers or conveyed by customer service representatives, which would have required installation and operation of the service). Likewise, the study did not verify whether the service delivered the capacity or other operational parameters claimed by the service provider.

The services that we found available to small business are summarized below and presented in more detail in Appendix E. The services are typically offered over a closed network, in which the infrastructure provider is also the ISP. Alternative ISPs have limited (if any) ability to access the infrastructure on a competitive basis. This market situation is contrary to the market conditions in countries that outperform the United States in broadband access, affordability, and performance. Indeed, a notable 2010 report, "Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World" (also called "the Berkman Report"), indicated that:

> Our most surprising and significant finding is that "open access" policies—unbundling, bitstream access, collocation requirements, wholesaling, and/or functional separation—are almost universally understood as having played a core role in the first generation transition to broadband in most of the high performing countries; that they now play a core role in planning for the next generation transition; and that the positive impact of such policies is strongly supported by the evidence of the first generation broadband transition.[18]

Further, the Berkman Report found that the United States is a middle-of-the-pack performer (when compared to countries that are members of the Organisation for Economic Co-operation and Development) on most first-generation broadband measures and a weak performer on prices for high and next-generation speeds. This situation places small businesses in the United States at a competitive disadvantage against many businesses across the globe.

[18] Berkman, "Next Generation Connectivity," 13.

3.1.1 Fiber-to-the-Premises (FTTP)

In the past five years, some service providers have begun to install fiber optic technology to the premises of individual customers in select markets. Fiber optic technology has theoretically almost unlimited capacity. Once fiber is installed, the service provider can increase the capacity of the link simply by upgrading the electronics.

In the 2000s, municipal service providers and Verizon Communications introduced fiber-to-the-premises (FTTP) technology in the United States. FTTP services included data, video, and voice. Service areas for Verizon's FTTP service, called FiOS, included metropolitan areas in the Northeast and Mid-Atlantic states and former GTE service areas in the south and west (see Appendix E for further details).

FTTP services typically range from 512 Kbps to 50 Mbps, including symmetrical services up to 50 Mbps. Because the technology is fiber optic-based, service providers can upgrade and provide new services more quickly than can providers using other, less flexible technologies.

In many metro markets, providers such as Qwest and AT&T offer high-capacity, fiber-based circuits that support data rates ranging from 100 Mbps to more than 1 Gbps. These services, however, have limited footprints, start at around $1,000 per month, and often have expensive set- up and activation charges—making them unaffordable for most small businesses.

3.1.2 Cable Modem

Since the mid-1990s, cable TV providers have upgraded their systems to provide Internet service. They constructed fiber optics to a neighborhood node and interconnected it to the existing coaxial cable, upgrading the cable as necessary. This made it possible for the cable to operate as a two-way system.

Because most of the capacity of a cable system is in the downstream (network-to-customer) direction, service offerings are significantly faster downstream. Typically the speed is two to ten times faster downstream.

Like the fiber providers, cable operators can upgrade the speed of their service. This is done by dedicating more of the channel capacity to interactive data services (e.g., by eliminating or compressing traditional television services), by increasing the channel bandwidth of the system, by using more advanced equipment, or by building fiber optics closer to the customer. However, the physical medium of the coaxial cable is more limited than fiber optics, so cable operators will face more challenges in expanding than providers that already have fiber optics to the premises.

Where it exists, and where FTTP is not an option, cable is generally the higher-speed offering, especially in the downstream direction. It is, however, on average more costly, and potentially less well suited to the customer who has very limited capacity needs and is seeking lower monthly fees.

According to the survey, 30% (metro) to 33% (rural) of businesses subscribe to this service. After DSL, it is the second-most common connection type.

The total average monthly access fees reported in the survey for cable Internet ranges from $86 (rural) to $124 (metro). Price satisfaction in the survey was approximately 3.25 (on a one-to-five scale, with five meaning "very satisfied"), and speed satisfaction was approximately 3.6.

3.1.3 Digital Subscriber Line (DSL)

DSL services became available in the mid-1990s as telephone companies connected their existing copper lines to data modems using previously filtered high frequencies, and connected those modems to the phone companies' fiber optic backbones. Connections to the fiber could be made at the phone company's central office or at remote DSL access modules (DSLAMs) in outdoor cabinets or vaults.

DSL is frequently more readily available to small businesses than is cable modem service, largely because DSL makes use of existing phone company networks, which include business areas, unlike cable modem service, which utilizes the cable networks that traditionally served primarily residential areas.

DSL services costs range from $35 to $195 per month. DSL downstream speeds range from 768 Kbps to 24 Mbps. The maximum speed available depends on the length of the DSL line. Most are, like cable, asymmetrical. Symmetrical DSL (SDSL) is also available, for example, to replicate or replace the older 1.5 Mbps T1 technology. Some DSL providers also provide services with service level agreements (SLA).

The survey reports that DSL is the most common connection type, with 39% (rural) to 50% (metro) of small businesses using the service.

The survey also indicates that the monthly cost paid for service is $68 (metro) to $80 (rural), indicating a substantially lower cost than that paid for cable Internet. On a one-to-five scale, with five meaning "very satisfied," price satisfaction is approximately 3.3, slightly higher than the result for cable. On the same scale, the satisfaction with speed is approximately 3.3, somewhat lower than for cable.

3.1.4 Wireless Broadband

There is a range of wireless broadband technologies, and these technologies are becoming a more significant part of the wireless landscape. Technologies range from the so-called 2G/3G/4G services provided by commercial cellular carriers for consumers using "smart phones" or computer air cards, to Wireless Internet Service Provider (WISP) technologies through which service providers with fixed antennas provide service to consumers' radio or access point devices over licensed or unlicensed frequencies. Wireless technologies have been identified by the FCC as a solution to providing broadband to unserved and underserved rural areas. Wireless service providers typically publish maps showing their service areas.

It is important to note the strengths and weaknesses of wireless broadband technology. Clearly, mobility and the ability to provide services without building cable plant are advantages. However, wireless relies on spectrum—essentially the available "channels" over the air—which can be scarce. It is also necessary to have proximity and sometimes even line of sight between the customer and the antenna, which makes wireless difficult to use in some geographic areas and, depending on signal strength, to use indoors.

In addition many providers impose monthly data usage limits which will make most businesses view wireless broadband as a supplementary technology and not as a primary broadband connection. Also, the slower speed of wireless broadband, relative to a wired connection, will likely lead users who can afford both wired and wireless services to use them for different but complementary purposes.

Downstream speeds range from 128 Kbps to 300 Kbps for 2G services, 600 Kbps to 1.5 Mbps for 3G services, and 1.5 Mbps to 6 Mbps for 4G services (see Appendix E for further details). Costs range from $20 to $60 per month, and depend on a range of factors, including monthly data usage, whether the customer purchased the device from the service provider, and the contract term.

The survey reports that 3% (metro) to 6% (rural) rely on "wireless paid" technologies.

3.1.5 Satellite

Satellite broadband is available to any potential customer who can install a satellite dish facing in the correct direction. It is an option for many businesses that cannot obtain fiber, cable, or DSL services. Capacity has increased with improvements in communications technology, availability of spectrum, and launch of more satellites. Download speeds range from 1 Mbps to 5 Mbps. Scalability is limited by the number of satellites, the availability of spectrum, and the capabilities of the wireless technology. Capacity is asymmetrical, owing in part to the technological challenge of simultaneously serving large numbers of geographically spread-out customers in the upstream direction.

One unavoidable limitation of satellite is the delay in communications caused by the distance of the satellite from the earth. HughesNet satellites are in geosynchronous orbit more than 20,000 miles from the user, and the satellite acts as a midway relay point, so each communications link is more than 40,000 miles long—requiring, for end-to-end communications, at least one-fourth second for the signal to propagate.[19] The delay, or latency, makes it difficult or impossible to use delay-sensitive applications, such as voice or video. The monthly cost ranges from $60 to $400.

According to the survey, 2% (metro) to 7% (rural) of small businesses use the service.

The survey also reports that the average monthly service fees for satellite ranges from $86 (rural) to $163 (metro). On a one-to-five scale, with five meaning "very satisfied," the survey indicates price satisfaction is lower than for any other category, ranging from 2.2 (rural) to 2.7 (metro). Speed satisfaction varies widely, with rural reporting a lower level than any connection type other than dial-up, and metro reporting a relatively high level of satisfaction. It can be inferred that satellite is a technology of last resort for many of the rural users. The metro users (2%) represent a small sample size, and the satellite may be for specialized use, such as emergency backup or credit card transactions.

[19] Radio signals travel at the speed of light, approximately 186,000 miles per second.

3.2. Broadband Needs Are Expanding

Broadband is not an end in itself. The value of broadband to small business is in its ability to reliably and consistently deliver applications—in other words, Internet content, e-mail, and e-commerce. Broadband applications also include telecommuting, videoconferencing, data backup, Voice over Internet Protocol (VoIP), distance learning, security cameras, and remote access.

Broadband must provide the needed applications to and from the business for all the users at the business, as well as the business' customers. Higher-quality broadband means more flexibility in using and adding applications, and applications running better and more reliably. Therefore, a suitable business broadband connection requires taking into account all of the presently used applications, all of the users using them, and all of the applications that the business might need to use in the future. The service should also be scalable, in the event that the business outgrows the connection.

Some businesses have more critical needs—for example, those that could not function if the business could not connect, or if customers or suppliers could not connect into the business. While websites and e-commerce are typically "hosted" away from the business at a data center, many other applications must connect to the business. For those businesses, it is critical to have an option to secure a primary and a backup connection, or to obtain a service with an SLA from the provider, guaranteeing a particular level of performance, with penalties for nonperformance.

Business processes can run radically differently if high-capacity, high-quality broadband is available for a reasonable cost. Given suitable assumptions, entire classes of applications—server access, videoconferencing, VoIP trunking, video upload, server backup, telecommuting, and distance learning, for example—require more than 5 Mbps downstream. These applications are not currently supported by satellite, and hence will require other broadband services. The applications can be supported by higher-speed DSL services and higher-end cable services if those services are available at the location of the business. Five Mbps DSL services require, however, the appropriate proximity to a phone central office or DSLAM, and therefore might not be available at a business location, even if the phone company has lines to the business. Cable may adequately support the applications, but again, cable might not be present at the business location. And these speed requirements assume a single user at a given location; as more users are added the suitability of DSL and cable modem services quickly decline. It is also important to note that cable services from the smaller providers in smaller markets become significantly more expensive above 5 Mbps—typically more than $100 per month. In sum, even businesses with some broadband availability will face availability and cost barriers that may slow or stop their use of broadband applications.

Table 2 provides examples of applications available to businesses, given a particular broadband service speed. The table assumes:

- A single user.
- For downloading small files up to 1 MB, download time less than 10 seconds is good, 10 to 15 seconds is fair, and more than 15 seconds is not acceptable.
- For downloading small files up to 2 MB, download time less than 20 seconds is good, 20 to 25 seconds is fair, and more than 25 seconds is not acceptable.

- For uploading videos of 1 GB, upload time less than 30 minutes is good, 30 to 90 minutes is fair, and more than 90 minutes is not acceptable.
- For downloading high-definition videos (2 GB), download time less than 10 minutes is good, 10 to 15 minutes is fair, and more than 15 minutes is not acceptable.
- For applications such as videoconferencing and remote server access, no concurrent usage of the same application by the same user.
- Server back-up will normally occur during off-peak times (10 p.m. to 6 a.m.).
- For telemedicine files up to 160 MB,[20] download time of less than 30 seconds is good, 30 to 60 seconds is fair, and more than 60 seconds is unacceptable.

[20] Ackerman, "Telemedicine."

Table 2: Typical Applications and Their Performance for Various Download/Upload Broadband Speeds (Single User)

Applications	**56 Kbps/ 56 Kbps** *(Dial-up, maximum speed)*	**256 Kbps/ 256 Kbps** *(DSL; Cable)*	**768 Kbps/ 384 Kbps** *(DSL; Cable; Satellite)*	**1 Mbps/ 384 Kbps** *(DSL; Cable; Satellite)*	**3 Mbps/ 768 Kbps** *(DSL; Cable; Satellite)*	**7 Mbps / 768 Kbps** *(DSL; Cable; Fiber)*	**10 Mbps/ 1 Mbps** *(DSL; Cable; Fiber)*	**15 Mbps/ 2 Mbps** *(Cable; Fiber)*	**20 Mbps/ 2 Mbps** *(Cable; Fiber)*	**25 Mbps/ 5 Mbps** *(Cable; Fiber)*	**50 Mbps/ 10 Mbps** *(Cable; Fiber)*	**100 Mbps/ 10 Mbps** *(Fiber)*
Simple text e-mail without attachments (50 KB)	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Web browsing	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
E-mail with large attachments or graphics (500 KB)	Bad	OK	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Download small files (e.g., a 50-page text document with limited graphics) (1 MB) [1]	Bad	Bad	OK (11 sec.)	Good (8 sec.)	Good (3 sec.)	Good (2 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)
Download large files (e.g., a 100-page text document with graphics) (2 MB)[2]	Bad	Bad	OK (21 sec.)	Good (16 sec.)	Good (6 sec.)	Good (3 sec.)	Good (2 sec.)	Good (2 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)	Good (1 sec.)
Online trading, e-business	Bad	Bad	OK	Good	Good	Good	Good	Good	Good	Good	Good	Good
Online meeting presentation and document sharing	Bad	Bad	OK	Good	Good	Good	Good	Good	Good	Good	Good	Good
Videoconferencing streaming at 384 Kbps (desktop/single user)[3]	Bad	Bad	OK	OK	Good	Good	Good	Good	Good	Good	Good	Good
Third-party hosted applications such as e-mail, data backup[4]	Bad	Bad	OK	OK	OK	Good	Good	Good	Good	Good	Good	Good
Remote server access using VPN client[3]	Bad	Bad	Bad	Bad	OK	OK	OK	OK	Good	Good	Good	Good
Multi-point videoconferencing streaming at 768 Kbps for a group of five to six[3]	Bad	Bad	Bad	Bad	Bad	OK	Good	Good	Good	Good	Good	Good

Applications	**56 Kbps/ 56 Kbps** *(Dial-up, maximum speed)*	**256 Kbps/ 256 Kbps** *(DSL; Cable)*	**768 Kbps/ 384 Kbps** *(DSL; Cable; Satellite)*	**1 Mbps/ 384 Kbps** *(DSL; Cable; Satellite)*	**3 Mbps/ 768 Kbps** *(DSL; Cable; Satellite)*	**7 Mbps / 768 Kbps** *(DSL; Cable; Fiber)*	**10 Mbps/ 1 Mbps** *(DSL; Cable; Fiber)*	**15 Mbps/ 2 Mbps** *(Cable; Fiber)*	**20 Mbps/ 2 Mbps** *(Cable; Fiber)*	**25 Mbps/ 5 Mbps** *(Cable; Fiber)*	**50 Mbps/ 10 Mbps** *(Cable; Fiber)*	**100 Mbps/ 10 Mbps** *(Fiber)*
Voice over IP (ten external lines)	Bad	Bad	Bad	Bad	Bad	OK	OK	Good	Good	Good	Good	Good
Upload videos, presentations (1 GB)[5]	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK (67 min.)	OK (67 min.)	Good (27 min.)	Good (14 min.)	Good (14 min.)
Download high-definition video in real time (2 GB)[6]	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK (14 min.)	OK (11 min.)	Good (6 min.)	Good (3 min.)
Server backup (1 TB capacity) with daily incremental backup up to 20 GB[4]	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK	Good	Good
Telecommuting	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK	Good	Good
Distance learning	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK	Good	Good
Telemedicine (e.g., radiological images such as mammograms) (160 MB)[7]	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	Bad	OK (52 sec.)	Good (26 sec.)	Good (13 sec.)

Notes:
1. For downloading small files up to 1 MB, download time less than 10 seconds is good, 10 to 15 seconds is fair, and more than 15 seconds is not acceptable.
2. For downloading small files up to 2 MB, download time less than 20 seconds is good, 20 to 25 seconds is fair, and more than 25 seconds is not acceptable.
3. For applications such as videoconferencing and remote server access, no concurrent usage of the same application by the same user.
4. Server backup will normally occur during off-peak times (10 p.m. to 6 a.m.).
5. For uploading videos of 1 GB, upload time less than 30 minutes is good, 30 to 90 minutes is fair, and more than 90 minutes is not acceptable.
6. For downloading high-definition videos (2 GB), download time less than 10 minutes is good, 10 to 15 minutes is fair, and more than 15 minutes is not acceptable.
7. For telemedicine files up to 160 MB, download time of less than 30 seconds is good, 30 to 60 seconds is fair, and more than 60 seconds is unacceptable.

Table 2 defines performance needs from today's perspective. The demand for higher-capacity connections will continue to rise—as, for example, more small businesses explore public or private "cloud computing" services, which support and deliver hosted applications and storage over the Internet. Unlike traditional hosting services, cloud computing can employ variable pricing—making it more affordable for small businesses—and no special equipment beyond Internet access and a personal computer is required.

3.3. Economic Impact Analysis of Broadband on Small Business

A recent report highlighting the benefits of broadband connectivity in the United States[21] found substantial benefits from the use of broadband Internet. The report estimated that broadband produces a net consumer benefit on the order of $32 billion per year to U.S. households. While the report did not quantify the annual benefit to U.S. businesses, it did cite a number of business benefits, including:

- Firms use broadband connections to improve efficiency and productivity, both in their internal processes and in their interactions with customers. The economic gains translate to profits and producer surplus to businesses, with a portion of the gains being passed to consumers.
- Profits and producer surpluses are also generated by firms that invest in broadband infrastructure, broadband service providers, and the providers of value-added services offered via broadband. The estimated accounting profits (producer surplus) of the top five broadband value-added service providers were $10.6 billion in 2008.[22]

Benefits of broadband extend well beyond a given business' financial statements. Increased availability and affordability of broadband can encourage increased telework, for example—which leads to reduced transportation costs and pollutants.

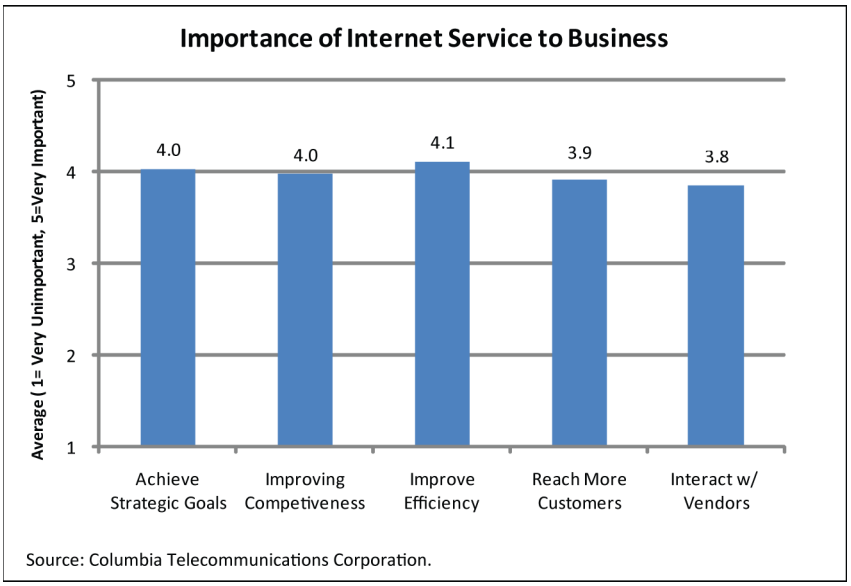
Many countries in Europe and the Pacific Rim have been more aggressive in broadband deployment and the development of a competitive environment. The countries in these regions recognize the importance of broadband to their economies. An overview of the U.S. broadband environment compared to global competitors is presented in Section 3.5. In addition the Berkman Report offers an extensive analysis of the impact of broadband policies and business models implemented in Europe and the Pacific Rim.[23]

[21] Dutz, Orszag, and Willig, "Substantial Consumer Benefits."
[22] Dutz, Orszag, and Willig," p. 36.
[23] Berkman, "Next Generation Connectivity," 28-81.

3.3.1 Literature Review: Importance of Broadband Access

The Internet has transformed the way businesses operate, communicate with employees, and interact with customers. To help measure this impact, survey respondents were asked how important Internet service is to several aspects of their businesses. As seen in Figure 2 the use of the Internet is important to many aspects of business, including the ability to achieve strategic goals, improve competitiveness and efficiency, reach customers, and interact with vendors.

Figure 2: Survey Respondent Importance of Internet Service to Business (Aggregate)



Respondents were asked to rank various business attributes on a scale of one (strongly disagree) to five (strongly agree). Respondents generally agreed that:

- "High-speed Internet access is as essential to my business as other services such as water, sewer, or electricity" (average score of 3.7).
- "Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access" (average score of 3.2).
- "Our business would realize greater long-term benefits by increasing our use of high-speed Internet access" (average score of 3.4).

While the survey results yield clear evidence that firms, and in particular small firms, see the importance of broadband, the magnitude of efficiencies that would result from significant expansion of high-speed or broadband Internet access cannot be quantified. However, a number of studies over the past five years suggest that these impacts would be large.

- Investment in broadband technology and access yields significant benefits to the U.S. economy by stimulating productivity.

  In an earlier Advocacy-funded study, for example, Pociask finds that investment in broadband technology and access yields significant benefits to the U.S. economy by stimulating productivity—leading to increased output and jobs. However he finds an ur-

ban/rural divide within the category of small firms, with a significantly reduced rate of broadband usage by rural small businesses.[24]

- The relative size of a business and its geographical area affects its digital sophistication.

  Similar to Pociask, Arbore and Ordanini, noting the well-known "digital gap" between large and small firms, focus on the differences within small and medium-sized enterprises (SMEs). Their findings confirm that the relative size of the company—and the associated internal resources—is an important factor among SMEs; but locational factors (their geographical area) further affect their digital sophistication, especially for the smallest firms. Arbore and Ordanini do identify certain strategic actions, however (like outsourcing decisions) that can mitigate size and location disadvantages in acquiring broadband.[25]

- Smaller firms need to rely on external advice in adopting technologies.

  Aguila-Obra and Padilla-Melendez further pursue the issue of adoption of Internet technologies. They find, somewhat surprisingly, that the size of the firm does not affect its ability to acquire new Internet technologies. However, because smaller firms have less managerial capability, they need to rely on external advice in adopting these technologies; in part because of managerial limitations, less sophisticated technological development was seen in smaller firms.[26] With the decline in choices of Internet providers (see Section 3.4.2) the added-value services that smaller businesses desire are not readily available.

- Using the Internet to establish direct contact with customers can reduce business transactions cost.

  Lohrke, Franklin, and Frownfelter-Lohrke investigate the ways that SMEs can use the Internet to enhance their productivity. In particular, by establishing direct contact with customers (bypassing reliance on intermediaries) they can reduce transactions cost. The authors surveyed 42 U.S. SMEs and found that those highly dependent on transmitting product information to and from customers were more likely to make heavy use of the Internet.[27] Atrostic and Nguyen's study based on U.S. Census data found the use of computer networks in business (not necessarily broadband) to increase productivity in manufacturing by more than 10%.[28]

- A firm's capabilities influence its likelihood of adopting broadband applications.

  Turning specifically to broadband, Colombo and Grilli examine the patterns of adoption of broadband-based *applications* by Italian SMEs. They discover that both *intra-firm capabilities* (e.g., productivity and employee IT expertise) and *extra-firm capabilities* (e.g.,

[24] Pociask, "Broadband Use by Rural Small Businesses."
[25] Arbore and Ordanini, "Broadband Divide Among SMEs," 83-99.
[26] Del Aguila-Obra and Padilla-Melendez, "Organizational factors," 94-110.
[27] Lohrke, McClure Franklin, and Frownfelter-Lohrke, "Internet as an Information Conduit," 159-178.
[28] Atrostic and Nguyen, "IT and Productivity in U.S. Manufacturing," 493–506.

a large potential skilled labor pool) explain the firm's likelihood of adopting broadband applications.[29]

- Broadband adoption and business productivity are linked.

  Most recently, efforts have been made to quantify the productivity and cost-efficiency benefits of broadband. Fornefeld et al. extrapolate from case studies of broadband adoption in the United Kingdom and Italy and prior statistical studies to come up with large predicted impacts on business productivity in Europe—up to 5% for manufacturing and 10% for services.[30]

- Broadband access provides production efficiencies and allows the creation of new markets and firms.

  Jayakar et al.—based on their own review of literature—find broadband access to provide both traditional production efficiencies as well as allowing the creation of new markets and firms.[31] While acknowledging that not all firms and industrial sectors will benefit, the economy as a whole will gain. They refer to the earlier study by Crandall et al.[32] which estimated significant gains in output and employment due to broadband deployment in the U.S.; based on state-level FCC data over the 2003 to 2005 period, they find that every one percentage point increase in broadband penetration increases employment by 0.2% to 0.3% per year. For the entire U.S. private non-farm economy, this translates to an increase of about three hundred thousand jobs, with the impact most significant in the education, health care, and financial services sectors.

- Broadband extends benefits beyond the business.

  Focusing on the telecommunications industry in the United States, Majumdar et al. find a positive relationship between broadband deployment and local exchange carriers' productivity, indicating that broadband has "two-sided" benefits to firms (and ultimately consumers) at both ends of the enhanced network (they refer to this as "second-order spillovers of productivity").[33]

3.4. How Competitive Is the U.S. Broadband Market?

A review and analysis of the broadband market using traditional tools to evaluate competition reveals that very little, if any, competition exists. Credit is due to the incumbent providers for building the infrastructure that delivers first-generation broadband service nationwide, of course. But small business consumer choice in a given geographical location is limited to very few broadband providers, and the absence of regulation, high market entry barriers, and little to no

[29] Colombo and Grilli, "Diffusion of Broadband-Based Applications," 174-185.
[30] Fornefeld, Delaunay, and Elixmann, *Impact of Broadband on Growth and Productivity*.
[31] Jayakar, Schejter, and Taylor, "Small Businesses and Broadband."
[32] Crandall, Lehr, and Litan, "Effects of Broadband Deployment."
[33] Majumdar, Carare, and Chang, "Broadband Adoption and Firm Productivity."

buyer or supplier bargaining power combine to create a market that is uncompetitive and shows limited potential to keep up with demands for higher capacity.[34]

3.4.1 Tools to Evaluate Market Concentration and Competition

The Herfindahl-Hirschman Index

The most commonly used measure of market concentration or market competition is the Herfindahl–Hirschman Index (HHI), which is used by the U.S. Department of Justice when reviewing potential mergers.[35] The HHI, which is an index to define the level of market concentration, sums the squares of market share percentage for all companies in a market. In proposed revised guidelines released for public comment on April 20, 2010, an HHI of less than 1,500 represents a relatively unconcentrated market. An HHI between 1,500 and 2,500 represents a moderately concentrated market. Any industry with an HHI greater than 2,500 is considered to be "highly concentrated." In markets with an HHI greater than 2,500 there would be serious anti-trust concerns over a proposed transaction that would increase the HHI by more than one hundred points.

Calculating the HHI on a market-by-market basis clearly shows that broadband Internet service is heavily concentrated and that such limited competition means that consumers have few choices.[36] Many providers will disagree with this conclusion and attempt to "prove" their position by looking at market shares on a national basis; however, national market share is not a valid aspect of an HHI calculation. Competition must be measured from the consumer's perspective—that is, the alternatives available to an individual consumer at a given location, noting that consumers do not have access to the services offered by all national providers, only those available at their home or business address. (See, for example, Figure 73, which indicates the variability of service availability in different regions of the county.) In other words, the HHI must be calculated on a market-by-market basis. Further, the addition of another provider in a market will not necessarily make the market competitive; a competitive market must not only offer a choice of providers, but those providers must each have a reasonable share of the market.

As an illustration, consider the Internet services market in the city of San Francisco. Given that the city has multiple Internet providers one might expect that residences and business enjoy the benefits of a competitive Internet market. Market research conducted in the summer of 2008 enabled computation of the HHI for San Francisco's residential Internet market. As seen in Table 3, given that AT&T and Comcast had a combined 85% market share, the HHI was quite high (over 3,230). If AT&T and Comcast were to reduce their market share to 34% each and if AT&T's and Comcast's lost market share were spread evenly among other providers, the HHI would drop dramatically to approximately 2,400—a level the Department of Justice would consider moderately concentrated. However, if AT&T's and Comcast's lost market share were to shift to only one other provider, the HHI would drop only to approximately 2,540—and the market would still be considered "heavily concentrated" or one with limited competition under the proposed Justice Department definition.

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[34] Modern economic theory of the firm—especially game-theoretic approaches—suggests that markets with as few as two and certainly with three firms can be reasonably competitive, as long as antitrust enforcers ensure no explicit collusion occurs and the ability of consumers to choose among vendors is facilitated.
[35] U.S. Department of Justice, "Herfindahl-Hirschman Index."
[36] CTC calculations and Study, 2008.

Table 3: Herfindahl-Hirschman Index Calculations for San Francisco[37]

Provider	Market Share (%)	Square of Market Share
AOL	4.40	19.40
Astound (RCN)	1.86	3.44
AT&T	44.30	1,962.44
Comcast	34.69	1,203.67
Earthlink	4.12	16.96
Meraki (Free-the-Net)	0.41	0.17
Other	4.51	20.36
Covad	0.75	0.56
DSL Extreme	0.37	0.14
Net Zero	0.82	0.67
People PC	0.32	0.10
Sonic	1.05	1.09
Speakeasy	0.97	0.94
Verizon	0.37	0.14
Web Pass	1.06	1.13
Total	100.00	3,231.22

Source: Market research conducted by CTC

In order for a market to be competitive, then, consumers need a choice among a range of providers, no single provider can have a majority market share, and many providers (not just two or three) must have significant market presence. When the infrastructure is bundled with the retail service and left largely unregulated—as it is with cable modem and DSL services—reaching a competitive market in a given community will be difficult, if not impossible, to obtain.

The Porter Five Forces of Competition

We are dealing with an industry that is dominated by large firms with large sunk costs. It was not so long ago many of these firms were regulated utilities. Moreover, the industry is typically, in effect, an unregulated duopoly with little to no oversight. While there are a number of different phone and cable providers in the United States (which, it could be argued, constitutes a "market") there is in fact typically only one cable company and one phone company serving a given geographic area. When available wireless providers do offer another alternative, however, they provide services that are not as robust as cable modems or DSL and they still do not make the market competitive. Whether these providers offer retail services directly to the consumer or indirectly by providing connectivity and backhaul to smaller independent service providers (wireline or wireless), they are well entrenched in the value chain.

Examining existing market conditions in the United States with the Porter's Five Forces Model—the framework developed by Michael Porter, a professor at Harvard Business School—

[37] CTC calculations.

provides insight into broadband market conditions for small business customers.[38] It is critical to distinguish the difference between the transport (infrastructure) and the service. The lack of competitive open access to infrastructure limits the ability of competitive ISPs and other information service providers to offer new and creative services to small businesses.

According to Porter, competitive rivalry within an industry is determined by conditions related to five factors. These factors and their relationship to infrastructure are:

- **Intensity of the Rivalry.** The U.S. broadband market contains, at best, a few service providers in a given market; essentially one or two infrastructure providers in markets where service is available; high fixed costs (for building and maintaining infrastructure), resulting in high market-entry barriers; and high exit barriers (for existing providers to leave the market). Furthermore, incumbent providers do not have an "obligation to serve" and face little to no threat to market share or profits because the barriers to entry are very high.

  The rivalry between incumbent broadband providers may be evident at times (on a price basis), but other rivalry considerations indicate that the market otherwise lacks competition. When consumers have only one or very few service provider options for an essential service, the industry is typically regulated. Absent regulation, the fewer the service providers, the higher the prospect of excessive profits, poor service, or both—which is the condition seen in the United States for Internet service.

- **Threat of New Competitors.** The barrier to entry for potential infrastructure overbuilders is cost. Duplicative infrastructure costs make the prospect nearly impossible due to a number of factors, including limited rights-of-way, pole congestion, access to existing internal building or home wiring, and material and labor costs.

- **Threat of Substitute Products.** While it may seem that satellite is a substitute for wireline broadband infrastructure (see discussion in Appendix E) the limited capability and high cost of connecting to the satellite network as compared with a wireline network dispels that notion. Likewise, the relatively limited speed of wireless networks, their caps on bandwidth usage, the difficulty providers are having keeping up with growth in demand, and the fact that wireless traffic is ultimately handed off to wireline infrastructure mean that wireless networks are not full competitors with wireline networks.

- **Bargaining Power of Buyers.** Alternative Internet providers that want to enter the market also have limited buying power, in terms of access to the Internet (capacity) and access to existing infrastructure. The alternative providers must acquire this access from the incumbent providers with which they compete in the retail marketplace. The incumbent providers will price wholesale access to the Internet and their existing infrastructure at a level similar to what they charge on a retail basis—making it difficult or impossible for new entrants to offer a competing retail service.

- **Bargaining Power of Suppliers.** Suppliers (owners) of Internet infrastructure are few and they have substantial market power. As indicated above, the suppliers are often the incumbent retail cable and DSL providers. This condition exists both in metro and rural

[38] Porter, *Competitive Advantage*.

markets. Without access to competitive wholesale and infrastructure markets, small business providers will not be able to offer competitive and innovative retail services.

3.4.2. The Closing of the Broadband Market to Small Business Providers

One of the unfortunate byproducts of recent broadband regulatory change has been the exclusion of small businesses from the broadband provider/ ISP market. While this outcome was likely unintended by regulators, thousands of existing U.S. small business ISPs were effectively removed from the market over the course of the past decade—resulting in a far less robust competitive market and in the decimation of a small business economic sector.[39]

To understand how this change happened, the history of small businesses in the Internet market must be understood. The early commercial Internet offered small businesses enormous opportunity as the Internet experienced explosive growth in the 1990s, with the number of households subscribing to dial-up access increasing from one million in 1990 to nearly fifty million in 2001.[40] This growth was enabled in part by the access to an unrestricted communications network that thousands of independent ISPs—many of which were small businesses—used as the basis of their offerings. This competition-rich market fostered innovation and lowered the prices that small businesses *consumers* paid for Internet access, as well as creating a dynamic small business *provider* market.

In the formative days of the commercial Internet, customers used their computers' modems to access the Internet over dial-up telephone circuits. Subscribers plugged their modems into their standard telephone line and dialed their chosen ISP; this was just like making a regular telephone call, but instead of a person talking to a person, the subscriber's computer used the phone line to "talk" to the ISP. Customers paid separately for their telephone service and their ISP's dial-up Internet access.

This system (in which Internet service could be purchased separately from the "pipe" that transported it) fostered competition among ISPs, including many small businesses. Indeed, the ISP industry—mirroring the number of households subscribing to dial-up Internet access—experienced remarkable growth in the 1990s. The number of ISPs increased from roughly four hundred to five hundred in the late 1980s to between seven thousand and eight thousand providers in the late 1990s—on the order of ten to fifteen ISPs per one hundred thousand subscribers.[41] Because a successful dial-up ISP required no more than a few hundred customers to finance a modem pool and Internet connection,[42] many of these ISPs were small businesses.[43]

The large number of ISPs also benefited small business customers by helping to expand the Internet based businesses (eBay, Amazon, Yahoo) and providing Internet access that was previously unavailable to them. The explosion of ISPs brought the Internet to homes and small business-

[39] Advocacy expressed its concern over the impact that FCC rulings would have on the Internet market in letters submitted to the FCC in 2002 and 2003. See Sullivan, Menge, and Saade, 2002, and Sullivan, Menge, and Saade, 2003.
[40] Cooper, "Importance of ISPs."
[41] Cooper, "Importance of ISPs," 6.
[42] Cooper, "Public Interest," 58.
[43] Ibid., 55.

es. By competing with one another for market share, providers opened markets that were ignored by larger ISPs, prompting dominant firms to provide services that might have been unavailable absent the competition.[44]

Competition also reduced subscription rates, making Internet access more affordable for small businesses. To further compete, the ISPs offered personalized customer service and hands-on support, such as house calls and complimentary software installation.[45] As a consequence, there were few "plain vanilla ISPs"; instead innovative providers offered customized services to satisfy particular customer interests.[46] Moreover, because of their localized knowledge, these small business providers were uniquely positioned to address site-specific user needs. Small ISPs also provided intangible benefits. As a Sonic.net subscriber wrote in 2000, "[I]f I bailed out of this small, familiar place tomorrow and signed on with AOL, or AT&T Worldnet… I would miss the satisfaction I get whenever I drive into town and pass the Sonic.net offices and imagine them in there."[47]

Over time, the Internet—and ISPs—evolved. The bandwidth needed to access the newest types of online content exceeded the capabilities of dial-up modem connections, prompting consumers to seek the higher-capacity service offerings of advanced telecommunications networks. Digital Subscriber Line (DSL) ISPs, which bundled Internet service and the "pipe" through which it was delivered, emerged as a promising alternative. DSL providers leased wholesale circuits from the incumbent telephone company, provisioned the circuits for DSL, and sold basic Internet access along with specialized applications and services to subscribers.

The ability of ISPs to lease circuits from the telephone company promoted competition among DSL providers. DSL providers were recognized as "common carriers" under the Telecommunications Act of 1996.[48] As such, the Federal Communications Commission required telephone companies to grant DSL providers open architecture and nondiscrimination in access to their networks, allowing DSL providers to use the networks on terms and conditions identical to other carriers.[49] This "open, ubiquitous" access led to an emergence of an industry of DSL ISPs, including small businesses, and was thought to be "among the most critical conditions for the success of the Internet" at that time.[50]

As cable operators deployed cable modem service, however, and evolved from video providers to providers also of interactive Internet service, they resisted providing access to their lines. In contrast to the open telephone networks available to dial-up and early DSL service providers, cable operators sought to close their networks to competitive providers by creating proprietary

[44] Ibid., 7.
[45] Hafner, "In Praise."
[46] Cooper, "Public Interest," 58.
[47] Hafner, "In Praise."
[48] *Telecommunications Act of 1996*, Public Law 104-104, *U.S. Statutes at Large* 110 (1996).
[49] U.S. Congress, "Conference Report, Telecommunications Act of 1996" (stating that the Act is intended to open up markets to competition by removing unnecessary regulatory barriers to entry: "to provide for a pro-competitive, deregulatory national policy framework designed to accelerate rapidly private sector deployment of advanced services and information technologies and services to all Americans by opening all telecommunications markets to competition....").
[50] Cooper, "Public Interest," 1-2.

rules. The nature of these restrictions is embodied in a term sheet Time Warner offered to ISPs seeking to access its cable lines, whose stipulations were as follows:

- Prequalification of ISPs to ensure a fit with the gatekeeper business model
- Applying ISPs must reveal sensitive commercial information as a precondition to negotiation
- Restriction of interconnecting companies to Internet access sales only, precluding a range of other intermediary services and functions provided by ISP to the public (e.g. no ITV [interactive TV] functionality)
- Restriction of service to specified appliances (retarding competition for video services)
- Control of quality by the network owner for potentially competing video services
- Right to approve new functionalities for video services
- A large nonrefundable deposit that would keep small ISPs off the network
- A minimum size requirement that would screen out niche ISPs
- Approval by the network owner of the unaffiliated ISP's home page.
- Preferential location of network owner advertising on all home pages
- Claim by the network owner to all information generated by the ISP
- Demand for a huge share of both subscription and ancillary revenues
- Preferential bundling of services and control of cross marketing of services
- Applying ISP must adhere to the network operator's privacy policy[51]

Unable to satisfy these conditions and because of an FCC determination that DSL would be exempt from common carriage requirements (see next page), small ISPs were not able to compete.[52]

From an infrastructure perspective Internet access in the United States is controlled by a relative handful of telephone and cable companies. These companies operate closed proprietary networks, on which they can limit or restrict access to competitive ISPs, and give affiliated ISPs preferential location, interconnection, and traffic prioritization. This situation is amplified because in a given market typically only one or two infrastructures are available.

The above observation is supported by the findings of the Berkman Report. Based on comparing the impact of the market structures on the availability, performance, and cost of access in various countries, the report's authors recommended consideration of several open access policies and practices.[53] Current policies and practices in the United States are contrary to these recommendations.

In the past decade, a series of regulatory and court decisions eliminated the open, dynamic market for ISPs that had existed in the dial-up days in favor of the closed model pioneered by the cable industry. In *National Cable & Telecommunications Association v. Brand X*,[54] the Supreme

[51] Cooper, "Importance of ISPs," 21.
[52] Cooper, "Public Interest," 63-64.
[53] Berkman, "Next Generation Connectivity," 8-10.
[54] 545 U.S. 967 (2005)**;** see also Noguchi, "Cable Firms."

Court held that cable companies need not share their infrastructure with Internet Service Providers such as Brand X and EarthLink, thereby exempting cable providers from many of the regulations that phone companies must follow.[55] As a result, cable companies are not required to provide access to their networks such that other providers can reach consumers. Soon thereafter, the FCC determined that DSL would also be exempt from common carriage requirements on the theory that deregulation of DSL services is necessary for deployment of broadband technology.[56] These decisions represented a marked departure from the common carrier rules that led to the success of myriad small ISPs in the early days of the Internet.

These decisions preclude true broadband competition because of the impracticability of constructing numerous physical broadband networks. While there may be significant competition in provision of programming and services such as telephone, e-mail, and video, there is no significant competition in provision of the infrastructure over which all of those services operate. Competitors, including small businesses, can now reach customers only by building their own facilities—at a prohibitive cost that effectively precludes the participation of small businesses. This situation is akin to a scenario in which the national road network were owned by UPS and closed to competitors; in order to provide service, small competitors (and even large ones such as FedEx and DHL) would be forced to build their own network of roads and highways—a prohibitive bar to competition. The result in the communications context is comparable: a broadband monopoly or duopoly of incumbent cable and telephone companies.

As a result, many ISPs have gone out of business because they cannot access the distribution networks, at any price.[57] The dynamic small business provider market of the early commercial Internet era has ceased to exist, with the disappearance of many of the smallest providers.[58] In fact, while there had been ten to fifteen ISPs per one hundred thousand customers for dial-up services, there are now fewer than two ISPs per one hundred thousand customers on the high-speed Internet and less than one ISP per one hundred thousand customers for cable modem service.[59]

3.5. U.S. Broadband Position Compared with Global Competitors

Despite widespread recognition of the benefits of broadband, the United States lags other nations in broadband speeds and penetration rates. Indeed, the Information Technology and Innovation Foundation (ITIF) ranked the United States fifteenth among thirty Organisation for Economic Co-operation and Development (OECD) nations in 2008, using a composite measure of household broadband penetration, speed, and price.[60]

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[55] The Court addressed the classification of cable modem service providers with respect to the Communications Act of 1934 and the Telecommunications Act of 1996, deferring to the FCC's determination as to whether cable companies provide "information services" rather than "telecommunications services." 545 U.S., 986–1000.
[56] Specifically, the ruling reclassified DSL as an information service. Federal Communications Commission, FCC 05-150, 2005 WL 2347773. See also Mohammed, "FCC May Let Phone Companies Off DSL Hook," and Orlowski, "FCC Opens Door to ISP Wipe-Out."
[57] See Note 39.
[58] Hafner, "In Praise."
[59] Cooper, "Public Interest," 8.
[60] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership."

