The Farm Bill and Rural Economies: Broadband Investment Over the last Decade

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Abstract:

Rural communities have had less Internet service accessibility than their urban counterparts and, as a consequence, have been perceived as disadvantaged. Federal government policy makers have recognized the shortfall in service provision with its perceived disadvantage and have been trying to address it through the Food, Conservation, and Energy Act of 2008 and The Farm Security Act of 2002 (what have been more commonly called the Farm Bills), and the American Recovery and Reinvestment Act (ARRA) of 2009. This support was renewed with the recent passage of the Agriculture Act of 2014 (the newest Farm Bill). Policy makers have, however, been asking what has been the impact of this broadband Internet investment on rural America. The answer is not simple and much of the impact will not be felt for years. That is the focus of this research paper.

Introduction

The recent enactment of the 2014 Farm Bill, with its reaffirmation of the federal government's support of broadband investment, continues a long tradition of federal support for communication technology in rural areas. The question of what we get from this federal investment, however, has increasingly been raised. The answer is not simple. Some facts are now known; some can be posited now but will not be completely known until later, much as the impact of the Federal-Aid Highway Act of 1956 was only fully felt considerably after the initial investments. And lastly, some possible impacts are only the subject of futurists' guesses now.

The paper focuses on what is known, whether completely or not, andis composed of 4 major parts: (1) a brief historical review of rural communication technology adoption; (2) discussion on federal government involvement; (3) a review of the literature on attempts to measure Internet's impact on the economy; and (4) an exploration of the underlying, often

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unrecognized in economic models, factors that impact on rural economies. The last part consists of a preliminary analysis.

Historical Background

For rural areas, lagging in communication investment has been a fact of life from the beginning of the technological revolution, whether it was the telegraph, express mail, air mail, or telephone, with the possible exception of the 2-way radio. In the rollout of the telephone system, the structure of the telephone market proved to be an important factor, putting rural areas at even greater disadvantage vis-à-vis urban areas.

At the end of the 19th century one company, the Bell System, known universally as Ma Bell but lawfully known as the American Telephone and Telephone (AT&T) Company, held all the patents for the telephone system and as monopolists tend to do, collected rents impeding a wide adoption of the new technology. In this case AT&T realized a great deal of profit by restricting its technology to areas with ample wealthy customers, mostly the largest urban areas, i.e. the classic monopoly condition of marginal revenue exceeding marginal cost.

The growth and diffusion of the telecommunication system went through many fits and starts in the ensuing years because the patents raised economic and legal barriers to telephone service for non-Bell system areas. That is until a consent decree, known as the Kingsbury Letter, was offered by Ma Bell, ahead of anti-trust action that had been picking up steam in the Woodrow Wilson administration, allowed access to their national system by small companies while retaining monopoly control over much of the country. Essentially the agreement gave AT&T the right to become a national monopoly subject to some federal regulation (AT&T).

The market structure today is much more competitive, though the underlying principle remains the same: companies invest where they earn the highest returns. The market, though, has been in a great deal of flux, as exemplified by the number of cellular phone and cable-telephone company mergers, making analysis more challenging.

The pattern of communication and information service adoption and use continues to be neither uniform across the country or across income groups (Stenberg [2013]; Stenberg et al [2009]). Some have used the term "Digital Divide" to describe this variance in telecommunication service availability, though the term has never been concisely defined, and often is not used within the communication technology community. The term, basically, describes a line separating the technology "haves" from the "have-nots." Unlike the term "poverty-line" the definition is a bit amorphous, but, like the poverty-line it is often used in a political context.

Internet household adoption increased significantly during the 1990s and early 2000s, but the rate of increase has slowed down considerably during the last few years. The increase occurred for all regions and income groups. Nearly three-quarters of American households now subscribe to some Internet service. The higher a household's income, the more likely it will use the Internet. Income is a more critical element determining adoption for Internet use than for personal computer. Rural areas lag in Internet use in the aggregate and across all income groups (Stenberg [2013]).

