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Bringing Broadband to Rural America

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Regional and Community Analysis Staff

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Senior Manager

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Emily Wavering Corcoran
Senior Research Analyst

Roisin McCord
Associate Regional Economist

Surekha Carpenter
Intermediate Research Analyst

Jacob Crouse
Associate Research Analyst

Laura Ullrich
Regional Economist

Alexander Marré
Regional Economist

Design: Cecilia Bingenheimer

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To inquire about our publications, contact:
The Federal Reserve Bank of Richmond
Research Department
P.O. Box 27622, Richmond, Va. 23261-7622
email: caorichmondfed@rich.frb.org
www.richmondfed.org/community_development/

Bringing Broadband to Rural America

AUTHOR
Alexander Marré

Introduction

High-speed broadband internet service has transitioned from a luxury good to an increasingly necessary utility.[1] Rural regions are particularly susceptible to poor broadband infrastructure coverage, however, because they pose a costly business case for providers. The economic case for rural broadband infrastructure, though, is compelling despite its cost: Broadband access and adoption in rural areas is linked to increased job and population growth, higher rates of new business formation and home values, and lower unemployment rates. Unlike with many other types of infrastructure, the long-run benefits of broadband access could grow exponentially, given the potential for innovation and productivity gains it provides.[2,3]

In the near term, the COVID-19 pandemic has thrust the problem to the forefront of policy discussions. Employers are using remote work as a tool to protect the health and safety of their employees. Similarly, schools are offering online learning or hybrid approaches. Remote work and distance learning are difficult to achieve without a broadband internet connection at home that is fast enough to handle their audio and video requirements. At the same time, increased demand for online services during the COVID-19 pandemic has slowed speeds for those who have access.[4]

The Pew Research Center conducted a national survey at the beginning of the pandemic that drives home the importance of reliable internet service.[5] The internet was a source of information about the coronavirus and a tool for connecting with doctors and other medical professionals for both urban and rural respondents: 62 percent of rural respondents searched online for coronavirus information, and 13 percent used the internet for communicating with health professionals. One quarter of all respondents and 14 percent of rural respondents used the internet to work remotely.

Lack of access to broadband internet in rural areas is not a new problem. Low population density and

long distances to existing infrastructure make the upfront cost of infrastructure expansion high for providers. Once built, rural areas have lower adoption rates due to lower average incomes, a higher share of the population that is elderly or disabled, and lower average levels of educational attainment. A costly build out combined with low probability of paying for it with customers make some rural places an unattractive business case for broadband service.[6]

How big of a problem is lack of access to broadband service? Over 18 million Americans lack access to high-speed broadband service, according to the Federal Communication Commission's (FCC) 2019 broadband deployment report.[7] This figure, however, is widely seen as an underestimate of the true problem. Census blocks are considered served by broadband internet if just one household or business can "reasonably" be serviced. In urban areas, census blocks are reasonably small. In rural areas, though, census blocks can be hundreds of square miles. Alternative measures of access to broadband service put the number of unserved Americans as high as 42 million.[8]

To finish broadband expansion in the United States, large subsidies will likely be needed. Alternative technologies may be required in high-cost areas where rapid expansion is needed. Alternative providers may also be needed, and -- where no potential private-sector provider exists – public-private partnerships may be needed to propel infrastructure projects forward.

Local economic impacts of broadband access and adoption

Access to broadband internet service holds the potential for boosting overall economic growth. Communication infrastructure helps to improve coordination and reduce transaction costs in the marketplace. According to an article by Czernich et al., it also "may further facilitate macroeconomic growth by accelerating the distribution of ideas and information, fostering competition for and development of new products and processes, and facilitating the introduction of new work practices, entrepreneurial activities and improved job matching."[9] One study of the economic impacts of broadband infrastructure expansion among 25 developed countries found that a 10 percentage point increase in broadband access resulted in a 0.9 to 1.5 percentage point increase in annual per capita growth.[10]

Can large-scale economic gains translate down to the local level in rural areas? Overall, despite the limitations of data on broadband access and methodological challenges, the research suggests potentially positive impacts of broadband on local economies.[11,12] Effects tend to be stronger in rural areas that are closer to metropolitan areas than in more remote regions, and the use of broadband (adoption) rather than access alone is more powerful.