Looking at speed alone, the United States fares even worse. According to the OECD, the average advertised download speed offered by broadband providers was 107.7 Mbps in Japan and 52.7 Mbps in South Korea. By these figures, the United States ranks twenty-fourth globally, with average advertised broadband download speed of 14.6 Mbps.[61] Put another way, while people in Japan can upload a high-definition video in twelve minutes, the same task takes 2½ hours in the United States at average upload speeds.[62]

In South Korea, which is ranked first for broadband among thirty OECD nations,[63] the average actual download speed is 49.5 Mbps according to ITIF.[64] The government announced plans in 2009 to further improve its network, aiming to achieve upload and download speeds of 1 Gbps by 2013.[65] Penetration is likewise extremely high, with 95% of homes subscribing.[66]

This success can be attributed to a variety of government initiatives. Notably, South Korea was the first of the ranked nations to establish a national information technology policy, approving the "Framework Act on Informatization Promotion" in 1987. The 1987 plan was followed by a series of initiatives to construct and promote a national fiber network. In 2004, the government also launched the "u-Korea Master Plan," with the goal of creating a ubiquitous information infrastructure by 2010.

The South Korean government has also facilitated broadband growth and adoption through several initiatives to advance high-tech businesses, many of which are small and medium-sized companies. For instance, in 1997, it enacted a "Special Law for the Promotion of Venture Businesses" (SLPVB), which was designed specifically to support small, high-tech "venture" businesses (i.e., businesses based on a "patented leading-edge technology").

In addition, South Korea has promoted broadband through a Cyber Building Certificate system created in 1997, which prompted construction of high-speed Internet cafes ("PC-bang"), which, in turn, led the public to demand similar speeds at home and work.[67]

Sweden is another highly ranked country that established an early and robust national broadband strategy and provides significant government resources to facilitate build-out and adoption. (ITIF ranks Sweden sixth among thirty OECD nations for broadband.[68]) In fact, Sweden was the first country in Europe to develop a national broadband plan, recommending in 1999 that the government should take steps to facilitate deployment in rural areas. By 2007, the government reported nearly 100% broadband access. The government aspires for even greater penetration, prompting a 2008 advisory committee to suggest the government provide $500 million in grants to increase speed and access to the 145,000 people and 39,000 businesses that are not yet connected. The government has also incentivized broadband infrastructure development through tax reductions in high-cost areas, funding to local authorities in rural areas to support carrier-neutral

[61] Organisation for Economic Co-operation and Development, "OECD Broadband Portal."
[62] Communications Workers of America, "Report on Internet Speeds," 2.
[63] Ibid., 6.
[64] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership."
[65] Paul, "South Korea."
[66] "South Korea Tops in Broadband Penetration Study."
[67] Kim, Moon, and Yang, "Broadband Penetration and Participatory Politics," 4-5.
[68] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership," 6.

networks, and requiring construction of high-speed infrastructure by state-owned entities. In addition to these efforts to increase supply, the government has stimulated demand through digital literacy programs for small and medium-sized businesses, libraries, and schools. The government has also given tax relief to employers that provide computers to their employees for home use.[69]

Europe as a whole has long recognized the importance of public policies to facilitate widespread broadband adoption, too. In 1994, the European Council tasked a group of prominent experts to prepare recommendations for the Community and the Member States. This mandate led to the release of the "Bangemann Report," a document that called for a "proactive role of governments in ensuring [ ] equitable access to the network [by small and medium–sized enterprises]."[70] The report notes that competition alone may not stimulate sufficient investment. Rather, policies must be developed to "promote public awareness," with "**particular attention … to the small and medium sized business sector.**"[71] In the ensuing years, the European Commission has continued to recognize that "investment in ICT is … a key factor for firms' competitiveness and for overall economic growth."[72] Perhaps due to this "attention" roughly 80% of small businesses and 90% of medium-sized businesses in the EU had access to broadband as of January 2009.[73]

That said, the broadband market in individual European countries has room for improvement. For example, the ITIF ranks the United Kingdom thirteenth among thirty OECD nations for broadband (roughly on par with the U.S. ranking),[74] despite the UK government's stated goal of having "the most competitive and extensive broadband market in the G7 by 2005."[75] ITIF asserts that this ranking may be attributed, in part, to inadequate funding for the government's stated goals.[76]

Similarly, Germany is ranked sixteenth among thirty OECD nations for broadband. ITIF attributes this ranking to the government's failure to allocate adequate resources toward its broadband goals, focusing instead on "supporting research networks" and "developing national broadband coverage maps."[77]

[69] Ibid., 20.
[70] Jayakar, Schejter, and Taylor, 27.
[71] Bangemann et al., "Europe and the Global Information Society," 16 (emphasis in original).
[72] Jayakar, Schejter, and Taylor, 31.
[73] Smihily and Storm, "ICT Usage in Enterprises 2009."
[74] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership."
[75] Broadband Stakeholders Group, "UK National Broadband Strategy 2004," 1.
[76] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership," 21.
[77] Ibid., 6 and 21.

4. Use of Broadband by Small Businesses Today

The April 2010 survey of small businesses collected information on their use of broadband and the impact of broadband on their businesses. It requested details about the respondents (e.g., size, type of business) and their business practices, their use of computers and broadband, and their satisfaction with their broadband options and service. (The complete survey instrument is in Appendix A.) Responses were separated into metro and rural segments for an additional level of evaluation. The survey results were also compared to the results of a similar Advocacy survey conducted in 2003, to track small business broadband use and perceptions over time.

A key finding of the survey is that U.S. small businesses have embraced broadband and Internet access as a central and essential part of their business operations and strategies. Indeed, broadband is central to U.S. small businesses in ways that it is not to individuals. The small business broadband adoption rate has increased to 90% as of the date of this survey (April 2010), compared to 74% of adults with broadband access in their homes and just 65% of adults who use their home broadband connections, according to a 2010 FCC report.[78] Excluding small businesses that do not have any computers, the level of broadband adoption jumps to 95%.

But while small businesses are clearly finding value in broadband, they are not entirely satisfied with the speed of their Internet connections or their choice of providers and services (i.e., the level of competition in their local markets).

This section provides insights and histograms of selected survey responses regarding businesses' use of the Internet, satisfaction with provider choice, satisfaction with connection speed, how the businesses use the Internet to reach their strategic objectives, and other attributes. Further analysis is provided in the appendices attached to this report. Appendix A, for example, is a copy of the survey instrument that was submitted to randomly selected small businesses across the United States. Appendix B summarizes some of the basic business information collected in the survey and additional data tables. Appendix D provides details on business practices and strategies, a comparison to the 2003 Advocacy survey on Internet use, and analysis of differences across the regions of the United States.

4.1. Small Business Use of Computers and Internet Service

This section summarizes the information collected in the survey about the availability of broadband connectivity, the prices respondents pay for their connections, and their business use of the Internet.

Key findings of the survey include the following:

- Only 1.8% of respondents indicate that no broadband option is available to them—but if satellite is excluded as a broadband option (as has been the assumption under the broadband stimulus programs), the percentage of small businesses reporting having no broadband option jumps to 7.7% for rural respondents and 3.5% for metro-area respondents.

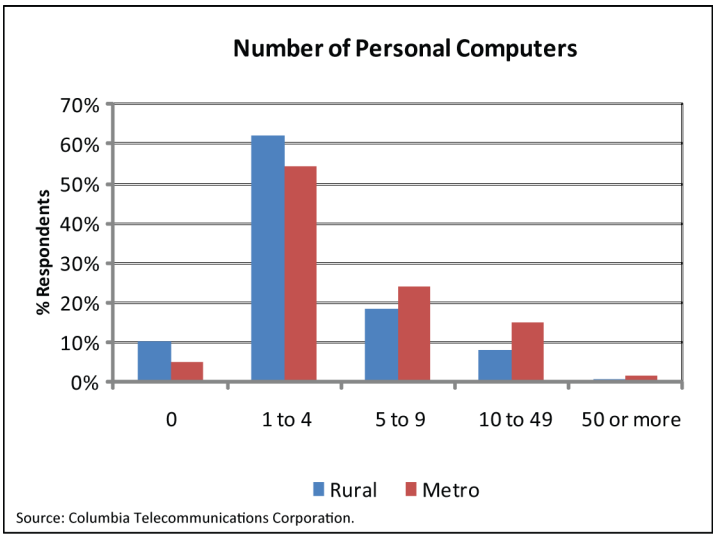
[78] Horrigan, "Broadband Adoption and Use," 3.

- The survey results indicate gaps between metro-area and rural businesses in terms of broadband availability, speed, and price—as well as how those businesses use the Internet. These gaps indicate the potential for even greater broadband impact in rural areas if more robust and cost-effective broadband services were available. Stated otherwise, the provider market has not fully responded to the rural small business consumer market for service.
- While metro businesses pay more for Internet service, the data do not indicate that comparable services are priced higher in metro areas than in rural areas. The opposite may be true (i.e., that rural respondents are paying more for slower service.) Also, metro respondents are more likely to use leased-line service (the most expensive) and less likely to use dial-up service (the least expensive) than are rural respondents. Overall, respondents pay an average of $110 per month for Internet service, though most pay between $50 and $99 per month.
- Of businesses with Internet access, metro-area businesses are nine percentage points more likely to have a website, which is a statistically significant difference. Metro-area businesses are also more likely to use websites for e-commerce than are their rural counterparts.

4.1.1 Computer and Type of Internet Used

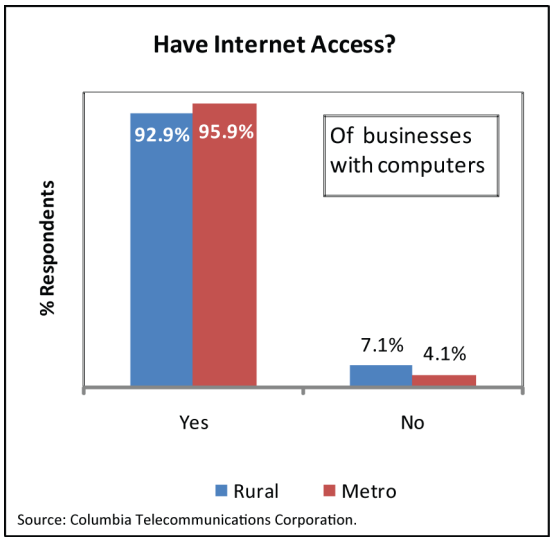
Approximately 94% of businesses responding to the survey use computers, including 95% of metro businesses and 90% of rural businesses. While the difference is not statistically significant, the tendency of metro businesses to have more computers is evident in the following figure. Since metro and rural businesses have the same average number of employees at their business location (see Figure 45), the number of computers per employee is also higher at metro locations.

Figure 3: Survey Respondent Number of Personal Computers (Rural/Metro)



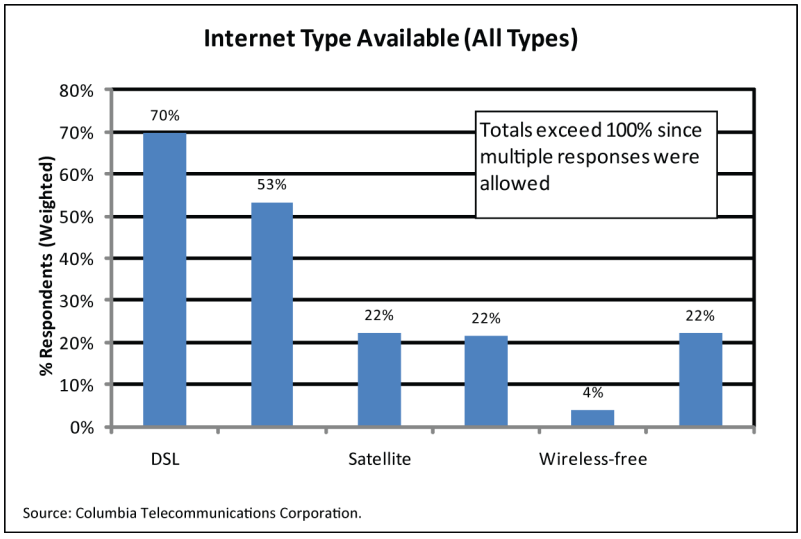
Of businesses with computers, 95% have Internet service: 93% of rural and 96% of metro businesses (not a statistically significant difference). Including businesses with no computers, 90% of all respondents—85% of rural businesses and 92% of metro businesses—have Internet access. Although this difference is statistically significant, it is largely due to the lower use of computers in general for rural businesses.

Figure 4: Survey Respondent Internet Access (Rural/Metro)



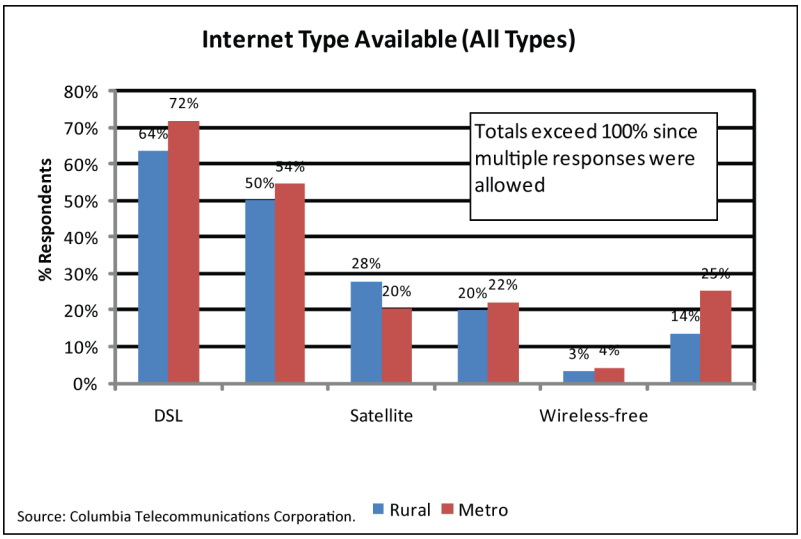
Respondents were asked what types of Internet service are available at their location. Excluding dial-up, the most widely available Internet connection type reported by survey respondents is DSL, followed by cable. Only 1.8% of the respondents indicated that no broadband option is available (same for metro and rural). If satellite is excluded as a broadband option the percentage of small businesses without a broadband option jumps to 7.7% for rural respondents and 3.5% for metro respondents.

Figure 5: Survey Respondent Internet Type Available (Aggregate)



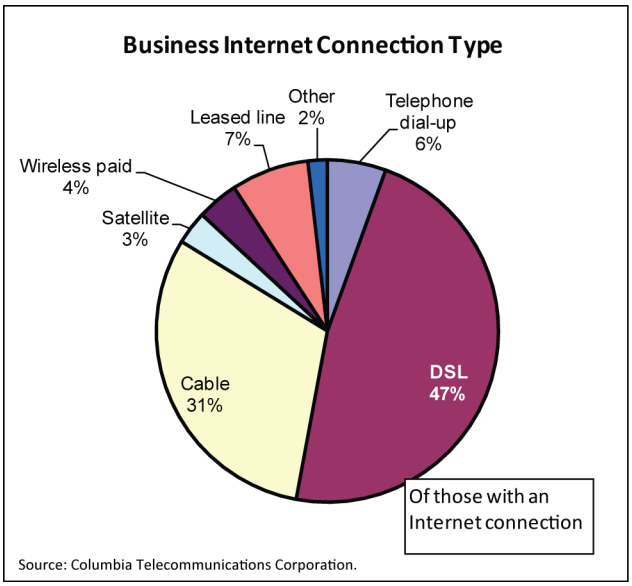
Metro businesses have greater availability of all types of Internet connection, except satellite. The largest difference between the segments is availability of leased-line service.

Figure 6: Survey Respondent Internet Type Available (Rural/Metro)



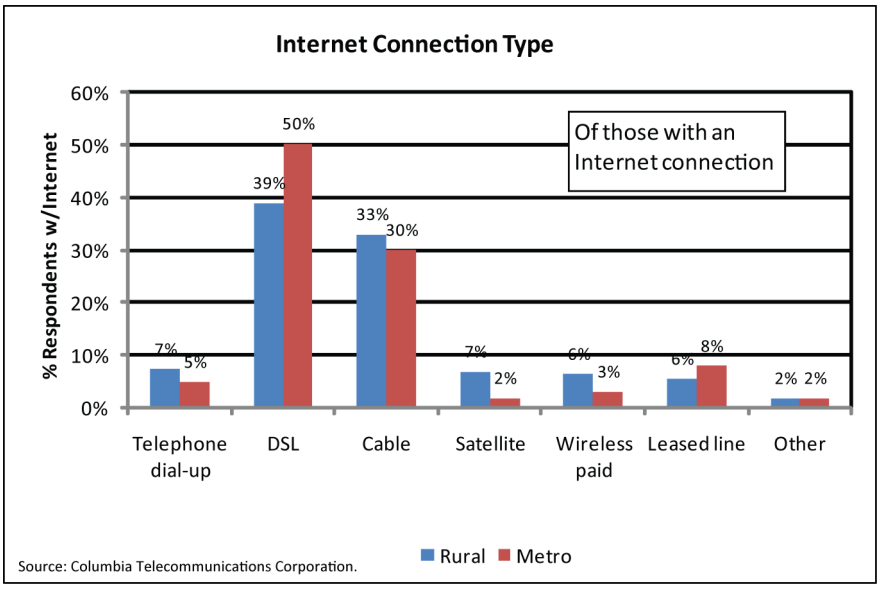
Nearly one-half of respondents with Internet connections use a DSL connection, while nearly one-third use a cable connection. Other connection types each comprise less than 10% of the Internet market.

Figure 7: Survey Respondent Internet Connection Type (Aggregate)



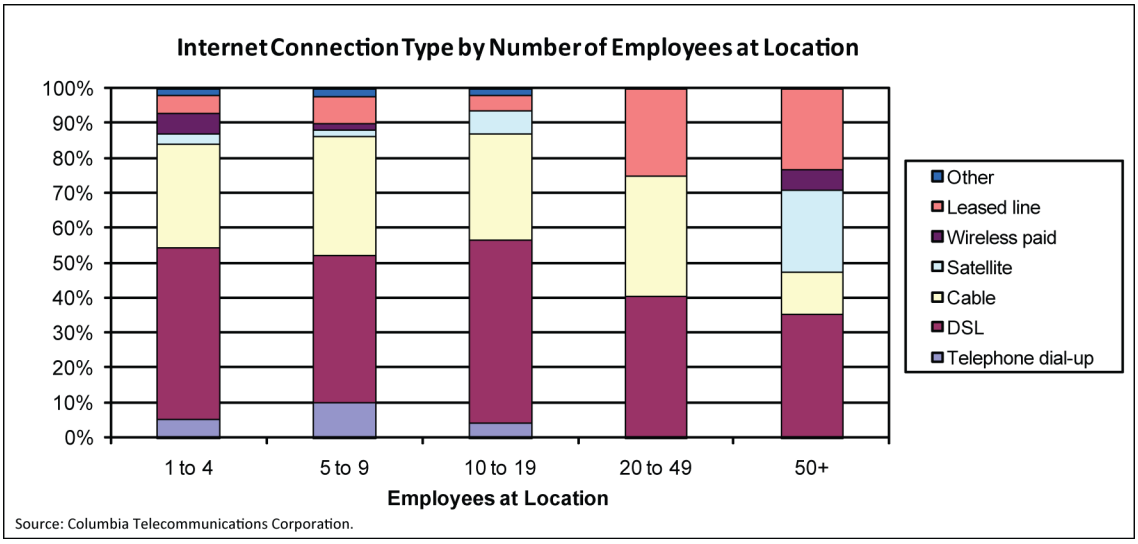
Metro businesses are significantly more likely to have DSL Internet service compared to rural businesses, and are slightly more likely to have a leased line (T3, ISDN, etc.). Rural businesses have higher shares of cable, satellite, dial-up, and paid wireless Internet service.

Figure 8: Survey Respondent Internet Connection Type (Rural/Metro)



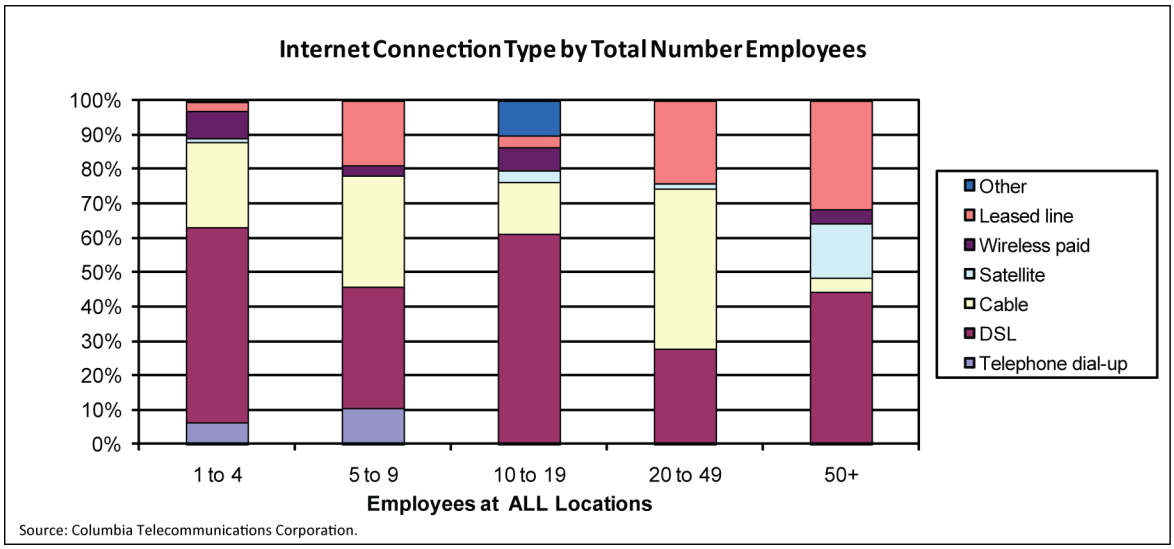
Business locations with fewer employees are more likely to have telephone dial-up connections, while larger businesses are more likely to have leased-line or satellite Internet service. This is intuitive because the need for a very high speed connection is typically greater for a larger number of employees, and the cost of a very high speed connection can be diluted across more employees. The shares of DSL and cable are very similar except in the largest company size category. Approximately three-fourths of businesses that do not have any Internet service have fewer than five employees.

Figure 9: Survey Respondent Internet Connection Type by Number of Employees at Location



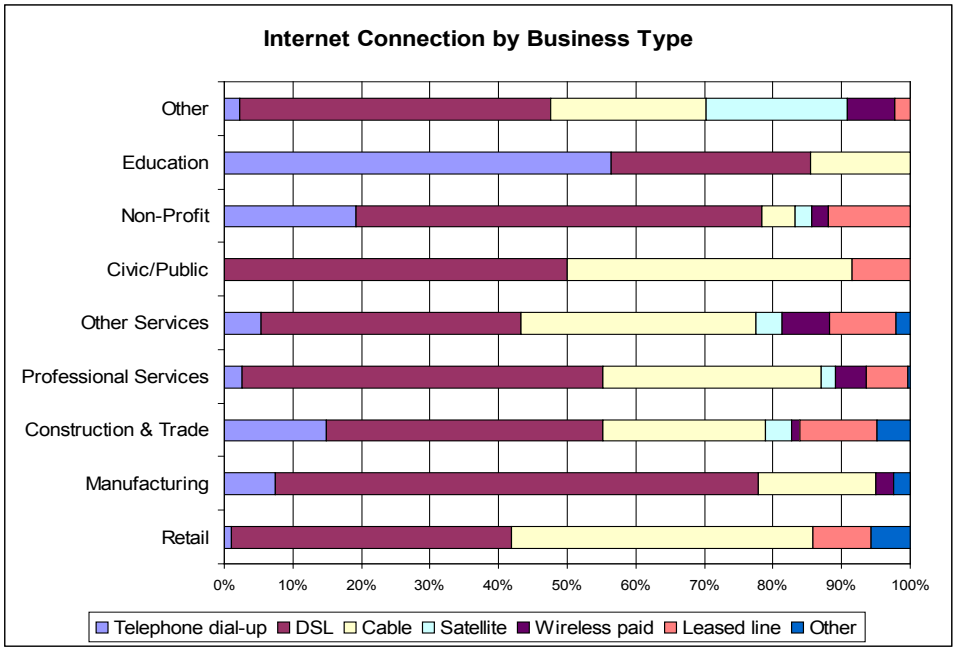
Additional analysis shows that some of the business locations with a small number of employees that have leased-line service are parts of larger companies. A proportionately larger share of businesses with a total of twenty employees or more have leased-line service.

Figure 10: Survey Respondent Internet Connection Type by Total Number of Employees



Respondents in the education and non-profit sectors are most likely to have dial-up Internet service, but this is based on a very small number of responses in these categories. Leased-line Internet service is purchased by approximately 10% of businesses in many industry categories, including non-profits, civic/public, professional services, construction and trade, retail, and other services. This shows the wide range of business types taking advantage of leased-line services where they are available, needed, and deemed affordable.

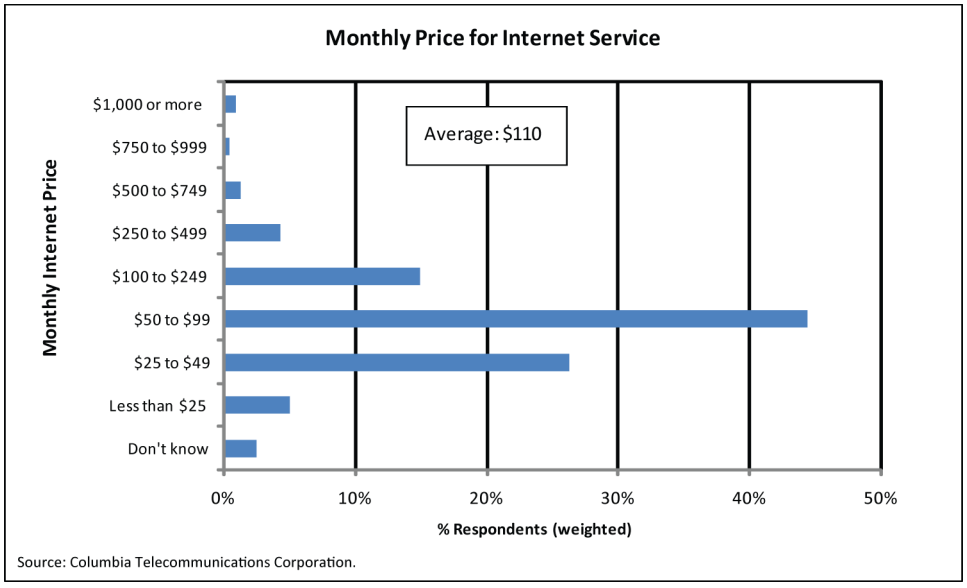
Figure 11: Survey Respondent Internet Connection by Business Type



4.1.2 Price Paid for Internet Service

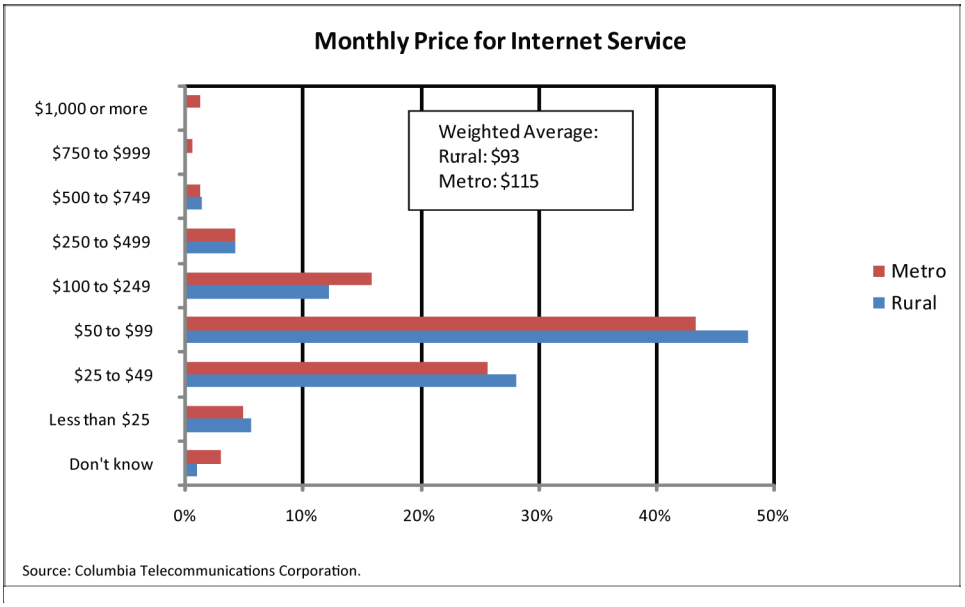
Respondents pay an average of $110 per month for Internet service. Most of the businesses pay between $50 and $99 per month.

Figure 12: Survey Respondent Monthly Price for Internet (Aggregate)



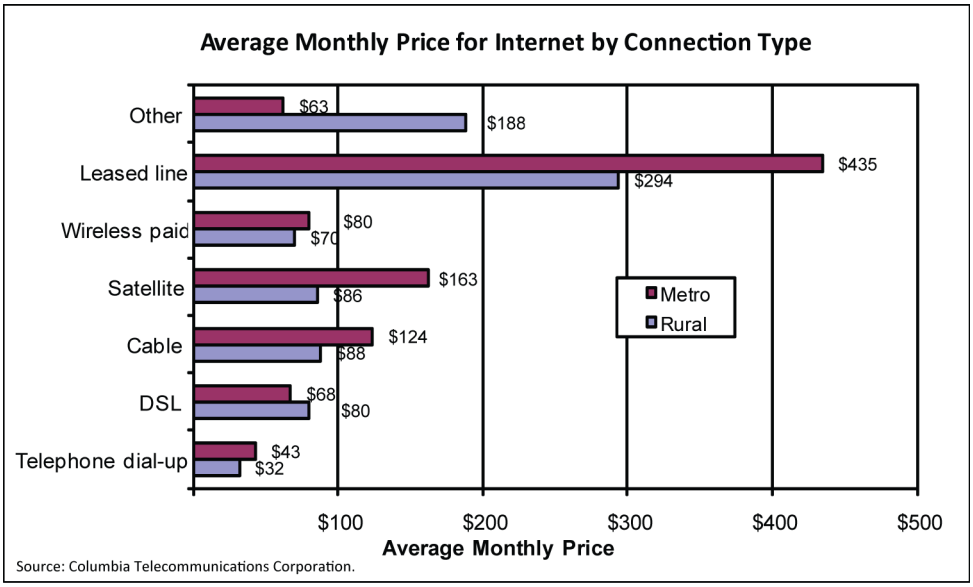
Metro businesses pay more for Internet service, although this is partially explained by their greater use of leased-line service (the most expensive) and lesser use of dial-up service (the least expensive). Metro businesses pay an average of $115 per month for Internet service while rural businesses pay an average of $93 per month. This difference of $22 or 24% is fairly large, although there is no statistical measure of the significance of this difference given the calculation of the weighted averages.

Figure 13: Survey Respondent Monthly Price for Internet Connection (Rural/Metro)



Within the different types of Internet connections, rural businesses pay less than metro customers for all types of service except DSL and "other." However, respondents did not specify the bandwidths they buy, so some of the price difference could be explained by different levels of service (speed) being purchased within a given connection type. (Comparing the availability and price of services offered in select metro and rural regions indicates that rural customers pay significantly higher prices than metro customers for the same bandwidth, and that higher-bandwidth, higher-priced services are more readily available in the metro regions than in the rural regions.)

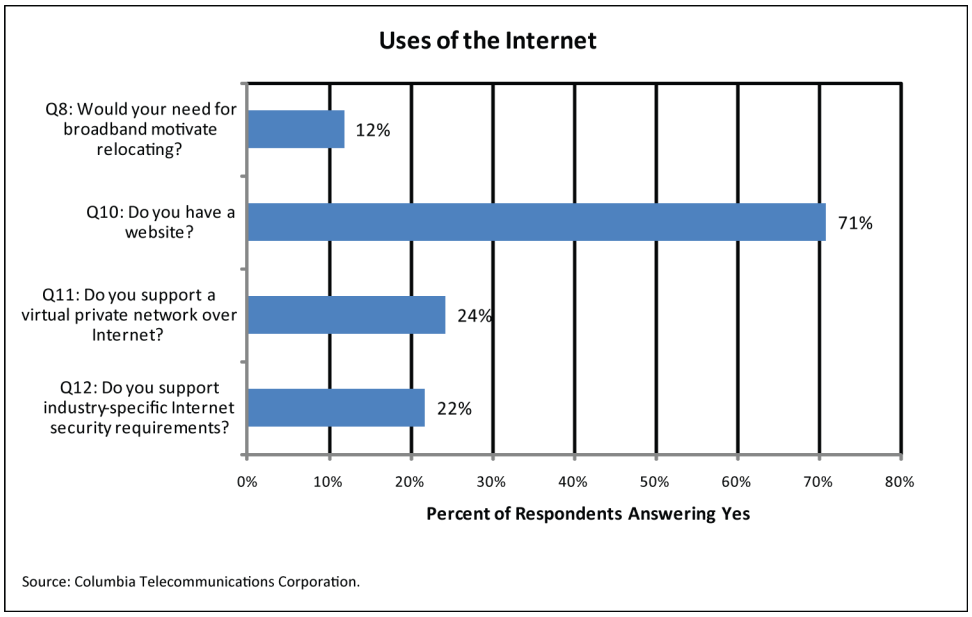
Figure 14: Survey Respondent Average Monthly Price for Internet by Connection Type (Rural/Metro)



4.1.3 Uses of the Internet

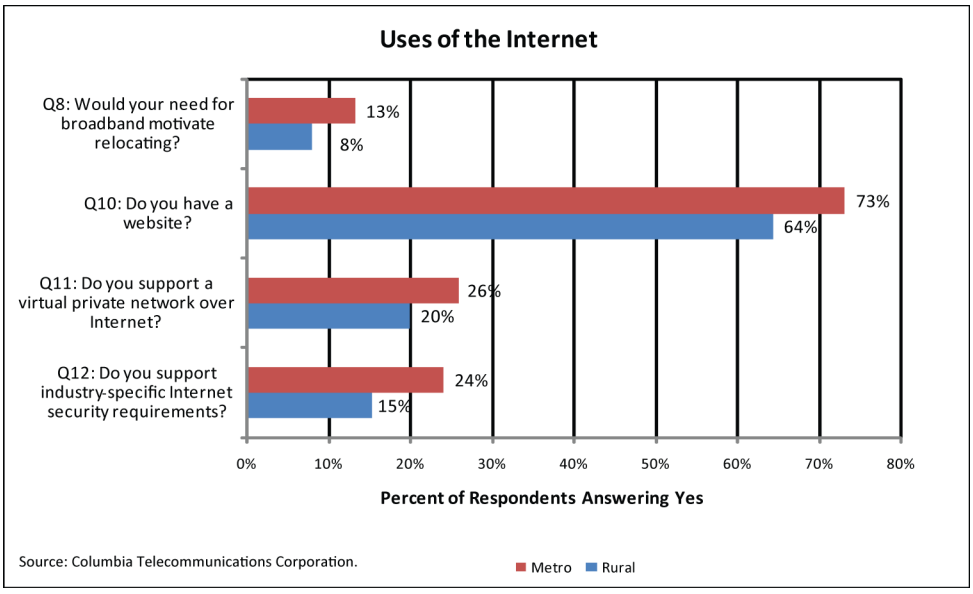
Approximately 71% of business respondents have a website, while one-fourth support a virtual private network over the Internet. Only a small percentage of respondents would consider relocating for access to a broadband Internet connection.

Figure 15: Survey Respondent Uses of the Internet (Aggregate)



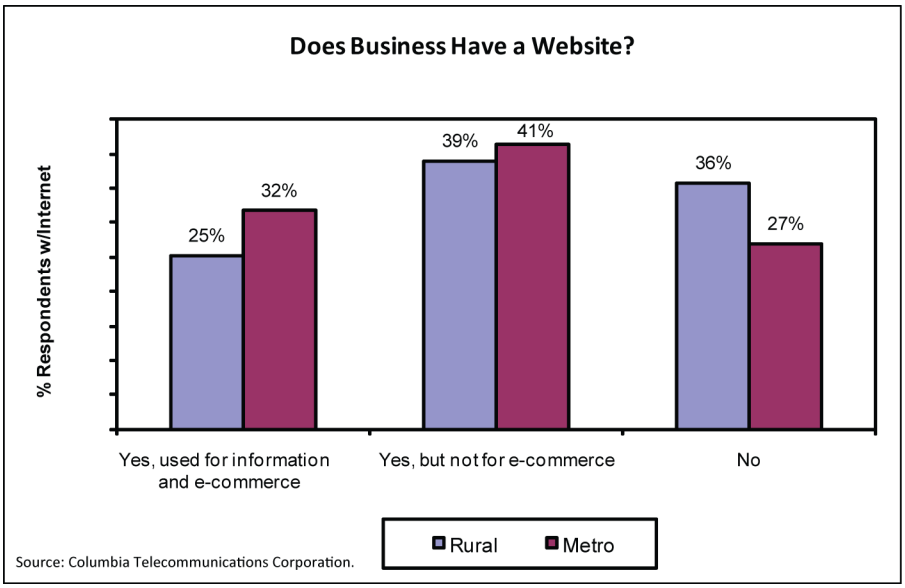
Metro businesses are more likely to relocate to access broadband Internet, have a website, support a virtual private network, and support industry-specific security requirements. This information suggests that metro businesses use the Internet to a greater extent than rural businesses for a variety of reasons, including to enhance their businesses and to meet business requirements.

Figure 16: Survey Respondent Uses of the Internet (Rural/Metro)



Of businesses with Internet access, approximately 64% of rural and 73% of metro businesses have a website, a statistically significant difference. Metro businesses are more likely to use websites for both information and e-commerce than their rural counterparts.

Figure 17: Survey Respondents With and Without Websites (Rural/Metro)



4.2. Importance of and Satisfaction with Internet Service

This section summarizes the information collected in the survey about respondents' perceptions of their need for broadband connectivity, the speed and price of their broadband connections, the importance of various aspects of Internet service, and the level of competition among broadband providers in their market.

Key findings of the survey include the following:

- Small businesses in both metropolitan and rural areas report that broadband Internet access is important to them in terms of achieving strategic goals, improving competitiveness and efficiency, reaching customers, and interacting with vendors.
- Almost half (48%) of rural respondents and more than one-third (37%) of metro respondents report that they are not satisfied with their Internet speed. Rural respondents with either satellite or dial-up Internet connections—generally the two slowest options among broadband technologies—are the least satisfied with their connection speed. This may relate to rural businesses' lack of choice among providers and services; if they have no other options, then they are forced to use a low-speed service or go without any connection. In metro areas, in contrast, there are typically a number of service options available to small businesses, so those that are dissatisfied with their connection speeds can choose a faster service if they are able to pay for it.

- The survey data also point to a need for more choice among broadband service providers for many small businesses. When asked to compare what is important to them in terms of their Internet service, and how satisfied they are with those elements of their service, the largest gap—meaning the areas of greatest need for small businesses—is in their ability to choose among providers. In other words, in order meet the breadth of price, customer service, and performance needs small businesses want more choice among providers.

4.2.1 Need for More Speed

Respondents were asked to specify the minimum Internet connection speed they need, as well as their desired connection speed. Nearly one-fourth of respondents say they need more than 10 Mbps for business purposes, while nearly one-half say that they desire speeds of greater than 10 Mbps. Interestingly, almost 30% of respondents desire a speed greater than 50 Mbps, which would require FTTP technology, or fiber close to the premises for DSL or cable modem.

Figure 18: Survey Respondent Internet Speed Needed and Desired (Aggregate)

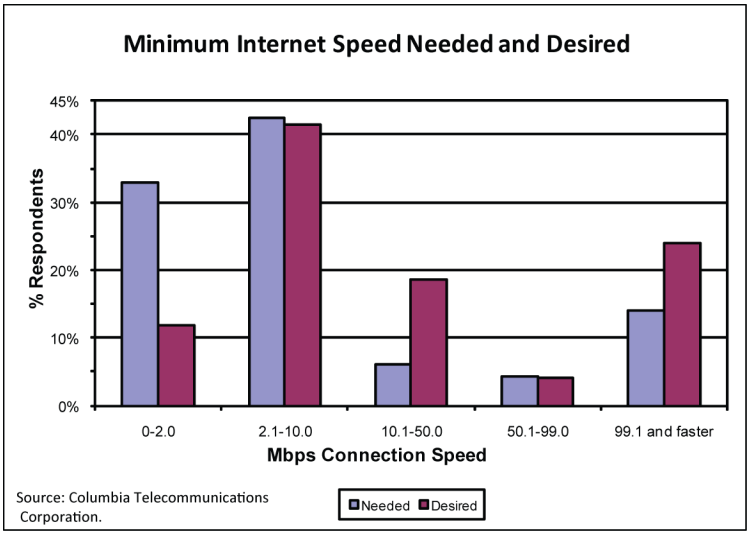
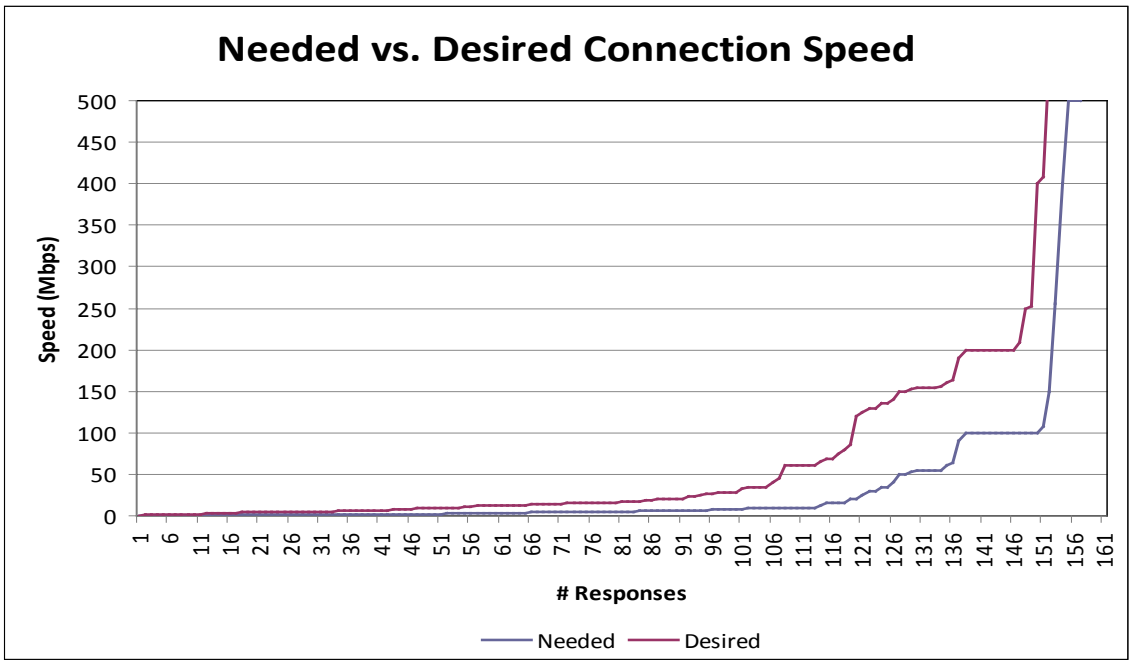


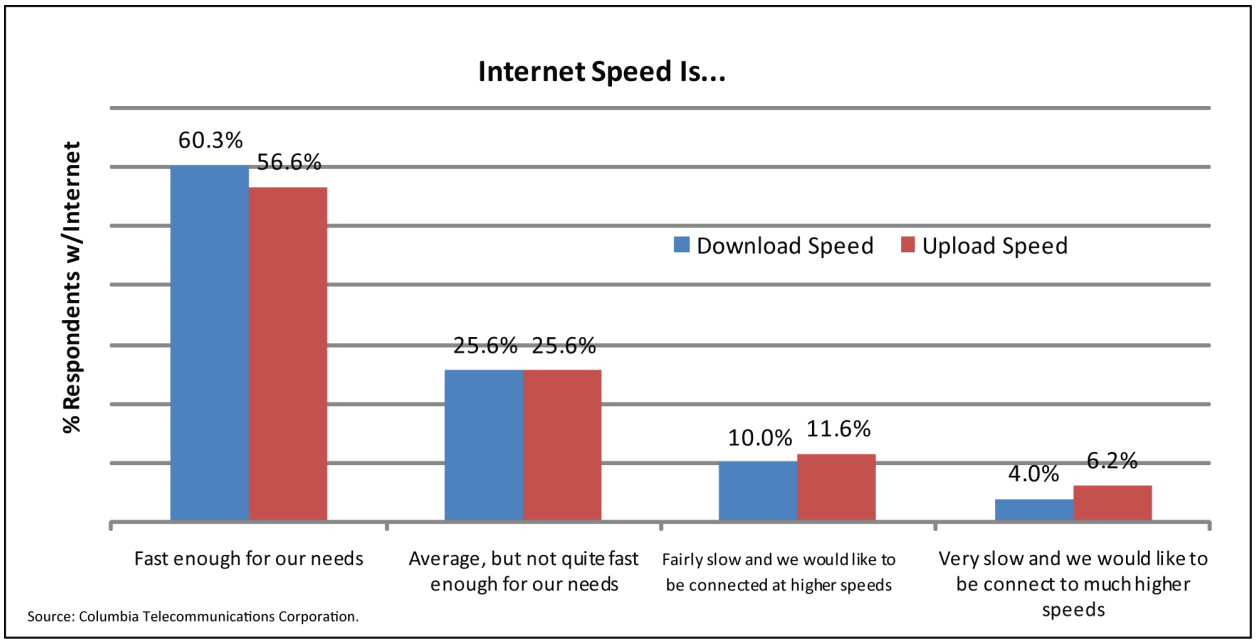
Figure 19 shows respondents' needed and desired Internet connection speeds with each line rank-ordered from highest to lowest (individual responses are not "paired" in this graph). There is a sizeable gap between the needed and desired speed at a need of about 10 Mbps. Approximately one-third of respondents see the need for more speed to meet their emerging needs.

