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The Impacts of the USDA Broadband Loan and Grant Programs: Moving Towards Estimating a Rate of Return

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How much does publicly-funded infrastructure stimulate local economic performance? This broader debate comes into focus via research that estimates the relative benefits and costs of federal efforts to promote broadband in rural areas.

The potential stimulative effect of publicly-funded infrastructure on local economic performance has long been a staple in the public discourse on United States rural development policy. An important rationale offered to justify public infrastructure investments argues that they can raise private sector output directly, as an intermediate input into private production processes; and indirectly, by providing complementary inputs that raise the rate of return on private capital. At the same time, geographic remoteness and low population densities of many rural communities impose significant limits on the rate of return to private infrastructure provision — hence, the call for public infrastructure investment.

A salient example of this may be found in recent debates over the role and scope of federal investment in infrastructure enabling deployment of broadband technology into rural areas. Broadband technology delivers enhanced information and communications services at rapid transmission rates to end users. Increasing the availability of broadband in rural communities has been an explicit U.S. rural development policy goal for nearly two decades. Since 2000, federal broadband grant and loan programs authorized under consecutive Farm Bills have directed more than $1.8 billion to private telecommunications providers in 40 states with the explicit goal of making high-speed data transmission capacity available to rural residents and businesses. In 2009, the American Recovery and Reinvestment Act authorized $2.5 billion in federal funding for these purposes.

$4.3 Billion

authorized since 2000 make high-speed data transmission capacity available in rural areas.

Proponents point to research projecting large macroeconomic benefits from widespread broadband deployment. Research focused specifically on rural areas generally suggests positive impacts of broadband deployment on income per capita, local employment, number of business establishments and firm location. Other work highlights broader community and social impacts of broadband deployment and adoption on migration, civic engagement, education and healthcare.

An important takeaway message from work that has been done on the impacts of broadband is that the distribution of economic benefits is not likely to be uniform, either spatially or across industries. In our own work, we have found evidence that USDA Broadband Loan programs have created a range of impacts – some positive, some negative – that vary across industries and across the rural-to-urban continuum.

We have further found that while the loan programs have been effective in meeting their goal of creating more broadband availability in rural areas, it is by no means inevitable that this greater availability translates into improved economic outcomes.

In this NC State Economist article, we summarize our recent research aimed at establishing the rate of return to federal government efforts to promote broadband in rural areas (Kandilov and Renkow 2018). Specifically, we assessed the impact of USDA's broadband loan and grant programs on the average payroll per worker over those programs' first five years (from 2002 to 2007). Combining our estimates of those per-worker impacts with information on the size of those loans and grants enabled us to produce a rough estimate of the relative benefits and costs generated by those programs.

The Importance of Assessing the Relative Benefit and Costs of Broadband Investments

Work to date on evaluating government broadband investments has not generated estimates of the rate of return or relative benefits and costs of those investments. Such information is clearly of significant value.

- It provides a benchmark to gauge whether investments pay for themselves. Key benefits of extending and expanding high-speed internet access into underserved areas, such as telemedicine, distance education and personal communication – typically would go unmeasured in assessments of benefits mediated through local economic activity. To the extent that those potentially large but hard-to-measure benefits are deemed desirable – or even a social imperative – a positive cost-benefit ratio reflects that securing those benefits is being done via programs that pay for themselves.
- Estimation of a rate of return on broadband investments provides a point of reference for comparison with alternate types of public investment. For example, return-on-investment studies exist for public health program interventions or road investments. Assembling comparable information for broadband investments has value for contributing to more efficient allocation of public resources across a more complete range of alternatives.

USDA Broadband Loan and Grant Programs

In December 2000, Congress authorized a Pilot broadband loan program to help expand broadband access in geographically remote and underserved rural communities. Program eligibility criteria included having a population of 20,000 or less, having no prior access to broadband, and providing a minimum matching contribution of 15 percent by recipients of the loan. Loans were extended mainly to small telecommunications

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services firms at varying (subsidized) interest rates; most participating communities qualified for a “hardship rate” of 4 percent.

Administered by the USDA’s Rural Utilities Service (RUS), Pilot loans worth $180 million were made in 2002 and 2003 to broadband providers serving 98 communities located in 13 states. Beginning with the 2002 Farm Bill, funding for the current (post-Pilot) broadband loan program was expanded. Through 2007 — the period covered by our analysis in this paper — these loans totaled $2.23 billion. The RUS has also operated a Community Connect Broadband Grant program since 2002. This program appears to be targeted to the most under-served rural areas, insofar as eligibility requirements specify that no high-speed internet is available in the community. By contrast, loan program eligibility only requires that at least 15% of households are unserved.

Begun at the time of the Pilot Broadband Loan Program, Community Connect grants were designed to promote telemedicine and distance learning (“community-oriented connectivity”) in rural areas with no broadband service. Grantees are required to deploy free broadband service to community facilities for at least two years, as well asoffering broadband to residential and business customers. Total authorizations for the Community Connect Grant program between 2002 and 2007 amounted to $66 million.

Our Approach

Over the period considered, Community Connect grants were disbursed to operators in 59 zip codes across 24 states. Pilot broadband loans were distributed for projects in 302 zip codes (across 13 states). Current broadband loans financed projects in 488 zip codes (30 states). We analyzed the impacts of the broadband loan and grant programs using zip code-level data for the 37 states that received at least one broadband loan or grant through 2007.