Studies of the economic impacts of broadband expansion into rural areas can be broadly categorized into local labor market effects, benefits accruing to consumers, benefits accruing to businesses and homeowners, and benefits accruing to participants in telemedicine and distance learning. Highlights of these findings follow:

- Studies of local labor markets have found positive impacts of broadband access and adoption on business location decisions and employment growth in rural areas, although the impact of broadband on business activity is generally larger in urban areas.[13,14,15,16] Isolating the effects of broadband infrastructure on economic activity is difficult, since access and economic growth tend to increase simultaneously, making it difficult to establish causality. One study that attempted to uncover the causal effect of broadband expansion on economic growth found some evidence of a positive effect, with the strongest employment impacts on technology-reliant industries.[17]

- Consumers can choose from a wider array of goods and services when broadband access is available. The ability to shop online helps consumers save money. Economists have used surveys of these savings to estimate the economic benefit of gaining access to broadband service at an annual savings of $1,850 per household.[18] A study from Ohio State University extrapolated these savings to estimate the economic benefits of gaining access to broadband service for Ohio's rural residents at $1.9 billion over 15 years.[19] Extrapolating this approach to all counties in the United States under a conservative adoption rate of 20 percent would yield $43.8 billion over 15 years.[20] Chart 1, below, estimates the annual economic benefit to consumers using the same approach as the Ohio State University study.

- Local businesses can benefit from access to broadband in several ways. High-speed internet can lead to improved matches between jobs and workers, making the hiring process more efficient.[21] It can also

reduce the cost of sharing knowledge, ideas, and information beneficial to the business. Broadband can also expand the pool of potential customers and reduce the cost of accessing suppliers.[22] Farm operations may benefit from the information that the internet can provide, increasing farm output and prices received and lowering input costs. One study estimated that increasing rural broadband access could achieve a 3 percent increase in farm profits across the United States.[23]

- Homeowners can benefit through higher home values, as broadband is often considered a desirable amenity for prospective buyers. Most home value studies have focused on urban areas, but a recent empirical analysis of the effect of broadband speeds on rural housing values shows that increasing the number of houses in a rural county with faster internet speeds by 10 percent results in an average increase in housing values from $230 to $661. Higher home values can translate into increased property tax revenues, thereby increasing the availability of public services.[24,25]

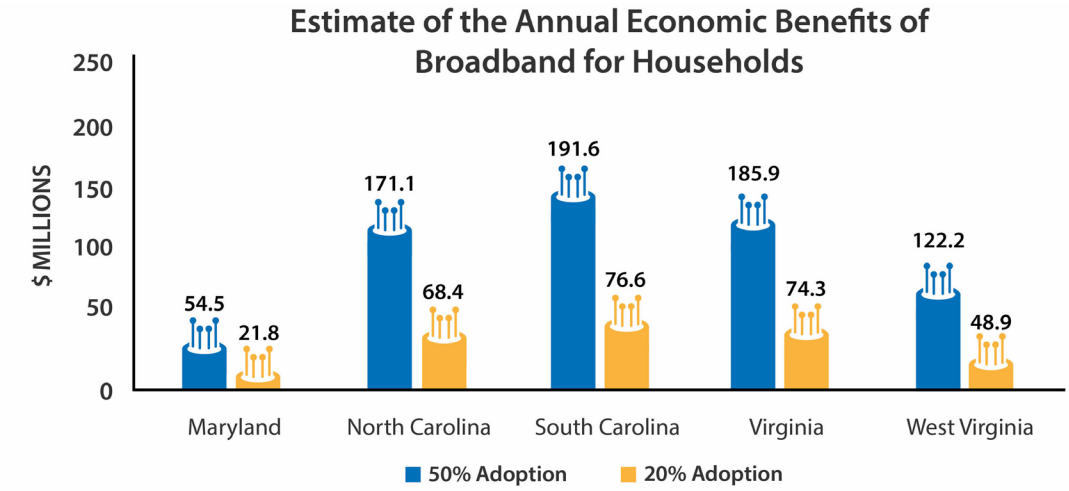
- Broadband access can create economic benefits in the telemedicine and distance education arenas. Telemedicine can deliver hospital cost savings, transportation savings for patients, and increased service provision.[26] What is more, electronic health records, health information exchanges, and mobile health technologies are on the rise.[27] Access to telehealth could be especially critical given the challenge of hospital closures in rural America.[28] With respect to education, broadband access opens the possibility of providing distance learning options to rural students.[29]