Figure 19: Survey Respondent Internet Speed Needed vs. Desired (Aggregate)



Approximately 60% of respondents say that their Internet download speed is fast enough for their needs. Less than 5% say that their download speed is very slow, and these are primarily dial-up users.

Figure 20: Survey Respondent Internet Speed (Aggregate)



Metro respondents are more satisfied with their Internet speed, with 63% responding that their download speed is fast enough for their needs, compared to 52% of rural respondents (this difference is statistically significant).

Figure 21: Survey Respondent Satisfaction with Internet Download Speed (Rural/Metro)

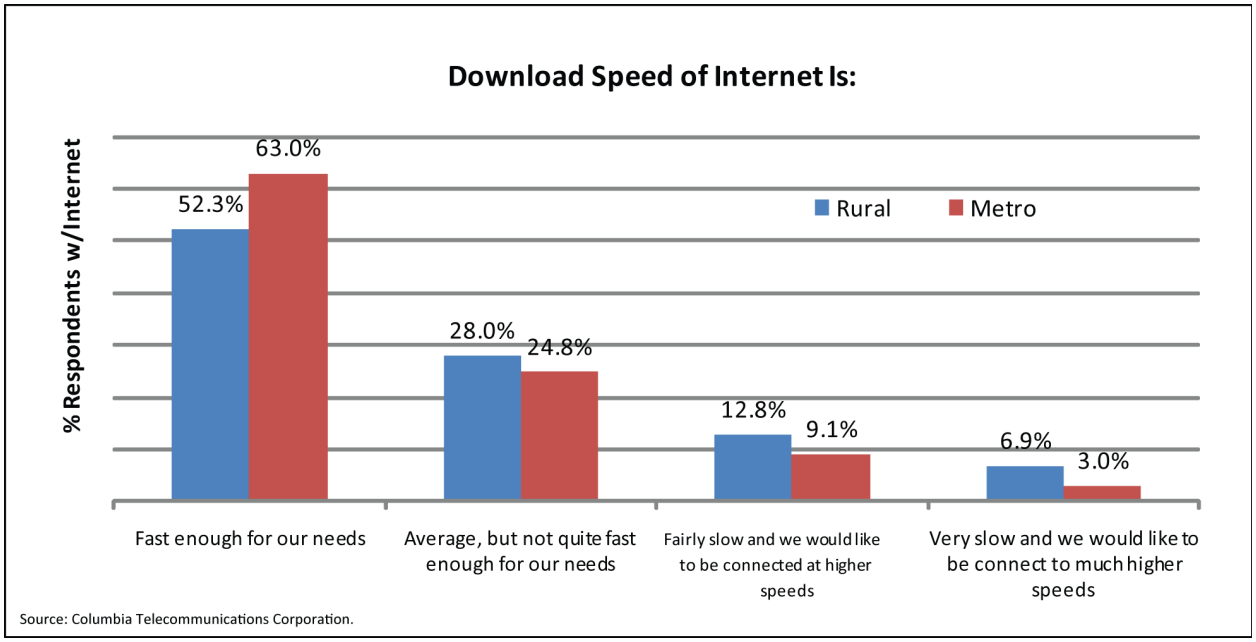
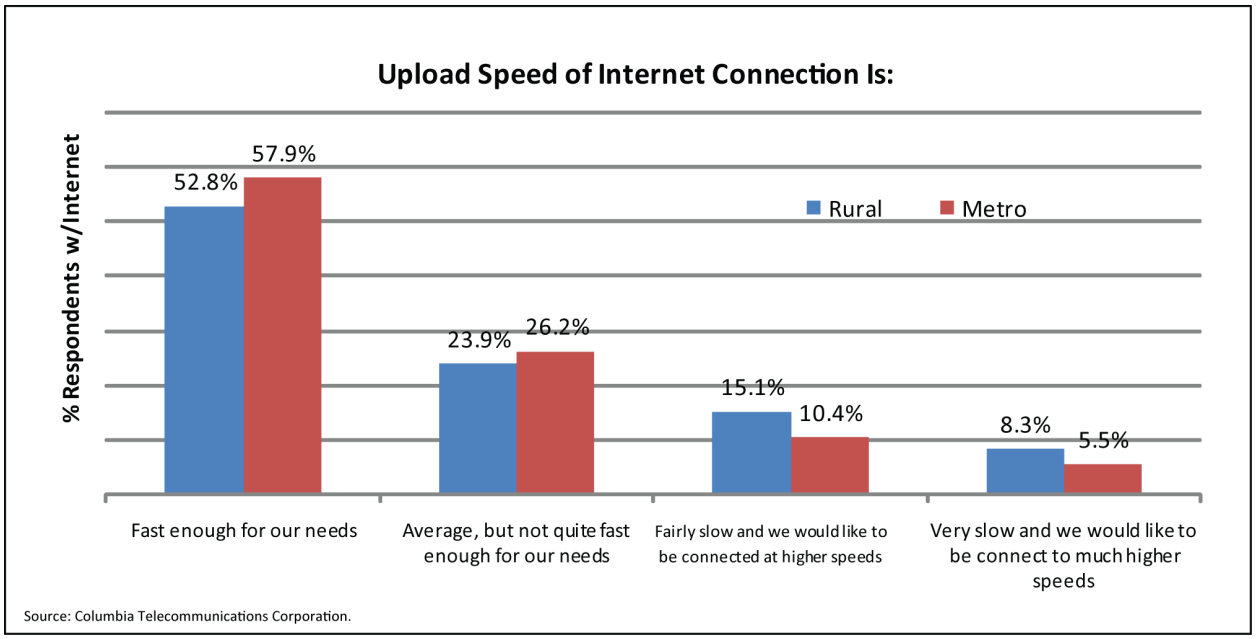


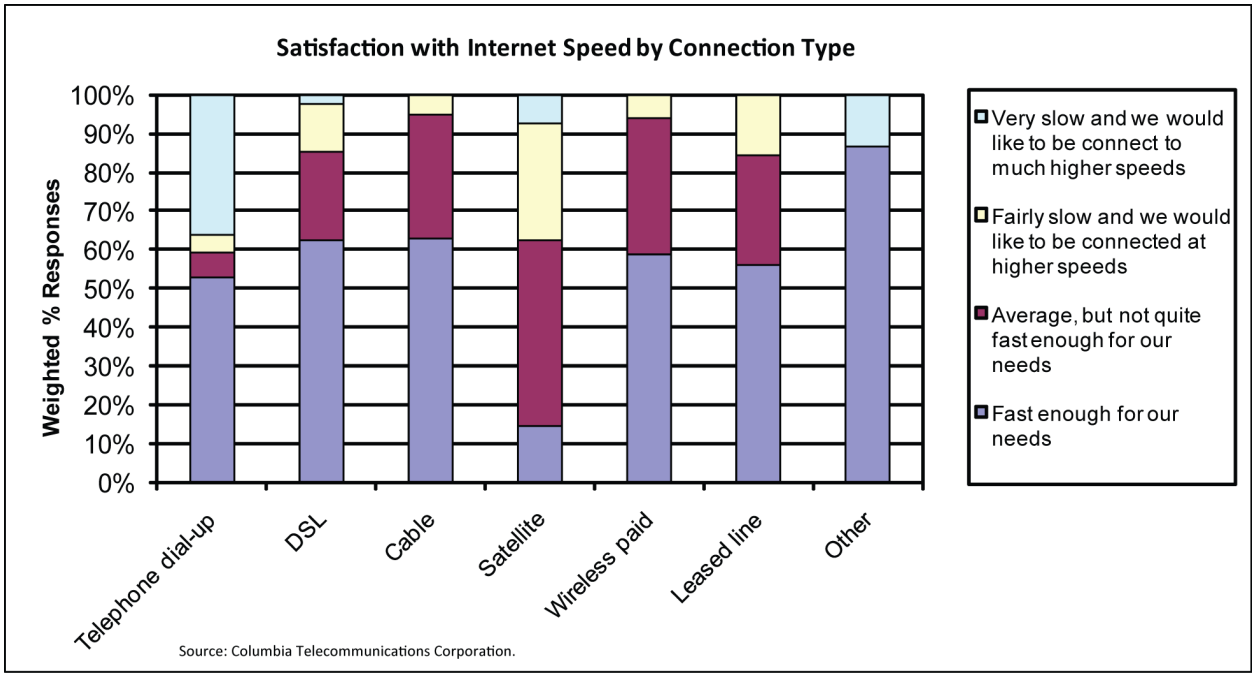
Figure 22: Survey Respondent Satisfaction with Internet Upload Speed (Rural/Metro)



As would be expected, respondents with dial-up connections are the most likely to say that their connections are very slow. The connection type with the least number saying that it is fast

enough for their needs is satellite. This indicates the desire of satellite Internet subscribers for higher-speed service.

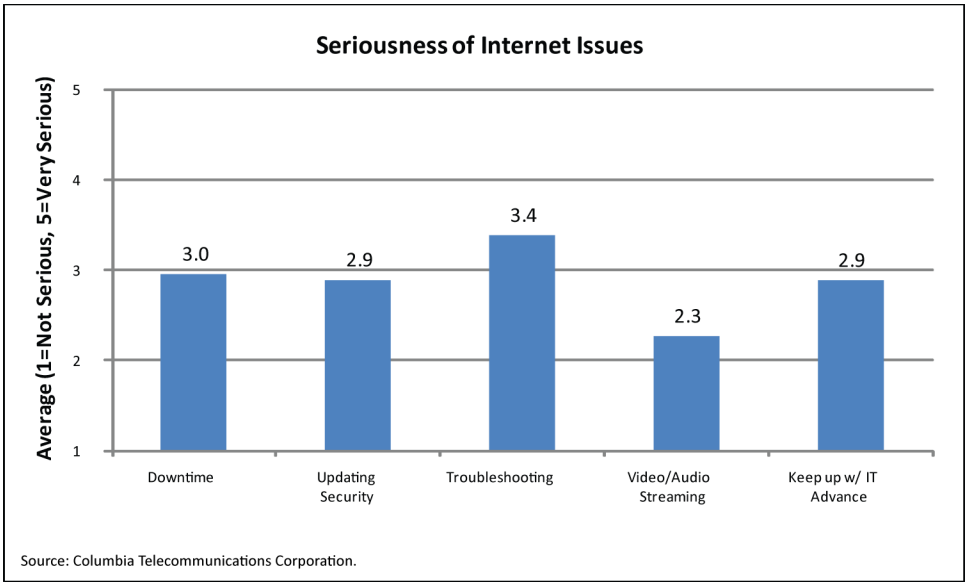
Figure 23: Survey Respondent Satisfaction with Internet Speed by Connection Type



4.2.2 Internet Use Issues

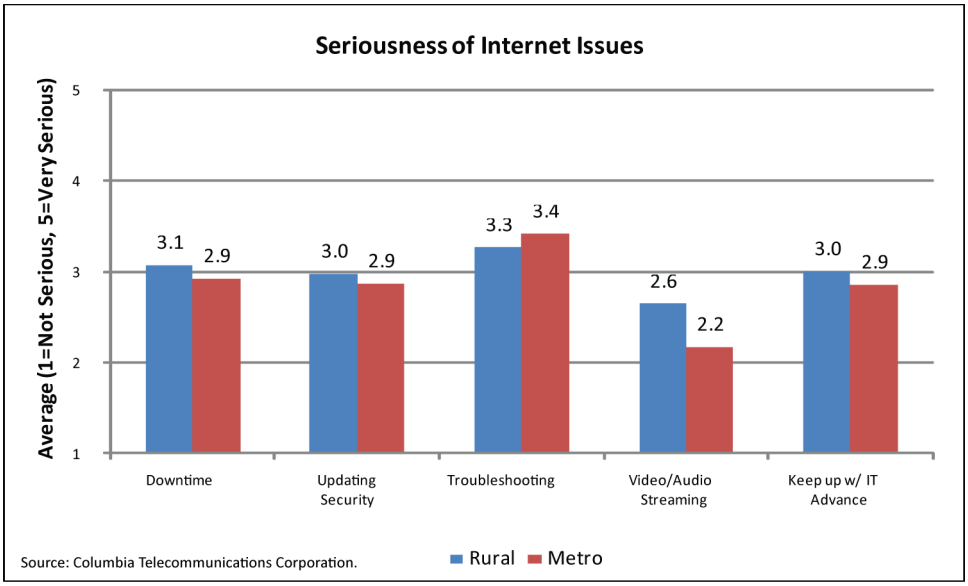
Businesses are most concerned about getting timely service when they have an Internet connectivity problem ("troubleshooting") and are least concerned about audio or video streaming tying up their systems.

Figure 24: Survey Respondent Internet Issues (Aggregate)



The most serious Internet connectivity problem identified by both rural and metro businesses is getting prompt troubleshooting service, while the impact of video/audio streaming tying up the system is the least serious problem. The only issue that is significantly different between rural and metro businesses is video/audio streaming, which might be related to slower connection speeds of rural businesses.

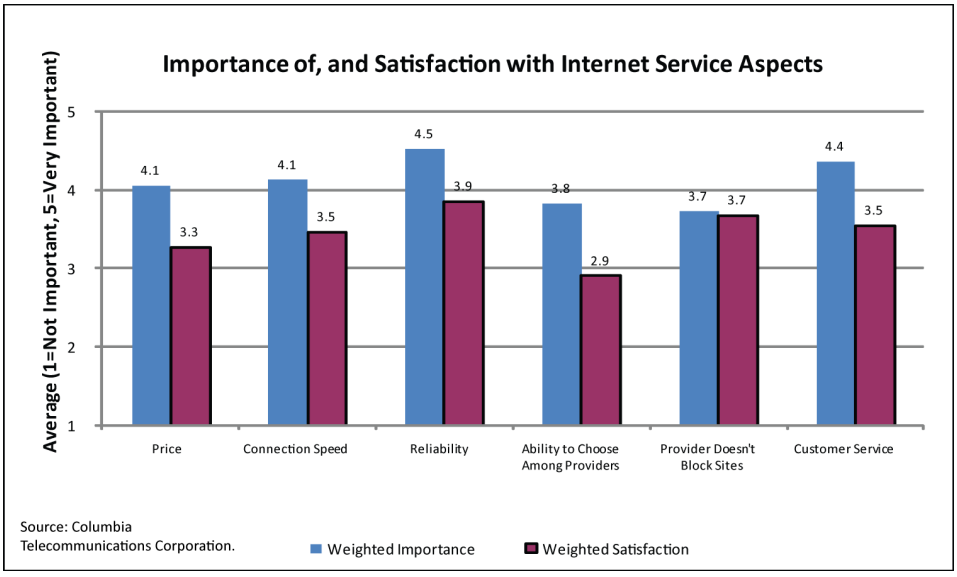
Figure 25: Survey Respondent Internet Connectivity Problems



4.2.3 Satisfaction with Internet Service Attributes

Businesses were asked to rank the importance of, and their satisfaction with, several key aspects of their Internet service. The largest gaps between importance and satisfaction are the ability to choose among competing providers and customer service. These responses highlight, in the eyes of small business Internet subscribers, the areas of greatest need for improvement by Internet service providers.

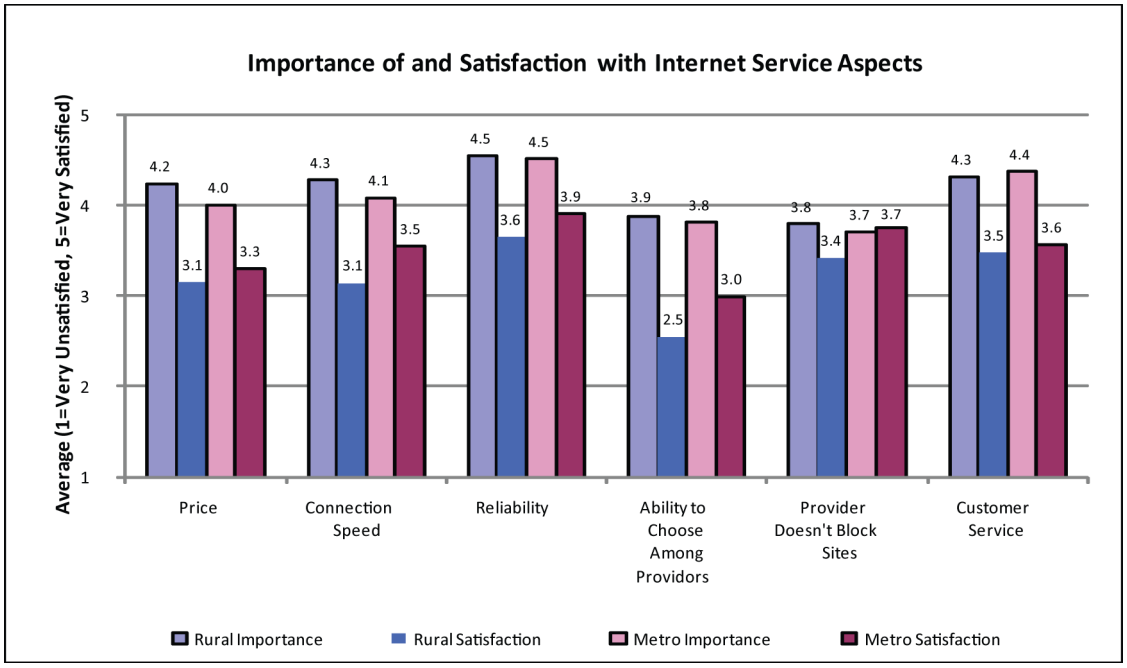
Figure 26: Survey Respondent Importance of and Satisfaction with Internet Service Aspects (Aggregate)



The levels of importance of different aspects of Internet service are very similar between metro and rural businesses, indicating that they place similar value on most aspects of Internet services. The only statistically significant differences are in price and speed; rural businesses placed slightly more importance on those aspects compared to metro businesses. Metro respondents are more satisfied with all aspects of Internet service, especially connection speed and their ability to choose among competing providers. In terms of satisfaction, the difference is statistically significant for all aspects except price and customer service.

For all respondents, there is a statistically significant gap between importance of and satisfaction with all aspects of Internet service except for the confidence that the Internet provider does not block selected Web sites. The widest gaps for rural businesses are connection speed and ability to choose among competing providers. The widest gaps for metro businesses are the ability to choose among providers and customer service.

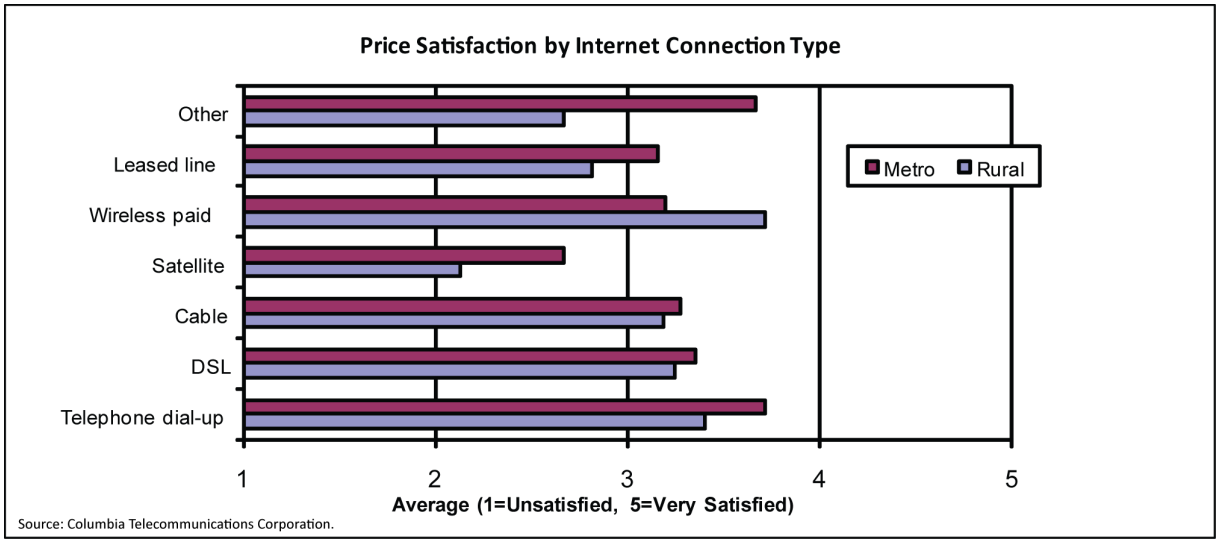
Figure 27: Survey Respondent Importance of and Satisfaction with Internet Service Aspects (Rural/Metro)



4.2.4 Satisfaction with Internet Service Price

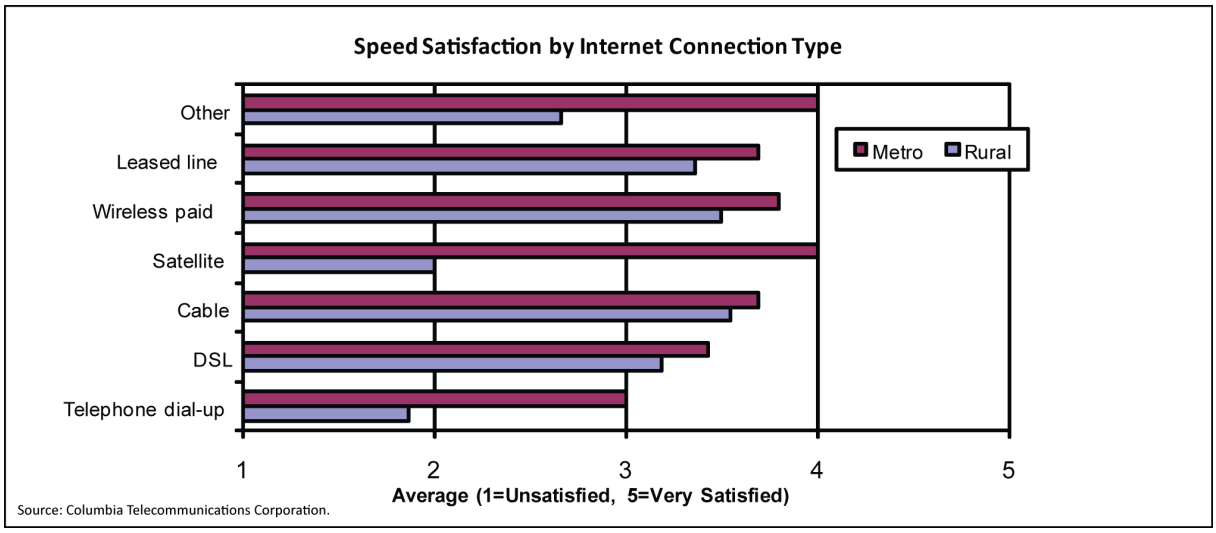
Subscribers for most types of Internet connections are somewhat satisfied with the price paid for Internet service. Respondents with satellite Internet service are the least satisfied with the price paid for service in both the rural and metro segments.

Figure 28: Survey Respondent Price Satisfaction by Internet Connection Type (Rural/Metro)



Respondents with leased-line, cable, DSL, and paid wireless Internet service are generally satisfied with their connection speed in both the metro and rural segments. Rural respondents with either satellite or dial-up Internet connections are the least satisfied with their connection speed. (In metro areas, where there are typically a number of service options, people who are not satisfied with their connection speeds can choose a new connection type; thus, metro users of dial-up or satellite have chosen those low-speed options. In rural areas, where service options are more limited, dial-up and satellite users typically do not have any other choice—and thus may be forced to use a low-speed service.)

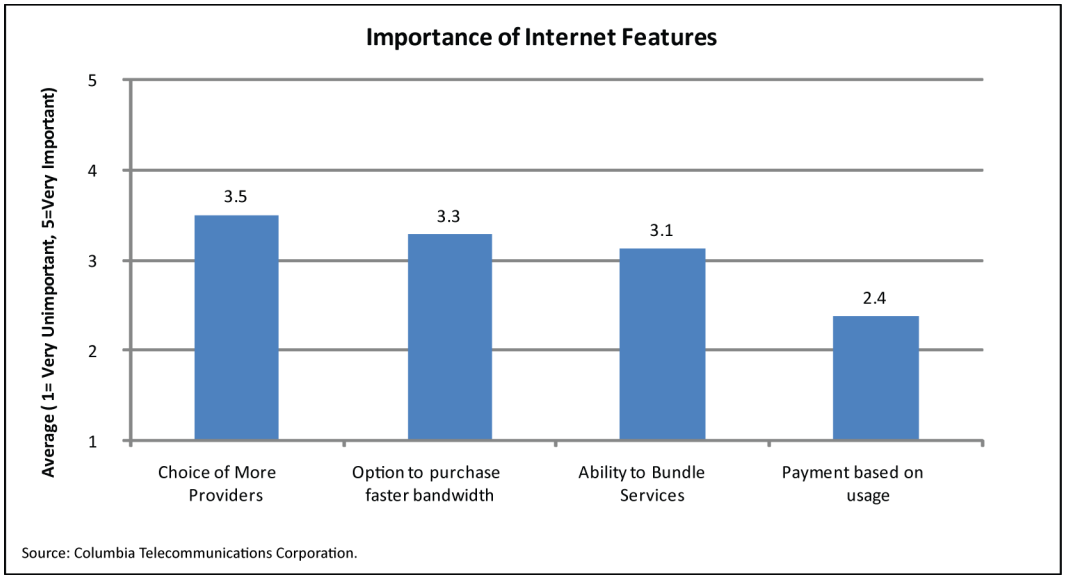
Figure 29: Survey Respondent Speed Satisfaction by Internet Connection Type (Rural/Metro)



4.2.5 Importance of Internet Features

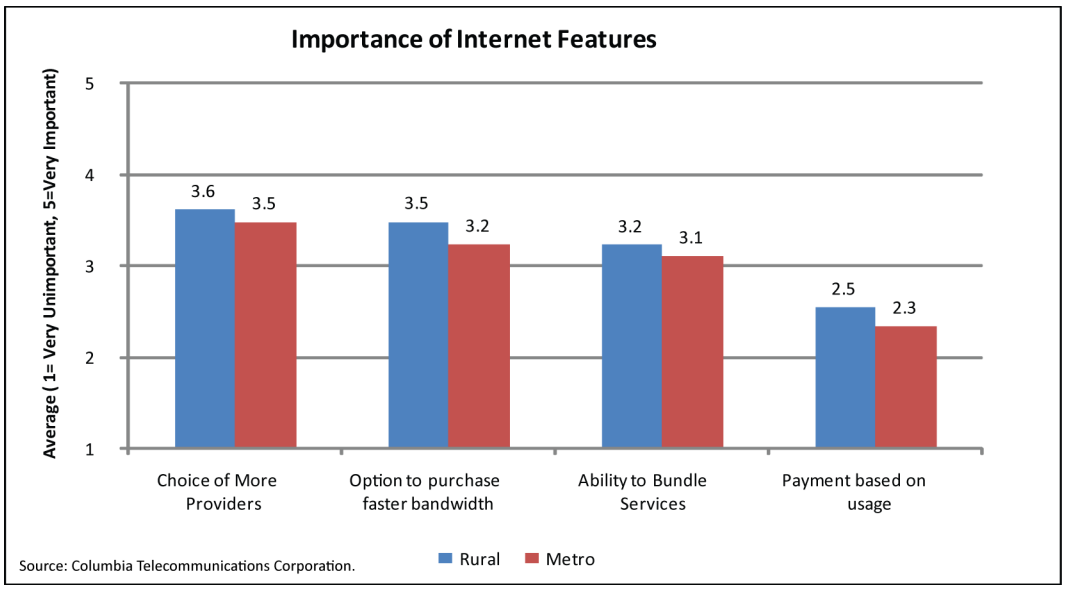
Of the choices presented in the survey, respondents stated that the most important Internet feature is the ability to choose from more providers, followed closely by the option to purchase faster bandwidth. The option to pay for Internet based on usage is of low importance to the small businesses.

Figure 30: Survey Respondent Importance of Internet Features (Aggregate)



Rural respondents placed slightly more importance on various Internet connection aspects, including a greater choice of providers, options to purchase very high speed bandwidth, bundling phone and Internet, and usage-based payments. However, none of the differences between rural and metro segments is statistically significant.

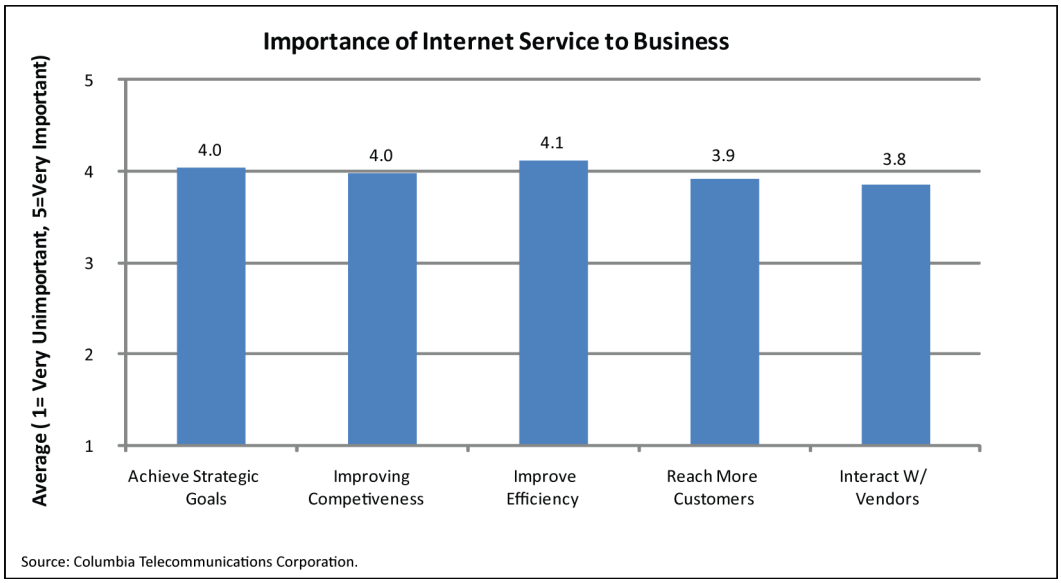
Figure 31: Survey Respondent Importance of Internet Features (Rural/Metro)



4.2.6 Importance of Internet Service to Business

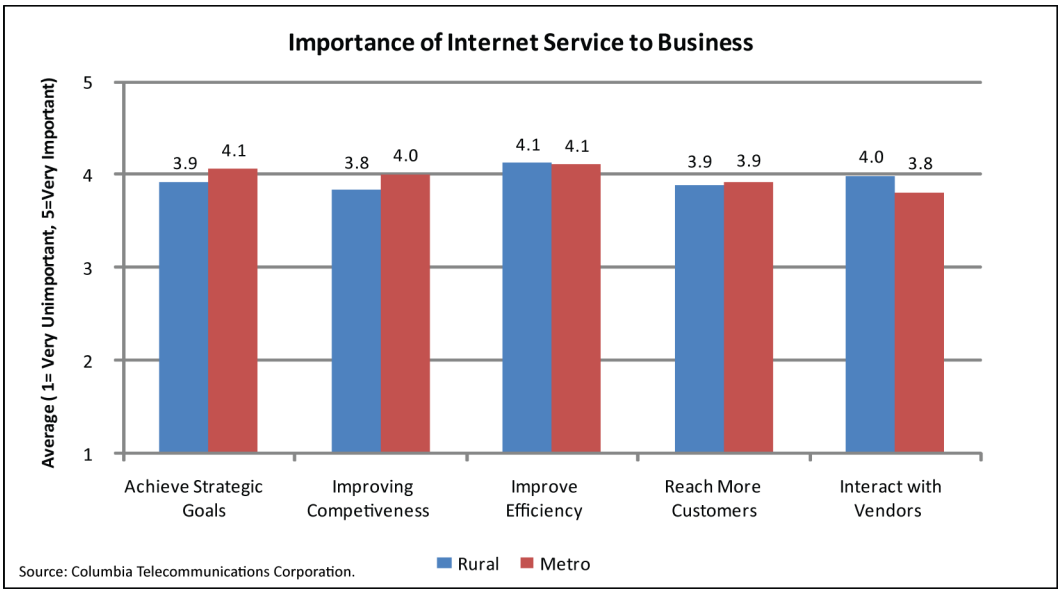
Respondents were asked how important Internet service is to several aspects of their businesses. Use of the Internet is important to many aspects of business, including the ability to achieve strategic goals, improve competitiveness and efficiency, reach customers, and interact with vendors.

Figure 32: Survey Respondent Importance of Internet Service to Business (Aggregate)



Businesses in both the metro and rural segments have very similar responses to the importance of all aspects including achieving strategic goals, improving competitiveness and efficiency, reaching customers, and interacting with vendors. These responses indicate that businesses in both rural and metro locations have similar views and values regarding the use of the Internet in business strategies and success.

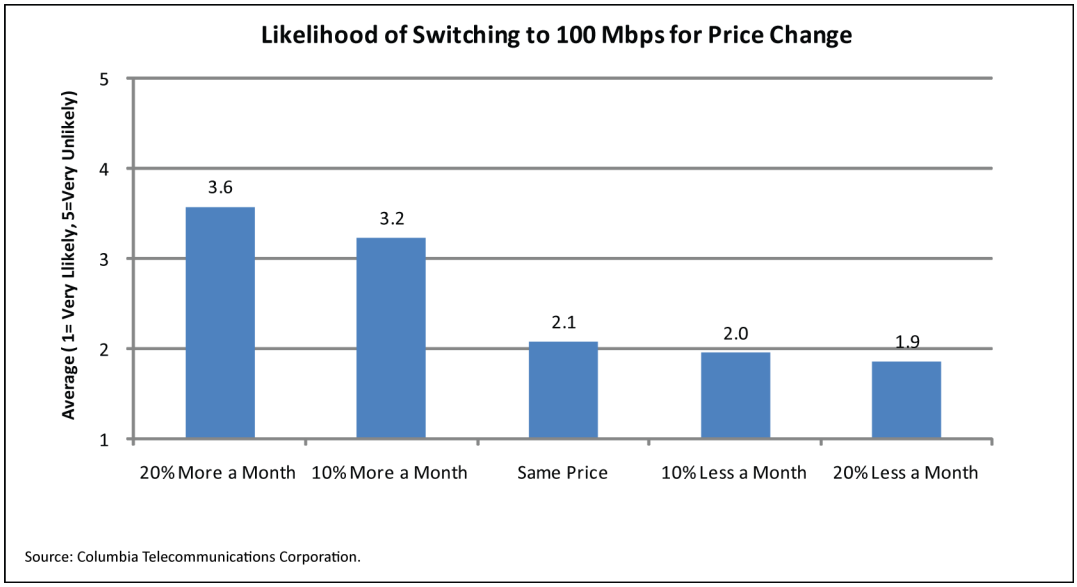
Figure 33: Survey Respondent Importance of Internet Service to Business (Rural/Metro)



4.2.7 Likelihood of Switching Internet Providers

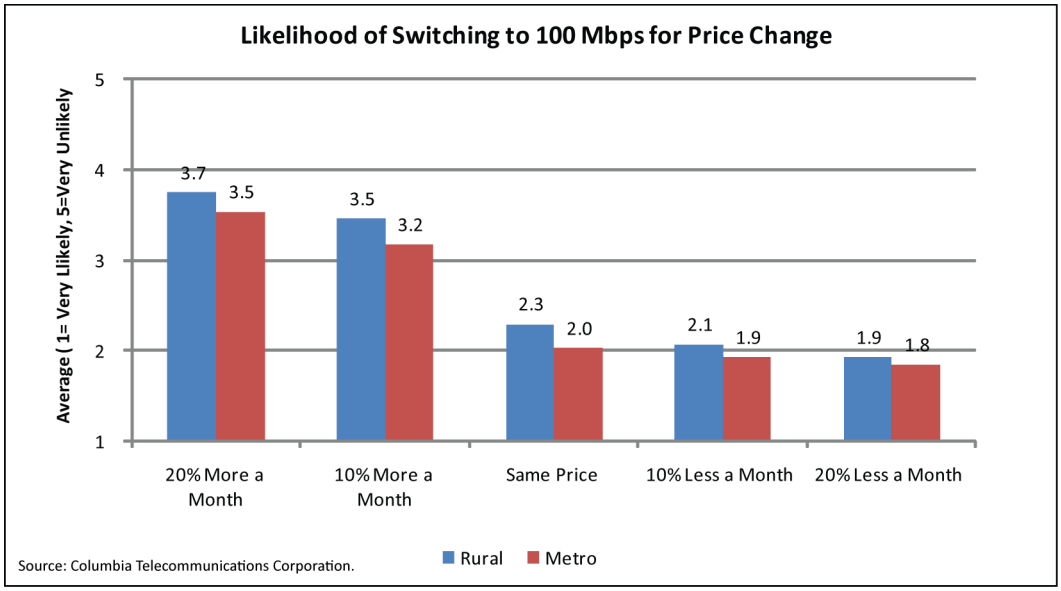
Respondents are likely to switch to a higher-speed Internet connection (100 Mbps) as long as the price does not increase. Even for a 10% price increase, businesses are significantly less likely to switch to higher-speed service.

Figure 34: Survey Respondent likelihood of Switching to 100 Mbps Service for Price Change (Aggregate)



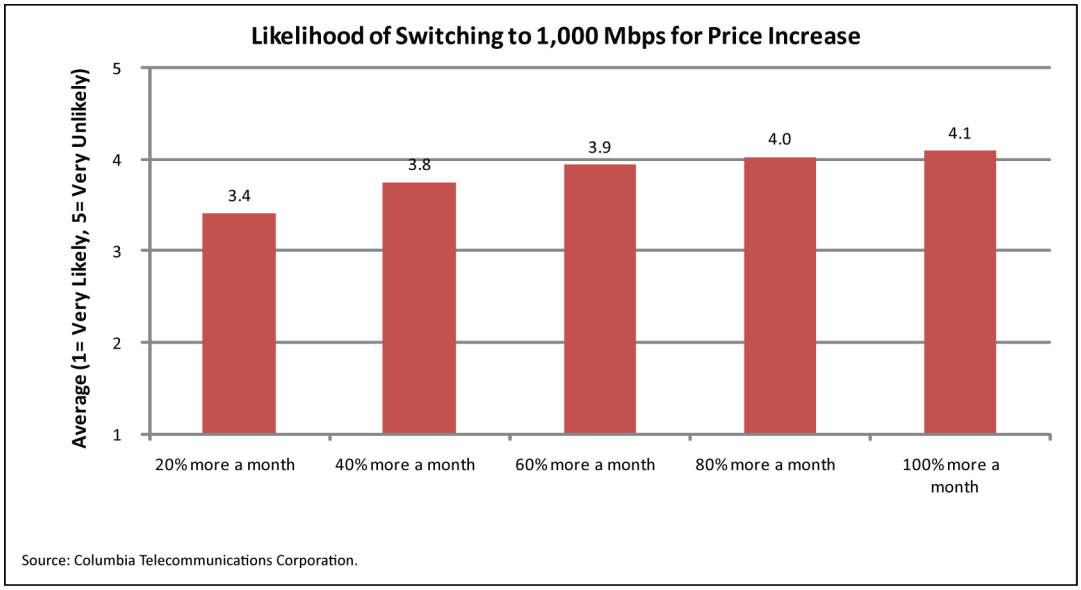
Rural respondents are slightly more likely to switch to 100 Mbps Internet service at all price levels. However, the differences are not statistically significant at any price level, higher or lower than the current price.

Figure 35: Survey Respondent Likelihood of Switching to 100 Mbps Service for Price Change (Rural/Metro)



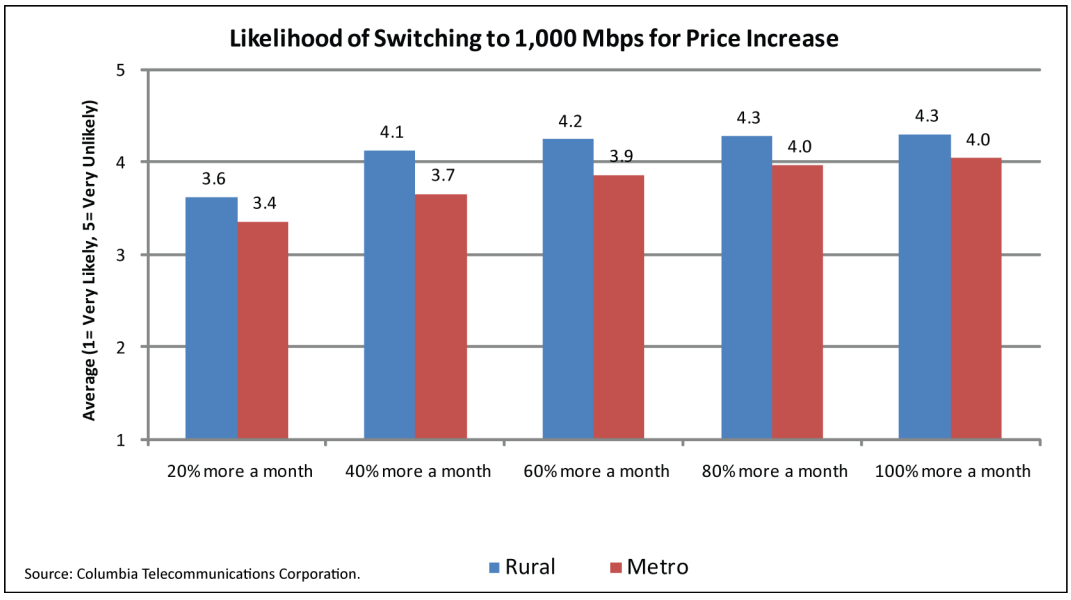
Businesses are somewhat hesitant to pay more for an extremely fast Internet connection of 1,000 Mbps. This is especially true for prices that are 40% or more higher than their current prices.

