

Broadband Demand: The Cost and Price Elasticity of Broadband Internet Service in Rural Pennsylvania

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Key Findings and Policy Considerations

This year-long research project surveyed rural and urban Pennsylvanians about their willingness to pay for high-speed broadband service. It provides a unique first look into factors that continue to create substantial barriers to closing the digital divide.

The researchers surveyed 1,446 Pennsylvania residents in May and June 2020. They used a hybrid telephone/SMS (short message service, or “text messaging”) survey that asked respondents about the type of internet technology available to them, broadband pricing, and willingness to pay for 25 Megabits per second (Mbps) broadband.

Key findings

1. There are differences in the types of internet service used by urban and rural respondents, with urban respondents reporting higher use of cable and fiber connectivity and rural respondents reporting higher use of dial-up, DSL, and satellite;
2. An evaluation of pricing data alone masks important differences in speed tiers between urban and rural respondents;
3. Within pricing tiers, rural respondents are more likely to have slower internet speeds and urban respondents are more likely to have faster speeds;
4. Urban and rural respondents are receiving systematically inequitable service - not only in terms of broadband speed, but also in price for service;
5. The demand for broadband service shows a “sweet spot” in terms of willingness to pay in the under \$60/month range; and,
6. When speed and price are held stable, rural respondents have a higher willingness to pay for broadband than urban residents.

Policy considerations

1. Change Pennsylvania’s current definition of “broadband” – currently defined as 1.544 Mbps download and 128 kilobits per second upload speed – to meet or exceed federal definitions for broadband.
2. Establish government support mechanisms for broadband buildout that provide greater transparency and standardized public disclosure of broadband service characteristics, including speed, regular pricing, and service limitations.
3. Commission a statewide study to assess and derive a broadband affordability formula and model for how much low-income households can afford to spend on broadband without having to sacrifice other necessities such as rent, food, medical care, etc.
4. As suggested in earlier research on broadband availability and access, policymakers should maximize the options for broadband service provision by allowing other viable entities, such as community-based networks, municipalities, and cooperatives, to deploy broadband across rural Pennsylvania.

This project was sponsored by a grant from the Center for Rural Pennsylvania, a legislative agency of the Pennsylvania General Assembly. Information in this report does not necessarily reflect the views of individual board members or the Center for Rural Pennsylvania. For more information, contact the Center for Rural Pennsylvania, 625 Forster St., Room 902, Harrisburg, PA 17120, phone: (717) 787-9555, info@rural.palegislature.us, www.rural.palegislature.us.

The digital divide is a long-standing problem that has disadvantaged far too many already-marginalized constituencies. Over the past several years, interest in more accurately documenting the true state of broadband connectivity has grown dramatically;¹ with the coronavirus pandemic forcing millions of Americans to work and learn from home, the importance of ensuring universal broadband connectivity has never been more salient.²

For the past 2 years, Pennsylvania has been at the forefront in developing new broadband mapping resources and pioneering methodologies. These resources, data, and methodologies are currently being adopted by numerous federal agencies, states, and local municipalities. Yet while our understanding of the true state of broadband availability has grown dramatically over the past 2 years, our understanding of one of the key barriers to adoption – price and consumer demand – has languished.

“Broadband Availability and Access in Rural Pennsylvania,” a 2019 report published by the Center for Rural Pennsylvania, collected more than 11 million broadband speed tests from across Pennsylvania to measure broadband speeds. Results from that study documented that median speeds across most areas of the state do not meet the Federal Communications Commission’s (FCC’s) criteria to qualify as broadband. The methodologies and core technologies pioneered by this research team are now having a major impact on data collection efforts across the country.³

While access to broadband is an essential prerequisite to adoption, our understanding of why non-adoption is higher across rural communities has been limited by a lack of empirical documentation.

One key argument used to explain this urban-rural digital divide – one that has been often reiterated by Internet Service Providers (ISPs) – has been the declaration that rural areas lack sufficient return-on-investment (ROI) to make rural build-out feasible. Often, this cost-benefit analysis is predicated on a notion that the lower population density of rural communities is further confounded by assumptions of lower take rates (percentage of eligible people who adopt broadband service),

less disposable income, and less interest in broadband connectivity, as explaining the persistent lower adoption rates spanning large swaths of rural America.

The further assumption has too often been that potential rural customers are a less viable market due to an intrinsic lower level of interest in broadband connectivity. Meanwhile, national regulatory and policy agencies have eschewed inquiry into actually verifying the fundamental assumptions being made by ISPs; and the research literature, by

and large, has likewise been relatively

silent on empirically deriving a basic measure of the price elasticity of demand for broadband (i.e., how does interest in broadband change given different pricing).