Economic multiplier studies pull all these economic effects together to gauge the potential overall economic impact of broadband access on a local economy. Two studies from Purdue University's Center for Regional Development estimated the economic impacts of expanding broadband in the areas served by seven rural electrical cooperatives in Indiana and compared it to the cost of expansion.[30,31] Benefit-cost ratios for expansion in each electrical cooperative's footprint ranged from three to four, meaning every dollar spent on expansion would result in about three to four dollars in economic benefits to Indiana. The per-member net economic benefits in the coverage area amounted to $24,293, which was used to extrapolate an estimated $12 billion in net benefits to the state of Indiana for universal broadband access.

The cost-funding gap for broadband infrastructure

Given the long-term economic benefits of broadband accessibility, why is broadband service not universally available? At the heart of the issue are low returns on investment for providers. As discussed earlier, high upfront capital costs and few

Table 1: Consumer Surplus Estimates for States



Sources: Author's calculations using broadband consumer surplus estimates[18,19] and the Federal Communications Commission, 2020 Broadband Deployment Report.

potential customers make it less profitable to provide broadband service to many rural areas. Rural areas faced a similar problem with access to electricity in the early part of the 20th century. Only one in 10 farmers had electricity in 1930, compared with nine in 10 urban and rural nonfarm residents. The Rural Electrification Administration was created in 1935, and significant public resources were spent to achieve nearly universal access within 25 years.[32]

How do broadband infrastructure subsidies available today compare with the need? Federal and state governments have programs to subsidize broadband infrastructure investment.

- The FCC's Rural Digital Opportunity Fund (RDOF) is by far the largest source of funding available. It is comprised of a $20.4 billion investment in broadband infrastructure over 10 years, from 2020 until 2030. Funds are made available through a reverse auction, where providers compete in two auctions. The first auction occurred in late October with $16 billion available, with the remaining $4.4 billion available for a second auction at a time to be determined.[33] Eligible locations for the Phase I auction were areas with no service, with the Phase II auction opening up to partially served locations and locations that received no funding in the Phase I auction. Results from the Phase I auction were released in early December 2020, showing 180 bidders winning $9.2 billion in nearly all locations eligible. The remaining $6.8 billion from Phase I will be reallocated to Phase II, bringing the total support available in that auction to $11.2 billion.[34] Another source of funds allocated by the FCC is the Alternative Connect America Fund, providing $4.9 billion.

- The second largest source of broadband infrastructure support is from the USDA's eConnectivity Pilot Program. Also known as the ReConnect Program, funds have been allocated under two auctions to provide loans, grants, and loan/grant combinations to broadband service providers for infrastructure projects. Among other criteria, the program requires an area to show that at least 90 percent of households in the proposed funding area lack access to broadband service, unlike the first phase of the FCC's RDOF program, which requires areas to demonstrate that all households in the proposed funding area lack broadband service. This difference allows the ReConnect program to provide relief to those areas that are essentially unserved for the vast majority of residents but are not eligible for the FCC's RDOF subsidies available in Phase I. As of the writing of this article, over $1.3 billion has been allocated through the ReConnect program.[35] Combined with other programs in the USDA's Rural Utilities Service, total broadband infrastructure support is about $2.3 billion.