Figure 36: Survey Respondent Likelihood of Switching to 1,000 Mbps Service for Price Change (Aggregate)



Rural businesses are also somewhat more likely to switch to 1,000 Mbps Internet service for a price increase of any level compared to their current service. The differences are statistically significant in the 40%, 60%, and 80% categories. Notably, those with slower speeds are more eager to get *much* faster speeds; it may be that those who are satisfied with their service do not see a need for improvement. Because rural respondents pay less for their existing Internet service, the percentage increases translate to smaller dollar values for rural respondents.

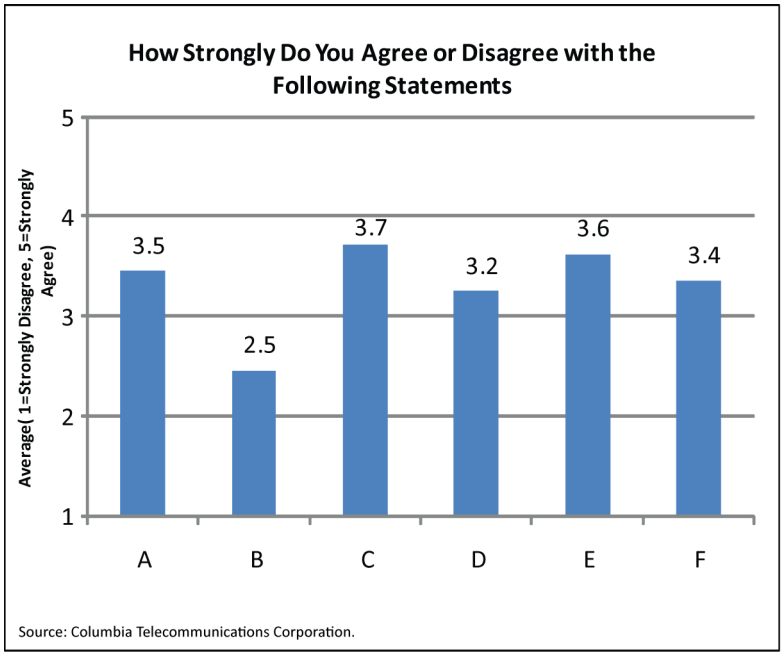
Figure 37: Survey Respondent Likelihood of Switching to 1,000 Mbps Service for Price Change (Rural/Metro)



4.2.8 Internet Service Has Become an Essential Service

Respondents generally agree that high-speed Internet access is an essential service, and that it improves efficiency, is available at affordable prices, and provides benefits to business. However, the respondents do not agree that the availability of high-speed Internet is a factor in business location decisions.

Figure 38: Survey Respondent Perception of Benefits of High-Speed Internet (Aggregate)



A: Our local market currently offers high-speed Internet access at prices that my business can afford.

B: The availability of affordable high-speed Internet acccess is a factor I consider in deciding where to locate my business.

C: High-speed Internet access is as essential to my business as other main services such as water and sewer or electricity.

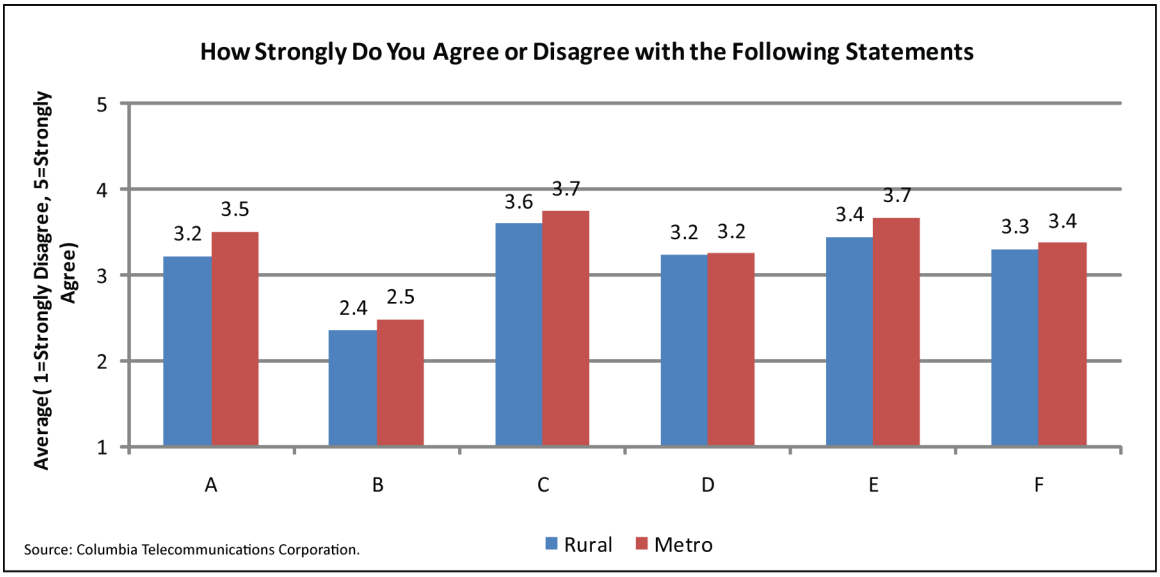
D: Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access.

E: Mobile access to the Internet will become more important to my business operations in the next 5 years.

F: Our business would realize greater long-term benefits by increasing our use of high-speed Internet access.

Metro respondents are slightly more likely to agree that their Internet service is important to various businesses aspects and successes. However, the differences are very small, with the only statistically significant difference in high-speed Internet affordability. The relatively small differences between the segments indicate that metro and rural businesses have similar perceptions of the benefits of high-speed Internet.

Figure 39: Survey Respondent Perception of Benefits of High-Speed Internet (Rural/Metro)

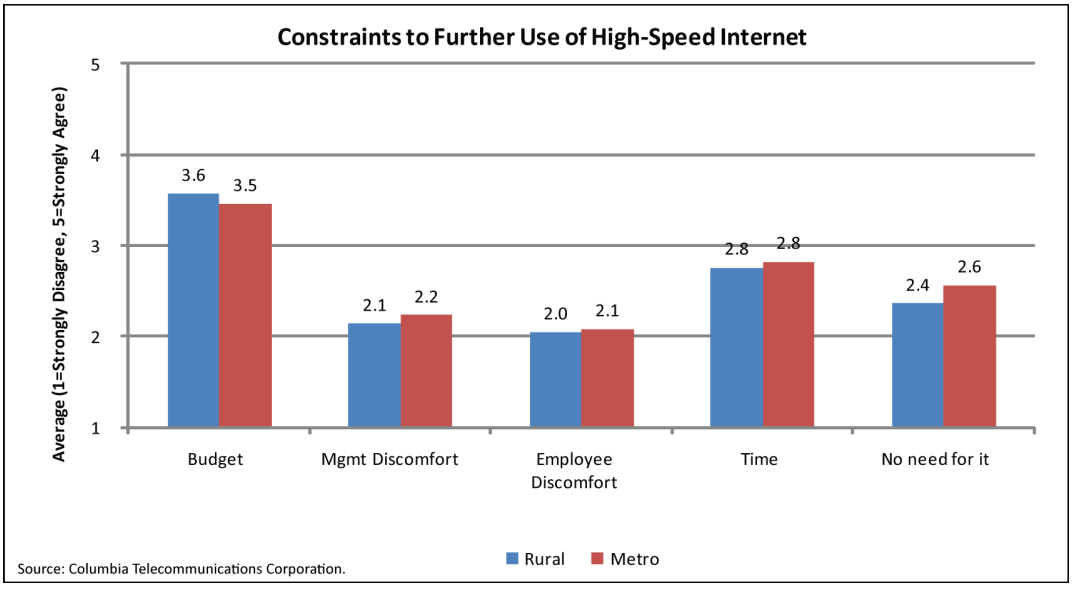


A: Our local market currently offers high-speed Internet access at prices that my business can afford.
B: The availability of affordable high-speed Internet acccess is a factor I consider in deciding where to locate my business.
C: High-speed Internet access is as essential to my business as other main services such as water and sewer or electricity.
D: Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access.
E: Mobile access to the Internet will become more important to my business operations in the next 5 years.
F: Our business would realize greater long-term benefits by increasing our use of high-speed Internet access.

4.2.9 Constraints to Further High-Speed Internet Use

Budget concerns are cited as the largest constraint to further use of high-speed Internet. There is little difference between rural and metro businesses in this regard. Across both segments, budget issues are the most important constraint to further use of high-speed Internet, while employee and management discomfort are the least important constraints.

Figure 40: Survey Respondent Constraints to Further Use of High-Speed Internet (Rural/Metro)



5. Conclusion

The Internet has transformed the way small businesses operate, communicate with employees, and interact with customers. Survey respondents indicate Internet service is an important tool for achieving strategic goals, improving competitiveness and efficiency, reaching customers, and interacting with vendors. Respondents further indicate that high-speed (broadband) Internet access is as essential to their business as other utilities such as water, sewer, or electricity (see Section 4).

Further, although there is not a significant difference between metro and rural markets in terms of businesses' need for broadband, there are significant differences between metro and rural areas with respect to availability of high-speed options, performance, and price of broadband.

Small businesses want both competition and choice (of providers and services) in broadband, and are dissatisfied with the choices they currently have available. The survey data demonstrate that the small business Internet market does not provide this competition or choice to small businesses—not necessarily from a price perspective, but from an overall performance and value perspective.[79] Of the options presented in the survey, for example, respondents stated that the most important features of Internet service are the ability to choose from more providers and improve customer service, followed closely by the option to purchase faster bandwidth.

Defining broadband on speed alone is challenging and inadequate. The number of applications that businesses need to run over their data and Internet connections continues to increase. The speed required to support these applications is also increasing. Therefore, what appears to be an adequate broadband speed today will appear to be as slow as dial-up tomorrow.

Businesses have a wide range of needs regarding the speed of their Internet access. While most businesses indicate they are able to obtain access to speeds they need at a price that is affordable, almost one-third of businesses indicate a need for speeds that require greater-capacity networks than currently exist in most of the United States.

Cable, wireless, and telephone companies will continue to advance the capabilities of their respective infrastructures, particularly in areas where revenues and return on investment are highest. However, it is not clear that they will expand their existing footprints to deploy new technologies in areas they do not currently serve. In addition, their existing infrastructures have significant limitations when compared to fiber-to-the-premises (FTTP), which reaches only a small fraction of the United States. The cable, wireless, and telephone company networks will require extensive upgrades, such as the construction of fiber optics closer to the premises, in order to provide businesses the capacity many currently need and most will eventually need.

[79] The survey found that businesses are generally satisfied with pricing (except for satellite services and leased lines—see Figure 28). The survey also found that businesses are generally satisfied with speed (except for satellite services and dial-up—see Figure 29). However we get a different perspective when we measure the difference between importance and satisfaction (see Figure 27).

5.1. Recommendations

Our findings in the survey and secondary research indicate that the Internet market is not meeting the needs of small businesses in the United States. Our findings show that the market for broadband in the United States is not competitive—resulting in poor performance and high prices for advanced services. Our findings are further amplified by the Berkman Report, which concludes that the United States is a middle-of-the-pack performer on most first-generation broadband measures, and a weak performer on prices for high speeds and next-generation speeds.[80] We recommend consideration of the following steps to assist in advancing the U.S. small business broadband market.

- Stay the course on national broadband planning and implementation of the National Broadband Plan.

The National Broadband Plan is an important first step in realizing the potential of ubiquitous broadband access and adoption, for small businesses as well as other sectors—but adequate follow-through with respect to regulatory goals and funding is essential to achieving the plan's goals. The experience of some countries in Europe and Asia illustrates the potential pitfalls of national broadband planning that is not paired with necessary funding. (See Section 3.5.)

In the United Kingdom, for example, the government recognized that "broadband makes a genuine and substantial impact on business productivity and competitiveness," particularly for small businesses.[81] It established high goals for its broadband market but relied largely on market forces to meet them, and in one significant study, ranked thirteenth among thirty nations for broadband.[82] The Information and Technology and Innovation Foundation (ITIF) asserts that this ranking may be attributed, in part, to inadequate funding for the government's stated goals.[83]

Similarly, the government of Germany—which placed broadband infrastructure at the core of a national initiative in 2003 to develop an "Information Society"—has not achieved its goals. Germany is ranked sixteenth among thirty nations for broadband.[84] ITIF attributes this ranking—which is similar to that of the United States and United Kingdom—to the government's failure to allocate adequate resources toward its broadband goals, focusing instead on "supporting research networks" and "developing national broadband coverage maps."[85]

- Encourage and enable small business broadband *providers* and other competitors by providing access to network infrastructure or otherwise lowering barriers to entry.

Significant effort is necessary to open the broadband provider market to small businesses. One of the unfortunate byproducts of recent regulatory activity has been the exclusion of small businesses from the broadband provider/ ISP market. While this outcome was likely unintended by regulators, thousands of existing U.S. small business ISPs were effectively removed from the

[80] Berkman, "Next Generation Connectivity," 78-81.
[81] Broadband Stakeholders Group, "UK National Broadband Strategy," 2.
[82] Atkinson, Correa, and Hedlund, "Explaining International Broadband Leadership," 6.
[83] Ibid., 21.
[84] Ibid., 6.
[85] Ibid., 21.

market over the course of the past decade—resulting in a far less robust competitive market and in decimation of a small business economic sector.

In the early years of the commercial Internet, when the dominant form of access was dial-up, enormous opportunity existed for small business providers because the law allowed them to purchase access to the networks of dominant providers such that they could reach consumers. The capital costs for entering the Internet provider market—little more than the price of appropriate hardware and software, and an Internet connection that could be resold to customers—were thus within reach of a small business. Absent the opportunity to purchase access to existing networks, small businesses would have had to undertake the extraordinary expense of building an entire communications network throughout a community to reach the consumer market.

In the former environment, small business Internet providers multiplied and thrived. But the past decade has seen a shift to the latter environment, and small businesses have disappeared from the market.

In the last decade, a series of regulatory and court decisions (see Section 3.4.2) eliminated the open, dynamic market for ISPs that had existed in the dial-up era in favor of the closed model that had been the norm for cable television services (i.e., the exclusion of competing companies from the networks of dominant cable and phone companies).

The outcome is that many ISPs cannot reach consumers because they cannot access the distribution networks to consumer homes and businesses. Providers can now reach customers only by building their own facilities—at a prohibitive cost that effectively precludes the participation of small businesses (or even competitive large businesses that do not already own facilities). It is impractical for small businesses to construct an entire physical broadband network (at the cost of tens or hundreds of millions of dollars) in order to enter the market.[86]

The dynamic small business provider market of the early commercial Internet era has ceased to exist, with the disappearance of many of the smallest providers.[87] In fact, while in the dial-up era there existed ten to fifteen ISPs per one hundred thousand customers, there are now fewer than two ISPs per one hundred thousand customers of high-speed Internet and less than one ISP per one hundred thousand customers for cable modem service.[88]

A possible solution to reopen this market to small businesses and other competitors is to afford them once again access to the distribution networks at reasonable cost. This model separates the requirement to own physical infrastructure from the ability to deliver services over that infrastructure. This outcome could be achieved by requiring access at a reasonable cost such that the dominant provider can make a profit and the competitive provider can access the network and reach potential customers.

[86] This situation is akin to a scenario in which the national road network were owned by UPS and closed to competitors; in order to provide service, small competitors (and even large ones such as FedEx and DHL) would be forced to build their own networks of roads and highways—a prohibitive barrier to small business participation.
[87] Hafner, "In Praise."
[88] Cooper, "Public Interest in Open Communication Networks," 8.

Alternatively (or additionally), this outcome could be achieved by facilitating and incentivizing networks that voluntarily make available to small businesses the opportunity to reach consumers by purchasing access over the distribution network.

The Berkman Report also concluded that the emphasis on open access policies appears to be warranted by the evidence collected in other countries which have sought to increase levels of completion by creating open access policies and otherwise lowering market entry barriers in their respective markets.[89]

- Define future broadband speeds to meet small business application needs.

The definition of broadband has been hotly debated, but the debate has frequently been dominated by self-interested industries that tend to define broadband in terms of the speed of the product or technology they offer. From a small business perspective, however, this is the wrong approach. *Application needs* should be the defining metric; in other words, broadband is a connection that is sufficient in speed and capacity such that it does not limit a user's required application. As users become more sophisticated, the speed and capacity of a given connection will need to continually increase to be considered adequate broadband. This definition must consider download and upload capacity—both of which are essential for small business growth and competitiveness.

It therefore follows that broadband should be defined in terms of a range of speeds, understanding that small business needs vary dramatically depending on location, field, and growth patterns. Most businesses suggest that download speeds of 2 Mbps to 10 Mbps meet current needs (see Figure 18), but almost 30% of business respondents indicated a need for speeds beyond 50 Mbps.

The definition of broadband should also take into account actual speeds as demonstrated at small business premises, rather than potential, peak, or theoretical speeds. As the FCC recently recognized in the National Broadband Plan, broadband carriers frequently advertise speeds that are far higher than those they actually deliver:

> [A]ctual experienced speeds for both downloads and uploads are materially lower than th[ose] advertised…. [T]he actual download speed experienced on broadband connections in American households is approximately 40–50% of the advertised "up to" speed to which they subscribe. The same data suggest that for upload speeds, actual performance is approximately 45% of the "up to" advertised speed (closer to 0.5 Mbps).[90]

It follows that the definition of broadband, as both a benchmark and a form of consumer education, should emphasize actual, not advertised or theoretical, speeds.

[89] Berkman, "Next Generation Connectivity," 82-88.
[90] Federal Communications Commission, "The National Broadband Plan."

- Provide small businesses accurate, actionable data to make broadband purchasing decisions.

There currently do not exist standards for how broadband is advertised and, as a result, the information released by providers is frequently insufficient for small businesses to make "apple-to-apple" comparisons of services.[91] Small business consumers would be able to make informed purchasing decisions if they had accurate, understandable information about broadband attributes that affect performance, including actual (not theoretical) upload and download speeds, and upload and download oversubscription.[92]

The current situation is a more complex version of an earlier technical situation: advertising for stereo equipment in the 1970s. At the time, a device's output wattage was considered the most important measure of its performance. Some stereo retailers and manufacturers advertised the peak-to-peak wattage, while others advertised the peak wattage and still others advertised the root mean square (RMS) wattage.[93] Because of the differences among these measurements, a stereo advertised at 100 Watts could actually have more effective output power than one advertised at 200 Watts. To eliminate consumer confusion, regulators ultimately required that advertised output power be in RMS.

A broadband location-certification program is another means by which small businesses could be provided with accurate, usable data to enable them to make informed decisions. The idea is that the government (or some independent, reliable, government-certified entity) would investigate areas where small businesses locate—and would certify the actual speeds and reliability of the broadband services available at that location. Thus, for example, a business park, office building, or strip mall could be certified at varying levels for broadband, enabling them to market that attribute to potential small business tenants. Small businesses would have reliable data regarding broadband as they made decisions regarding where to locate and whether to buy broadband services at that location. And private investment to these locations would be stimulated by both the certification process and the need to meet actual, not theoretical, speed thresholds to attain certification.[94]

- Protect small business consumers.

As consumers of broadband services, small businesses often face a number of distinct disadvantages that limit their choices and use of broadband. First, they are often required to sign one-, three-, or even five-year service contracts with typically steep penalties for early termination. Second, they pay higher rates than do residential customers for comparable service.

[91] The New America Foundation has called for "disclosure standards" for broadband providers. See Lennett et al., "Broadband Truth-in-Labeling."

[92] A network's oversubscription rate is the ratio of the sum of all subscribers' advertised bandwidth (e.g., one thousand subscribers who have been sold 1 Mbps service represent 1,000 Mbps in total subscribed bandwidth) to the capacity of the service provider's connection to the Internet. If the one thousand subscribers' provider has a 100 Mbps connection, then the oversubscription rate is 1,000 Mbps divided by 100 Mbps, or ten.

[93] Peak wattage is one-half of the peak-to-peak wattage; RMS is 0.707 times peak wattage.

[94] An analogous program has proven successful in South Korea, where buildings with high-speed access are issued a government certificate.

While the survey shows that small businesses are somewhat satisfied with the price they pay for most types of broadband connections, supplemental research to compare business and residential broadband services in a number of communities found that in each community, the business customers pay two to three times the price paid by residential customers for equivalent download and upload speeds (see Appendix C).

Further, a comparison of service options across all types of broadband technology shows the range of contract requirements to which small businesses must agree, either to get reduced pricing or to secure service at all (see Appendix F). These long contract terms essentially lock the businesses into their service.

Eliminating the barriers that prevent small businesses from switching broadband service providers and ensuring that providers cannot charge higher rates to small business customers than to residential customers would give businesses greater flexibility in buying affordable services that meet their needs.

- Consider creating federal broadband incentive programs that focus on small businesses.

Given the demonstrated importance of broadband access to small businesses, and the economic engine that small businesses represent, creating an incentive program that is focused on the infrastructure needs of small businesses could produce far-reaching benefits nationwide.

Small businesses need broadband training and adoption programs, as well. However, broadband adoption programs in the United States have tended to focus on the residential market, with particular targeting of schoolchildren, seniors, and those who are low-income.

Many small business consumers could be helped by broadband training programs that not only assist them in making informed purchasing decisions, but also assist them in fully realizing the benefits broadband offers small businesses. High-quality training courses focused on specific business uses for broadband could enable businesses to maximize their broadband connections for applications ranging from accounting to supply chain management to customer service.[95]

- Consider small business needs in Universal Service reform to support rural small businesses.

The United States has invested to achieve telecommunications Universal Service for decades, with a set of priorities based on providing to all Americans adequate services over adequate facilities at reasonable cost. But the focus of the Universal Service programs has been on institutions (through the e-rate program for schools and libraries and the rural health care pilot program for health care entities) and on residential service (through the High-Cost and Low Income programs).

[95] By way of example, the Chinese government has funded programs to support small business website design and construction, wireless applications, and marketing advice. The German government facilitates consulting advice to small and medium-size businesses.

As the United States undertakes the process of reforming the Universal Service Fund (USF) and its related programs, the needs of small business should be taken into account. The importance of small business in the daily lives of Americans and in the economic life of the nation cannot be underestimated—yet the survey data indicate that small businesses in rural areas lag behind their metro counterparts in terms of broadband access in general, and broadband speed in particular. The data also suggest that rural small businesses pay more than metro businesses for comparable broadband services.

Targeted federal funding, through the USF or another mechanism, could help close this rural/urban broadband gap among small businesses as USF has closed the rural/urban gap for telephone services.

A small business-focused program could improve service availability and access speeds by supporting investments in broadband infrastructure and promoting innovative broadband adoption efforts in rural areas. Similarly, future programs like BTOP could include consideration of areas of concentrated small business activity as "community anchors"—thus opening the way for construction of very-high-capacity fiber optics to those areas to support small business operations.

- Consider efforts that expand small business broadband deployment and adoption.

One such example is increasing broadband adoption through increased telecommuting, a use of the technology that is of great interest to both small businesses and their employees, and which offers a range of benefits. Increasing telecommuting could, in turn, lead to greater demand (i.e., a willing market) for broadband deployment, especially in rural and underserved areas.

According to the data, nearly half of small business employers currently allow telecommuting (see Figure 51). Notably, about 28% of rural businesses and 24% of metro businesses indicate that they would encourage more telecommuting if employees had very-high-speed Internet.

This finding has implications for home-based broadband access, because affordable, high-speed Internet access for employees appears to be a key factor in increasing the number of small businesses that allow telecommuting. For many employees, telecommuting may be limited by what they may perceive to be the prohibitive cost of owning a home computer and purchasing a home broadband subscription. This barrier to individual adoption could be overcome through tax incentives for employers who subsidize or provide broadband and hardware for employee home use.

If the number of small businesses that allow telecommuting were to increase, both businesses and employees could see cost savings; businesses, especially those in rural areas, would have access to an expanded labor pool; and whole communities might experience a range of social and environmental benefits.

Businesses with telecommuting employees can limit their monthly office expenses (e.g., mortgage or rental payment, utility costs) by using office space that is smaller than what they would need if all employees worked on site each day. Creating virtual offices would also lower employers' and employees' commuting costs. Ancillary savings for such costs as dry cleaning, take-

out coffee, and lunches at restaurants would also accrue to small businesses and their employees through the use of telecommuting arrangements.

Beyond the benefits to individual businesses or employees, though, reducing or eliminating employees' commutes through broadband-enabled telecommuting would lead to a set of "off the balance sheet" effects that would benefit entire communities. Research conducted in a number of cities found that increased telecommuting would create a significant positive environmental impact by reducing carbon emissions from vehicles, and reducing air pollution in general.

And in terms of the social benefits of telecommuting, reducing the number of commuters on the roads would lead to reduced traffic congestion and commuting time for those employees going to an office—and, particularly for employees who do not have to commute, the potential "soft" benefits of improved employee morale and an improved sense of their quality of life.

6. Bibliography

Ackerman, Michael J. *Telemedicine: Networks in the Service of Healthcare.* Presentation, 2010. http://courses.mbl.edu/mi/2010/presentations_spring/Telemed.ppt (accessed July 22, 2010).

Arbore, Alessandro, and Andrea Ordanini. "Broadband Divide Among SMEs: The Role of Size, Location and Outsourcing Strategies." *International Small Business Journal*, 2006: 83-99.

Asia-Pacific Development Information Programme. *The Role of Governments in Promoting ICT Access and Use by SMEs: Considerations for Public Policy.* APDIP e-Note 12, United Nations Development Programme, 2007. http://www.apdip.net/apdipenote/12.pdf/ (accessed September 30, 2010).

Atkinson, Robert D., Daniel K. Correa, and Julie A. Hedlund. *Explaining International Broadband Leadership.* Report, Washington, D.C.: Information Technology and Innovation Foundation, 2008. www.itif.org/index.php?id=142 (accessed September 30, 2010).

Atrostic, B.K., and Sang V. Nguyen. "IT and Productivity in U.S. Manufacturing: Do Computer Networks Matter?" *Economic Inquiry*, July 2005: 493 –506.

Bangemann, Martin et al. "Europe and the Global Information Society: Bangemann Report Recommendations to the European Council." *UMIC-Agency for the Knowledge Society.* 1994. http://www.umic.pt/images/stories/publicacoes200801/raport_Bangemanna_1994.pdf (accessed September 30, 2010).

Berkman Center for Internet & Society at Harvard University. "Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from Around the World." 2010. http://cyber.law.harvard.edu/pubrelease/broadband/ (accessed September 30, 2010).

Broadband Stakeholders Group. *UK National Broadband Strategy 2004.* UK Department for Business Innovation and Skills, 2004. http://www.bis.gov.uk/files/file13444.pdf (accessed September 30, 2010).

Broadband Wales Observatory. "United Kingdom Broadband Market Report 2005." Report, 2006. http://wales.gov.uk/topics/businessandeconomy/broadbandandict/broadband/?lang=en (accessed July 22, 2010).

Broadband Wales Observatory. "United Kingdom Broadband Market Report 2006." Report, 2007. www.bbwo.org.uk/broadband-3277 (accessed July 22, 2010).

Colombo, Massimo G., and Luca Grilli. "The Diffusion of Broadband-Based Applications Among Italian Small and Medium Enterprises." In *Telecommunication Markets: Drivers and Impediments*, edited by Peter Curwen, Justus Haucap and Brigitte Preissl, 174-185. Physica-Verlag Heidelberg, 2009.

Communications Workers of America. "A Report on Internet Speeds in All 50 States." Report, Washington, D.C., 2009. http://files.cwa-union.org/speedmatters/state_reports_2009/CWA_Report_on_Internet_Speeds_2009.pdf (accessed September 30, 2010).

Cooper, Mark. *Public Interest in Open Communication Networks.* Report, Consumer Federation of America, 2004.

Cooper, Mark. *The Importance of ISPs in the Growth of the Commercial Internet: Why Reliance on Facility-Based Competition Will Not Preserve Vibrant Competition and Dynamic Innovation on the High-Speed Internet.* Report, Consumer Federation of America, 2002. http://www.consumerfed.org/pdfs/ispstudy070102.pdf (accessed September 30, 2010).

Crandall, Robert, William Lehr, and Robert Litan. "The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of U.S. Data." *Issues in Economic Policy* (The Brookings Institution) 6 (2007). http://www.brookings.edu/papers/2007/06labor_crandall.aspx (accessed September 30, 2010).

Del Aguila-Obra, Ana R., and Antonio Padilla-Melendez. "Organizational Factors Affecting Internet Technology Adoption." *Internet Research*, 2006: 94-110.

Dutz, Mark, Jonathan Orzag, and Robert Willig. *The Substantial Consumer Benefits of Broadband Connectivity for U.S. Households.* Compass Lexicon for the Internet Innovation Alliance, 2009.

European Commission. "Glossary: Community survey on ICT usage in enterprises." *Eurostat Statistics Explained.* May 27, 2010. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Community_survey_on_ICT_usage_in_enterprises (accessed September 30, 2010).

European Union. "Newtime FP6 Project." *Broadband in Europe for All: A Multi-Disciplinary Approach (BREAD).* 2004. http://www.ist-bread.org/fp6_projects.asp?page=121 (accessed September 30, 2010).

"Farm Security and Rural Investment Act of 2002, Public Law 107-171." *U.S. Statutes at Large 116*, 2002: 6020.

Federal Communications Commission. *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities.* FCC 05-150, 2005 WL 2347773 (released September 23, 2005).

Federal Communications Commission. "Chapter 3: Current State of the Ecosystem-Exhibit 3-G." In *The National Broadband Plan*. Washington, D.C., 2010. http://www.broadband.gov/plan/3-current-state-of-the-ecosystem/ (accessed July 29, 2010).

—. "In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion (GN Docket Nos. 09-137, 09-051)." *Sixth Broadband Deployment Report.* July 20, 2010. http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0720/FCC-10-129A1.pdf (accessed July 29, 2010).

Fornefeld, Martin, Gilles Delaunay, and Dieter Elixmann. *The Impact of Broadband on Growth and Productivity.* Study, MICUS Management Consulting GmbH for the European Commission, 2008.

Gray, Colin. "Broadband and Its Effects on Small Business Networks: A Theoretical Framework and Some Empirical Findings." *48th International Council of Small Business World Conference.* Belfast, 2003.

—. "Microfirms Go Broadband for Business." *CORDIS ICT Results.* June 16, 2004. http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=65432 (accessed September 30, 2010).

Hafner, Katie. "In Praise of the Mom-and-Pop ISP." *New York Times.* August 17, 2000. http://www.nytimes.com/2000/08/17/technology/in-praise-of-the-mom-and-pop-isp.html (accessed July 10, 2010).

Horrigan, John B. *Broadband Adoption and Use in America.* OBI Working Paper Series No. 1, Washington, D.C.: Federal Communications Commission, 2010. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296442A1.pdf (accessed September 30, 2010).

Jayakar, Krishna, Amit Schejter, and Richard Taylor. *Small Businesses and Broadband: Key Drivers for Economic Recovery.* Working Paper, State College: Institute for Information Policy at Pennsylvania State

University, 2010. http://comm.psu.edu/about/centers/institute-for-information-policy/smallbusiness.pdf (accessed September 30, 2010).

Kim, Heekyung Hellen, Jae Yun Moon, and Shinkyu Yang. "Broadband Penetration and Participatory Politics: South Korea Case." *Proceedings of the 37th Hawaii International Conference on System Sciences (HICSS '04)-Track 5*. hicss, 2004. vol. 5, 4-5.

Lennett, Benjamin, Chiehyu Li, Dan Meredith, James Losey, Robb Topolski, and Sascha Meinrath. "Broadband Truth-in-Labeling." *New America Foundation.* September 23, 2009. http://oti.newamerica.net/publications/policy/broadband_truth_in_labeling (accessed October 1, 2010).

Lohrke, Franz T., Geralyn McClure Franklin, and Cynthia Frownfelter-Lohrke. "The Internet as an Information Conduit: A Transaction Cost Analysis Model of U.S. SME Internet Use." *International Small Business Journal*, 2006: 159-178.

Majumdar, S. K., O. Carare, and H. Chang. "Broadband Adoption and Firm Productivity: Evaluating the Benefits of General Purpose Technology." *Industrial and Corporate Change*, June 2010.

Miniwatts Marketing Group. *Internet World Stats: World Internet Usage and Population Statistics.* June 30, 2010. http://www.internetworldstats.com/stats.htm (accessed August 23, 2010).

Mohammed, Arshad. "FCC May Let Phone Companies Off DSL Hook." *Washington Post*, August 4, 2005. http://www.washingtonpost.com/wp-dyn/content/article/2005/08/03/AR2005080302126.html (accessed September 30, 2010).

National Cable & Telecommunications Assn. v. Brand X Internet Services. 545 U.S. 967 (2005).

Noguchi, Yuki. "Cable Firms Don't Have to Share Networks, Court Rules." *Washington Post*, June 28, 2005: http://www.washingtonpost.com/wp-dyn/content/article/2005/06/27/AR2005062700415.html (accessed July 21, 2010).

Organisation for Economic Co-operation and Development. "OECD Broadband Portal." *Services and speeds (5a): Average advertised download speeds, by country (Oct. 2009)*. June 10, 2010. http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html (accessed September 30, 2010).

Orlowski, Andrew. "FCC Opens Door to ISP Wipe-Out: Re-Monopolizing the Phone Service." *Andrew Orlowski blog.* August 6, 2005. http://andreworlowski.com/2005/08/06/fcc-opens-door-to-isp-wipe-out/ (accessed August 22, 2010).

Paczkowski, John. "The Median U.S. Broadband Speed? South Korea's Divided by Four." *All Things Digital.* August 26, 2009. http://digitaldaily.allthingsd.com/20090826/cwa/ (accessed September 30, 2010).

Paul, Ian. "South Korea to Get Super High-Speed Broadband." *PCWorld.* February 3, 2009. http://www.pcworld.com/article/158799/south_korea_to_get_super_highspeed_broadband.html (accessed September 30, 2010).

Pociask, Stephen B. *A Survey of Small Businesses' Telecommunications Use and Spending.* Report, Washington, D.C.: U.S. Small Business Administration, Office of Advocacy, 2004. http://www.sba.gov/advo/research/rs236tot.pdf (accessed September 30, 2010).

Pociask, Stephen B. *Broadband Use by Rural Small Businesses.* Report, Washington, D.C.: U.S. Small Business Administration, Office of Advocacy, 2005. http://www.sba.gov/advo/research/rs269tot.pdf (accessed September 30, 2010).

Porter, Michael. *Competitive Advantage: Creating and Sustaining Superior Performance.* New York: Free Press, 1985.

Smihly, Maria, and Hendrikus Storm. *ICT Usage in Enterprises 2009.* Data in Focus, Eurostat, 2010. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-10-001/EN/KS-QA-10-001-EN.PDF (accessed September 30, 2010).

"South Korea Tops in Broadband Penetration Study." *PhysOrg.com.* June 19, 2009. http://www.physorg.com/news164595432.html (accessed July 21, 2010).

Sullivan, Thomas M., Eric E. Menge, and Radwan Saade. "Ex Parte Presentation in a Non-Restricted Proceeding: Initial Regulatory Flexibility Analysis for Appropriate Framework for Broadband Access to the Internet over Wireline Facilities (CC Dkt. No. 02-33)." *Letter to Federal Communications Commission Chairman Michael K. Powell.* U.S. Small Business Administration Office of Advocacy, August 27, 2002. http://www.sba.gov/advo/laws/comments/fcc02_0827.pdf (accessed October 1, 2010).

—. "Ex Parte Presentation in a Non-Restricted Proceeding: Initial Regulatory Flexibility Analysis for Triennial Review of Unbundled Network Elements (CC Dkt. No. 01-338; CC Dkt. No. 96-98; CC Dkt No. 98-147)." *Letter to Federal Communications Commission Chairman Michael K. Powell.* U.S. Small Business Administration Office of Advocacy, February 5, 2003. http://www.sba.gov/advo/laws/comments/fcc03_0205.pdf (accessed October 1, 2010).

"Telecommunications Act of 1996, Public Law 104-104." *U.S. Statutes at Large 110*, 1996.

Texas Transportation Institute. "Annual Urban Mobility Report: Performance Measure Summary-Seattle, WA." *TTI: Urban Mobility Information.* 2009. http://mobility.tamu.edu/ums/congestion_data/tables/seattle.pdf (accessed September 30, 2010).

U.S. Congress. House. "Conference Report, Telecommunications Act of 1996." *104th Cong., 2d sess.* 1996. H. Rept. 104-458.

U.S. Department of Agriculture, Rural Utilities Service. "Notice of Funds Availability (NOFA) and solicitation of applications." *Federal Register (vol. 75, no. 14)*, January 22, 2010.

U.S. Department of Commerce, National Telecommunications and Information Administration. "Notice of Funds Availability (NOFA) and solicitation of applications." *Federal Register (vol. 75, no. 14)*, January 22, 2010.

U.S. Department of Justice. *The Herfindahl-Hirschman Index.* August 15, 2005. http://www.usdoj.gov/atr/public/testimony/hhi.htm (accessed June 29, 2010).

U.S. Environmental Protection Agency, Office of Mobile Sources. "Automobile Emissions: An Overview." *Fact Sheet OMS-5.* August 1994. http://www.epa.gov/OMS/consumer/05-autos.pdf (accessed July 12, 2010).

Xin, Gong. "3G applications to tap SMEs market potential." *China Economic Net.* February 5, 2010. http://en.ce.cn/Insight/201001/29/t20100129_20888385.shtml (accessed July 21, 2010).

Appendix A: Survey Instrument

This appendix contains the cover letter and complete survey instrument mailed to nearly ten thousand businesses nationwide in April 2010.

Impact of Broadband Speed and Price on Small Business

A Survey of Businesses for The U.S. Small Business Administration's Office of Advocacy

April 2010

SBA Office of Advocacy
www.sba.gov/advo

OMB Control Number: 3245-0371

Appendix A

The U.S. Small Business Administration's Office of Advocacy is exploring the ways in which small businesses access and use high-speed Internet services, and evaluating the importance of broadband speed and price for small businesses.

The purpose of this survey, which Advocacy is required to conduct by Congress under Public Law 110-385, Sec.105, is to gather information regarding your current use of Internet services and your projected future needs for services. The results of this survey will be incorporated into a report due to Congress by October 2010.

Columbia Telecommunications Corporation (CTC) has been awarded the contract (SBAHQ-09-C-0050) to conduct this research. The attached questionnaire is an important tool for filling the gap in available data.

The estimated time to complete this survey is 15 minutes. You are not required to respond to the survey unless it displays an OMB Control Number that is currently valid. Comments on the estimated completion time should be sent to the Small Business Administration, Chief AIB, 409 Third Street, SW, Washington, DC 20416, and the Desk Officer for the Small Business Administration, Office of Management and Budget, New Executive Office Building, Room 10202, Washington, DC 20503. DO NOT SEND THE COMPLETED SURVEYS TO THESE ADDRESSES.

Your participation in this survey is voluntary. If you choose to participate, this survey should be completed by the person who makes consumer decisions for your business use of Internet services.

Your time and effort are appreciated. Thank you in advance for completing and returning this important survey.

Please return the completed survey by May 14, 2010, in the enclosed postage-paid envelope.

If you have any questions regarding this survey, please contact Dr. Radwan Saade, Office of Advocacy, U.S. Small Business Administration, at 202-205-6878.

COMPUTERS AND INTERNET SERVICE

1. How many personal computers or terminals do you have at this location? *(✓only one)*

☐ 1 None *(Please skip to question 33 on page 76)*
☐ 2 1 to 4
☐ 3 5 to 9
☐ 4 10 to 49
☐ 5 50 to 99
☐ 6 100 or more

2. a) Do you have Internet access at your location? *(✓only one)*

☐ 1 Yes *(Please continue to question 3)*
☐ 2 No *(Please complete question 2b below)*

2b) What is the main reason your business does not have Internet access? *(✓only one and continue to question 33 on page 76)*

☐ 1 No need
☐ 2 Can access at another location (Please specify: _____)
☐ 3 Have concerns with online data security
☐ 4 Too expensive
☐ 5 Other (Please specify: _____)

3. Which types of Internet services are available at your business location (to the best of your knowledge)?
(✓all that apply)

☐ 1 Digital Subscriber Line (DSL)
☐ 2 Cable modem connection
☐ 3 Satellite (HughesNet, WildBlue, or other)
☐ 4 Wireless paid service (Clearwire or other)
☐ 5 Free wireless service
☐ 6 Leased line (T1, T3, Frame Relay, MetroEthernet, or other)

4. How does your business connect to the Internet? *(✓only one)*

☐ 1 Telephone line—dial-up
☐ 2 Digital Subscriber Line (DSL)
☐ 3 Cable modem connection
☐ 4 Satellite (HughesNet, WildBlue, or other)
☐ 5 Wireless paid service (Clearwire or other)
☐ 6 Free wireless service
☐ 7 Leased line (T1, T3, Frame Relay, MetroEthernet, or other) (Please specify: _____)
☐ 8 Other (Please specify: _____)

5. Approximately how much do you pay PER MONTH for Internet service at this location?

☐ 1 Less than $25
☐ 2 $25 to $49
☐ 3 $50 to $99
☐ 4 $100 to $249
☐ 5 $250 to $499
☐ 6 $500 to $749
☐ 7 $750 to $999
☐ 8 $1,000 or more
☐ 9 Don't know

6. What is the minimum broadband speed you need to operate your business? Please specify in Mbps: _____

7. What is your desired broadband speed to operate your business? Please specify in Mbps: _____

8. Would your need for broadband motivate you to relocate your business to a location that had higher-speed broadband available?

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

9. How many mobile (wireless with modem connections) laptop computers does your business support?

☐ 1 None supported by our business
☐ 2 1 to 4
☐ 3 5 to 9
☐ 4 10 to 49
☐ 5 50 to 99
☐ 6 100 or more
☐ 7 Don't know

10. Does your business have a Web site?

☐ 1 Yes, used for information and e-commerce (payments, etc.)
☐ 2 Yes, but it is not used for e-commerce
☐ 3 No

11. Do you support a virtual private network over the Internet?

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

12. Are you required to support any industry-specific Internet security requirements (example: financial industry or HIPAA medical standards)?

☐ 1 Yes

☐ 2 No

☐ 3 Don't know

13. Who has the most expertise on your firm's Internet connectivity? *(✓only one)*

☐ 1 You

☐ 2 An employee in the firm

☐ 3 An outside information technology (IT) services provider you use

14. Do you have <u>one or more</u> employees who spend at least half of their time on information technology (IT) matters such as Internet connectivity, fixing network problems, installing and fixing computer hardware and software, managing a Web site, etc.?