This research aimed to fill this gaping hole in understanding the issues that are driving today’s digital divide, providing a series of exploratory analyses based on survey data collected from rural and urban broadband customers across Pennsylvania. By looking at factors such as “willingness to pay” and existing pricing differentials within speed tiers, these analyses provide a unique first look into factors that continue to create substantial barriers to closing the digital divide.

This study was conducted using a hybrid telephone/SMS (short message service, or “text messaging”) polling methodology of 1,446 registered voters throughout Pennsylvania in May and June of 2020. These surveys asked respondents to answer a number of broadband speed, broadband pricing, willingness to pay, and demographic questions. Key results from these analyses include findings of substantial technological and speed tier differentiators between rural and urban constituencies, but also a higher “willingness-to-pay” measure (for 25 Megabits per second, or Mbps, broadband service) in rural areas of the state than among urban respondents. These findings help shed new light on the real costs (to consumers) and potential revenue-generation to entities that build broadband services for rural constituencies.

Data for this study were collected in cooperation with Public Policy Polling – a firm with expansive experience in conducting nationwide polling on a variety of subject matter – employing a questionnaire developed by the project team from the

X-Lab and key project partners. The international team of broadband researchers convened for this project included researchers whose expertise spans: network research; telecommunications technologies; federal, state, and municipal broadband regulations and policies; and statistical, geospatial, and econometric analysis.

This year-long research effort focused princi-

pally on measuring willingness to pay to generate an empirically derived broadband price elasticity of demand curve. By exploring potential differentials between rural and urban broadband pricing, broadband service bundling, and willingness to pay for 25 Mbps broadband, this research provides a compelling first look at several relatively underexplored phenomena.

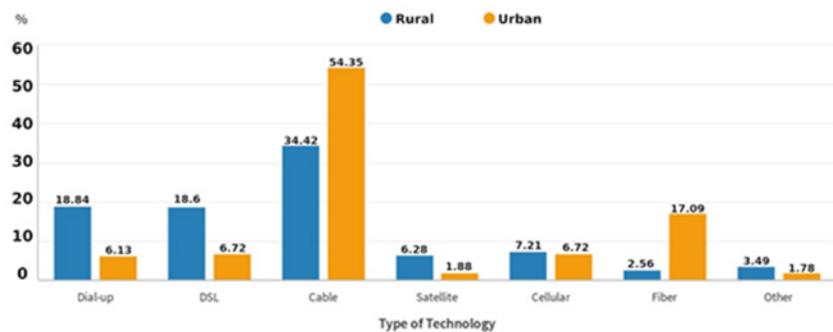
Key findings

The principal findings from this study are decidedly relevant for policymakers interested in how demand for broadband service is impacted by price (i.e., price elasticity of demand); and also have implications for initiatives seeking to close the digital divide; for funding agencies supporting broadband build-out; and for local, state, and national officials investigating the state of broadband connectivity across Pennsylvania and the rest of the country.

Key findings include the following:

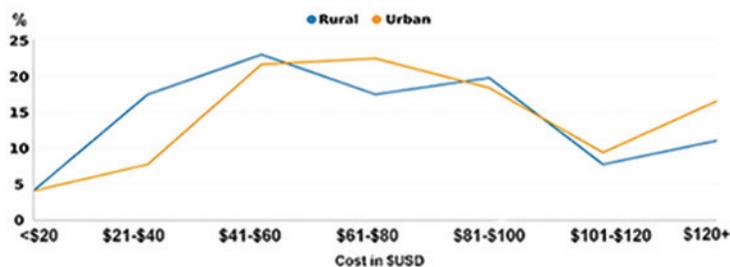
1 Substantial service provision technology differentials exist between urban and rural communities, with urban respondents reporting far higher use of cable and fiber internet connectivity and rural respondents reporting higher use of dial-up, DSL (Digital Subscriber Line), and satellite internet connections.