Our sample included only zip codes with population of 20,000 or less as of 2000 — the year the Pilot Broadband Loan program was authorized (and two years before the first Pilot loans were made). We restricted the sample in this way because the loans and grants were directed to small communities of 20,000 or less. We used zip code-level data because zip codes are the smallest geographic area which resembles a community eligible for these broadband loans and for which data on economic outcomes is publicly available.

Our empirical analysis measured how local payroll per employee, a proxy for the average wage rate, was affected by receipt broadband loan and grants. Data on annual payroll and employment at the 5-digit zip code level were obtained from the Zip Code Business Patterns data set collected by the U.S. Census Bureau.

Findings

Our empirical analysis compared changes in annual payroll per worker in locations that received a broadband loan or grant (“treated” zip codes) with changes in payroll per worker in that locations that did not receive a grant or a loan (“control” zip codes). To account for the fact that communities that received broadband grants or loan were not randomly selected, we used a technique called propensity score matching.

This involved first estimating the factors determining the likelihood of a locality successfully getting a loan, and then using that information to improve the statistical precision with which we can link loan receipt to an economic outcome — in our case, the effect of loans and grants on payroll per worker. We additionally controlled for a host of other zip code-specific characteristics which, if unaccounted for, may bias the econometric estimates.

Our statistical analysis indicated that a $1 increase in zip code per capita broadband loan results in about a $1.08 increase in annual payroll per worker. A very similar number ($1.07) was estimated for the Pilot loan program. These estimates of the marginal impact of receiving a broadband loan were statistically significant.

In contrast, we found no statistically significant impact of broadband grants received on the payroll per worker. The implication is that that grants did not affect the average zip code level payroll per worker. Given that these grants are awarded to the least connected, hitherto unserved areas, it is possible that other community deficits render the provision of broadband alone insufficient to have generated substantial economic impact over the period analyzed.

Our estimates of the marginal impact of a loan on average payroll enable us to compute an estimate of the benefits and costs of the two loan programs (Table 1). (Because we detected no significant impact of Community Connect grants, we did not compute benefit:cost ratios for that program). Applying those marginal effects to the average zip code loan size provides a sense of the average per-employee impulse to treated zip codes attributable to an average-sized loan. Multiplying this by the number of employees per zip code then yields an estimate of annual benefit — essentially, our best estimate of the added increment to total payroll attributable to loan receipt. This is an annual benefit , so we compute the net present value of the stream of these annual benefits at two discount rates, 10 percent and 5 percent, rows (5) and (6) in Table 1. Given that broadband loans were "last mile" loans justified based on the cost of provision of broadband services, we take the cost of broadband investment to be as large as the loan itself. Dividing annual benefits by these average total costs yields benefit cost ratios ranging from 3.46 to 6.51 for the Pilot loan program, and between 2.86 and 5.71 for the current loan program.

Table 1. Benefits versus Costs for Pilot and Current Broadband Loan Programs

Variable	Pilot Loan Program	Current Loan Program
(1) Average employment per zip code	1,256	1,660
(2) Average loan per capita (2007 dollars)	$5.04	$195.81
(3) Marginal effect of loan per capita on payroll/worker	1.071	1.081
(4) Local annual benefit =(1)x(2)x(3)	$6,783	$351,387
(5) Total benefit per zip code (10% discount rate)	$67,831	$3,513,874
(6) Total benefit per zip code (5% discount rate)	$135,663	$7,027,749
(7) Average population per zip code	3,915	5,804
(8) Total loan cost per zip code = (7)x(2)	$20,828	$1,230,448
Benefit: Cost ratio at 10% discount rate = (5)	**3.26**	**2.86**
Benefit: Cost ratio at 5% discount rate=(6)	**6.51**	**5.71**

Implications

We regard the foregoing analysis as encouraging but preliminary. Our estimated benefit-cost ratios suggest that the return to federal investment in broadband loan programs has been substantial and very much in the same ballpark as benefit-cost estimates from a range of public health interventions. This is an important, policy-relevant finding.

> **"The return to federal investment in broadband loan programs has been substantial"**

That said, the incidence of those benefits — i.e., deciphering who the beneficiaries are, and in particular where they live — is not discernable from the data at our disposal. We do know that generally only a small fraction of individuals in a particular zip code would also work in that zip code; so the benefits of increased payroll in one location would no doubt create significant spillovers to other communities. Also, there would be labor market implications for nearby locations within the commutershed. Attention to these sorts of spatial spillovers merits further analysis.

Finally, our measures of benefits are likely under-estimates. Our analysis ignores positive impacts of broadband availability on property values — notably house prices, but other commercial or agricultural land values as well. Additionally, bringing enhanced access to high-speed internet to a community increases communication opportunities for residents of that community. An assessment of the value of such opportunities remains unaccounted as well. Quantifying these additional benefits represents a fruitful area for future research.

Research Cited

Kandilov, I.T. and M. Renkow. 2018. "The Impacts of the USDA Broadband Loan and Grant Programs: Moving Towards Estimating a Rate of Return." Washington, DC: Farm Foundation.