☐ 1 Yes

☐ 2 No

SATISFACTION WITH & IMPORTANCE OF INTERNET SERVICES

15. Would you say your <u>download</u> Internet connection speed (transfer of data to a PC) is: *(✓only one)*

☐ 1 Fast enough for our needs

☐ 2 Average, but not quite fast enough for our needs

☐ 3 Fairly slow and we would like to be connected at higher speeds

☐ 4 Very slow and we would like to be connected at much higher speeds

16. Would you say your <u>upload</u> Internet connection speed (transfer of data from a PC) is: *(✓only one)*

☐ 1 Fast enough for our needs

☐ 2 Average, but not quite fast enough for our needs

☐ 3 Fairly slow and we would like to be connected at higher speeds

☐ 4 Very slow and we would like to be connected at much higher speeds

17. Using a scale of 1 to 5, how SERIOUS are these Internet connectivity problems for your business:

Problem	*Not at All Serious*				*Very Serious*
(a) Downtime	1	2	3	4	5
(b) Updating online security on our computers	1	2	3	4	5
(c) Getting timely or prompt service when we have a problem	1	2	3	4	5
(d) Online audio or video streaming tying up our system	1	2	3	4	5
(e) Keeping up with the speed of technological advances in IT	1	2	3	4	5

18. Using a scale of 1 to 5, please rate how IMPORTANT the following aspects of INTERNET service are to your business:

Aspect	*Very Unimportant*				*Very Important*
(a) Total price paid for service	1	2	3	4	5
(b) Connection speed	1	2	3	4	5
(c) Reliability (uptime)	1	2	3	4	5
(d) Ability to choose among competing providers	1	2	3	4	5
(e) Confidence that Internet provider does not block selected Web sites	1	2	3	4	5
(f) Customer service	1	2	3	4	5

19. Using a scale of 1 to 5, please rate how SATISFIED you are with the following aspects of your INTERNET service:

Aspect	*Very Unsatisfied*				*Very Satisfied*
(a) Total price paid for service	1	2	3	4	5
(b) Connection speed	1	2	3	4	5
(c) Reliability (uptime)	1	2	3	4	5
(d) Ability to choose among competing providers	1	2	3	4	5
(e) Confidence that Internet provider does not block selected Web sites	1	2	3	4	5
(f) Customer service	1	2	3	4	5

20. On a scale of 1 to 5, please rate how IMPORTANT these features are to your business:

Feature	*Not at All Important*				*Very Important*
(a) Choice of a greater number of phone and Internet providers	1	2	3	4	5
(b) Option to purchase Internet bandwidth with speeds 10 to 100 times that of cable modem or DSL	1	2	3	4	5
(c) Ability to bundle phone and Internet on the same monthly bill	1	2	3	4	5
(d) Ability to pay for Internet based on usage (amount of data)	1	2	3	4	5

21. Using a scale of 1 to 5, please rate how IMPORTANT your INTERNET service is to the following aspects of your business:

Business Aspect	*Very Unimportant*				*Very Important*
(a) Ability to achieve your strategic goals	1	2	3	4	5
(b) Improving competiveness	1	2	3	4	5
(c) Improving operational efficiency	1	2	3	4	5
(d) Ability to reach more customers	1	2	3	4	5
(e) Ability to interact with vendors/partners	1	2	3	4	5

22. On a scale of 1 to 5, how LIKELY are you to switch to much faster Internet service (100Mbps—more than 10 times faster than DSL or cable modem) if it costs (compared to your current service):

Change in Price per Month	*Very Likely*				*Very Unlikely*
(a) 20% more per month?	1	2	3	4	5
(b) 10% more per month?	1	2	3	4	5
(c) The same price?	1	2	3	4	5
(d) 10% less per month?	1	2	3	4	5
(e) 20% less per month?	1	2	3	4	5

23. On a scale of 1 to 5, how LIKELY are you to switch to much faster Internet service (1,000Mbps—more than 100 times faster than DSL or cable modem) if it costs (compared to your current service):

Change in Price per Month	*Very Likely*				*Very Unlikely*
(a) 20% more per month?	1	2	3	4	5
(b) 40% more per month?	1	2	3	4	5
(c) 60% more per month?	1	2	3	4	5
(d) 80% more per month?	1	2	3	4	5
(e) 100% more per month?	1	2	3	4	5

24. Using a scale where 1 is STRONGLY DISAGREE and 5 is STRONGLY AGREE, please indicate whether or not you agree with the following statements.

Statement	*Strongly Disagree*				*Strongly Agree*
(a) Our local market currently offers high-speed Internet access at prices that my business can afford.	1	2	3	4	5
(b) The availability of affordable high-speed Internet access is a factor I consider in deciding where to locate my business.	1	2	3	4	5
(c) High-speed Internet access is as essential to my business as other main services such as water and sewer or electricity.	1	2	3	4	5
(d) Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access.	1	2	3	4	5
(e) Mobile (outside the office) access to the Internet will become more important to my business operations in the next 5 years.	1	2	3	4	5
(f) Our business would realize greater long-term benefits by increasing our use of high-speed Internet access.	1	2	3	4	5

25. Using a scale of 1 to 5, please indicate to what extent you AGREE or DISAGREE that the following <u>constrain the ability of your business to further use high-speed Internet</u>.

Statement	*Strongly Disagree*				*Strongly Agree*
(a) Budget or finance considerations	1	2	3	4	5
(b) Management discomfort with greater use of high-speed Internet	1	2	3	4	5
(c) Employee discomfort with greater use of high-speed Internet	1	2	3	4	5
(d) No time to explore greater use of high-speed Internet	1	2	3	4	5
(e) No need to further use high-speed Internet	1	2	3	4	5

26. Does your business currently allow telecommuting (working from home)? *(✓only one)*

☐ 1 Yes

☐ 2 No, and unlikely to allow telecommuting next year

☐ 3 No, but possibly next year

27. What percent of employees take advantage of telecommuting?

1 None
2 About 10% of employees (1 in 10)
3 About 20%
4 About 30%
5 About 40%
6 About 50%
7 More than 50%
8 Don't know

28. Would your business allow or encourage more telecommuting if employees had home Internet connections that supported very high-speed data transfers and high-quality video-conferencing?

1 Yes
2 No
3 Don't know

29. Do you reimburse employee expenses (full or partial) for a home Internet connection if it is used for business purposes?

1 Yes
2 No
3 Don't know

30. Do you use video-conferencing, and if yes, which type?

1 No, we do not use video-conferencing
2 Yes, we use desktop—Web-based
3 Yes, we use conference room—portable
4 Yes, we use conference room—fixed
5 Yes, we use another type (Please specify: _____)

31. Has your business considered using a VoIP (Voice over Internet Protocol) telephone service?

1 Yes, already use *(Please answer 31b below)*
2 Yes, considered but did not use
3 Yes, under consideration
4 No, I am familiar with it but am not considering
5 Unfamiliar with the technology
6 Don't know

31b) Which type(s) of VoIP do you use? *(✓only one)*

1 Internal LAN
2 External via Internet connection
3 Both internal LAN and external Internet connection

32. Does your business provide or reimburse employee expenses for a cell phone or handheld data service, and if yes, for how many employees?

1 No employees provided or reimbursed

2 Yes, 1 to 4 employees

3 Yes, 5 to 9 employees

4 Yes, 10 to 49 employees

5 Yes, 50 to 99 employees

6 Yes, 100 or more employees

7 Don't know

BUSINESS PRACTICES AND STRATEGIES

Instructions: The following questions are designed to determine your company's business practices and strategies. Please circle the number that best reflects **actual** conditions in your company.

For example, in question 33, if your company has a strong emphasis on research and development (R&D), a 4 or 5 choice is appropriate; if your company has an emphasis on production of established products, a 1 or 2 is appropriate; and if your company balances both R&D and production, a 3 choice is appropriate.

33. In general, my company favors:

Product Emphasis						R&D Emphasis
A strong emphasis on the marketing of tried-and-true products or services	1	2	3	4	5	A strong emphasis on R&D, technological leadership, and innovation

34. How many new lines of products/services has your company marketed in the past 3 years?

	Low		Neutral		High	
No new lines of products/services	1	2	3	4	5	Many new lines of products/services
Changes in product/ service lines have been mostly minor in nature	1	2	3	4	5	Changes in product/ service lines have usually been quite dramatic

35. In dealing with competitors, my company:

	Responds		Neutral		Initiates	
Typically responds to actions that competitors initiate	1	2	3	4	5	Typically initiates actions to which competitors then respond
Is very seldom the first business to introduce new products/services, admin techniques, operating technologies, etc.	1	2	3	4	5	Is very often the first business to introduce new products/services, admin techniques, operating technologies, etc.
Typically seeks to avoid competitive clashes, preferring a "live-and-let-live" posture	1	2	3	4	5	Typically adopts a very competitive, "undo-the-competitors" posture

36. In general, my company has:

	Low		Neutral		High	
A strong appetite for low-risk projects (with normal and certain rates of return)	1	2	3	4	5	A strong appetite for high-risk projects (with chances of very high returns)

37. Owing to the nature of the environment, my firm generally:

	Cautious		Neutral		Bold	
Explores gradually via cautious, incremental behavior	1	2	3	4	5	Takes bold, wide-ranging actions to achieve the firm's objectives

38. When confronted with decision-making situations involving uncertainty, my company typically:

	Methodical		Neutral		Aggressive	
Adopts a "wait-and-see" posture to minimize the probability of making a costly decision	1	2	3	4	5	Adopts a bold, aggressive posture to maximize the probability of exploiting potential opportunities

COMPANY INFORMATION

39. Which best describes your position in the business?

☐ 1 Owner/Manager

☐ 2 Owner, but not manager

☐ 3 Manager, but not owner

☐ 4 Other

40. To which age group do you belong?

☐ 1 18 to 34 years

☐ 2 35 to 44 years

☐ 3 45 to 54 years

☐ 4 55 to 64 years

☐ 5 65 years or older

41. Is this business operated primarily from the home, including any associated structures such as a garage or a barn?

☐ 1 Yes

☐ 2 No

42. How long ago was this business started?

1 5 years or less
2 6 – 10 years
3 11 – 20 years
4 21 – 30 years
5 31 + years

How many employees work for this business (answer a) and b) below): a) **at this location?** ***(✓only one)***

1 1 to 4
2 5 to 9
3 10 to 19
4 20 to 49
5 50 to 99
6 100 or more

b) at all locations? *(✓only one)*

1 1 to 4
2 5 to 9
3 10 to 19
4 20 to 49
5 50 to 99
6 100 or more

43. Which industry best describes your business *(✓only one)*

1 Retail (Grocery Store, Department Store, Video Rental, etc.)
2 Manufacturing (Electronics, Fabrication, Assembly, etc.)
3 Construction and Specialized Trade Contracting
4 Professional Services (Legal, Engineering, Financial, Medical, etc.)
5 Other Services (Restaurant, Auto Repair, Hotel, etc.)
6 Civic/Public (City, County, State, Federal, etc.)
7 Non-Profit (Chuch, Charity, etc.)
8 Education (Public and Private)
9 Other (Please specify: _____)

THANK YOU FOR COMPLETING THE SURVEY

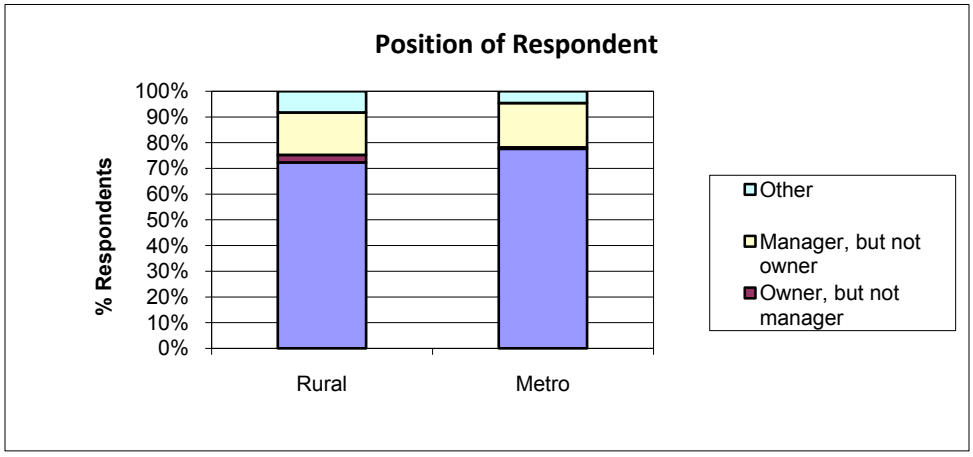
Appendix B: Company Respondent Profile and Survey Results

Company Information

This section summarizes some of the basic business information collected in the survey. The business data summarized in this section is also cross-tabulated with other survey data and is discussed in various sections of this report.

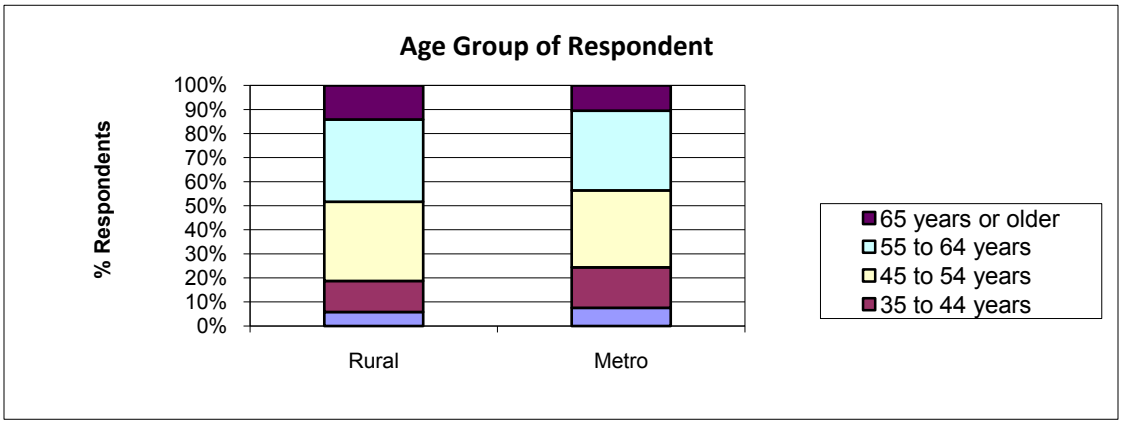
Approximately three-fourths of the survey respondents are the owners or managers of the business. Metro respondents are slightly more likely to be the owner/manager of the business, although the difference is nearly the same as the "other" category, which is larger for rural respondents.

Figure 41: Survey Respondent Position (Rural/Metro)



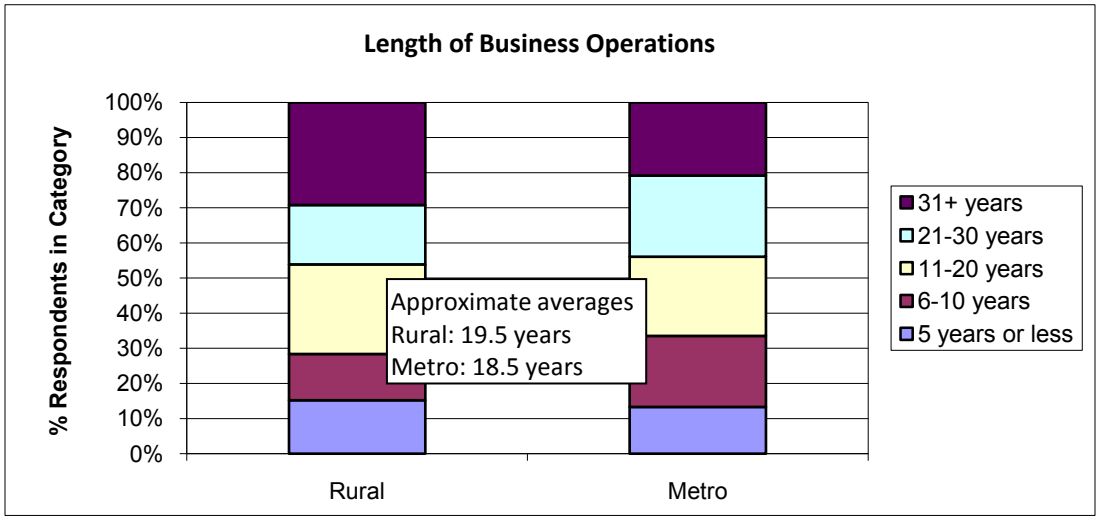
Rural respondents are also more likely to be in the sixty-five-or-over age category, which may reflect overall demographics of rural areas rather than a distinct difference within the business communities or group of respondents.

Figure 42: Survey Respondent Age Group (Rural/Metro)



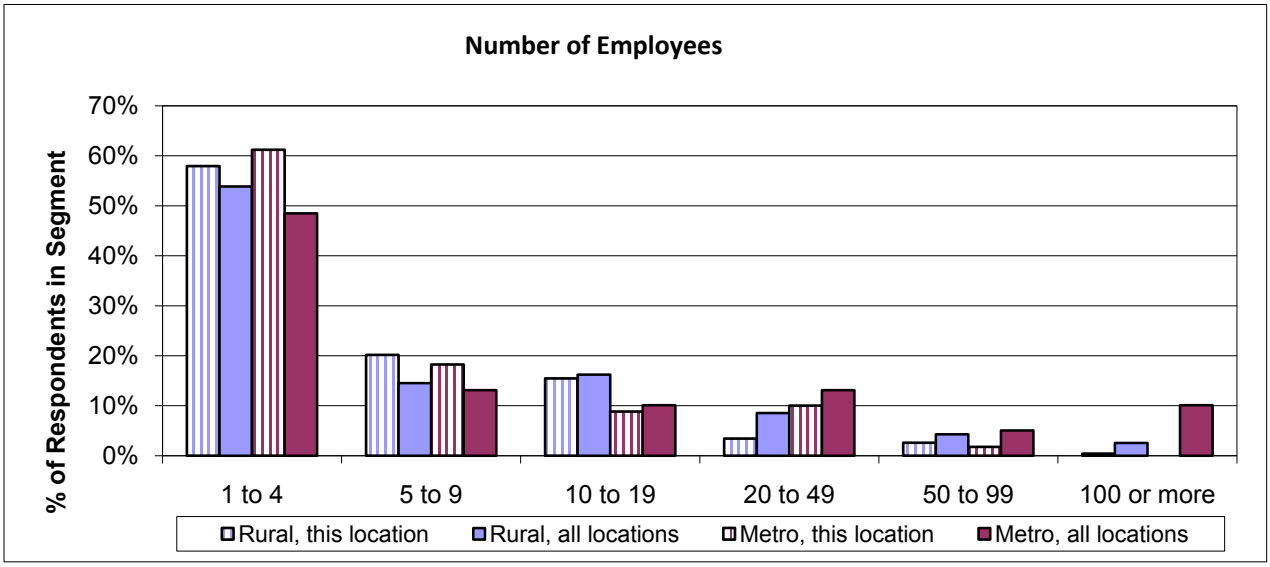
Rural businesses tend to have been in business slightly longer than metro businesses, although the aggregate difference is small.

Figure 43: Survey Respondent Length of Operations (Rural/Metro)



Over one-half of both metro and rural businesses surveyed have fewer than five employees at the location surveyed, and most have fewer than five employees at all locations. The relatively large proportion of metro businesses with more than one hundred employees at all locations may reflect the tendency of franchises to locate in more urban locations.

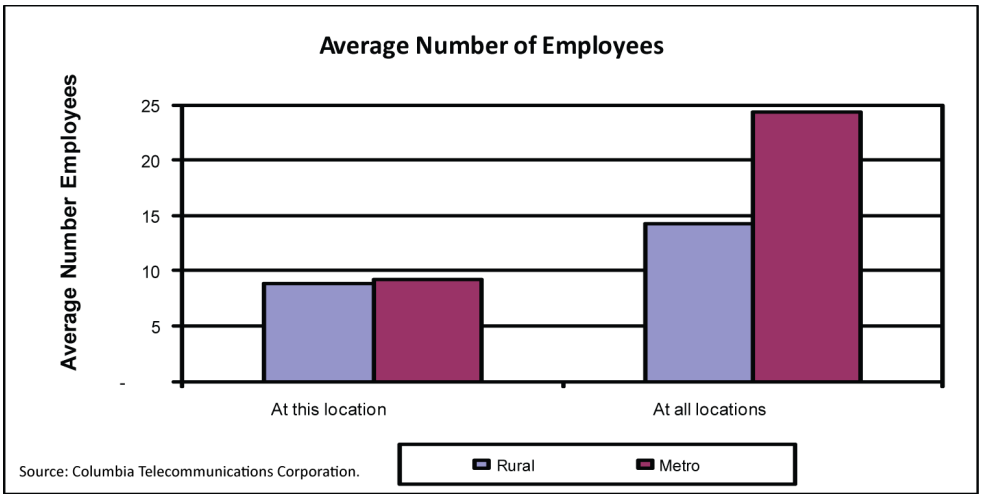
Figure 44: Survey Respondent Number of Employees (Rural/Metro)



The average number of employees at the surveyed location is approximately nine for both rural and metro businesses. However, metro businesses are more likely to be part of larger businesses or corporations with a greater number of employees. Including all employees in all locations, rural businesses averaged approximately fourteen employees while metro businesses averaged ap-

proximately twenty-four employees. (The averages are estimated from the mid-points of the ranges in Question 43 of the survey; see Appendix A.)

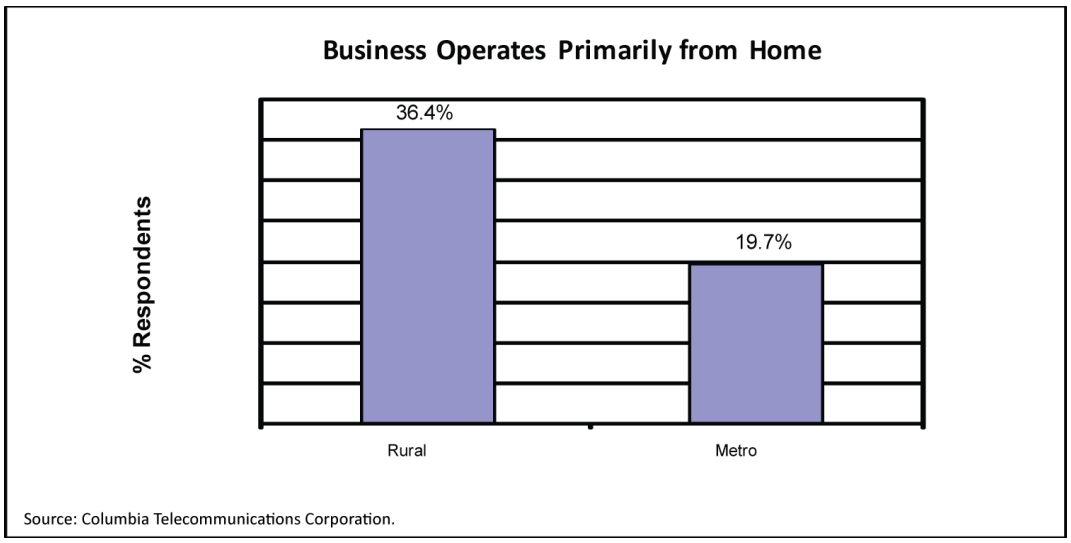
Figure 45: Survey Respondent Average Number of Employees (Rural/Metro)



Decisions about Internet connectivity at any given location are probably more influenced by the number of employees at the location than the total number of company employees, although some businesses may extend a common Internet connection to all locations. Since the number of employees at the surveyed location is roughly the same for both metro and rural businesses, most differences between metro and rural Internet use are probably not due to the number of employees, but rather to differences in service availability and the businesses' use of the Internet.

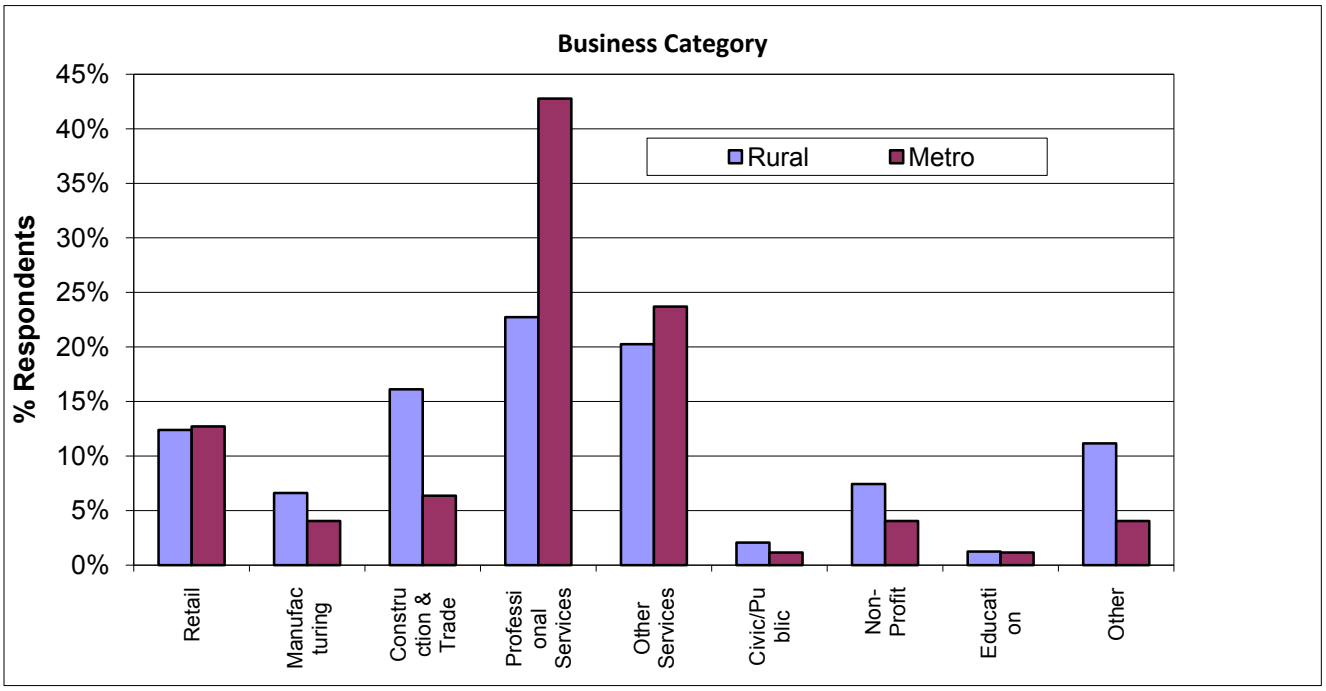
Approximately 36% of rural businesses and 20% of metro businesses operate primarily from the home. It is likely that many of these have shared Internet services with their home. In addition, the Internet choices for these locations are likely limited to those available to residences within the area rather than more business-oriented locations like an industrial park, office complex, or shopping mall.

Figure 46: Survey Respondent Operates Primarily from Home (Rural/Metro)



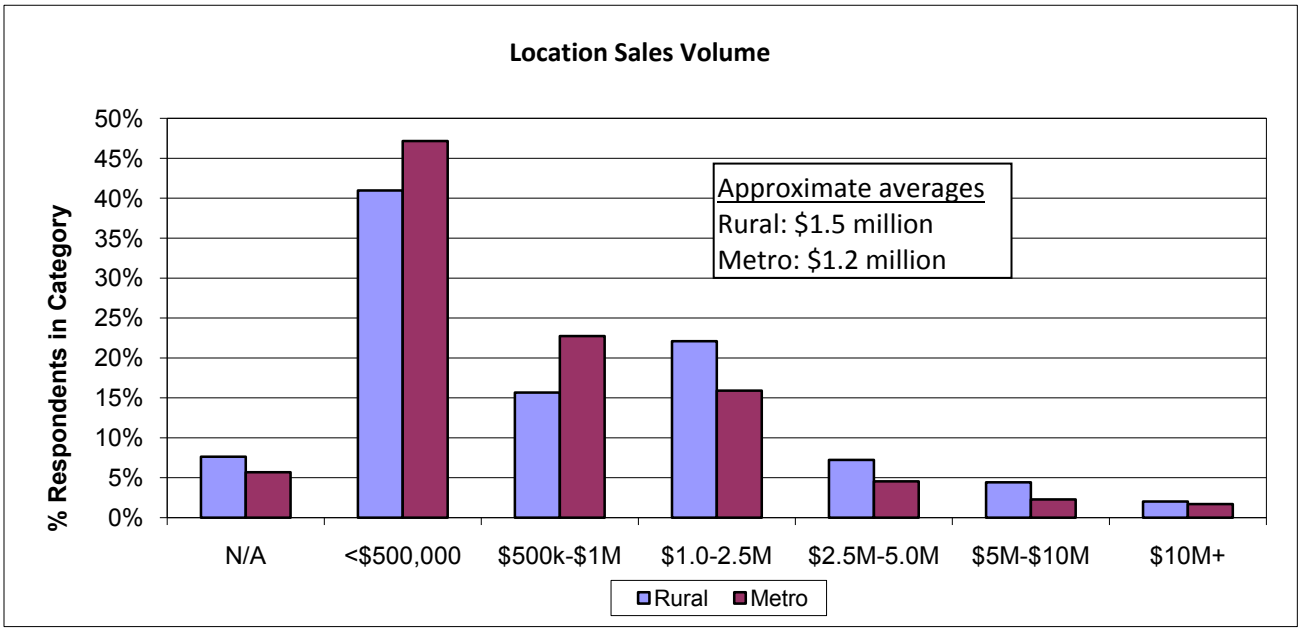
Metro businesses are much more likely to be in the professional services classification than rural businesses, while rural businesses are more likely to be in the construction and trade category. There are also many more rural respondents in the "other" category, which includes a number of agricultural respondents. Of all respondents, approximately 60% are in the professional or other services category. The retail sector is a distant second at 13% of all respondents. (See Figure 47.)

Figure 47: Survey Respondent Business Category (Rural/Metro)



Rural business respondents tended to have somewhat higher sales volume at the surveyed location than their metro counterparts, despite having approximately the same number of employees. Thus, the per-employee sales volume is larger for rural businesses than for metro businesses. This may reflect the types of businesses located in rural areas, such as the higher share of manufacturing and construction businesses.

Figure 48: Survey Respondent Location Sales Volume (Rural/Metro)



Survey Data

The survey responses for all questions are summarized in this Appendix, and are broken into rural and metro segments. Because the number of responses and population sizes of the rural and metro segments were different, the aggregate responses are weighted to reflect the total population of U.S. businesses as a whole. The weighting calculation is presented in the following table:

Weighting	Rural	Metro	Total
Survey responses received	249	176	425
Population (# of businesses):	1,716,622	4,695,232	6,411,854
Each survey represents (# of businesses):	6,894	26,677	—
Weight	20.5%	79.5%	100.0%

Source: Analysis of survey results conducted by CTC.

Rural/Metro Cross-Tabulations of Survey Responses

Q1: Personal computers at this location?	Rural	Metro	Total	Weighted Total
0	25	9	34	27
1 to 4	154	96	250	240
5 to 9	46	42	88	95
10 to 49	20	26	46	55
50 to 99	2	2	4	4
100 or more	0	1	1	2
Total	247	176	423	424

Q2a: Internet access at this location?	Rural	Metro	Total	Weighted Total
Yes	210	162	372	382
No	16	7	23	20
Total	226	169	395	402

Q2b: Main reason business does not have Internet access?	Rural	Metro	Total	Weighted Total
No need	2	1	3	3
Can access at another location	1	3	4	6
Have concerns with online data security	1	0	1	0
Too expensive	1	1	2	2
Other	1	0	1	0
Total	6	5	11	12

Q3: Internet type available?	Rural	Metro	Total	Weighted Total
DSL	141	120	261	277
Cable	111	91	202	212
Satellite	62	34	96	88
Wireless-paid	44	37	81	86
Wireless-free	7	7	14	16
Leased Line	30	42	72	88

Q4: How does business connect to the Internet?	Rural	Metro	Total	Weighted Total
Telephone dial-up	16	8	24	21
DSL	85	82	167	184
Cable	72	49	121	120
Satellite	15	3	18	12
Wireless paid	14	5	19	15
Leased line	12	13	25	28
Other	4	3	7	7
Total	218	163	381	388

Q5: Price paid per month for Internet services?	Rural	Metro	Total	Weighted Total
Don't know	2	5	7	10
Less than $25	12	8	20	20
$25 to $49	60	42	102	102
$50 to $99	102	71	173	172
$100 to $249	26	26	52	58
$250 to $499	9	7	16	16
$500 to $749	3	2	5	5
$750 to $999	0	1	1	2
$1,000 or more	0	2	2	4
Total	214	164	378	388

Q6: Minimum Internet Speed Needed (Mbps)?	Rural	Metro	Total	Weighted Total
0-2.0	33	26	59	61
2.1-10.0	29	37	66	79
10.1-50.0	13	3	16	11
50.1-99.0	6	3	9	8
99.1 and faster	18	10	28	26
Total	99	79	178	185

Q7: Desired Internet Speed (Mbps)?	Rural	Metro	Total	Weighted Total
0-2.0	10	9	19	20
2.1-10.0	33	32	65	72
10.1-50.0	20	13	33	32
50.1-99.0	4	3	7	7
99.1 and faster	25	17	42	41
Total	92	74	166	173

Q8: Need for broadband motivate business to relocate?	Rural	Metro	Total	Weighted Total
Yes	17	21	38	45
No	177	118	295	290
Don't know	21	21	42	47
Total	215	160	375	381

Q9: How many laptops the business supports?	Rural	Metro	Total	Weighted Total
None supported by business	77	50	127	124
1 to 4	124	94	218	223
5 to 9	8	11	19	23
10 to 49	7	7	14	16
100 or more	0	2	2	4
Don't know	1	2	3	4
Total	217	166	383	393

Q10: Business have a website?	Rural	Metro	Total	Weighted Total
Yes, used for information and e-commerce	55	53	108	119
Yes, but not for e-commerce	85	69	154	161
No	78	45	123	115
Total	218	167	385	395

Q11: Business support a private network over Internet?	Rural	Metro	Total	Weighted Total
Yes	43	42	85	94
No	124	92	216	219
Don't know	50	29	79	74
Total	217	163	380	387

Q12: Business required to support Internet security standards?	Rural	Metro	Total	Weighted Total
Yes	33	40	73	86
No	158	118	276	281
Don't know	26	9	35	28
Total	217	167	384	394

Q13: Who has the most IT expertise in the business?	Rural	Metro	Total	Weighted Total
You (respondent)	127	87	214	212
Employee	44	42	86	94
Outside IT service provider	47	38	85	89
Total	218	167	385	395

Q14: One or more employees spend at least half their time on IT?	Rural	Metro	Total	Weighted Total
Yes	30	28	58	63
No	189	137	326	329
Total	219	165	384	392

Q15: Download Internet speed satisfaction	Rural	Metro	Total	Weighted Total
Fast enough for our needs	114	104	218	236
Average, but not quite fast enough for our needs	61	41	102	100
Fairly slow and we would like to be connected at higher speeds	28	15	43	39
Very slow and we would like to be connect to much higher speeds	15	5	20	16
Total	218	165	383	391

Q16: Upload Internet speed satisfaction	Rural	Metro	Total	Weighted Total
Fast enough for our needs	115	95	210	221
Average, but not quite fast enough for our needs	52	43	95	100
Fairly slow and we would like to be connected at higher speeds	33	17	50	45
Very slow and we would like to be connect to much higher speeds	18	9	27	24
Total	218	164	382	390

Q17: Seriousness of Internet connectivity issues	Downtime		Updating Online Security		Prompt Trouble-shooting		Video/ Audio Streaming Tying Up System		Keeping Up with IT Advances	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Not at all serious	57	49	49	44	43	27	59	64	42	33
Somewhat not serious	29	25	31	26	23	19	46	38	30	26
Neutral	33	25	53	35	44	33	51	35	62	56
Somewhat serious	35	17	40	21	45	27	30	15	51	25
Very serious	62	47	42	36	61	57	29	9	32	22
Total	216	163	215	162	216	163	215	161	217	162

Q18: Importance of Internet service aspects	Price		Connection Speed		Reliability (Uptime)		Ability to Choose Among Providers		Provider Doesn't Block Sites		Customer Service	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very unimportant	3	8	4	5	4	7	9	11	12	16	5	7
Somewhat unimportant	7	7	8	5	2	2	14	11	20	15	7	3
Neutral	38	33	20	28	14	7	57	37	55	36	22	14
Somewhat important	57	44	78	59	49	32	55	44	44	31	64	38
Very important	114	72	109	67	150	116	84	61	86	66	120	102
Total	219	164	219	164	219	164	219	164	217	164	218	164

Q19: Satisfaction with Internet service aspects	Price		Connection Speed		Reliability (Uptime)		Ability to Choose Among Providers		Provider Doesn't Block Sites		Customer Service	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very unsatisfied	14	13	21	8	7	4	53	25	6	5	9	7
Somewhat unsatisfied	40	15	36	16	25	8	51	23	20	9	24	14
Neutral	87	65	76	46	52	29	67	61	96	49	75	58
Somewhat satisfied	52	48	59	66	88	81	36	38	63	61	75	49
Very satisfied	24	21	25	28	46	42	11	17	29	40	35	36
Total	217	162	217	164	218	164	218	164	214	164	218	164

Q20: Importance of Internet features	Choice of More Providers		Option to Purchase Faster		Ability to Bundle Services		Payment Based on Usage	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very unimportant	16	14	17	21	38	26	60	57
Somewhat unimportant	16	18	25	27	25	27	45	39
Neutral	72	44	63	42	48	48	68	39
Somewhat important	47	52	61	41	64	30	20	14
Very important	67	36	51	33	43	33	23	15
Total	218	164	217	164	218	164	216	164

Q21: Importance of Internet service to the following features	Achieve Strategic Goals		Improving Competiveness		Improve Efficiency		Reach More Customers		Interact with Vendors	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very unimportant	8	4	10	5	7	7	10	14	11	13
Somewhat unimportant	15	14	16	18	10	13	16	8	15	15
Neutral	53	29	53	26	37	15	52	30	39	30
Somewhat important	54	39	61	38	61	50	54	38	55	40
Very important	90	79	80	78	105	80	88	75	100	67
Total	220	165	220	165	220	165	220	165	220	165

Q22: Likelihood of switching to 100 Mbps	20% More per Month		10% More per Month		Same Price		10% Less per Month		20% Less per Month	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very likely	24	22	27	37	107	95	121	102	146	114
Somewhat likely	18	22	33	25	26	19	32	18	14	9
Neutral	43	27	43	23	32	20	20	12	15	7
Somewhat unlikely	38	31	42	31	17	8	13	9	8	11
Very unlikely	95	61	72	48	35	21	30	20	33	20
Total	218	163	217	164	217	163	216	161	216	161

Q23: Likelihood of switching to 1,000 Mbps	20% More per Month		40% More per Month		60% More per Month		80% More per Month		100% More per Month	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Very likely	32	35	13	21	15	23	20	25	28	29
Somewhat likely	19	18	14	19	14	7	11	6	5	3
Neutral	42	28	29	28	21	28	10	14	6	11
Somewhat unlikely	34	20	37	21	20	17	22	23	13	10
Very unlikely	92	63	122	73	145	88	151	95	164	110
Total	219	164	215	162	215	163	214	163	216	163

Q24a: Our local market currently offers high-speed Internet access at prices that my business can afford	Rural	Metro	Total	Weighted Total
Strongly disagree	27	12	39	34
Somewhat disagree	21	17	38	40
Neutral	80	49	129	123
Somewhat agree	60	49	109	114
Strongly agree	32	38	70	82
Total	220	165	385	392

Q24b: The availability of affordable high-speed Internet access is a factor I consider in deciding where to locate my business	Rural	Metro	Total	Weighted Total
Strongly disagree	92	62	154	152
Somewhat disagree	29	25	54	57
Neutral	52	37	89	89
Somewhat agree	23	18	41	42
Strongly agree	24	23	47	52
Total	220	165	385	392

Q24c: High-speed Internet access is as essential to my business as other main services such as water and sewer or electricity	Rural	Metro	Total	Weighted Total
Strongly disagree	27	11	38	32
Somewhat disagree	24	22	46	50
Neutral	37	28	65	66
Somewhat agree	55	41	96	98
Strongly agree	77	63	140	147
Total	220	165	385	392

Q24d: Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access	Rural	Metro	Total	Weighted Total
Strongly disagree	38	23	61	58
Somewhat disagree	24	31	55	66
Neutral	58	34	92	87
Somewhat agree	46	36	82	85
Strongly agree	53	41	94	97
Total	219	165	384	392

Q24e: Mobile access to the Internet will become more important to my business operations in the next 5 years	Rural	Metro	Total	Weighted Total
Strongly disagree	29	16	45	42
Somewhat disagree	20	15	35	36
Neutral	52	35	87	86
Somewhat agree	60	39	99	96
Strongly agree	58	59	117	131
Total	219	164	383	390

Q24f: Our business would realize greater long-term benefits by increasing our use of high-speed Internet access	Rural	Metro	Total	Weighted Total
Strongly disagree	25	14	39	36
Somewhat disagree	25	22	47	50
Neutral	73	55	128	131
Somewhat agree	52	34	86	84
Strongly agree	45	38	83	88
Total	220	163	383	389

Q25: Constraint to high-speed Internet	Budget		Management Discomfort		Employee Discomfort		Time		No Need for It	
	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro	Rural	Metro
Strongly disagree	20	15	87	60	92	70	45	26	79	45
Somewhat disagree	17	17	41	34	38	32	31	29	27	31
Neutral	64	54	65	49	75	47	87	70	77	53
Somewhat agree	53	34	17	14	9	9	44	24	27	23
Strongly agree	64	44	6	7	3	6	12	14	9	13
Total	218	164	216	164	217	164	219	163	219	165

Q26: Business currently allow telecommuting?	Rural	Metro	Total	Weighted Total
Yes	96	77	173	180
No, and unlikely to allow telecommuting next year	108	81	189	193
No, but possibly next year	12	9	21	21
Total	216	167	383	394

Q27: Percent of employees who take advantage of telecommuting	Rural	Metro	Total	Weighted Total
None	123	94	217	222
10%	34	29	63	67
20%	7	9	16	19
30%	4	4	8	9
40%	0	3	3	5
50%	9	2	11	8
More than 50%	28	22	50	52
Don't know	10	4	14	12
Total	215	167	382	394

Q28: Would business allow/encourage more telecommuting if employees had very high-speed Internet and video-conferencing	Rural	Metro	Total	Weighted Total
Yes	60	40	100	98
No	114	97	211	224
Don't know	40	29	69	70
Total	214	166	380	391

Q29: Business reimburse employees for home Internet if for business purposes?	Rural	Metro	Total	Weighted Total
Yes	30	26	56	60
No	166	129	295	304
Don't know	14	9	23	22
Total	210	164	374	386

Q30: Business use video-conferencing? What type?	Rural	Metro	Total	Weighted Total
No	181	129	310	311
Yes, desktop, Web-based	33	32	65	72
Yes, conference room – portable	0	1	1	2
Yes, conference room – fixed	2	4	6	8
Yes, another type	1	1	2	2
Total	217	167	384	394

Q31a: Business considered using VOIP?	Rural	Metro	Total	Weighted Total
Yes, already use	19	29	48	60
Yes, considered but did not use	26	16	42	40
Yes, under consideration	24	25	49	55
No, familiar but not considering	73	45	118	113
No, unfamiliar with technology	61	47	108	111
Don't know	13	5	18	15
Total	216	167	383	394

Q31b: Type of VOIP used?	Rural	Metro	Total	Weighted Total
Internal LAN	5	7	12	15
External via Internet connection	19	17	36	39
Both internal and external	9	9	18	20
Total	33	33	66	73

Q32: Business provide/reimburse employees for cell phone or handheld data services?	Rural	Metro	Total	Weighted Total
No	116	87	203	207
Yes, 1 to 4 employees	78	57	135	136
Yes, 5 to 9 employees	8	10	18	21
Yes, 10 to 49 employees	11	9	20	21
Yes, 100 + employees	0	1	1	2
Don't know	3	1	4	3
Total	216	165	381	390

Q33: Business emphasis on product or R&D?	Rural	Metro	Total	Weighted Total
Product emphasis	77	50	127	124
Neutral-Product	55	29	84	76
Neutral	72	52	124	125
Neutral-R&D	19	25	44	53
R&D emphasis	10	12	22	26
Total	233	168	401	404

Q34a: New business products/services over the last 5 years?	Rural	Metro	Total	Weighted Total
Low	84	39	123	107
Low-Neutral	32	34	66	75
Neutral	60	54	114	123
High-Neutral	36	24	60	59
High	16	13	29	30
Total	228	164	392	394

Q34b: Changes in products/services over the last 3 years?	Rural	Metro	Total	Weighted Total
Low	68	37	105	96
Low-Neutral	44	40	84	91
Neutral	79	58	137	139
High-Neutral	30	20	50	49
High	6	5	11	12
Total	227	160	387	387

Appendix B

Q35: In dealing with competitors, my company:	Business responds to competitors' actions or initiates & competitors respond		Business seldom or often introduces new products, techniques, technologies		Business avoids or adopts a very competitive posture	
	Rural	Metro	Rural	Metro	Rural	Metro
Responds	15	20	21	29	34	30
Neutral-Responds	20	14	22	15	31	18
Neutral	141	84	121	63	115	73
Neutral-Initiates	33	29	44	34	41	34
Initiates	21	19	24	24	11	10
Total	230	166	232	165	232	165

Q36: Business appetite for low or high-risk projects?	Rural	Metro	Total	Weighted Total
Low	36	28	64	66
Low-Neutral	56	36	92	89
Neutral	117	72	189	181
High-Neutral	23	21	44	48
High	4	10	14	20
Total	236	167	403	403

Q37: Business adapts incrementally or boldly?	Rural	Metro	Total	Weighted Total
Cautious	35	28	63	66
Cautious-Neutral	48	36	84	86
Neutral	114	67	181	171
Bold-Neutral	38	28	66	67
Bold	2	8	10	15
Total	237	167	404	404

Q38: Business posture towards uncertainty is wait-and-see or aggressive?	Rural	Metro	Total	Weighted Total
Methodical	30	24	54	56
Methodical-Neutral	53	32	85	81
Neutral	94	70	164	167
Aggressive-Neutral	52	31	83	79
Aggressive	6	11	17	22
Total	235	168	403	404

Q39: Respondent position in business?	Rural	Metro	Total	Weighted Total
Owner/Manager	175	135	310	319
Owner, but not manager	7	1	8	5
Manager, but not owner	40	30	70	71
Other	20	8	28	23
Total	242	174	416	418

Q40: Age group of respondent?	Rural	Metro	Total	Weighted Total
18 to 34 years	14	13	27	29
35 to 44 years	31	29	60	65
45 to 54 years	79	55	134	133
55 to 64 years	82	57	139	138
65 years or older	34	18	52	47
Total	240	172	412	414

Q41: Business operates primarily from home?	Rural	Metro	Total	Weighted Total
Yes	88	34	122	100
No	154	139	293	316
Total	242	173	415	416

Q42: How long ago was the business started?	Rural	Metro	Total	Weighted Total
5 years or less	37	23	60	58
6-10 years	32	35	67	77
11-20 years	62	39	101	97
21-30 years	41	40	81	89
31+ years	71	36	107	96
Total	243	173	416	417

Q43a: How many employees at this location?	Rural	Metro	Total	Weighted Total
1 to 4	135	104	239	246
5 to 9	47	31	78	76
10 to 19	36	15	51	43
20 to 49	8	17	25	34
50 to 99	6	3	9	8
100 or more	1	0	1	0
Total	233	170	403	407

Q43b: How many employees at all locations?	Rural	Metro	Total	Weighted Total
1 to 4	63	48	111	114
5 to 9	17	13	30	31
10 to 19	19	10	29	26
20 to 49	10	13	23	28
50 to 99	5	5	10	11
100 or more	3	10	13	19
Total	117	99	216	229

Q44: Business industry type	Rural	Metro	Total	Weighted Total
Retail	30	22	52	53
Manufacturing	16	7	23	20
Construction and Specialized Trade Contracting	39	11	50	37
Professional Services	55	74	129	156
Other Services	49	41	90	95
Civic/Public	5	2	7	6
Non-Profit	18	7	25	21
Education	3	2	5	5
Other	27	7	34	25
Total	242	173	415	416

Appendix C: Case Studies

Case Study 1: Satellite Broadband—Towns' Dairy Farm, Wisconsin

Towns' Dairy Farm, in Janesville, Wisconsin, is an example of a small business that has access to broadband—but the broadband, delivered via satellite, is so low-speed and of such spotty reliability that it simply does not support the business' needs.