Rural vs. Urban Breakdown of Types of Connection Technology in Pennsylvania



Source: Broadband Price Elasticity in Rural Pennsylvania, 2020

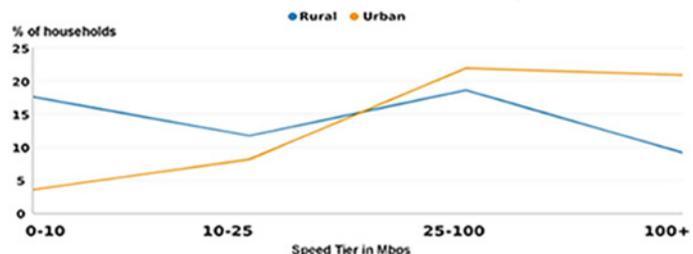
Rural vs. Urban Breakdown of Cost for Internet Service



Source: Broadband Price Elasticity in Rural Pennsylvania, 2020

2 Pricing data alone masks substantial differences within speed tiers between urban and rural constituencies.

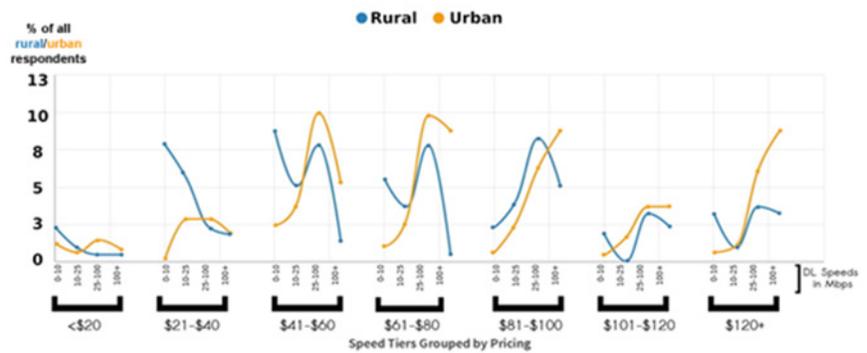
Rural vs. Urban Broadband Internet Speed Tiers



Source: Broadband Price Elasticity in Rural Pennsylvania, 2020

3 Within pricing tiers, the more in-depth investigation of real-world speeds documented that rural respondents were overrepresented within slower speed services, while urban respondents were more likely to have faster speeds; thus, dollar for dollar, rural respondents often received slower speeds than their urban counterparts.

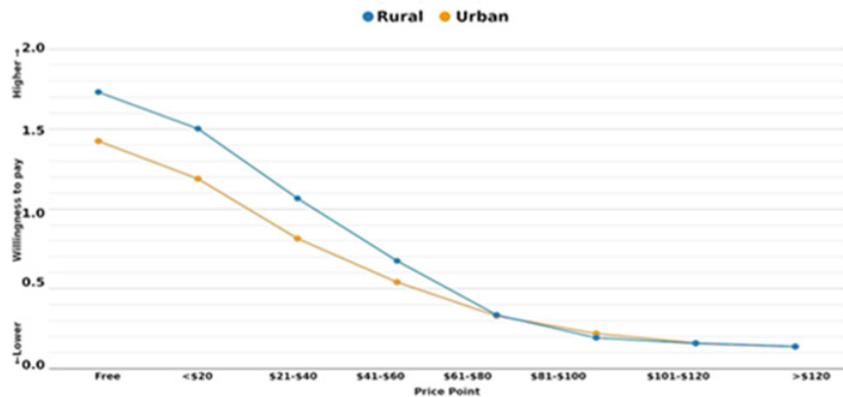
Rural vs. Urban Residential Pricing Over Speed Tier



Source: Broadband Price Elasticity in Rural Pennsylvania, 2020

4 The price elasticity of demand curve for broadband service provides evidence that there’s a “sweet spot” in terms of willingness to pay, as well as relatively static “unwillingness to pay” for services above \$80/month. In addition, at lower price tiers (less than \$60/month), rural respondents had a consistently higher willingness to pay than corresponding urban respondents.

Price Elasticity of Demand Curve for Rural and Urban Pennsylvania



Source: Broadband Price Elasticity in Rural Pennsylvania, 2020

Policy implications

The policy implications for this research are important, lending credence to the notion that urban and rural constituencies are receiving systematically inequitable service, not only in terms of speeds available, but also in terms of price for those services.

Therefore, Pennsylvania should change its current definition of “broadband” – as 1.544 Mbps download and 128 kilobits per second upload speed⁴ – to meet or exceed (long-established) federal definitions for broadband. The commonwealth’s definition is so antiquated that it is slower than the FCC’s 2010 “update” to 4 Mbps/1 Mbps, as well as its 2015 definition. Because state service provision requirements are predicated on the antiquated definition instead of the national standard,

they are creating substantial harm by promulgating the provision of substandard services to communities across the commonwealth.

According to this research, it appears that, when speed and price are held stable, rural constituencies may have a higher interest in broadband adoption than urban residents.

However, current instantiations of government support mechanisms for broadband buildout (including the \$16 billion Rural Digital Opportunities Fund administered by the FCC and the \$100 billion in broadband subsidies proposed by Congress in the 2020 Moving Forward Act) have thus far failed to mandate adequate data collection to ensure that inequities are addressed. Therefore, it is important to establish greater transparency and standardized public disclosure of broadband

service characteristics including speed, regular pricing, and service limitations.