Rural communication economics

Each rural location is distinctive, but some generalities can be gleaned. Residents in rural areas have always faced higher costs for implementation of telecommunication services than those in urban areas and, at least for the foreseeable future, will continue to do so despite the rapid change in technology that has greatly decreased the cost; the well-known Moore's Law on technology improvement has continued apace for the last 50 years. Economies-to-scale remain at the core of why rural areas face higher costs.

Rural areas, by definition, are characterized by low population density with the consequence that fewer people share telecommunication services over large, sometimes very large, distances. In this case fewer share in the cost of the central office switches, loop maintenance, and other common components of the local telecommunication system.

Wireless often will have the same reach in urban and rural areas, but rural areas will have fewer subscribers. Ironically, though, with the looming urban wireless spectrum congestion, rural citizenry may actually have one advantage over their urban brethren.

In addition, businesses and government use of telecommunication services have directly and indirectly subsidized household use of telecommunication services. This has been through in-place federal, state, and local policy programs. In practice, this has meant that telephone carriers in urban areas charged higher rates to their business customers and lower rates to household customers than they would have in a perfectly competitive market for telecommunication services. Rural telephone companies often do not have this luxury; rural areas have few large businesses or government operations.

Rural telephone providers also need more resources per customer, including duplicate facilities and backup equipment, to protect network reliability than do urban telephone providers. Equipment serving rural areas is often more exposed to the elements than urban-situated equipment. Rural-situated equipment, therefore, will experience more frequent breakdowns than urban-situated equipment. Rural maintenance and repair crews, especially those providing services in very remote regions, must cover a larger territory than urban crews. As a result service providers have more overtime, travel, and other expenditures when repair crews are not near their home base. Rural telephone service providers must spend more per customer for maintenance and repair than urban providers.

Telecommunication services have, of course, been undergoing a remarkable and fast paced transformation into what may now more accurately be called communication and information services. The cost of the new communication and information technologies, and resultant services, is not inexpensive. One study of rural telephone carriers in the U.S. that serve only remote rural areas by U.S. Department of Agriculture – Rural Utility Service (RUS) and National Telephone Cooperative Association (NTCA), though somewhat dated now, found that the rural carriers would not be able to recoup their investment from their customer base. The NTCA continues to make that argument.

Federal rural communication policy

Telecommunication policy has evolved a great deal from when Alexander Graham Bell first demonstrated his device in Washington, DC. At times the ebb-and-flow of federal involvement has varied momentously, but policy has always fallen within two major areas: (1) regulatory and (2) programmatic. Since the Telecommunications Act of 1996, policy has covered telephone, cable, computer, and Internet services. In other words, telecommunication policy includes everything that an Information Society uses to convey facts and ideas, one reason why the more inclusive term “communication and information policy” is used much more often within the policy community rather than the more traditional term “telecommunication policy.”

Federal policy, as it is currently constituted, intends to facilitate the development and adoption of new communication and information services while addressing some equity issues.

The 1996 Act deregulated the communication and information sectors and updated the universal service provisions. While on the one hand the deregulating Act reduced barriers to economic activity, essentially setting the regulatory boundaries further out, it also, in practice, increased the number of regulations. Many have been trying to get the Act updated as the Internet has evolved in many unforeseen ways and had essentially been an afterthought in the Act.

The equity issues were addressed in the Act by the continuing and reforming the universal service concept. The universal service provisions are the main means that the federal government uses to address equity issues in the distribution of communication and information services. The 1996 Act expanded on pre-existing universal service provisions with a provision to assist schools and medical facilities, with $2.25 billion dollars annually directly earmarked for schools and medical facilities in high-cost and low-income communities. The Act had mandated, at some indeterminate point in the future, consideration toward broadening of the definition of telephony to include Internet service provision. During the Bush administration the Commissioners at the Federal Communications Commission (FCC), however, declined to broaden the FCC's jurisdiction from communication services to communication and information services, limiting the FCC's jurisdiction over the Internet (technically the Internet is considered an information service). The FCC, however, has been changing what universal service coverage may include and has been slowly bringing Internet service provision more into the fold.