To understand the situation that Towns' finds itself in, it is instructive to consider the history of Ralls County, Missouri. The small businesses served by the Ralls County Electric Cooperative (RCEC) also had no choice for broadband other than satellite. And like Towns', many of those businesses found that the available satellite service was marginal at best. RCEC attempted to construct a high-speed wireless network to deliver Internet access, but that project failed—a victim of terrain that simply offered too many hurdles for effective wireless transmission. In the latest chapter of its attempt to bring broadband access to the region, RCEC received a grant/loan package in January 2010 from the federal Broadband Initiatives Program (BIP), administered by the Department of Agriculture's Rural Utilities Service (RUS), to cover the cost of a planned $19 million fiber-to-the-premises (FTTP) deployment.

With its federal funding secured, RCEC's broadband future is bright. Absent such intervention, Towns'—and small businesses like it—face a long road on their quest for effective broadband service.

A Brief History of the Farm

Over 100 years ago Scott Towns' grandparents, Malcolm and Bernadine Towns, founded a dairy farm in southern Wisconsin, near Janesville. Although Towns' Diary Farm's end product—milk—remains virtually unchanged since that time, the farm's production methods and processes have undergone a drastic evolution over the past century. It's not just that milk production is now at a volume that Malcolm Towns never imagined. When the dairy farm was founded there was no electricity or telephone. The household had no indoor plumbing and water was drawn by hand and delivered, bucket by bucket, to the livestock. There were no tractors, so horses pulled the plows. A visit to Janesville, just eight miles away, would consume a full day. For Scott, his father Richard, and his two brothers, Mark and Steve, who together operate today's farm, motorized vehicles and equipment, electricity, cellular telephones, computer-based data management, and the Internet have become an essential part of the farm's day-to-day operations. Without these essential tools, the farm would not survive.

Today's Operation

The farm includes 500 acres of land (95% corn and hay production, 5% pasture and buildings), 470 milk cows (420 active[96]), and 330 calves and heifers.[97] The milk cows are located at the original homestead site while the calves and heifers are located at three other locations on the property.

[96] Milk cows are cycled in and out of production to allow recovery and rest.
[97] A young cow that has not given birth; cows are not placed into milk production until after they have given birth.

In addition to Scott, his father, and his two brothers, the farm employs six full-time and five part-time staff. On Thursdays a veterinarian makes a regular visit to check on the herd's health—this in addition to the two to three emergency trips the vet makes in a typical week.

Nancy Towns, Scott's wife, has a role on the farm that is quite different than that of her mother-in-law, Ruth, or Scott's grandmother, Bernadine. In a previous generation Nancy's time would have been spent in the kitchen preparing meals for all the farm hands, tending chickens for food, and running the household. Today chickens are not raised for food and the farm hands pack their lunches or head to the local diner for their meals. Although Nancy does run the household and actively participates in the farm's operation, she also has two part-time jobs to supplement the farm's income: Nancy is the township clerk and manages the payroll for the local fire district.

Price is always a critical component for commodity-based markets such as milk. Internet access and data management have become essential, critical tools on the farm for controlling costs, maintaining competiveness, improving efficiency, reaching suppliers, and achieving strategic goals. Each of the farm's cows is tagged with a unique identifier number, for example, and data on their individual medical and production histories is stored in the farm's computer system. Scott downloads feed mixes from the farm's nutritionist each week over the Internet. He also uses the farm's Internet connection to schedule supply deliveries and check market pricing for feed; these are critical inputs to manage because the farm's 475 acres of corn and hay are insufficient to support the herd.

Internet Access Limited to Satellite

The three households on the farm property and the main barn each have computers and Internet access. Internet access is via satellite from Hughes, and costs $70 per month per location for a service supporting 1.2 Mbps downstream and 200 Kbps upstream.[98]

Scott and Nancy feel price, speed, reliability, and customer service are critical attributes for their Internet connection. With the exception of speed, however, they say that their satellite Internet connection falls short of expectations on each of these attributes. On clear days the reliability of the satellite service is great, but rainstorms and snowfall cause interruptions that make the service unusable. Calling customer service, they report, requires them to stay on the phone for what seems like hours, just to get an inadequate answer and be put on hold once again.

The farm's Internet connection supports most of the applications used in the farm's operation today, but not all. For example, remote video monitoring of the cows and facilities is of interest, especially during storms—just the times that the Internet service stops working. Similarly, part of Nancy's responsibilities as township clerk is making updates to the township website, but she cannot accomplish this task over the farm's Internet connection. Each time an update is attempted, a time-out error occurs (apparently caused by propagation delays in getting the signal to and back from the satellite in geo-stationary orbit thirty thousand miles above). When updates are required Nancy must go to local library to use its more robust Internet connection—turning a five-minute task into a one-hour chore.

[98] Hughes offers a range of satellite-based Internet services for businesses: $60 per month for 1 Mbps/128 Kbps, $70 per month for 1.2 Mbps/200 Kbps, $80 per month for 1.6 Mbps/250 Kbps, $120 per month for 2 Mbps/300 Kbps, $199 per month for 3 Mbps/512 Kbps, $299 per month for 3 Mbps/1 Mbps, $399 per month for 5 Mbps/1 Mbps.

An alternative wireless provider, LiteWire, has just begun to offer service in the region. LiteWire[99] does offer the promise of a lower cost and more reliable alternative to satellite—but its services are still lower-performing and higher-cost than the services available in Janesville.

Internet-Based Applications Will Expand

When electricity was first brought to the farm, it was used for lighting and operating some light-duty pumps. Today electricity is ubiquitous on the farm and very few, if any, processes can be run without it. Computer-based data and Internet access is quickly becoming as essential and will require speeds and reliability that satellite or today's wireless are unable to deliver. Not only will the farm see a need for increased data exchange over the Internet,[100] but it will need that level of data exchange internally as well. It is not hard to imagine the need for a wireless "Intranet" allowing handheld data devices to track cows with barcodes, read RFID (radio frequency identification) tags for tracking movement (cows and staff), and allow real-time access to a cow's milk production and medical history, or to ACL (automatic cow location) data.

Case Studies for Rural Markets: Providers, Bandwidth, and Pricing

The nationwide survey of small businesses conducted for this report in spring 2010 separated respondents into two segments: metro (businesses located in more urban areas) and rural (businesses located in more rural areas). The survey revealed that customers in the rural areas pay less for their Internet services than do their metro counterparts. However, the survey did not require the respondents to specify the exact bandwidths that they bought. Thus, while the survey revealed that rural customers pay less for Internet service, it does not provide a deeper insight into the levels of service (i.e., bandwidths) that metro and rural businesses receive for the price paid.

To augment the survey results, the following case studies describe the availability and price of services offered in metro and rural regions, and the services offered by a national provider and an independent local provider within a rural region. Comparing equivalent services offered in these metro and rural regions indicates that rural customers pay higher prices than metro customers for the same bandwidth. The case studies also indicate that, for the markets identified in the case study, higher-bandwidth services are available in the metro regions than in the rural regions. Those higher-speed metro services, for the markets identified in the case study, are priced higher than the lower speed bandwidth services offered in rural regions—so when metro customers pay more, they are paying more for faster services.

Both case studies below include tables that summarize the service offerings for small business customers. This information tells some of the story behind the survey findings and can be briefly summarized as follows. Compared to metro areas, the entry-level broadband services available in rural areas of both central Tennessee and Waseca, Minnesota are lower bandwidth service option(s). In Minnesota, for example, customers in the rural market of Waseca could obtain services at lower bandwidths (5 Mbps downstream/1 Mbps upstream) compared to the metro market of Minneapolis, where the lowest bandwidth service offered was 12 Mbps downstream/2 Mbps up-

[99] LiteWire offers a range of options starting at 300 Kbps download for $30 per month to a 3.2 Mbps (3,200 Kbps) download for $140 per month.

[100] Future needs include interactive videoconferencing for training, telemedicine (doctors and veterinarians), surveillance and other high-bandwidth applications.

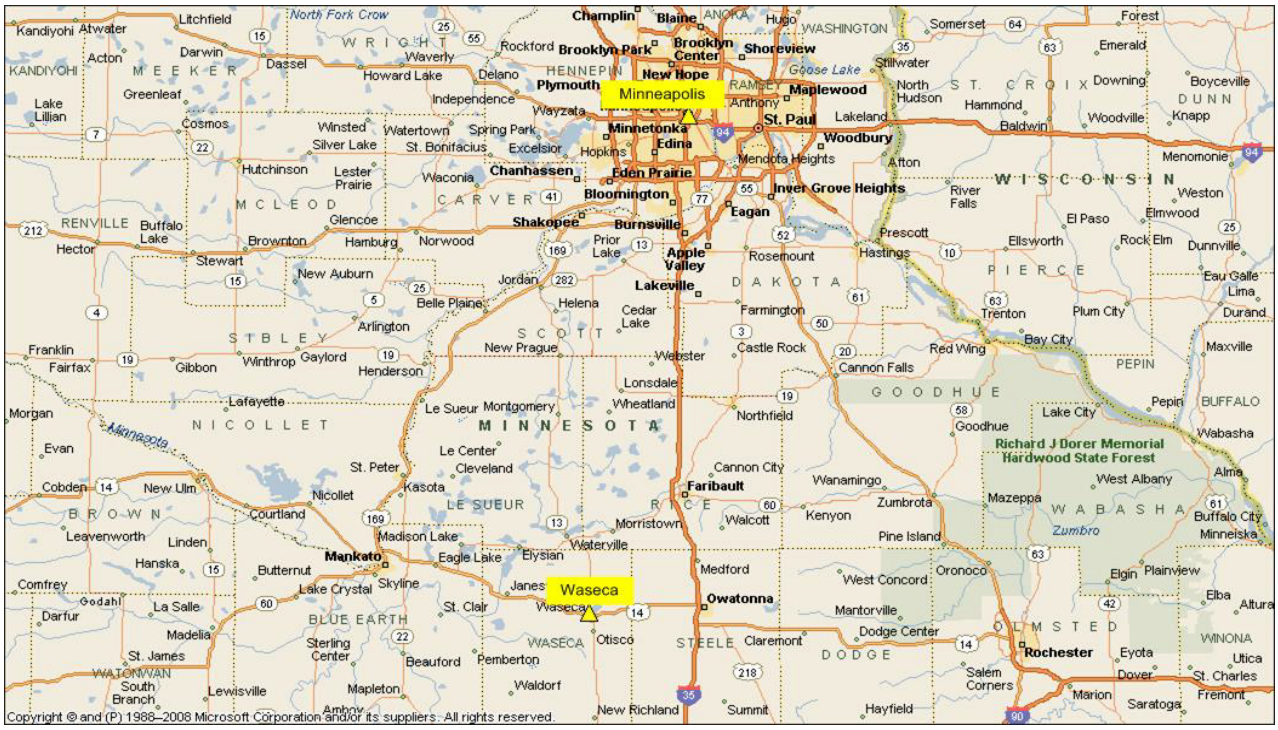
stream. However, in the rural to metro comparison, the option to choose lower bandwidth does not come with a correspondingly lower price. With a three-year agreement a customer in this rural area would pay the same price as someone receiving faster service (and with no service agreement) in the metro area. In the comparison of an independent local provider and national providers competing in rural central Tennessee, it was observed that the local provider offered service options with both lower bandwidths and lower prices. The lowest service option had a downstream bandwidth almost six to eight times lower than that offered by national providers (Charter and Comcast), and the service option was priced lower.

Simply comparing "prices" that a small business customer pays for Internet services in metro and rural areas, then, is not a fair or complete comparison; one must consider the level of service that a customer in each of these areas gets for the price paid.

Case Study 2: Metro vs. Rural Market in Minnesota

This section provides a comparison of services and pricing options provided within a metro and a rural market. For the purposes of this study, the market in Waseca, Minnesota (rural) was compared with the metro market of Minneapolis, Minnesota (see Figure 49, below). The service provider in Waseca is Mediacom while Comcast serves Minneapolis. A summary of the speeds and options offered by these carriers is presented in Table 4.

Figure 49: Metro vs. Rural Markets in Minnesota



Source: Microsoft Streets & Trips 2008, with CTC modifications

Mediacom's lowest-priced service in the rural region begins (with a three-year agreement) at a price similar to Comcast's lowest-priced option in the metro region, but the downstream and upstream bandwidths offered in the rural area are lower. For the same monthly cost of $59.95, a customer in Waseca can buy 5 Mbps downstream/1 Mbps upstream service, while a customer in Minneapolis can buy 12 Mbps downstream/2 Mbps upstream. Thus, the metro customer can buy twice as much bandwidth for the same price. All of Mediacom's higher-speed rural services offer lower bandwidths at higher prices than Comcast's metro offerings. Thus, while metro customers may pay more than rural customers, when they do they get higher bandwidth.

For instance, to get 15 Mbps downstream/2 Mbps upstream (i.e., "Advanced" service from Mediacom or "Preferred" service from Comcast) a rural customer in Waseca will pay 50% more than the metro customer in Minneapolis ($139.95 vs. $89.95) for the same bandwidth and will be required to sign a three-year contract. As another example, the highest bandwidth offered in Waseca is Ultra service, at 20 Mbps downstream/2 Mbps upstream. Comparing the price for this service with a similar bandwidth option available from Comcast in Minneapolis (Premium service, 22 Mbps downstream/5 Mbps upstream), a customer in Waseca would have to pay 2.5 times as much as a customer in Minneapolis, while accepting a lower upstream bandwidth.

The highest bandwidth offered within the metro area of Minneapolis is also much higher than that offered in Waseca—50 Mbps downstream/10 Mbps upstream. At $189.95 per month, it is both cheaper and faster than the fastest available rural service (as mentioned before, the Ultra service—which is 20 Mbps downstream/2 Mbps upstream for $249.95 per month). In other words, when compared to their rural counterparts, metro businesses see faster service for the same price and equivalent speeds for lower prices.

Table 4: Comcast Services in Metro Minneapolis, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month[a]
Starter	12 Mbps	2 Mbps	$59.95
Preferred	16 Mbps	2 Mbps	$89.95
Premium	22 Mbps	5 Mbps	$99.95
Deluxe	50 Mbps	10 Mbps	$189.95

*S*ource: http://business.comcast.com
a No service agreement period specified. Monthly costs for static IPs are: $14.95 for 1, $19.95 for 5, or $34.95 for 13.

Table 5: Mediacom Services in Rural Waseca, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month[a]
Standard	5 Mbps	1 Mbps	$59.95 (three-year agreement), $79.95 (one-year agreement)
Plus	10 Mbps	1 Mbps	$69.95 (three-year agreement), $99.95 (one-year agreement)
Advanced	15 Mbps	2 Mbps	$139.95 (three-year agreement), $179.95 (one-year agreement)
Ultra	20 Mbps	2 Mbps	$249.95 (one- or three-year agreement)

Source: http://mediacomcable.com/index.php

[a] Includes two static IPs at Plus level, three at Advanced level, and five at Ultra level. No static IPs available with Standard service.

Case Study 3: Small Independent Provider vs. National Provider in Rural Central Tennessee

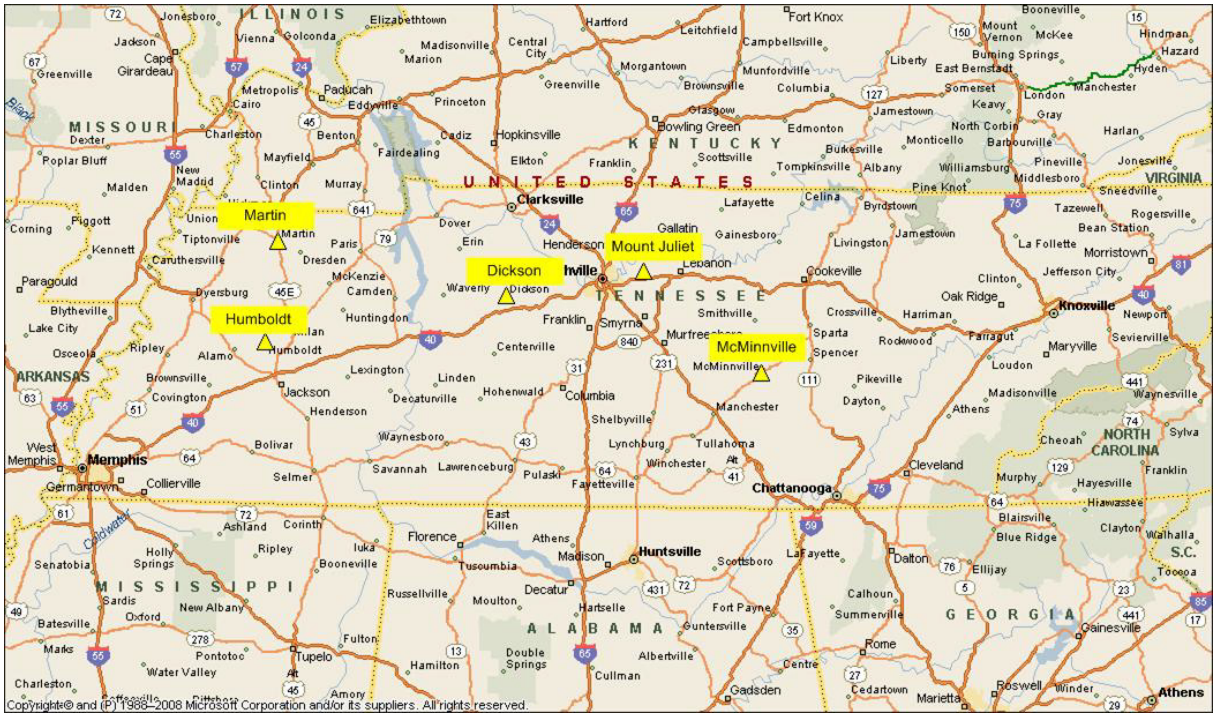
This section provides a comparison of broadband services and pricing options, in a rural region, provided by a local Internet service provider and those provided by a national cable service provider. For the purposes of this study, rural markets within five cities of central Tennessee were used, as shown in Figure 50. The Tennessee cities of Dickson, Humboldt, Martin, McMinnville, and Mount Juliet were chosen due to the similarity in their population sizes. All the cities with the exception of Humboldt are served by a national service provider. Dickson and Mount Juliet are served by Comcast while Martin and McMinnville are served by Charter Communications; Humboldt is served by InfoStructure Inc., a relatively small, local company. Table 6, Table 7, and Table 8 below summarize the speeds and options offered by these carriers.

The case study revealed that, for the cities under comparison, the national providers' offerings start at a higher bandwidth than the services offered by the local provider. InfoStructure offers bandwidth options starting at 1.5 Mbps, 3 Mbps, and 6 Mbps downstream while Charter's and Comcast's bandwidth options start at 8 Mbps and 12 Mbps downstream, respectively.

Secondly, comparing comparable services from the local and national providers, it is clear that a customer served by the local provider would have to pay a higher price for similar bandwidth. For example, the Broadband 15 MB service offered by InfoStructure and the Super and Preferred services offered by Charter and Comcast, respectively, are each around 15 Mbps downstream/2 Mbps upstream. The InfoStructure service costs more ($129.95) than Charter's service ($109.99) and Comcast's service ($94.95).

The highest bandwidth offered by the independent provider, InfoStructure, was 15 Mbps downstream/1.5 Mbps upstream, for $129.95 per month. Both national providers offer higher bandwidths. Comcast offers 50 Mbps downstream/10 Mbps upstream for $194.95 monthly. Thus, while Comcast's highest bandwidth in the rural area was more than three times as fast as InfoStructure's highest offering, Comcast's price was only 1.5 times more than InfoStructure's.

Figure 50: Rural Markets Within Central Tennessee Used in the Comparison Study



Source: Microsoft Streets & Trips 2008, with CTC modifications

Table 6: Independent Provider (InfoStructure) in Rural Tennessee

City	Service Name	Download Speed	Upload Speed	Price per Month[a]
Humboldt	1.5 MB	1.5 Mbps	250 Kbps	$39.95
	3 MB	3 Mbps	300 Kbps	$59.95
	1 MB /6 MB	6 Mbps	1 Mbps	$69.95
	1 MB /10 MB	10 Mbps	1 Mbps	$99.95
	15 MB	15 Mbps	1.5 Mbps	$129.95
	Rheinhausen	5 Mbps	5 Mbps	$800.00
	Jones	5 Mbps	5 Mbps	$800.00

Source: http://infostructure.net/

[a] No service agreement period specified. No information on static IPs available. For Rheinhausen and Jones services (provided over dedicated fiber), fiber connection costs of approximately $486.85 (Rheinhausen) or $361.39 (Jones) apply.

Table 7: National Provider (Charter) in Rural Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Martin and McMinnville	Basic	8 Mbps	1 Mbps	$79.99
	Super	16 Mbps	2 Mbps	$109.99
	Turbo	25 Mbps	3 Mbps	$199.99

Sources: Telephone conversations with Charter sales representatives
[a] Price based on a month-to-month service agreement. One static IP included; five more for $15 per month, thirteen more for $30 per month.

Table 8: National Provider (Comcast) in Rural Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Dickson and Mount Juliet	Starter	12 Mbps	2 Mbps	$64.95
	Preferred	16 Mbps	2 Mbps	$94.95
	Premium	22 Mbps	5 Mbps	$104.95
	Deluxe	50 Mbps	10 Mbps	$194.95

Source: http://business.comcast.com
[a] No service agreement period specified. Price inclusive of $5 monthly cable modem charge. Static IP charges per month: $14.95 for one, $19.95 for 5, or $34.95 for 13.

Case Study 4: A Comparison of Business and Residential Internet Pricing

This section provides a comparison of the pricing of residential broadband services versus the pricing of business broadband services, comparing the broadband services available in the same communities examined earlier in this Appendix. In each community, the business customers pay two to three times the price paid by residential customers for equivalent speeds.

Business and Residential Internet Services in Minnesota

This section examines Waseca, Minnesota, which is served by Mediacom, and Minneapolis, which is served by Comcast. The residential and business Internet service options provided by these providers are summarized in Table 9 and Table 10. Businesses in Waseca pay two to three times the price paid by residential customers for equivalent services provided by Mediacom.

- Mediacom's Plus service for business customers provides 10 Mbps download/1 Mbps upload speeds, which is comparable to Mediacom Online service for residential customers (12 Mbps download/1 Mbps upload). With a one-year agreement, business services ($99.95 per month) are twice as expensive as the somewhat faster residential services ($49.95 per month).
- Mediacom's Ultra service for business customers offers 20 Mbps download/1 Mbps upload speeds for $249.95 per month. Mediacom's Online Max residential service offers 20

Mbps download/2 Mbps upload for $74.95 per month. Thus, the business service is priced at more than three times the price of the residential service.

Table 9: Mediacom Business Services in Waseca, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month
Standard	5 Mbps	1 Mbps	$59.95 (three-year agreement), $79.95 (one-year)
Plus	10 Mbps	1 Mbps	$69.95 (three-year agreement), $99.95 (one-year)
Advanced	15 Mbps	2 Mbps	$139.95 (three-year agreement), $179.95 (one-year)
Ultra	20 Mbps	2 Mbps	$249.95[a]

Sources: Telephone conversations with Mediacom sales representatives and http://mediacomcable.com/index.php
[a] Pricing is the same for one- or three-year agreement.

Table 10: Mediacom Residential Services in Waseca, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month
Mediacom Online Intro	`3 Mbps	1 Mbps	$44.95 (no service commitment required)
Mediacom Online	12 Mbps	1 Mbps	$62.95 (no service commitment required)
Mediacom Online	12 Mbps	1 Mbps	$49.95 (one-year agreement)
Mediacom Online	12 Mbps	1 Mbps	$39.95 for 1st year; $49.95 for 2nd year[a]
Mediacom Online Max	20 Mbps	2 Mbps	$74.95[a]

Sources: Telephone conversation with Mediacom sales representative and http://mediacomcable.com/index.php
[a] Pricing with two-year agreement.

Table 11 and Table 12 provide the speeds and pricing for Comcast's services in Minneapolis. As in Waseca, business services are offered at a much higher rate than equivalent residential services.

- Comcast's Preferred service option for businesses provides a download speed of 16 Mbps and an upload speed of 2 Mbps at $89.95 per month. Comcast's equivalent residential service (Performance) offers 15 Mbps download/3 Mbps upload at $42.95 per month. Thus business customers pay more than twice what a residential customer pays (and for a slower upload rate).
- Comcast's highest-speed option for residential customers is the Extreme 50 service, which provides 50 Mbps download/10 Mbps upload for $99.95 per month. The highest-speed option offered to business customers is the Deluxe service, which offers the same download and upload speeds for $189.95 per month—or almost twice the price paid by residential customers for an equivalent service.

Table 11: Comcast Business Services in Minneapolis, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month[a]
Starter	12 Mbps	2 Mbps	$59.95
Preferred	16 Mbps	2 Mbps	$89.95
Premium	22 Mbps	5 Mbps	$99.95
Deluxe	50 Mbps	10 Mbps	$189.95

Source: http://business.comcast.com
[a] No service agreement period specified

Table 12: Comcast Residential Services in Minneapolis, Minnesota

Service Name	Download Speed	Upload Speed	Price per Month[a]
Economy Internet	`1.5 Mbps	384 Kbps	$24.95
Performance	15 Mbps	3 Mbps	$42.95
Blast	20 Mbps	4 Mbps	$52.95
Ultra	30 Mbps	7 Mbps	$62.95
Extreme 50	50 Mbps	10 Mbps	$99.95

Source: http://business.comcast.com
[a] No service agreement period specified.

Business and Residential Internet Services in Central Tennessee

To further compare pricing options for residential and business customers, this section looks at two service providers—Charter Communications and Comcast—in the markets of central Tennessee.

As shown in Table 13 and Table 14, the services offered by Charter Communications are the same in the cities of Martin and McMinnville, and in each city businesses pay more than twice as much as residential users for comparable services.

- Charter's Basic service for business customers is $79.99 per month and offers a download speed of 8 Mbps and upload speed of 1 Mbps. Charter offers an equivalent service to residential customers (Express) for $39.99. Thus the business customers pay twice as much as residential customers for the same service.
- The highest-speed option that Charter offers its residential customers is the Max service with 25 Mbps download/3 Mbps upload for $79.99 per month. The highest-speed service offered to business customers is Turbo, which offers the same speeds for $199.99—almost 2.5 times the price paid by residential customers.

Table 13: Charter Communications Business Services in Central Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Martin and McMinnville	Basic	8 Mbps	1 Mbps	$79.99
	Super	16 Mbps	2 Mbps	$109.99
	Turbo	25 Mbps	3 Mbps	$199.99

Sources: Telephone conversations with company sales representatives.
[a] Price based on a month-to-month service agreement.

Table 14: Charter Communications Residential Services in Central Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Martin and McMinnville	Lite	1 Mbps	512 Kbps	$19.99
	Express	8 Mbps	1 Mbps	$39.99
	Plus	16 Mbps	2 Mbps	$49.99
	Max	25 Mbps	3 Mbps	$79.99

Sources: http://www.charter.com/ and company representatives.
[a] No service agreement period specified.

As can be seen from Table 15 and Table 16 the services offered by Comcast are the same in the cities of Dickson and Mount Juliet, and in each city businesses pay more than twice as much as residential users.

- Comcast's Preferred business service is $94.95 per month for 16 Mbps download/2 Mbps upload. Comcast offers a similar service to residential customers (Performance) delivering 15 Mbps download/3 Mbps upload for $42.95 per month. Thus, Comcast's business customers pay more than two times the price paid by residential customers for similar speeds.
- The highest-speed option that Comcast offers its business customers is the Deluxe service with 50 Mbps download/10 Mbps upload for $194.95 per month. The highest-speed residential service, Extreme 50, provides the same speeds for $99.95 per month—or about half of what business customers must pay for equivalent service.

Table 15: Comcast Business Services in Central Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Dickson and Mount Juliet	Starter	12 Mbps	2 Mbps	$64.95
	Preferred	16 Mbps	2 Mbps	$94.95
	Premium	22 Mbps	5 Mbps	$104.95
	Deluxe	50 Mbps	10 Mbps	$194.95

Sources: Telephone conversations with company sales representatives.
[a] Pricing includes $5 per month charge for cable modem. No service agreement period specified.

Appendix C

Table 16: Comcast Residential Services in Central Tennessee

Cities	Service Name	Download Speed	Upload Speed	Price per Month[a]
Dickson and Mount Juliet	Economy Internet	`1.5 Mbps	384 Kbps	$24.95
	Performance	15 Mbps	3 Mbps	$42.95
	Blast	20 Mbps	4 Mbps	$52.95
	Ultra	30 Mbps	7 Mbps	$62.95
	Extreme 50	50 Mbps	10 Mbps	$99.95

Source: http://www.comcast.com
[a] No service agreement period specified.

Appendix D: Analysis of Business Use of Broadband

Business Use of Broadband for Telecommuting and Communications

This section summarizes the information collected in the survey about respondents' use of broadband connectivity to support telecommuting and advanced communications. Key findings of the survey include the following:

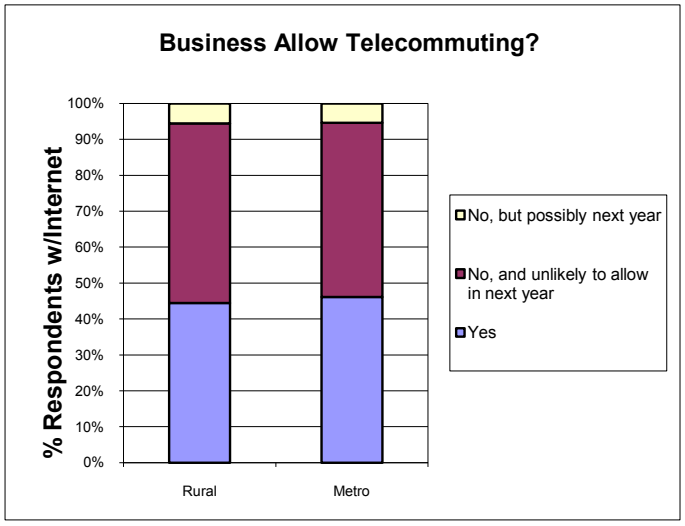
- Approximately 15% of respondents currently use Voice over Internet Protocol (VoIP)—an increase from 3.3% of businesses using VoIP in the 2003 Advocacy survey. Approximately 17% of metro businesses and 9% of rural businesses (a statistically significant difference) currently use VoIP.

- Approximately 28% of rural businesses and 24% of metro businesses indicate that they would encourage more telecommuting if employees had very-high-speed Internet that could support videoconferencing and other advanced features.

Use of Internet for Telecommuting

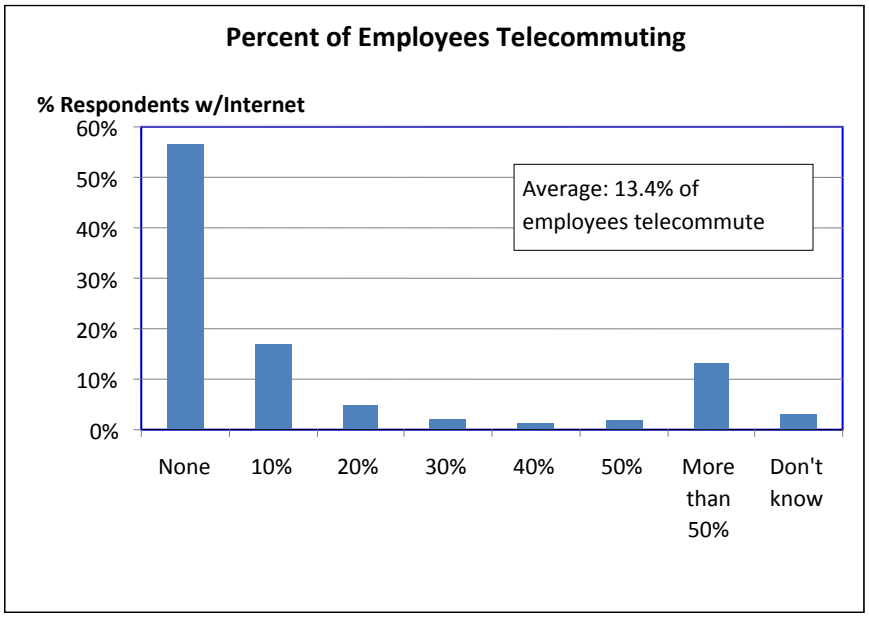
Slightly less than half of the respondents allow telecommuting. Approximately 44% of rural businesses and 46% of metro businesses currently allow telecommuting. An additional 5% to 6% of businesses may allow it within the next year.

Figure 51: Survey Respondent Percent Allowing Telecommuting (Rural/Metro)



Approximately 13% of all employees telecommute, at least some of the time. The percentage of employees telecommuting is about equal among metro (13.4%) and rural (13.3%) respondents.

Figure 52: Survey Respondent Percent of Employees Telecommuting (Aggregate)



Use of Videoconferencing

Approximately 12% of respondents use videoconferencing, with desktop, Web-based teleconferencing the most common form. More metro businesses than rural businesses use videoconferencing, by a margin of 23% to 17%. Nearly one-half of leased-line Internet subscribers use videoconferencing.

Figure 53: Survey Respondent Videoconferencing (Aggregate)

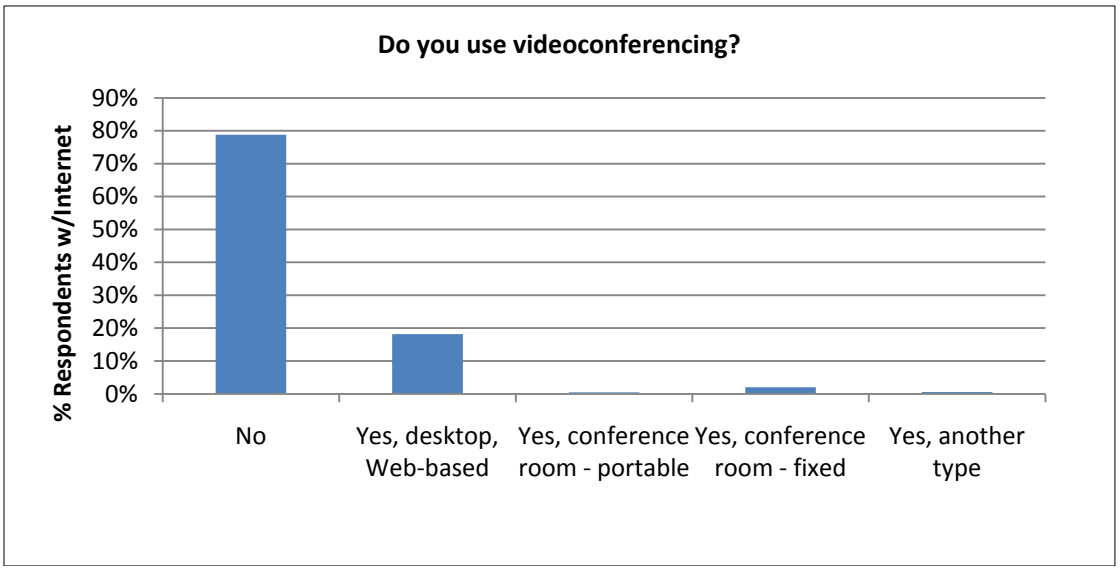
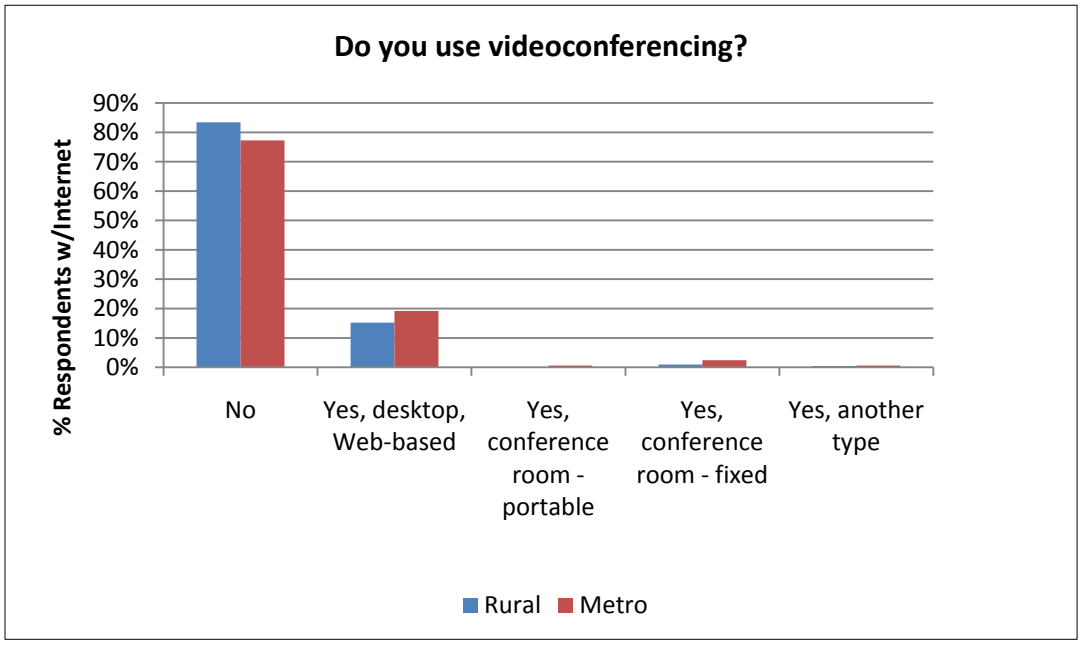


Figure 54: Survey Respondent Videoconferencing (Rural/Metro)



Use of Voice over Internet Protocol Telephone (VoIP)

Approximately 15% of respondents currently use Voice over Internet Protocol (VoIP)—an increase from 3.3% of businesses using VoIP in the 2003 Advocacy survey. Among all respondents, 28% are unfamiliar with the technology. Of the businesses currently using VoIP, 80% use an external Internet connection for VoIP while only 20% rely exclusively on an internal LAN. Approximately 17% of metro businesses and 9% of rural businesses (a statistically significant difference) currently use VoIP. There is little difference in familiarity with the VoIP technology between the metro and rural segments. The difference in adoption rates is related to the consideration and ultimate use of VoIP.