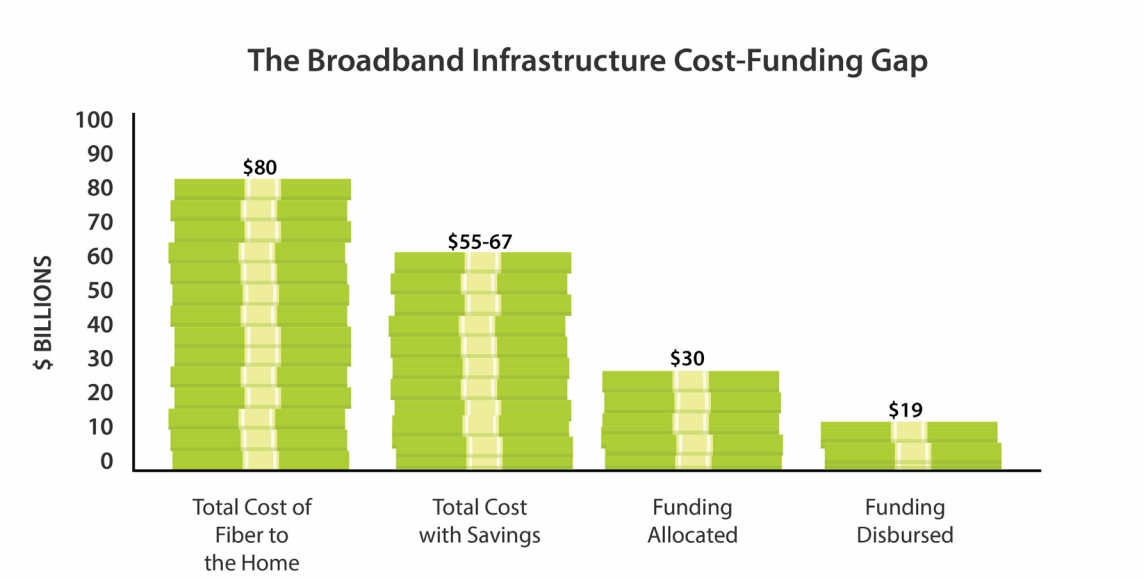
- States spend money on broadband infrastructure, some with dedicated funding streams and others on an ad hoc basis. The National Telecommunications and Information Administration conducted a survey of state broadband programs showing that less than $2 billion was spent in 2018-2019 by states to expand broadband infrastructure.[36]

- The CARES Act in response to the COVID-19 pandemic allocated funds to be used for broadband infrastructure expansion. A survey of states' uses of these funds by the National Governors Association shows that, at most, about $600 million of CARES Act funding went to broadband infrastructure projects.[37]

Reliable estimates of the cost of the infrastructure required for universal broadband coverage are hampered by poor data on existing coverage and existing infrastructure. However, a 2019 paper from the FCC put the size of upfront capital investment needed for ubiquitous broadband coverage at $80 billion.[38] An industry study conducted by the consulting firm Cartesian estimated that the total cost of laying fiber to all households currently unserved would be $85.6 billion.[39] As with the FCC's coverage numbers, both figures are likely an underestimate of the true size of the problem, but they are a useful starting point to judge if current funds are sufficient. Once the upfront capital costs are covered, revenues from internet subscribers will most likely cover network maintenance costs.

Summing the major sources of government funds for broadband infrastructure leads to a rough total of $30 billion available. Thus, what emerges from these rough figures is a sizeable gap of $50 billion to provide broadband infrastructure to every American household.

COST-FUNDING GAP



Sources and notes: Total cost of fiber to the home uses an estimate provided by the FCC.[2] Total cost with savings are the author's calculations using 2018 broadband coverage estimates from the FCC and studies of the cost of broadband infrastructure expansion.[39,40,41,45] Funding allocated and disbursed are provided by government sources and is only an estimate of the major funding sources directly targeting broadband infrastructure expansion.[32,33,34,35,36] Other federal grant and loan programs also fund broadband infrastructure projects as a subset of their overall portfolio or as a component of larger economic development projects.

Approaches to accomplishing rural broadband expansion

Are there promising approaches to expanding broadband infrastructure? One approach is using electric cooperatives to provide the service. Electrical cooperatives often have a fiber "backbone," which transmits data from the smart grid back to the operations center. Using the fiber backbone for smart grid applications as well as retail broadband service is an example of economies of scope, the term used to describe the savings achieved by having one firm produce multiple products. Electrical cooperatives also have easements and utility poles that can yield substantial cost savings. An industry study estimated that 60 percent of unserved households are in the service area of electrical cooperatives that do not currently offer broadband service.[40] Using cost estimates from that study and from an electric cooperative broadband expansion multiplier study conducted by Purdue University, we estimate that using electric cooperatives to provide broadband service could save between $8 billion and $15 billion from the $80 billion total cost of providing fiber to every currently unserved home.[41]