In addition the government has a number of separate programs addressing various equity issues. The main programs come from, as they are commonly called, the Farm Bills. The Farm Bills cover traditional agriculture programs as well as rural, natural resource, research and extension, and other activities. Each Farm Bill runs for approximately 5-years.

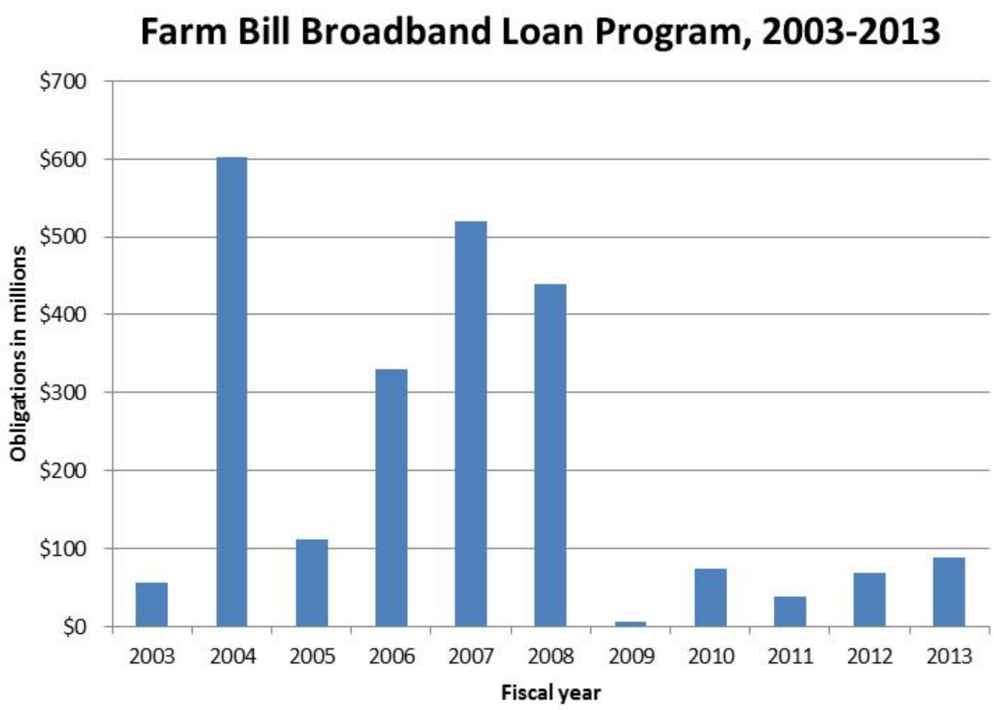
The rural broadband loan program and the telemedicine and distance learning programs come from this legislation and are administered by the USDA-Rural Utility Service (RUS). The telemedicine program delivers assistance for suppliers of telemedicine services by providing small loans and grants to rural health service providers. The program aims to improve telemedicine communication and infrastructure for rural communities. The RUS distance education program and a number of other federal, state, and local programs are designed to aid in the provision of distance learning programs. For rural communities the distance education or distance learning programs' goals are the improvement of education programs by increasing the breadth and depth of course curricula available to rural schools and students. RUS' primary broadband program is what is known as the Farm Bill Broadband Loan Program and, as its name indicates, provides loans to rural providers of Internet services at below market loan rates.

The access to rural broadband telecommunication services was extended by the 2013 Farm Bill with extensive instruction on eligibility requirements, recipient follow-up, metric usage, studies, and information gathering. Broadband was redefined as 4-Mbps downstream and 1-Mbps upstream transmission capacities, making it consistent with the current FCC definition.