The research also points to the need for a state-wide study to assess and empirically derive a broadband affordability formula and model for how much most low-income households can afford to spend on broadband without having to sacrifice other necessities such as rent, food, and medical care.

And, as suggested in earlier research on broadband availability and access, and the delivery of broadband in unserved and underserved areas of Pennsylvania, policymakers should maximize the options for broadband service provision by allowing other viable entities, such as community-based networks, municipalities, and cooperatives, to deploy broadband across rural Pennsylvania.

This research provides a considerable level of documentation and insight into the broadband willingness to pay of rural residents across Pennsylvania.

As a part of X-Lab's commitment to open source, peer review, and supporting ongoing research into the digital divide, the data, graphs, methodologies, equations and tools used in the development of this report are being made freely and publicly available to enable other researchers to further explore these exploratory analyses. The research team hopes that replication and confirmation of these findings will be undertaken and that further refinement will be conducted and integrated into future efforts to bridge the digital divide.

In conducting the literature review for this project, the research team identified a dearth of existing broadband price elasticity of demand studies; as such, the team and its collaborating partners were required to produce a new survey tool and methodology, both of which should provide a useful basis for further inquiry. Additional (more granular) research at the local, state, national, and international levels would help to shed light on how widespread (and substantial) pricing within speed tier differentials are; as well as how price elasticity of demand curves for different constituencies may vary. Along with measuring availability of actual broadband speeds, the ability for government, community and civic organizations to document willingness to pay in areas where broadband adoption is low would provide a key measure of potential discriminatory implementation practices unfairly targeting specific areas.

If one of the main findings stemming from these exploratory analyses holds – that rural constitu-

ents are demonstrably more willing to pay a higher fee for 25/3 Mbps broadband service than their urban counterparts – it would lend credence to the notion that the lower adoption rate must be due to differentiated service offerings (and not just cost). Likewise, documenting this higher willingness-to-pay rate would help ease concerns that take rates would be lower in rural areas (they should, in fact, be higher at most price points) and could help defray the attendant costs of buildout in areas with lower population densities. In turn, this would underscore that ROI models developed for urban buildouts may underestimate revenue streams among rural constituencies.

This work, although very useful on its own merits as a stand-alone document that specifically focuses on willingness to pay for 25/3 Mbps broadband service (and the associated price elasticity of demand curves), is complemented by the analyses stemming from the 2019 research, "Broadband Availability and Access in Rural Pennsylvania." An integrated mapping/visualization platform combining these data sources would enable Pennsylvania to identify not only where substandard service exists, but where demand in these underserved areas is highest, thus enabling far more targeted deployment of broadband implementation efforts.

1. As exemplified by the introduction of the Broadband Data Improvement Act [BDIA] in the U.S. Congress in June 2019. BDIA's goal, according to the bill's cosponsors, is to require "broadband providers to report data to create an improved National Broadband Map that is significantly more accurate and granular, and subject to an ongoing and multi-faceted challenge, validation, and refinement process." See: McMorris Rodgers, "McMorris Rodgers, O'Halleran Introduce Bipartisan Legislation to Improve Broadband Mapping in Rural Communities," <https://mcmorris.house.gov/mcmorris-rodgers-ohalleran-introduce-bipartisan-legislation-to-improve-broadband-mapping-in-rural-communities>. Accessed on June 10, 2020.

2. Former FCC Chairman, Tom Wheeler, stated on May 27, 2020, "The COVID-19 pandemic has highlighted the critical nature of access to fast and affordable internet service. Demand for high-speed internet access, defined as "broadband," has soared to new heights... The internet is no longer 'nice to have,' it is critical." See: Tom Wheeler, "5 steps to get the Internet to all Americans," <https://www.brookings.edu/research/5-steps-to-get-the-internet-to-all-americans>. Accessed on June 10, 2020.

3. As two examples, the National Telecommunications and Information Administration's National Broadband Availability Map integrates data and methodologies developed as a part of the "Broadband Availability and Access in Rural Pennsylvania" initiative (see: <https://broadbandusa.ntia.doc.gov/map>); and the state of North Carolina is currently doing likewise (see: Ryan Johnston, "North Carolina looks to challenge FCC over broadband coverage," <https://statescoop.com/north-carolina-fcc-challenge-broadband-maps>). Accessed on June 10, 2020.

4. See: Pennsylvania Department of Economic Development, "Broadband Resources," <https://dced.pa.gov/broadband-resources>. Accessed on June 10, 2020.

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