The biggest challenge to the electrical cooperative approach is that many states have ambiguous laws regarding broadband provision by electrical cooperatives. In some cases, state laws prohibit electrical cooperatives from providing broadband service entirely. The rationale behind these laws is concern over the cross-subsidization of broadband service by electrical service – that is, the possibility that electricity consumers could end up paying for broadband infrastructure even if they do not plan to use it. There are also legal issues surrounding the use of easements and providing service outside of an electrical cooperative's service area.[42] Some states are resolving these issues in favor of electrical cooperatives in the interest of providing service where investor-owned utilities show no interest in providing service.[43,44] Within the Fifth Federal Reserve District, the Choptank Electric Cooperative on Maryland's Eastern Shore successfully lobbied the state legislature to allow the cooperative to provide broadband within its electricity service area – about 54,000 customers in nine counties.

A second approach is to use less expensive technologies that sidestep the need for wired connections.[45] The main options are fixed wireless and satellite service. Fixed wireless uses line of sight connections between a central tower and the end user, meaning there is no need to go through the time and expense of laying fiber to every home. The approach is significantly less expensive – at least

initially. Satellite is another option, although it can be expensive and provides service that is generally slower. Using these approaches has the potential to reach the remaining 40 percent of households without broadband infrastructure coverage provided by the electrical cooperative option at a cost savings of $8 billion to $15 billion.

An example of this approach at work in the Fifth Federal Reserve District is a project of Shenandoah Telecommunications Co. ("Shentel") that is beginning to offer fixed wireless service called "Beam Internet."[46,47] Shentel invested $17 million in spectrum licenses in Virginia, West Virginia, and Ohio and is providing 25 Mbps download speed service. The technology can support speeds up to 100 Mbps, which bodes well for the future as speed demands rise. The technology can be deployed in a matter of months rather than the years it takes to lay fiber. Each tower can serve customers within a five-mile radius if there are no significant obstacles in the way.

A third area where action can be taken is in the creation of public-private partnerships (PPPs) to build broadband infrastructure when there are no existing providers in a locality. With PPPs, the key is to create a coalition of interested parties – typically a local government or economic development agency along with a private source for matching funds – that can create a broadband infrastructure project ready to apply for federal subsidies. There are many varieties of broadband PPPs, which makes evaluating the PPP approach as a whole difficult. They range from the public facilitation of private investment through economic development incentives, to public funding with private execution, to hybrid models where the locality and private partner share the costs and benefits.[48]

The PPP approach is gaining traction in West Virginia, where pockets of the state lack broadband service, have inadequate service, or lack a willing provider. The Claude Worthington Benedum Foundation – a foundation serving West Virginia and southwestern Pennsylvania with initiatives in economic and community development, among others -- has studied this approach closely as a way to get broadband projects started in the state, with an eye toward helping partnerships connect with the funding and technical assistance they need to get off the ground and running. The Thundercloud project is an effort to connect anchor institutions and businesses with high-speed fiber service in Huntington and a broader nine-county region. It was created by a nonprofit organization formed by local institutions: Marshall University, Marshall Health, and Mountain Health Network. The project received a $2.35 million POWER grant from the Appalachian Regional Commission and from the CDFI Appalachian Community Capital as seed money.[49,50]

Conclusion

It can be costly to get broadband to rural areas, but the potential payoff is high. The COVID-19 pandemic underscores the necessity of high-speed internet access for almost all Americans. As a combination of factors make rural areas too expensive for many providers, subsidies play an important role in making rural areas economically feasible for service. Comparing the costs of expansion against the subsidies available today shows that more subsidies are needed to close the gap. Engaging electrical cooperatives, using alternative technologies, and, in some instances, public-private partnerships work best for getting the job done.

About the Author

Alex Marré is a regional economist at the Baltimore branch of the Federal Reserve Bank of Richmond. He monitors and briefs the public on regional economic conditions and conducts research on economic issues in the Fifth Federal Reserve District. Previously, he was an economist at the U.S. Department of Agriculture, tracking economic conditions in rural America, and managed a research portfolio focused on human capital and rural economic development.

Marré earned a doctorate in agricultural and resource economics from Oregon State University in 2009, a master's degree in economics from Fordham University in 2004, and a bachelor's degree in economics with a minor in mathematics at Seattle University.

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