Figure 55: Survey Respondent Use of Voice over Internet Protocol (VoIP) (Aggregate)

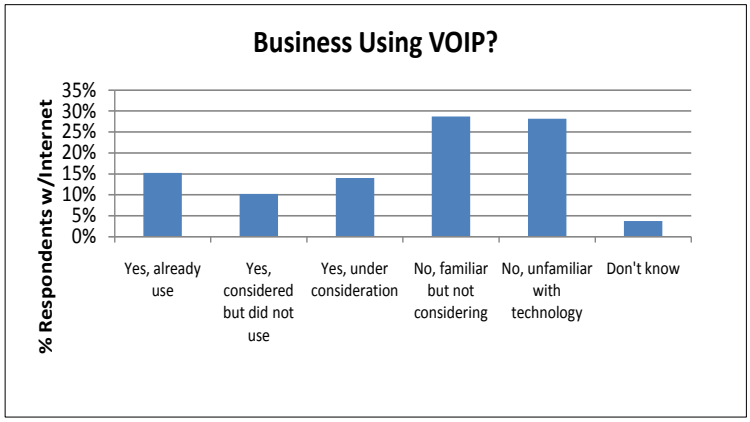
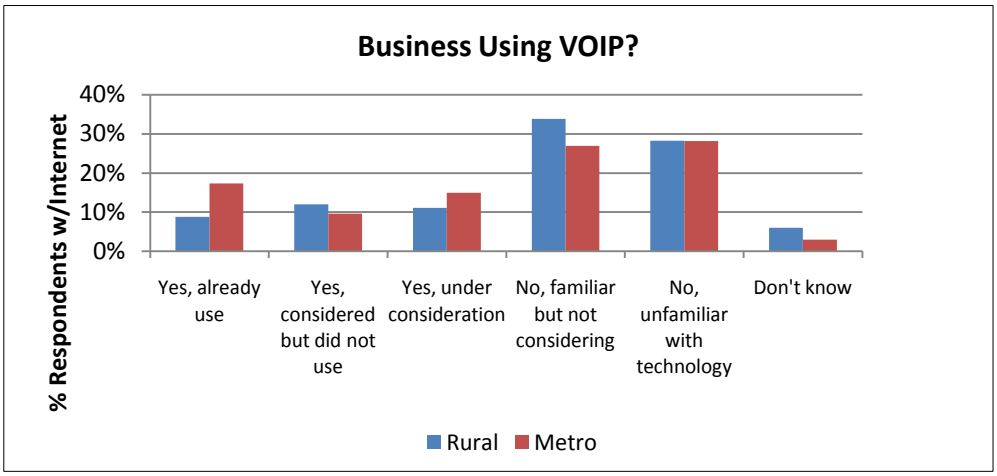


Figure 56: Survey Respondent Use of VoIP (Rural/Metro)



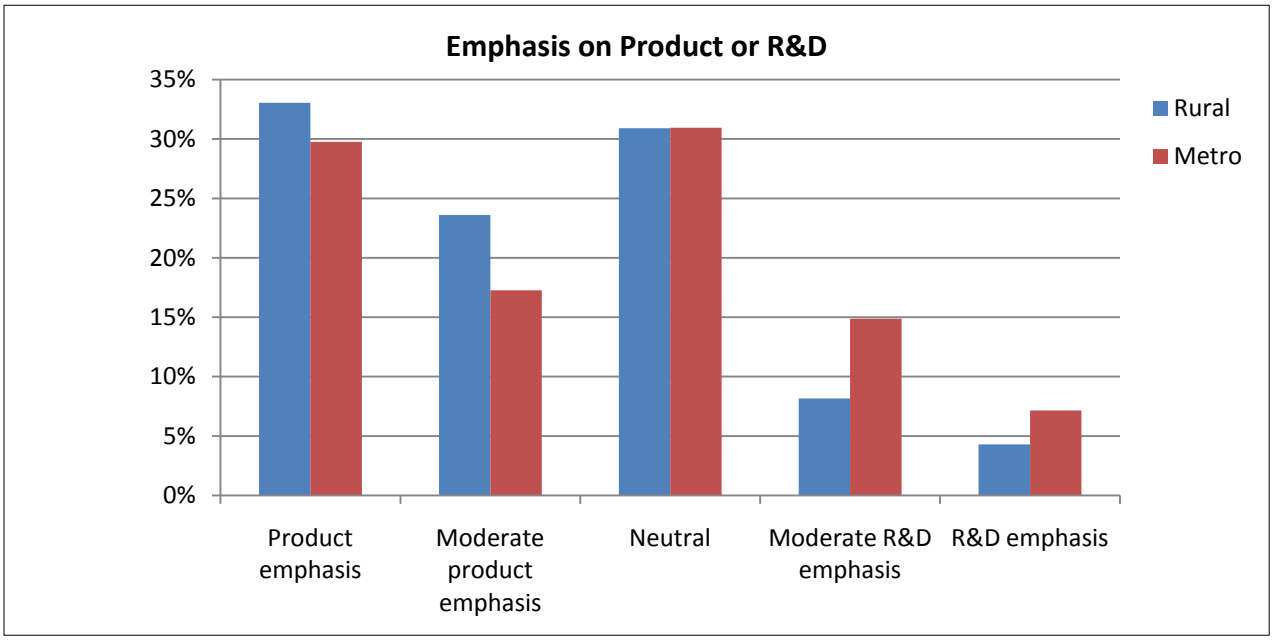
Nearly one-half of businesses with leased-line Internet service currently use VoIP, suggesting that very high speed Internet access is a key enabler of VoIP use. Most VoIP users connect through an external Internet connection. Only 15% of rural VoIP users and 21% of metro VoIP users connect exclusively through an internal LAN. Slightly less than one-half of all businesses reimburse employees for a cell phone or handheld device, with no significant difference between rural and metro businesses.

Business Practices and Strategies

This section summarizes the information collected in the survey about respondents' perceptions of their business practices and strategies. The survey found no statistically significant differences between metro and rural responses.

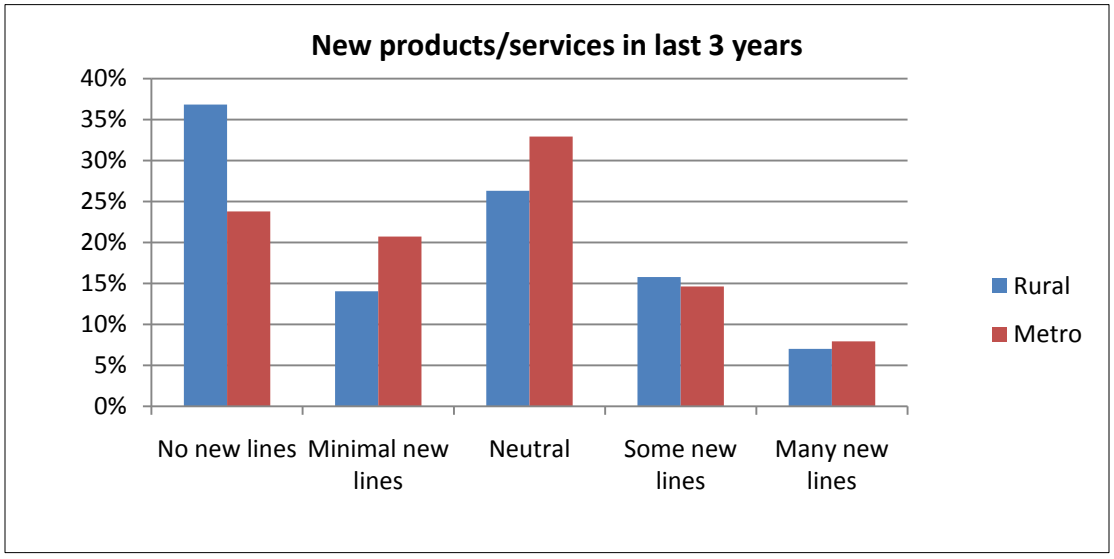
Rural businesses tend to be somewhat more focused on tried-and-true products or services than their metro counterparts. More metro businesses emphasize research and development (R&D), including technological leadership and innovation. Overall, more businesses have a product emphasis, although this may be partially due to current economic conditions and the lack of funding available for R&D projects or aggressive product development strategies.

Figure 57: Survey Respondent Emphasis on Product or R&D (Rural/Metro)



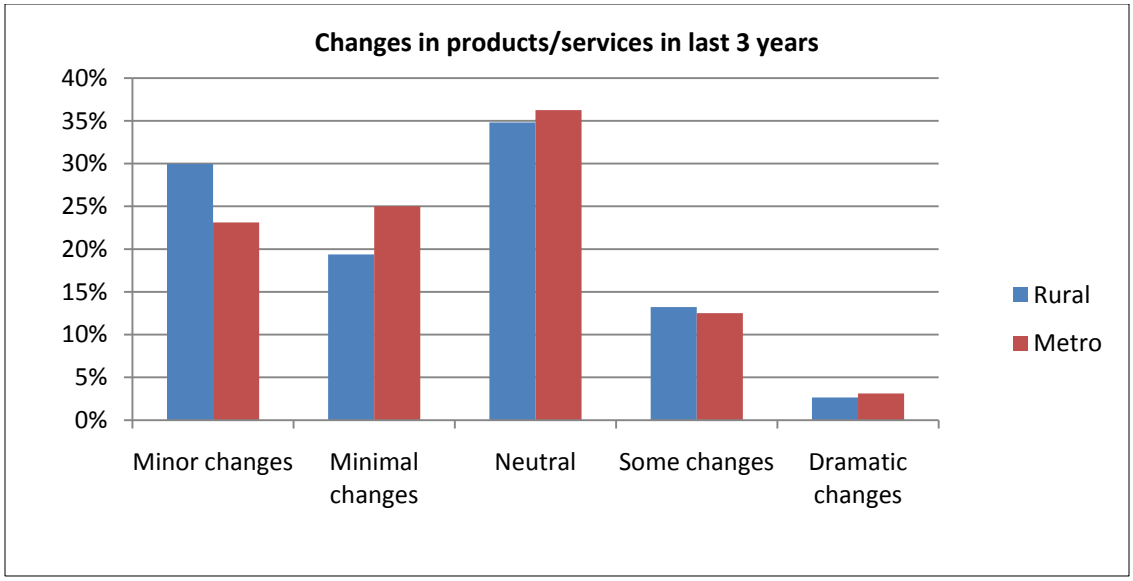
In general, rural businesses have introduced fewer new products/service lines in the past three years than metro businesses. However, the total share of all businesses introducing many new product lines in the past three years is less than 10%, possibly influenced by recent economic conditions.

Figure 58: Survey Respondent New Products or Services (Rural/Metro)



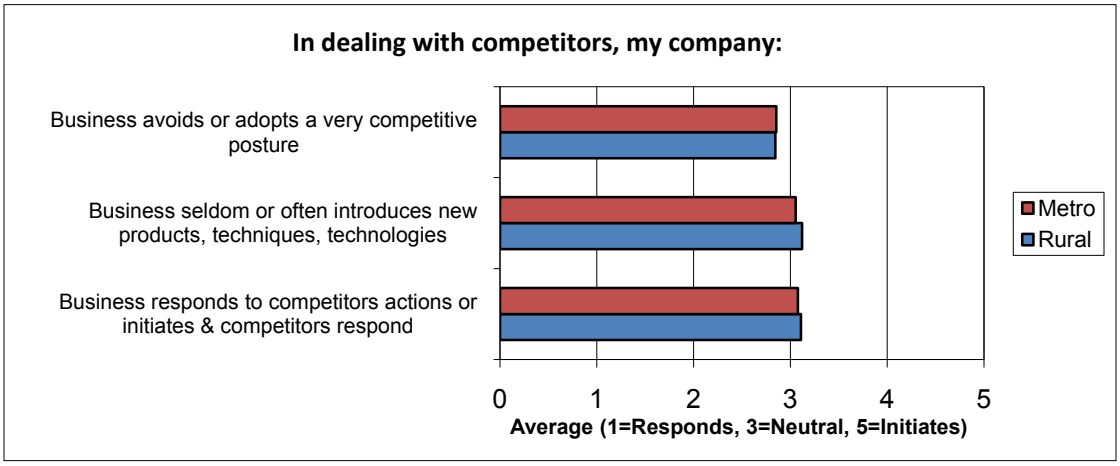
Rural businesses are also more likely to have made only minor changes to their products/service lines in recent years.

Figure 59: Survey Respondent Changes in Products or Services (Rural/Metro)



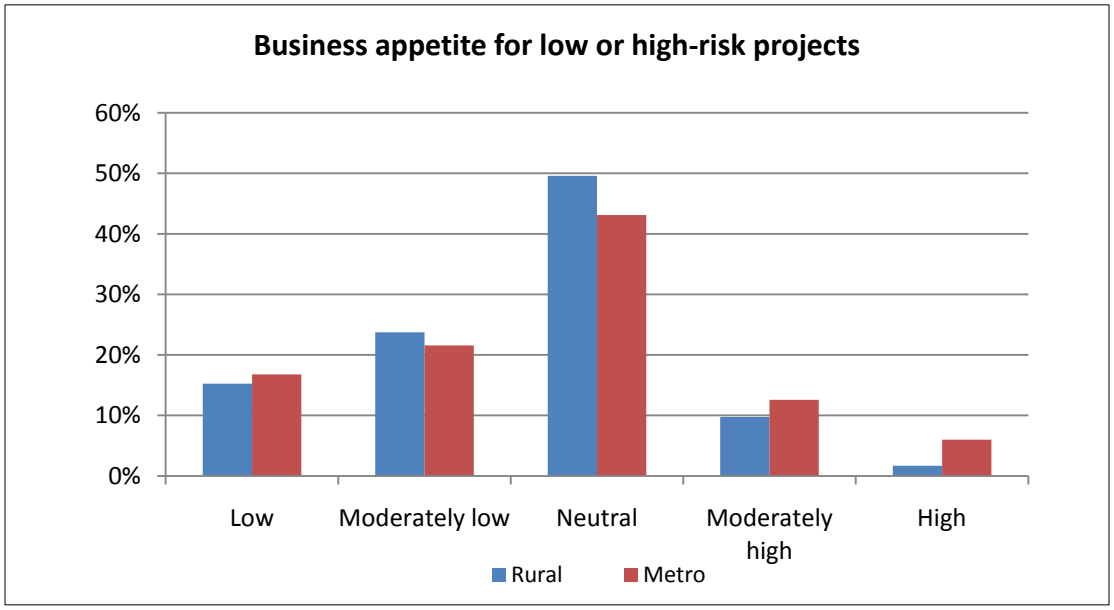
There is little difference between rural and metro businesses in the ways they respond to their competitors across the three categories captured in the survey.

Figure 60: Survey Respondent Response to Competitors (Rural/Metro)



In general, metro businesses have a slightly greater appetite for risk, but the difference is not statistically significant.

Figure 61: Survey Respondent Appetite for Risk (Rural/Metro)



There are not significant differences between rural and metro businesses in their caution about their overall business strategies and actions. Nor is there a significant difference in the aggressiveness with which rural and metro businesses make decisions. These results indicate that business appetite for risk and decision-making is relatively similar between metro and rural businesses.

Figure 62: Survey Respondent Approach to Change (Rural/Metro)

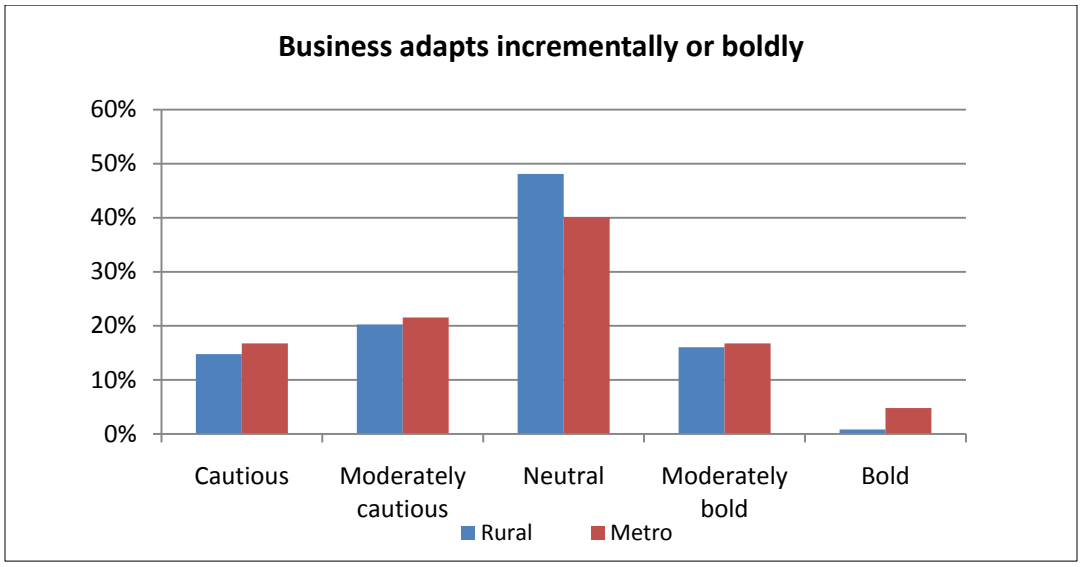
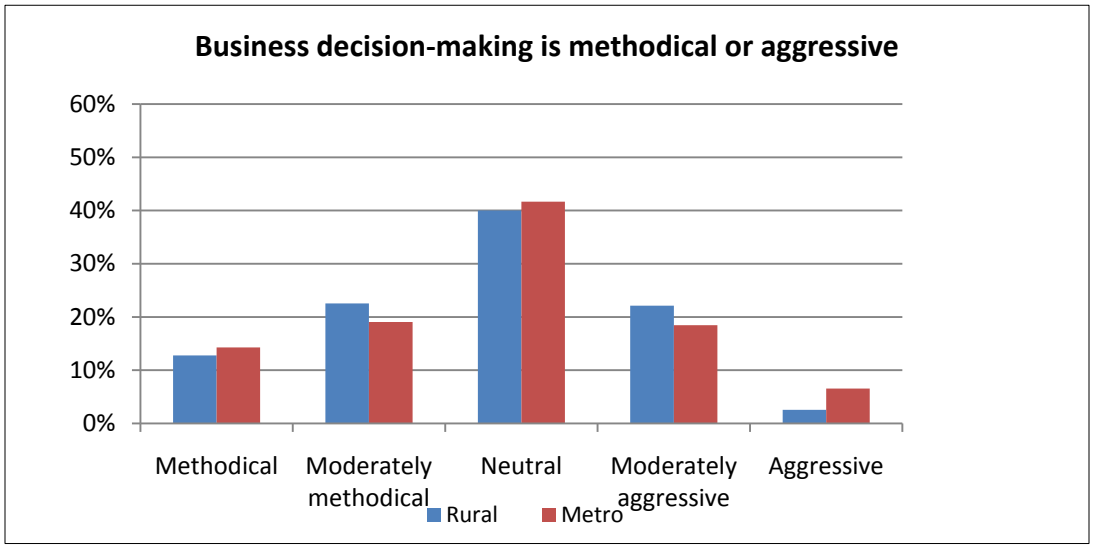


Figure 63: Survey Respondent Approach to Decision-Making (Rural/Metro)



Comparisons to 2003 Survey for the Office of Advocacy

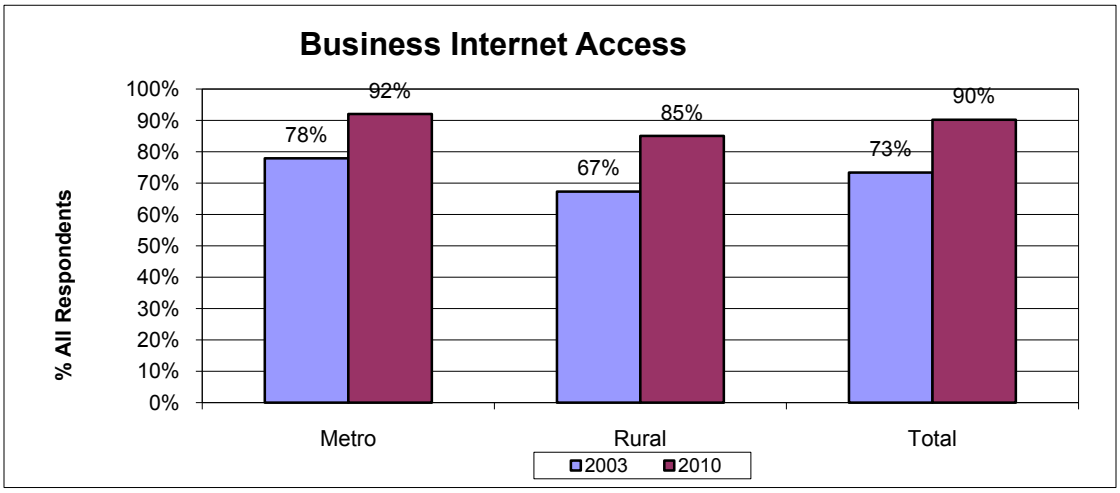
During fall 2003, TeleNomic Research, LLC conducted a survey of small businesses' telecommunications use and spending on behalf of Advocacy. While the 2003 survey focused more broadly on telecommunications, it included a number of questions about Internet access. This section includes comparisons of the 2003 and 2010 survey results regarding Internet use and prices, including breakdowns between metro and rural areas, where available.

The results of the 2003 survey were published in March 2004.[101] The mail survey had 458 responses, including 247 from metro businesses and 185 from rural businesses. It should be noted that the "metro" and "rural" definition was provided by the survey respondent in the 2003 survey, and may not perfectly match the standardized metro and rural sectors based on USPS carrier route designations (as defined in Section 2.2) in the current study.

Approximately 73% of respondents to the 2003 survey had Internet access, compared to 90% in the current survey (weighted average of metro and rural, including companies with no computers). Internet service among rural businesses increased by eighteen percentage points, from 67% to 85%. Internet service among metro businesses increased by fourteen percentage points, from 78% to 92%. The difference in Internet service between segments decreased from 11% in 2003 to 7% in 2010. Some of the remaining difference is attributed to the share of businesses not using any computers.

[101] Pociask, "Survey of Small Businesses' Telecommunications Use and Spending."

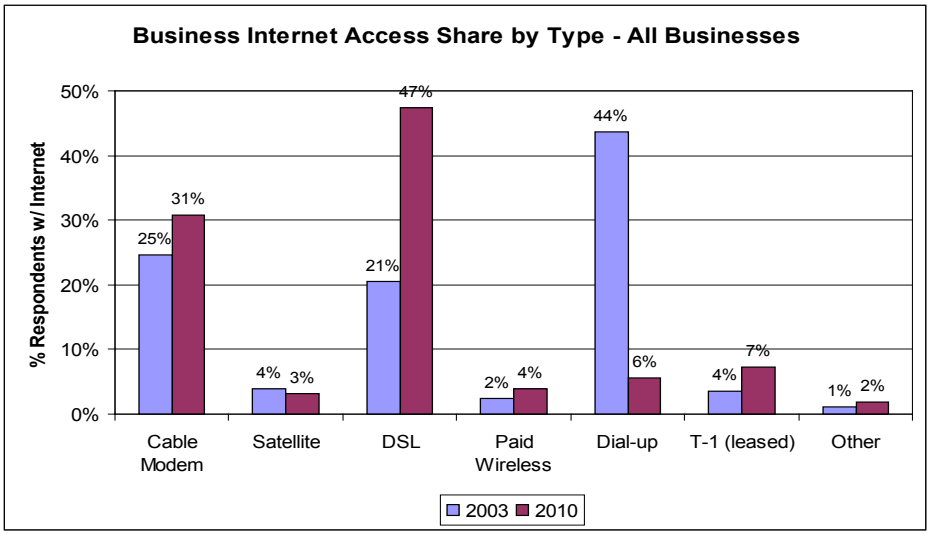
Figure 64: Business Internet Access, 2003 vs. 2010 Surveys (Rural/Metro)



The following pages compare the share of business Internet customers by connection type and the average price within each connection type. Comparisons are done for all businesses, the metro sector, and the rural sector. The 2003 survey data is taken from Table 39 and Table 40 of the survey report.[102]

The Internet connection types used by businesses have changed significantly over the past seven years. The share of businesses with dial-up Internet connections has dropped from 44% to 6%. The largest increase is in DSL connections, which now comprise nearly half of all business Internet connections. Shares of all other connection types have increased, with the exception of satellite, which has declined.

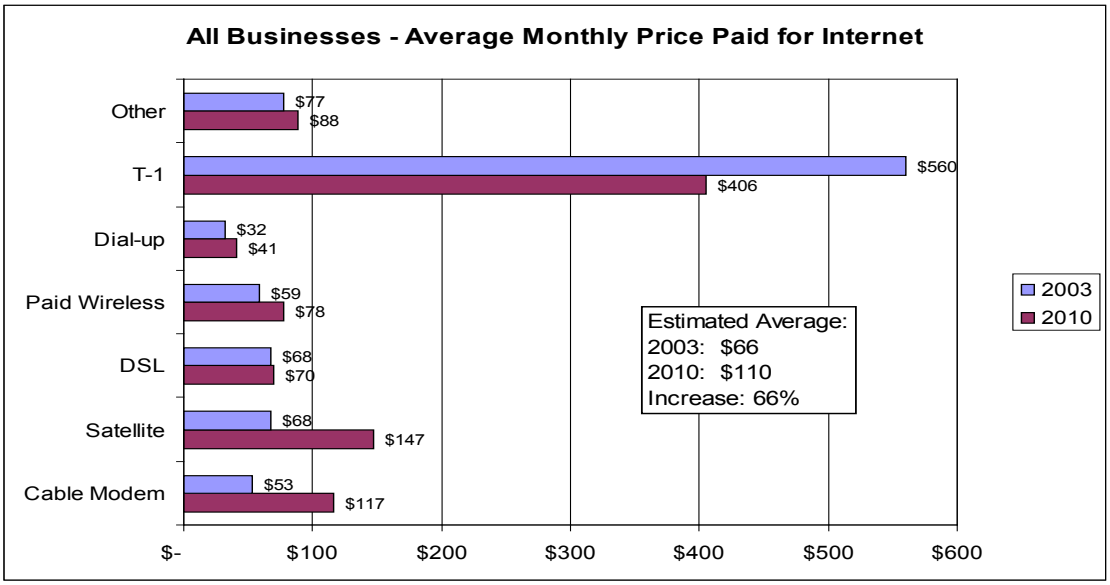
Figure 65: Business Internet Access Share by Type, 2003 vs. 2010 Surveys (Aggregate)



[102] Ibid.

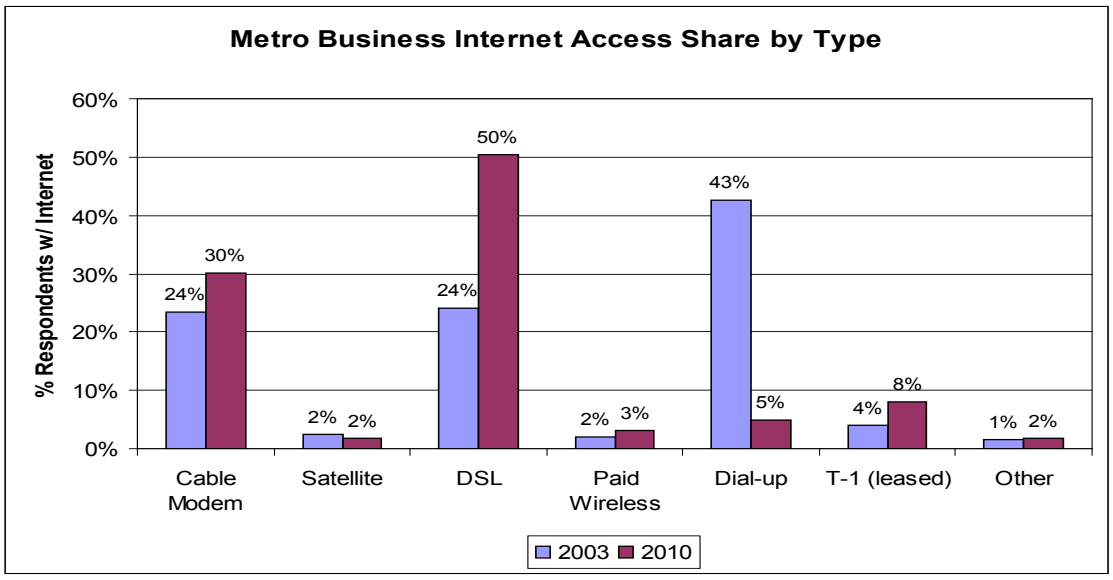
The average monthly price of Internet service to businesses has increased from $66 to $110, an increase of 67%. This includes the shift toward broadband connections and, in many cases, increased speeds within a certain technology. The cost of satellite service has increased the most while the cost of leased-line service (T-1 from the 2003 survey) has declined the most. Both of these results (satellite and leased-line) are based on a fairly limited number of responses to both the 2003 and 2010 surveys.

Figure 66: Business Internet Price by Type, 2003 vs. 2010 Surveys (Aggregate)



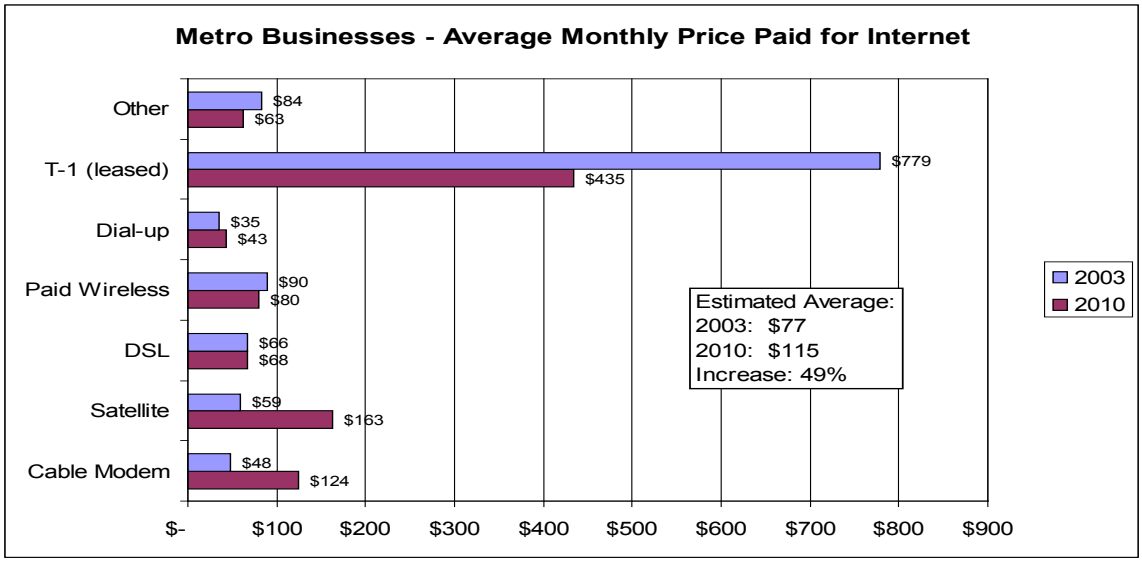
Metro businesses have largely shifted away from dial-up Internet connections toward broadband connections, especially DSL. DSL now comprises one-half of metro business Internet share while dial-up service has plummeted from 43% to 5%. The shares of cable modem, leased-line, and paid wireless have also increased, while the share of satellite connections for metro businesses has declined slightly.

Figure 67: Metro Business Internet Access Share by Type, 2003 vs. 2010 Surveys



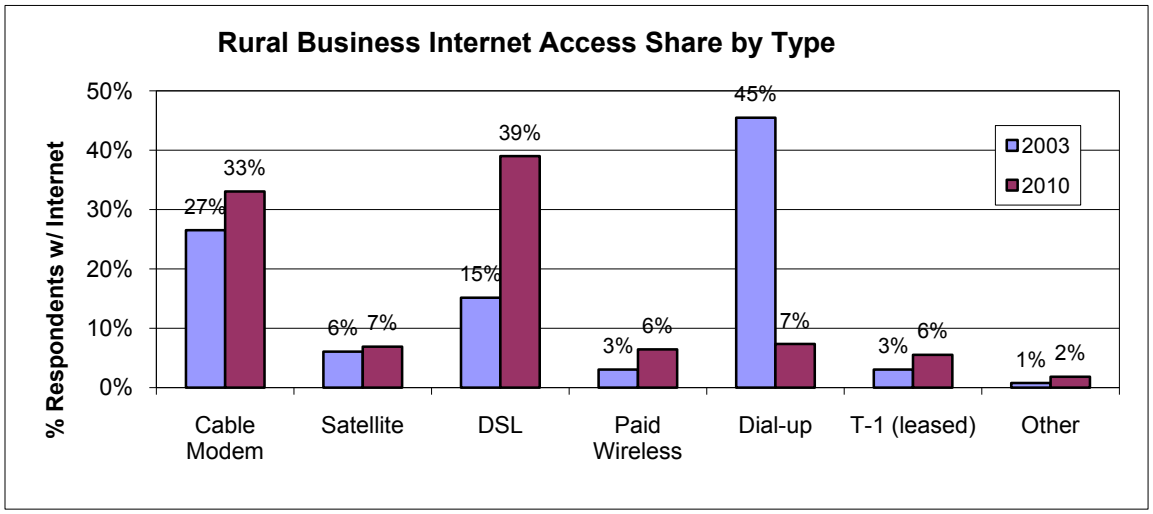
The average monthly price of Internet service to metro businesses has increased from $77 to $115, an increase of 49%. Prices have increased for satellite, cable, and dial-up service, but have declined for leased-line and paid wireless connections. The monthly price of DSL service to metro businesses has remained relatively stable since 2003.

Figure 68: Metro Business Internet Price by Type, 2003 vs. 2010 Surveys



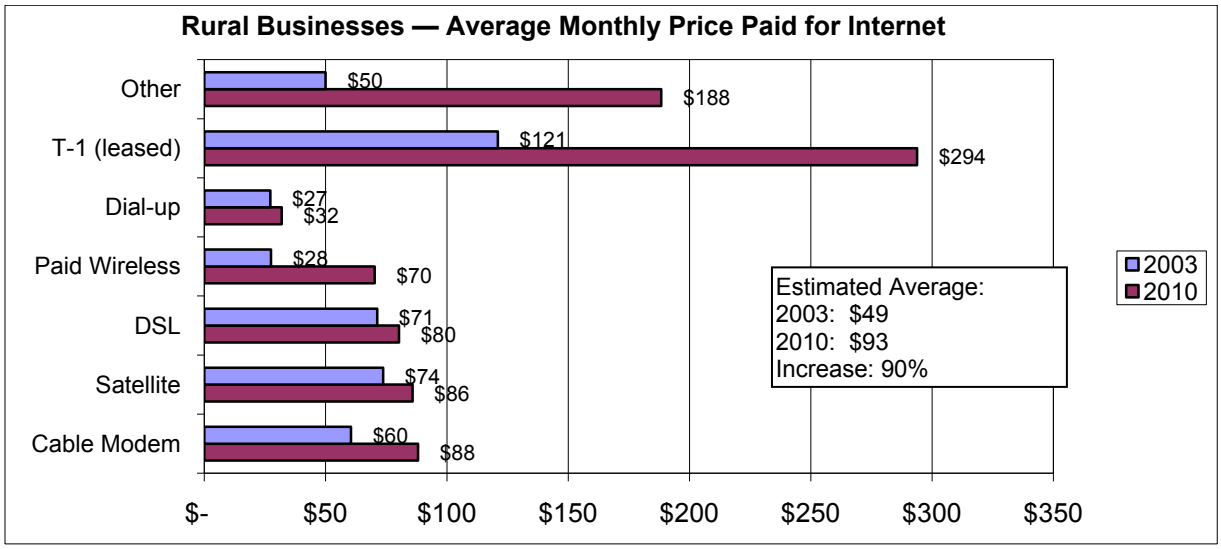
Rural businesses have also shifted away from dial-up Internet connections toward broadband connections, especially DSL. Dial-up Internet service now comprises less than 10% of the rural market, while DSL comprises nearly 40% and cable comprises nearly 35%. These shifts are similar in proportion to the metro sector discussed previously.

Figure 69: Rural Business Internet Access Share by Type, 2003 vs. 2010 Surveys



Prices for all types of rural Internet connections have increased, with the largest increases in leased-line and paid wireless service, and the smallest increase in DSL and dial-up. Rural businesses pay less than their metro counterparts for most types of Internet connections, though the gap has declined from $28 in 2003 to $22 in 2010 (see Figure 68 for comparative data). Please note that this comparison is with the price paid for Internet service, not a price comparison of equivalent services; the survey results and secondary research suggest that metro area business purchase higher-capacity Internet services.

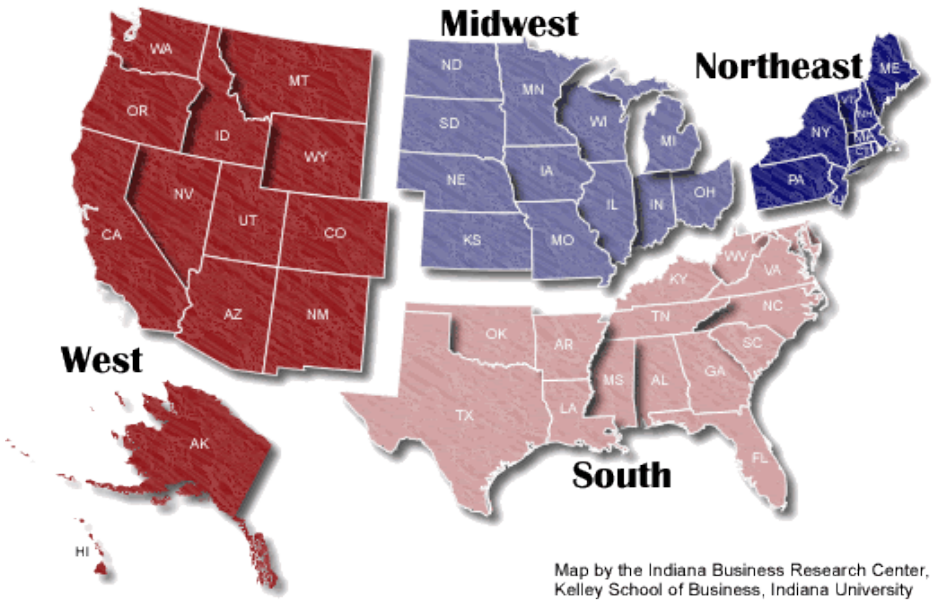
Figure 70: Rural Business Internet Price by Type, 2003 vs. 2010 Surveys



Analysis of Differences Across Regions in the United States

The survey responses were subdivided into the four primary Census regions for comparative purposes. The summaries presented in this section are not weighted for metro and rural responses, but are intended as a general comparison across geographic regions. The four Census regions are presented in Figure 71.

Figure 71: U.S. Census Regions



Source: STATS Indiana, www.stats.indiana.edu, Indiana Business Research Center at Indiana University's Kelley School of Business

The number of respondents in each Census region is presented in Table 17.

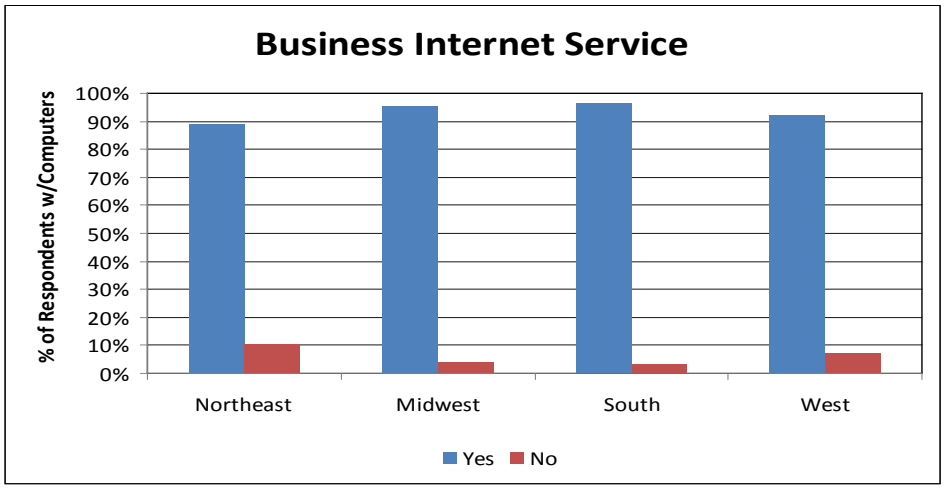
Table 17: Survey Respondents by Census Region

Census Region	Rural	Metro	Total
Northeast	53	16	69
Midwest	84	46	130
South	80	49	129
West	32	65	97
Total	**249**	**176**	**425**

Source: Survey responses.

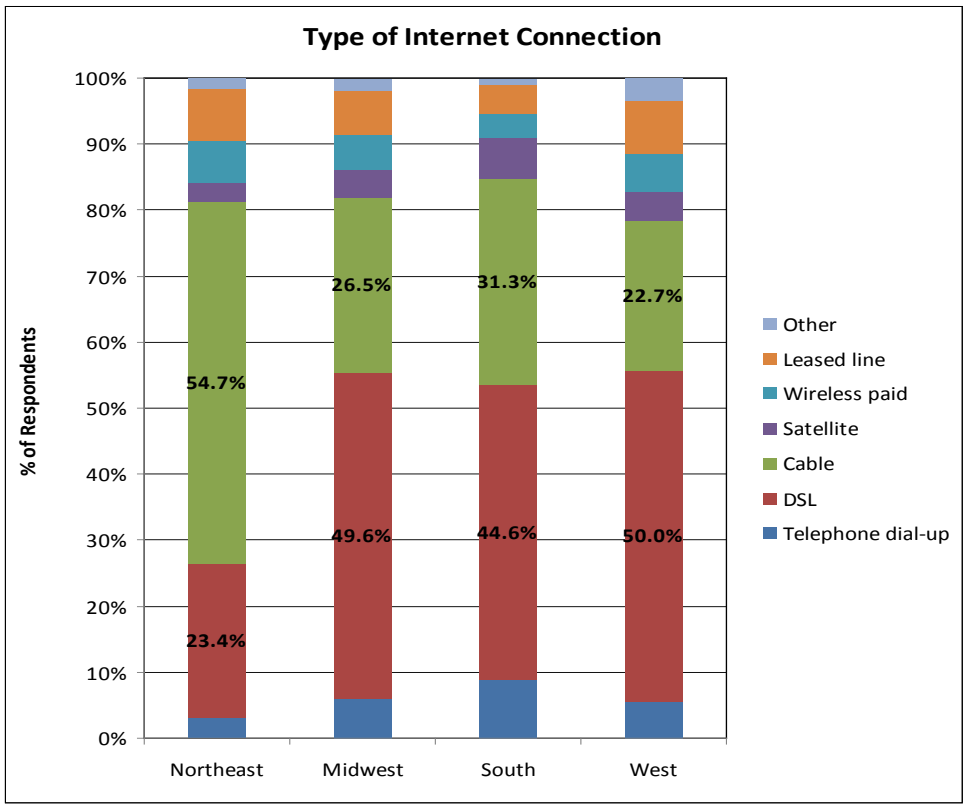
Over 90% of businesses with computers have Internet access at their business. The Northeast had the lowest percentage at 89.4% with Internet access, but also had the highest percentage of rural respondents.

Figure 72: Survey Respondent Internet Access by Region



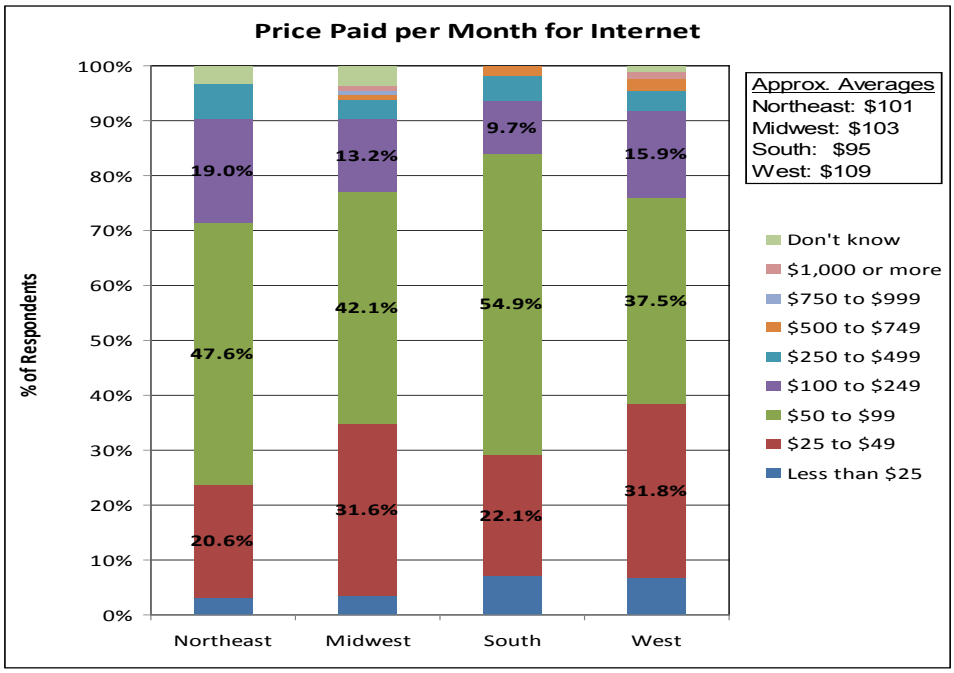
DSL is the dominant business Internet connection type, with the exception of the Northeast. In the Northeast, more than half of businesses have cable modem Internet connections.

Figure 73: Survey Respondent Type of Internet Connection by Region



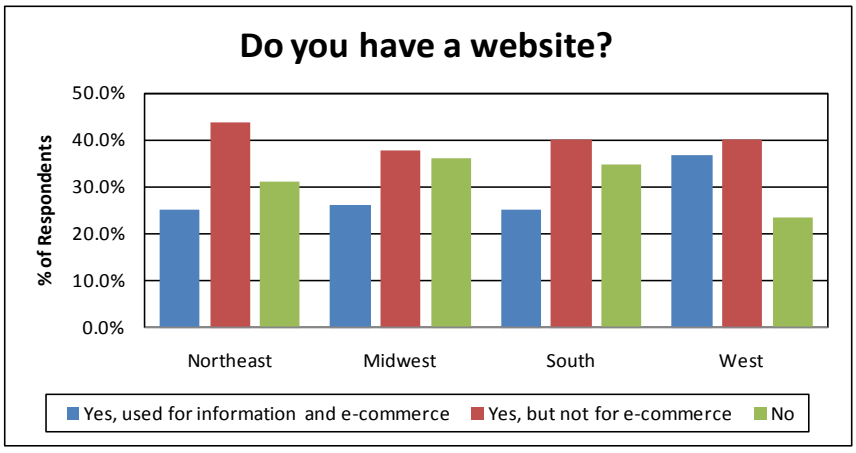
The $50 to $99 range is the most common price respondents are paying for Internet across all four census regions, with the majority paying between $25 and $99.

Figure 74: Survey Respondent Internet Price by Region



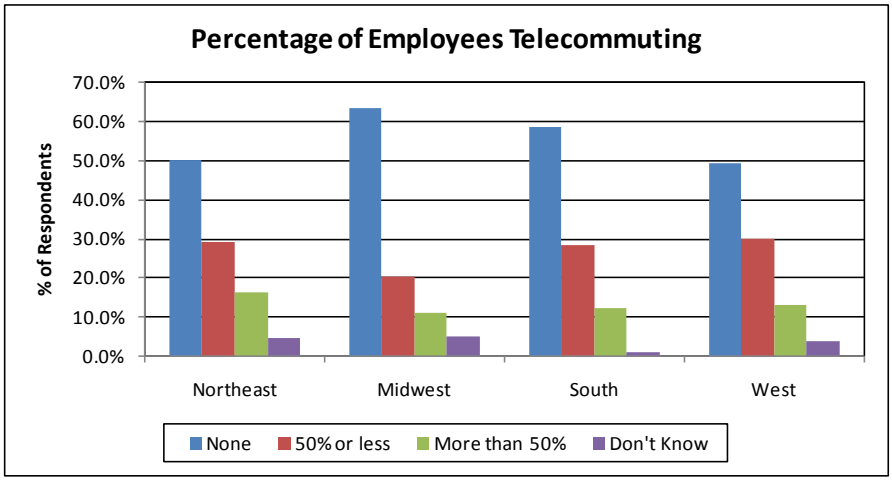
The majority of respondents also have a website, and most indicated that they use it for informational purposes (not for e-commerce). The West has the highest share of businesses with a website (76%), with half using the website for e-commerce.

Figure 75: Survey Respondents with Websites by Region



The majority of respondents do not support private networks over the Internet, but the West has the highest percentage of respondents that do at 25.0%. The West also has the highest share of respondents with employees telecommuting. The Midwest had the highest percentage of businesses with no telecommuting (63.2%) and not supporting a virtual private network (57.6%).

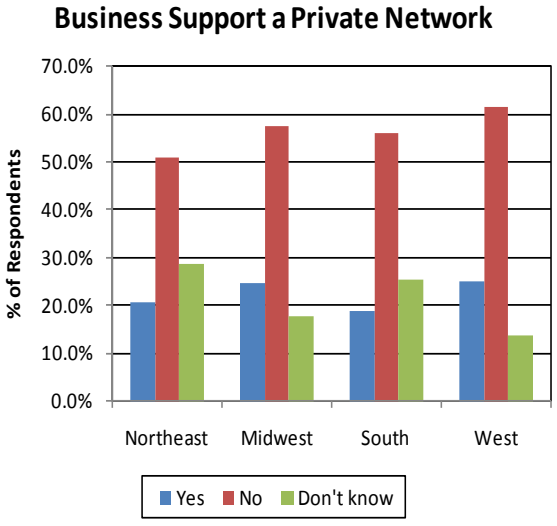
Figure 76: Survey Respondent Percentage of Employees Telecommuting by Region

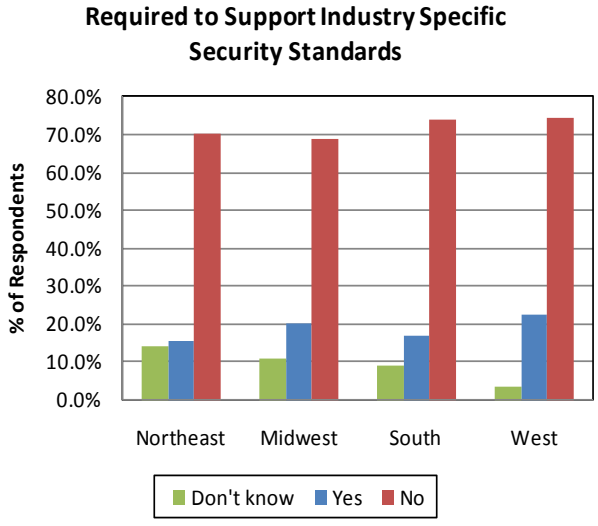


The Midwest also had the highest percentage of businesses not supporting a virtual private network (57.6%).

Fewer than one-fourth of businesses are required to support industry-specific security standards. The West has the highest share of respondents required to do so (22.5%) and the Northeast has the lowest (15.6%).

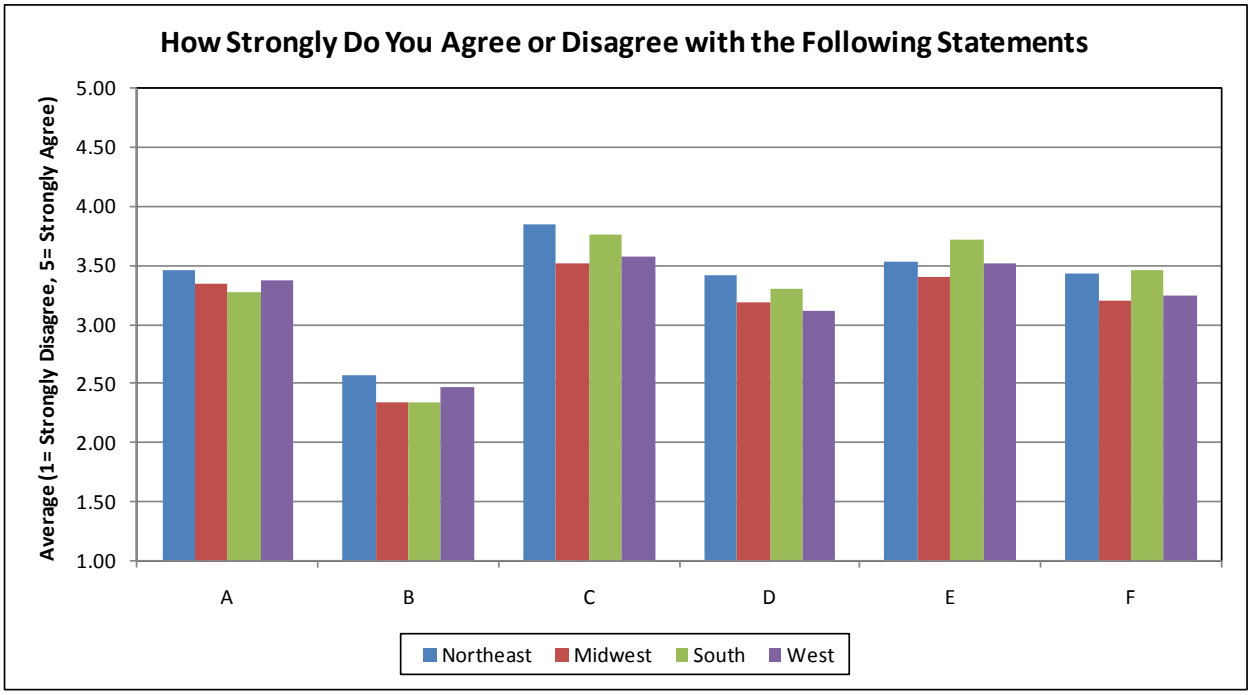
Figure 77: Survey Respondent Private Networks and Security Standards by Region





Respondents from the Northeast were more likely to agree and respondents from the Midwest were least likely to agree that their Internet service was available, affordable, and important to their businesses. While respondents across all regions agreed most with the statement that high-speed Internet is as important to their business as utilities such as electricity and water, respondents indicated that the availability of high-speed Internet that they can afford is not a primary factor in determining where to locate their businesses.

Figure 78: Survey Respondent Opinions on Internet Availability, Affordability, and Importance



The statements were as follows:

A. Our local market currently offers high-speed Internet access at prices that my business can afford.

B. The availability of affordable high-speed Internet access is a factor I consider in deciding where to locate my business.

C. High-speed Internet access is as essential to my business as other main services such as water and sewer or electricity.

D. Businesses like mine are able to function efficiently only if they and their customers have high-speed Internet access.

E. Mobile access to the Internet will become more important to my business operations in the next five years.

F. Our business would realize greater long-term benefits by increasing our use of high-speed Internet access.

Appendix E: Technical Details about U.S. Broadband Options

This section includes details about the services identified in Section 3.1. This study did not verify claims of service availability—it did not verify the accuracy of information posted by providers or conveyed by customer service representatives (which would have required installation and operation of the service). Likewise, the study did not verify whether the service delivered the capacity or other operational parameters claimed by the service provider.

Fiber-to-the-Premises (FTTP)

In the past five years, some service providers have begun to install fiber optic technology to the premises of individual customers in select markets. Fiber optic technology has theoretically almost unlimited capacity. Once fiber is installed, the service provider can increase the capacity of the link simply by upgrading the electronics.

In the 2000s, municipal service providers and Verizon Communications introduced fiber-to-the-premises (FTTP) technology in the United States. Verizon's FTTP service, called FiOS, included data, video, and voice. Service areas for included metropolitan areas in the Northeast and Mid-Atlantic states and former GTE service areas in the South and West.[103] Fiber is currently available in Washington, D.C. and other Mid-Atlantic and northeastern states: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Virginia. FiOS is also available in the western states of California, Oregon, and Washington, and in the southern states of Florida, Texas, and South Carolina. FiOS is predominantly present within the states' metropolitan areas (sometimes, but not always, including their urban cores); it is not ubiquitously present across these states and is virtually nonexistent in rural areas.

FTTP services in our sample range from 512 Kbps to 50 Mbps, including symmetrical services up to 50 Mbps as summarized in Table 18. Appendix F provides more details on the providers and the specific services provided by each of the providers. Because the technology is fiber optic-based, service providers can upgrade and provide new services more quickly than can providers using other, less flexible technologies.

[103] The service areas for Verizon were obtained from http://www.fiberexperts.com/fios-availability.html and http://www.consumerfiber.com/fios-availability.

Table 18: Summary of Speeds and Price Ranges for FTTP Services

Service	Download Speed/Upload Speed	Monthly Price Range
FTTP 1 (under 5 Mbps)	512 Kbps/256 Kbps 4 Mbps/512 Kbps	$25 to $30
FTTP 2 (5 Mbps to 15 Mbps)	8 Mbps/8 Mbps 6 Mbps/768 Kbps 10 Mbps/1.5 Mbps	$37 to $55
FTTP 3 (15 Mbps to 50 Mbps)	16 Mbps/16 Mbps 24 Mbps/24 Mbps 25 Mbps/5 Mbps 25 Mbps/25 Mbps 35 Mbps/35 Mbps	$77 to $130
FTTP 4 (Over 50 Mbps)	50 Mbps/10 Mbps 50 Mbps/50 Mbps	$180 to $195

Sources: Columbia Telecommunications Corporation, based on industry interviews and Web research. For companies contacted, see Appendix F.

Even within cities and counties where FiOS is available, individual customers are sometimes told that service is not available to their residences, small businesses, or blocks. Individual addresses must be verified. Therefore service cannot be considered complete and uniform on a regional basis.

The survey performed for this report did not explicitly include FTTP as a connection type.[104] Therefore some respondents may have placed it in the "other" category, which would have meant that 2% of respondents, at the most, were receiving this service.

Other service providers, including most local exchange providers, will offer high-speed business services over fiber optics, primarily in metropolitan areas. These are summarized in Table 19 with more details on the exact services and pricing provided in Appendix F.

Table 19: Summary of Speeds and Price Ranges for High-Speed Fiber Services for Businesses

Service	Connection Type	Monthly Price
T1 circuit	1.5 Mbps	$250 to $1,200
T3 circuit	45 Mbps	$3,000 to $12,000
OC-3	155 Mbps	$15,000 to $100,000

Sources: Columbia Telecommunications Corporation, based on industry interviews, www.broadbandlocators.com/t1.php, and www.bandwidtht1.com. For companies contacted see Appendix F.

The technology used for these high-speed services is primarily for larger users and is different from FiOS and the municipal FTTP services in that it is typically only constructed to a particular

[104] Some respondents may have included FiOS as a cable service, for example.

building or street if a customer requests it, and it is typically more costly. One example is AT&T Opt-e-MAN, which provides a range of service from 2 Mbps to 1,000 Mbps for $800 to $3,370 per month. It is not an Internet service but a metropolitan area network (MAN) service, which can interconnect multiple buildings belonging to a business, or connect a business to an Internet service provider (which would require an additional fee for the Internet "pipe" to connect to the MAN "pipe").

AT&T Opt-e-MAN, AT&T Gig-a-MAN, Verizon TLS, and other fiber MAN services are enterprise offerings, potentially suited only for the largest small businesses, and likely not practical or affordable for most small businesses. They are available only in areas where the service provider central office is upgraded for the service, and there may be an additional fee for construction if the service is not in the area—with fiber construction costing tens or hundreds of thousands of dollars per mile.

Respondents to the survey using these technologies might have responded "leased line" or "other" to describe the service. Given the monthly cost of these services, a few percent at the most are users.

Cable Modem

Cable TV was primarily intended as an entertainment medium with a target market that was almost exclusively residential. This is why cable operators did not originally build to office parks, downtown commercial areas, and industrial areas. As a result, cable broadband is still not an option for many business customers, unless they wish to pay for the cable operator to construct to their area.

Because most of the capacity of a cable system is in the downstream (network-to-customer) direction, service offerings are significantly faster downstream. Typically the speed is two to ten times faster downstream. However, one provider, Time Warner Cable, provides a 5 Mbps symmetrical service (Appendix F).

Like the fiber providers, cable operators can upgrade the speed of their service. This is done by dedicating more of the channel capacity to interactive data services (e.g., by eliminating or compressing traditional television services), by increasing the channel bandwidth of the system, by using more advanced equipment, or by building fiber optics closer to the customer. However, the physical medium of the coaxial cable is more limited than fiber optics, so cable operators will face more challenges in expanding than providers that already have fiber optics to the premises.

The services in our sample varied based on the provider (Appendix F). Comcast provided the highest speeds, up to 105 Mbps downstream. Cox offered up to 55 Mbps downstream. Suddenlink offers services up to only 10 Mbps downstream and Mediacom offers services up to only 20 Mbps downstream. These providers serve mostly smaller cities away from major metropolitan areas (i.e., rural). Costs for these services range from $27 to $629 per month.

None of the cable providers surveyed offer a service level agreement (SLA)—that is, contract terms that require the provider to pay the customer if speed, availability or other parameters fall below a minimum level.

A summary of the services and pricing is provided in Table 20 while more details on each provider are available in Appendix F.

Table 20: Summary of Speeds and Price Ranges for Cable Services

Service	Download Speed/ Upload Speed	Monthly Price Range
Cable 1 (under 3 Mbps)	256 Kbps/256 Kbps 768 Kbps/384 Kbps 1 Mbps/128 Kbps 1.5 Mbps/384 Kbps 1.5 Mbps/3 Mbps 2 Mbps/2 Mbps	$27 to $209
Cable 2 (3 Mbps to 5 Mbps)	3 Mbps/384 Kbps 4 Mbps/512 Kbps 4 Mbps/768 Kbps	$33 to $279
Cable 3 (5 Mbps to 10 Mbps)	5 Mbps/384 Kbps 5 Mbps/768 Kbps 5 Mbps/1 Mbps 5 Mbps/1.5 Mbps 5 Mbps/5 Mbps 6 Mbps/1 Mbps 7 Mbps/2 Mbps 8 Mbps/1 Mbps 8 Mbps/2 Mbps	$40 to $300
Cable 4 (10 Mbps to 20 Mbps)	10 Mbps/1 Mbps 10 Mbps/2 Mbps 10 Mbps/3 Mbps 10 Mbps/5 Mbps 15 Mbps/2 Mbps 15 Mbps/3 Mbps 16 Mbps/2 Mbps	$45 to $629
Cable 5 (20 Mbps to 50 Mbps)	20 Mbps/2 Mbps 20 Mbps/4 Mbps 22 Mbps/5 Mbps 25 Mbps/3 Mbps 25 Mbps/5 Mbps 30 Mbps/5 Mbps 30 Mbps/7 Mbps	$55 to $250
Cable 6 (50 Mbps to 105 Mbps)	50 Mbps/10 Mbps 55 Mbps/5.5 Mbps 105 Mbps/10 Mbps	$90 to $379

Sources: Columbia Telecommunications Corporation, based on industry interviews and Web research. For companies contacted, see Appendix F.

The survey did not formally examine the cable systems to understand the basis for the differences in speed. However, the Comcast systems are known to have been upgraded to the latest DOCSIS 3.0 technology, making speeds beyond 25 Mbps technically possible for a significant num-

ber of users.[105] Also, service providers in smaller and more isolated areas have fewer options to buy wholesale backbone Internet connections, and those connections, often bought in smaller increments, can be substantially more costly than the capacity bought wholesale by Comcast in multiple metropolitan areas—often ten or twenty times the cost.

Digital Subscriber Line (DSL)

DSL services costs in our sample range from $35 to $195 per month; a summary of the available services and pricing is provided in Table 21. Details on services provided by each of the providers and the pricing for these services are provided in Appendix F.

Table 21: Summary of Speeds and Price Ranges for DSL Services

Service	Download Speed/ Upload Speed	Monthly Price Range
DSL 1 (under 1 Mbps)	128 Kbps/128 Kbps 416 Kbps/416 Kbps 768 Kbps/384 Kbps	$30 to $75
DSL 2 (1 Mbps to 3 Mbps)	1 Mbps/384 Kbps 1.5 Mbps/384 Kbps 1.5 Mbps/896 Kbps 1.5 Mbps/1 Mbps 1.5 Mbps/1.5 Mbps	$35 to $195
DSL 3 (3 Mbps to 5 Mbps)	3 Mbps/512 Kbps 3 Mbps/768 Kbps	$45 to $70
DSL 4 (5 Mbps to 8 Mbps)	6 Mbps/768 Kbps 6 Mbps/1 Mbps 7 Mbps/5 Mbps 7.1 Mbps/768 Kbps	$45 to $80
DSL 5 (8 Mbps to 10 Mbps)	8 Mbps/1 Mbps	$119
DSL 6 (10 Mbps to 15 Mbps)	10 Mbps/1 Mbps 12 Mbps/1.5 Mbps 12 Mbps/5 Mbps	$55 to $129
DSL 7 (over 15 Mbps)	15 Mbps/1 Mbps 20 Mbps/5 Mbps 24 Mbps/3 Mbps	$70 to $150

Sources: Columbia Telecommunications Corporation, based on industry interviews and Web research. For companies contacted, see Appendix F.

DSL services are theoretically available wherever copper phone lines exist, making them potentially more ubiquitous than cable. However, DSL availability is limited if central offices are not equipped with DSL equipment, if the copper lines are too long, if copper lines are in poor condition, or if filters in the outside cable plant need to be replaced.

[105] Cable modem is a shared medium. A geographic area of a few hundred customers shares a pool of capacity. Thus operators can be limited in offering many customers in a single area the highest speeds, potentially requiring the operator to upgrade that neighborhood to provide the service.

The AT&T U-verse service is a high-capacity DSL service with short copper lines offering data speeds up to 24 Mbps. AT&T installs cabinets in each U-verse served neighborhood to reduce the copper line length, and connects each cabinet with fiber optics.

Wireless Broadband

The rapidly increasing use of wireless technologies has made it difficult for service providers to keep up with demand for capacity; service can be uneven in some areas, particularly during peak times. In response, service providers impose bandwidth caps and charge customers on a per-usage basis. Currently, AT&T is the only service provider that does not offer an unlimited (no-cap) service option, but it has been reported that other services providers may follow this trend and begin to limit their service.

Downstream speeds in our sample range from 128 Kbps to 300 Kbps for 2G services, 600 Kbps to 1.5 Mbps for 3G services, and 1.5 Mbps to 6 Mbps for 4G services (see Table 22, below). Costs range from $20 to $60 per month, and depend on a range of factors, including monthly data usage, whether the customer purchased the device from the service provider, and the contract term. Details on services provided by each of the providers and the pricing for those services are included in Appendix F.

Table 22: Summary of Speeds and Price Ranges for Wireless Internet Services

Service	Device	Download Speed	Upload Speed	Monthly Data Usage	Monthly Price Range
2G/2.5G-EDGE/GPRS, 1xRTT service	PC cards, USB modems	128 Kbps to 300 Kbps	70 Kbps to 100 Kbps	10 MB to 5 GB	$20 to $50
3G- EVDO Rev A, HSDPA service	PC cards, USB modems	600 Kbps to 1.5 Mbps	500 Kbps to 1.2 Mbps	200 MB to 250 MB	$25 to $40
3G- EVDO Rev A, HSDPA service	PC cards, USB modems	600 Kbps to 1.5 Mbps	500 Kbps to 1.2 Mbps	5 GB to unlimited	$40 to $60
3G- EVDO Rev A, HSDPA service	Smart phones	600 Kbps to 1.5 Mbps	500 Kbps to 1.2 Mbps	Unlimited, no corporate e-mail access	$30 to $55
3G- EVDO Rev A, HSDPA service	Smart phones	600 Kbps to 1.5 Mbps	500 Kbps to 1.2 Mbps	2GB to unlimited with corporate e-mail access	$40 to $55
3G- EVDO Rev A, HSDPA service	Smart phones	600 Kbps to 1.5 Mbps	500 Kbps to 1.2 Mbps	2GB with corporate e-mail and tethering	$50 to $60
4G WiMAX service	Home Internet service	1.5 Mbps to 6 Mbps	500 Kbps to 1.2 Mbps	Unlimited for home Internet	$30 to $40
4G WiMAX service	Mobile Internet service	1.5 Mbps to 6 Mbps	500 Kbps to 1.2 Mbps	Unlimited	$40 to $55

Sources: Columbia Telecommunications Corporation, based on industry interviews and Web research. For companies contacted, see Appendix F.

Actual speeds will depend on the signal strength and the congestion caused by the total number of users. Currently 4G is only available in select markets and only from Clearwire or Sprint. 3G services are in most metropolitan areas and many moderately built-up areas. 2G is available in most places where cellular phone service is available. Typically a phone or computer air card capable of the higher-speed services will operate with the lower speeds if the customer moves into an area with only the lower-speed service.

On a one-to-five scale, with five meaning "very satisfied," the survey indicates price satisfaction at or above the level for cable and DSL (3.2 for metro respondents and 3.7 for rural) and comparable speed satisfaction to cable (3.8 for metro respondents and 3.5 for rural). It is important to reiterate that this category spans a wide range of technology, including the cellular carriers as well as local WISPs, and that more detailed investigation is required to separate the two.

Satellite Broadband

The published monthly cost of satellite broadband in our sample ranges from $60 to $400; a summary of the available speeds and pricing is provided in Table 23 while details on the individual services and their pricing are provided in Appendix F.

Table 23: Summary of Speeds and Price Ranges for Satellite Services

Service	Download Speed/ Upload Speed	Monthly Price Range
1 Mbps to 3 Mbps	1 Mbps/128 Kbps 1.2 Mbps/200 Kbps 1.6 Mbps/250 Kbps 2 Mbps/300 Kbps	$60 to $120
3 Mbps to 5 Mbps	3 Mbps/512 Kbps 3 Mbps/1 Mbps 5 Mbps/1 Mbps	$200 to $400

Sources: Columbia Telecommunications Corporation, based on industry interviews and Web research. For companies contacted, see Appendix F.

Appendix F: Data on Service Options and Pricing

FTTP Services

Table 24: Speed and Price of Columbus (KS) Telephone Company–FTTP Services

Download Speeds	Upload Speeds	Monthly Price
8 Mbps	8 Mbps	$57
16 Mbps	16 Mbps	$77
24 Mbps	24 Mbps	$97

Sources: http://www.columbus-ks.com/internet/index.html, http://www.columbus-ks.com/index.html

Table 25: Speed and Price of Jackson (TN) Energy Authority–FTTP Services

Download Speeds	Upload Speeds	Monthly Price [a]
512 Kbps	256 Kbps	$25
4 Mbps	512 Kbps	$30
6 Mbps	768 Kbps	$40
10 Mbps	1.5 Mbps	$55
25 Mbps	5 Mbps	$120
50 Mbps	10 Mbps	$180

Source: http://www.jaxenergy.com/broadband/bundles /RATES_web.pdf

[a] No long-term service agreement specified. Pricing applies on a month-to-month basis.

Table 26: Speed and Price of Verizon FiOS–FTTP Services

Download Speeds	Upload Speeds	Monthly Price	Comments
Up to 25 Mbps	Up to 25 Mbps	$105 to $110	$105 with a one-year service agreement; $110 with a two-year service agreement
Up to 35 Mbps	Up to 35 Mbps	$125 to $130	$125 with a one-year service agreement; $130 with a two-year service agreement
Up to 50 Mbps	Up to 50 Mbps	$190 to $195	$190 with a one-year service agreement; $195 with a two-year service agreement

Sources: http://smallbusiness.verizon.com/products/internet/fios_pricing.aspx, http://www.dslreports.com/gmaps/fios, http://www.fiberexperts.com/fios-availability.html.

High-Speed Fiber Services for Businesses

Table 27: Speed and Price of AT&T High-Speed Fiber Services for Businesses

Service Name	Connection Type	Monthly Price	Comments
OPT-E-MAN-Bronze	100M port with 2M CIR to 1G port with 1G CIR	$800 to $3,030	Pricing with three-year service agreement. Available in twelve states.
OPT-E-MAN-Bronze	100M port with 5M CIR to 1G port with 1G CIR	$735 to $2,900	Pricing with five-year service agreement. Available in twelve states.
OPT-E-MAN-Silver	100M port with 5M CIR to 1G port with 1G CIR	$975 to $3,370	Pricing with three-year service agreement. Available in twelve states.
OPT-E-MAN-Silver	100M port with 5M CIR to 1G port with 1G CIR	$905 to $3,240	Pricing with five-year service agreement. Available in twelve states.
Giga-MAN	Dedicated fiber optic PTP Gigabit Ethernet connection	$2,500 to $3,300	Pricing with one- to five-year service agreement. [a]
Giga-MAN	NRC-admin., CO & customer connection	$3,290	n/a

Sources: http://www.von.com/news/2007/07/at-t-increases-opt-e-man-speeds.aspx, http://www.business.att.com/enterprise/service_localization/access-enterprise/ethernet-service-enterprise/opteman-service-enterprise/, http://www.illinois.net/contracts/AT&T/AT&T_Statewide_Opt_E_Man%20Pricing_3.08.pdf, http://www.business.att.com/enterprise/Service/access-enterprise/ethernet-service-enterprise/gigaman-service-enterprise/state=California/

[a] One-year service agreement, $2,500; three-year, $2,850; five-year, $3,300.

Table 28: Speed and Price of Verizon High-Speed Fiber Services for Businesses

Service Name	Connection Type	Monthly Price	Comments
T1 circuit	Full T1 (1.5M x 1.5M)	$473	Pricing with one-year service agreement
T1 circuit	Full T1 (1.5M x 1.5M)	$453	Pricing with three-year service agreement
T1 circuit	Full T1 (1.5M x 1.5M)	$423	Pricing with five-year service agreement
T3 circuit	45 Mbps	$4,300	Pricing with three-year service agreement

Source: http://smallbusiness.verizon.com/products/internet/fios_pricing.aspx

Cable Modem Services

Table 29: Speed and Price of Bright House Networks–Cable Modem Services

Download Speeds	Upload Speeds	Monthly Price
768 Kbps	384 Kbps	$33
10 Mbps	1 Mbps	$48
20 Mbps	2 Mbps	$63

Source: http://brighthouse.com/

Table 30: Speed and Price of Charter Communications–Cable Modem Services

Download Speeds	Upload Speeds	Monthly Price
1 Mbps	128 Kbps	$30
8 Mbps	1 Mbps	$40
16 Mbps	2 Mbps	$50
25 Mbps	3 Mbps	$65

Source: http://www.charter.com/

Table 31: Speed and Price of Comcast–Cable Modem Services

Download Speeds	Upload Speeds	Monthly Price
1.5 Mbps	384 Kbps	$27
15 Mbps	3 Mbps	$45
20 Mbps	4 Mbps	$55
30 Mbps	7 Mbps	$63
50 Mbps	10 Mbps	$100
105 Mbps	10 Mbps	$110

Source: http://files.shareholder.com/downloads/
CMCSA/845254023x0xS1193125-09-33975/1166691/filing.pdf

Table 32: Speed and Price of Cox–Cable Modem Services

Download Speeds [a]	Upload Speeds	Monthly Price
3 Mbps	384 Kbps	$33
15 Mbps	3 Mbps	$47
25 Mbps	5 Mbps	$65
55 Mbps	5.5 Mbps	$90

Sources: http://intercept.cox.com/, http://ww2.cox.com/residential/arizona/internet/preferred-internet.cox, http://ww2.cox.com/residential/arizona/internet/premier-internet.cox, and http://ww2.cox.com/residential/arizona/internet/ultimate-internet.cox.
[a] Download speeds available with a power booster.

Table 33: Speed and Price of Mediacom–Cable Modem Services

Download Speeds	Upload Speeds	Monthly Price
5 Mbps	1 Mbps	$80
10 Mbps	1 Mbps	$100
15 Mbps	2 Mbps	$180
20 Mbps	2 Mbps	$250

Sources: http://www.broadbandinfo.com/mediacom-communications/high-speed-internet/, http://phx.corporate-ir.net/phoenix.zhtml?c=98270&p=irol-IRHome

Table 34: Speed and Price of MegaPath–Cable Modem Services[106]

Download Speeds	Upload Speeds	Monthly Price [a]
256 Kbps	256 Kbps	$189
2 Mbps	2 Mbps	$209
3 Mbps	384 Kbps	$239
4 Mbps	768 Kbps	$279
6 Mbps	1 Mbps	$139
8 Mbps	2 Mbps	$289
10 Mbps	3 Mbps	$239
10 Mbps	5 Mbps	$629
15 Mbps	3 Mbps	$299
22 Mbps	5 Mbps	$229
30 Mbps	5 Mbps	$139
50 Mbps	10 Mbps	$379

Source: Telephone conversation with company sales representative.
[a] Pricing is based on MegaPath's contracts with cable providers such as Cox, Comcast, and Time Warner Cable. Pricing requires a one-year service agreement.

Table 35: Speed and Price of Suddenlink–Cable Modem Services[107]

Download Speeds	Upload Speeds	Monthly Price
4 Mbps	512 Kbps	$70
8 Mbps	1 Mbps	$130
10 Mbps	2 Mbps	$200

Source: Telephone conversation with company sales representative.

[106] Serves 90% of the country.
[107] Serves parts of California, Minnesota, Missouri, New Mexico, North Carolina, Ohio, Oklahoma, Texas, and West Virginia. Mainly serves towns of approximately one hundred thousand or less. Serves rural and suburban areas.

Table 36: Speed and Price of Time Warner Cable–Cable Modem Services

Download Speeds	Upload Speeds	Monthly Price [a]
5 Mbps	384 Kbps	$60
5 Mbps	768 Kbps	$50 to $100
5 Mbps	1.5 Mbps	$100 to $125
5 Mbps	5 Mbps	$200 to $400
7 Mbps	2 Mbps	$100 to $125
10 Mbps	2 Mbps	$165 to $300

Source: http://www.twcbc.com
[a] Pricing is the same for one-, two-, or three-year service agreement.

DSL Services

Table 37: Speed and Price of AT&T–DSL Services

Download Speeds	Upload Speeds	Monthly Price [a]
416 Kbps	416 Kbps	$75
768 Kbps	384 Kbps	$30
1.5 Mbps	384 Kbps	$50
3 Mbps	512 Kbps	$55
6 Mbps	768 Kbps	$70

Source: https://swot.sbc.com
[a] Requires a one- or two-year service agreement.

Table 38: Speed and Price of AT&T U-verse–DSL Services[108]

Download Speeds	Upload Speeds	Monthly Price
1.5 Mbps	1 Mbps	$40
6 Mbps	1 Mbps	$60
12 Mbps	1.5 Mbps	$70
24 Mbps	3 Mbps	$95

Source: http://www.att.com/u-verse

[108] Available in 122 markets across twenty-two states.

Table 39: Speed and Price of EarthLink–DSL Services[109]

Download Speeds	Upload Speeds	Monthly Price [a]
1.5 Mbps	384 Kbps	$50
3 Mbps	768 Kbps	$70
6 Mbps	768 Kbps	$80
8 Mbps	1 Mbps	$119
10 Mbps	1 Mbps	$129
15 Mbps	1 Mbps	$150

Source: http://www.earthlink.biz/highspeed
[a] Requires one-year service agreement; pricing information for the 10 Mbps download/1 Mbps upload option from sales representative.

Table 40: Speed and Price of MegaPath–DSL Services[110]

Download Speeds	Upload Speeds	Monthly Price
128 Kbps to 1.5 Mbps	128 Kbps to 1.5 Mbps	$70 to $195

Sources: Telephone conversations with company sales representative and http://www.megapath.com/about/network/

Table 41: Speed and Price of Qwest–DSL Services[111]

Download Speeds	Upload Speeds	Monthly Price
1.5 Mbps	896 Kbps	$40
7 Mbps	896 Kbps or 5 Mbps	$45
12 Mbps	896 Kbps or 5 Mbps	$55
20 Mbps	896 Kbps or 5 Mbps	$70

Sources: Telephone conversation with company sales representative and http://www.qwest.com/residential/internet/broadbandlanding/compare_plans.html

[109] Provides service in 319 cities across twenty-nine states; has large presence in Georgia, North Carolina, and South Carolina.
[110] Provides service across the country; announced plans in March 2010 to merge with Covad Communications to increase service footprint. Provides SDSL for business customers, however, speeds available vary depending on the distance from the central office. Specific SLAs are available. Exact speeds and pricing available upon providing specific addresses.
[111] Serves fourteen states (information provided by sales representative): Arizona, Colorado, Idaho, Iowa, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming.

Table 42: Speed and Price of Verizon–DSL Services

Download Speeds	Upload Speeds	Monthly Price [a]
1 Mbps	384 Kbps	$35
3 Mbps	768 Kbps	$45
7.1 Mbps	768 Kbps	$55

Source: https://www22.verizon.com/Residential /HighSpeedInternet/Plans/Plans.htm
[a] Requires a one-year service agreement.

Wireless Services

Table 43: Speed and Price of AT&T–Wireless Services

Plan Type	Download Speeds [a]	Upload Speeds [a]	Monthly Data Usage	Monthly Price
PC cards, USB modems	700 Kbps to 1.7 Mbps	500 Kbps to 1.2 Mbps	10 MB	$20
PC cards, USB modems	700 Kbps to 1.7 Mbps	500 Kbps to 1.2 Mbps	200 MB	$35
PC cards, USB modems	700 Kbps to 1.7 Mbps	500 Kbps to 1.2 Mbps	5 GB	$60
Smart phones	700 Kbps to 1.7 Mbps	500 Kbps to 1.2 Mbps	2 GB + corporate e-mail	$40
Smart phones	700 Kbps to 1.7 Mbps	500 Kbps to 1.2 Mbps	2 GB + corporate e-mail + tethering	$60

Sources: http://www.wireless.att.com/coverageviewer/#?type=data and http://www.wireless.att.com/businesscenter/business-programs/small/networks.jsp#BCN.
[a] These speeds are for 3G coverage. In areas where 3G coverage not available and EDGE network used to provide data connectivity, the speeds may range from 70 Kbps to 135 Kbps.

Table 44: C Speed and Price of Clearwire–Wireless Services[a]

Plan Type	Download Speeds	Upload Speeds	Monthly Data Usage	Monthly Price
Home Internet service	1.5 Mbps	500 Kbps	Unlimited	$30
	Up to 6 Mbps	1.5 Mbps	Unlimited	$40
Mobile Internet service	Up to 6 Mbps	1.5 Mbps	Unlimited	$40
	6 Mbps with peaks up to 10 Mbps	1.5 Mbps	Unlimited with access to 3G network	$55

Sources: http://www.clear.com/coverage and http://www.clear.com/shop/services/compareplans?compare=296&
[a] Available month-to-month or with a two-year contract. 4G coverage is currently available only in select cities in seventeen states.

Table 45: Speed and Price of Sprint–Wireless Services

Plan Type	Download Speeds [a]	Upload Speeds [a]	Monthly Data Usage [b]	Monthly Price [c]
Mobile PC cards, USB modems	3 Mbps to 6 Mbps (4G WiMAX speed)	Up to 1 Mbps	Unlimited on 4G network, 5GB on 3G network	$60
Mobile PC cards, USB modems	600 Kbps to 1.4 Mbps (3G speeds)	350 Kbps to 500 Kbps (3G speeds)	Unlimited on 4G network, 5GB on 3G network	$60

Sources: http://coverage.sprintpcs.com/IMPACT.jsp?INTNAV=ATG:HE:Cov, http://shop.sprint.com/en/stores/popups/compare_data_speeds_popup.shtml, and http://shop.sprint.com/en/stores/popups/4G_coverage_popup.shtml

[a] Speeds vary (50 Kbps to 700 Kbps download, 50 Kbps to 70 Kbps upload) when on roaming data network.

[b] 4G coverage is currently available only in select cities in seventeen states.

[c] Sprint does not offer separate data plans for smart phones; pricing is based on monthly minutes used with unlimited data usage.

Table 46: Speed and Price of T-Mobile–Wireless Services

Plan Type	Download Speeds	Upload Speeds	Monthly Data Usage	Monthly Price [a]
PC cards, USB modems	Typical 2.5G speeds of 200 to300 Kbps. Speeds up to 600 Kbps with peaks of 1 Mbps available in 3G (HSDPA service area).	2.5G upload speed from 70 to 100 Kbps; up to 500 Kbps available in 3G service area.	200 MB or 5 GB	$25 or $40
Smart phones	Typical 2.5G speeds of 200 to300Kbps. Speeds up to 600 Kbps with peaks of 1 Mbps available in 3G (HSDPA service area).	2.5G upload speed from 70 to 100 Kbps. Up to 500 Kbps available in 3G service area	Unlimited data access	$40 to $50

Source: http://www.t-mobile.com/coverage/pcc.aspx

[a] No plan contract required if customer pays for the upfront device cost. Device discount offered in exchange for two-year contract.

Table 47: Speed and Price of U.S. Cellular–Wireless Services

Plan Type	Download Speeds	Upload Speeds	Monthly Data Usage	Monthly Price [a]
USB modems	128 Kbps	128 Kbps	5 GB	$50

Source: http://www.uscellular.com/uscellular/common/common.jsp?path= /coverage-map/coverage-indicator.html

[a] Requires a $30 activation fee. With a two-year contract, device available at subsidized cost. Without contract, customer required to pay full device price.

Table 48: Speed and Price of Verizon–Wireless Services

Plan Type	Download Speeds [a]	Upload Speeds [a]	Monthly Data Usage	Monthly Price [b]
PC cards, USB modems, Express cards, MiFi, Netbooks, or Notebooks	600 Mbps to 1.4 Mbps	500 Kbps to 800 Kbps	250 MB or 5 GB	$40 or $60
Smart phones	600 Mbps to 1.4 Mbps	500 Kbps to 800 Kbps	Unlimited	$30 without / $45 with corporate e-mail access

Sources:
http://vzwmap.verizonwireless.com/dotcom/coveragelocator/Default.aspx?requesttype=NEWREQUEST?requesttype=newsearch&zip=20814&coveragetype=voiceandmessaging and http://www.verizonwireless.com/b2c/store/controller?item=planFirst&action=viewPlanDetail&sortOption=priceSort&catId=409, http://www.verizonwireless.com/b2c/mobilebroadband/?page=plans

[a] These speeds are for EV-DO Rev A and requires EV DO Rev A capable device and Rev A service area. In absence of either of these, the download speeds may be 400 Kbps to 700 Kbps and upload speeds may be 60 Kbps to 80 Kbps.

[b] There is a $35 activation fee. Typical required contracts are month-to-month, one year, or two years.

Satellite Services

Table 49: Speed and Price of HughesNet–Satellite Services[112]

Download Speeds	Upload Speeds	Monthly Price
1 Mbps	128 Kbps	$60
1.2 Mbps	200 Kbps	$70
1.6 Mbps	250 Kbps	$80
2 Mbps	300 Kbps	$120
3 Mbps	512 Kbps	$200
3 Mbps	1 Mbps	$300
5 Mbps	1 Mbps	$400

Source: Telephone conversation with company sales representative.

[112] Available in all states. Requires a clear line of sight to the southern sky.