A new program called the Rural Gigabit Network Pilot Program was added with an authorization of $10 million per fiscal year. It is to run for the full 5 years of the Farm Act and as it is a pilot with only $10 million in funding the geographic scope will be very small. Given that the technology is already well known, the pilot will likely elicit new data on the need for, and the economic effect of, ultrahigh speed Internet service in rural areas. One other trend in the rural development programmatic area of the Farm Bill was the specific inclusion of digital economy, or broadband technology usage, in some existing programs, though many programs were, de facto, already supporting increased rural business, government, and household Internet capabilities.

The Farm Bill Broadband Loan Program, however, has not been without its problems. The USDA Inspector General after review of the program found that loans were going to what it deemed as non-eligible recipient firms. One consequence of the finding was revision in the RUS process, the result, in part, can be seen in figure 1. The other reason for the drop in loan volume was the American Recovery and Reinvestment Act (ARRA) of 2009, as some of the loan activity shifted toward RUS's ARRA loan program and NTIA's grant program.

Figure 1:



Source: USDA-RUS.

Measuring the impact

Measuring the macroeconomic impact of computers and the Internet has long been problematic. Often the residual, after accounting for more tangible factors, was considered to be their contribution to economic growth and productivity. The effect on individual firms that have invested in information technology, on the other hand, has been shown to be great (Bresnahan, et al; Forman; Greenstein). The challenge of measuring the system-wide economic effect has become commonly known as the Solow paradox, or as he stated it -- "You can see the computer age everywhere but in the productivity statistics."

Jorgenson, Griliches, and Triplett, among others, discussed the macroeconomic measurement difficulties at great length in their papers measuring productivity gained in the U.S. economy from information technology. The difficulties include the price decline in the new information technology that has been often described as following Moore's Law. Aggregation was another difficulty in measuring the impact. McGuckin and Stiroh worked around the aggregation challenge by comparing production function estimates across specifications, econometric estimators, and data levels. They consistently found computers contributing strongly to productivity growth.

Cross-national studies also have been popular in studying the macroeconomic effect. Röller and Waverman used evidence from 21 OECD countries over two decades to examine telecommunication impacts. In their cross-national analysis they found a significant positive causal link, especially when a critical mass of telecommunications infrastructure, specifically near universality of service, is present.

Greenstein and McDevitt assessed broadband Internet's contribution to Gross Domestic Product (GDP) between 1999 and 2006. Their approach overcame some of the shortcomings of traditional GDP accounting. They showed that broadband contributed roughly $10 billion more to GDP in 2006 than dial-up Internet would have, or roughly 40-50 percent of Internet's contribution to the Internet.

Sub-national broadband impact studies, however, remain few in number. Measuring the regional economic effect from the increasing availability of broadband Internet access across geographical space brings more challenges. First, until the recent release of the National Broadband Map, no complete atlas of broadband access availability existed outside of the Form 477 Federal Communications Commission data on service providers with its critical limitations. No historical data exists. Second, broadband has not been available for long and the availability of broadband Internet access has rapidly increased across geographical space. Third, drawing out the effect of broadband from all other economic factors that are also taking place is challenging.

The Crandall, Lehr, and Litan study (2007) is the granddaddy of the sub-national research papers. In their study they examined the effects of broadband deployment on output and employment in a cross-sectional (state-level) analysis using ordinary least-squares statistical methodology. They found employment growth was strongly related to broadband employment. Output growth, however, was more tenuously related. Crandall, however, has brought doubt upon his own study and has said that he had reservations about the results.

In an early study Stenberg et al [2009] tried to overcome some of the challenges. In order to develop rural economic measures of the impact of broadband Internet, they developed a proxy for the likelihood of broadband Internet access to overcome the dearth of historical broadband data. Utilizing the proxy a statistical method called quasi-experimental design was used to explore causal relationships of broadband Internet access while controlling for other possible factors impacting the regional economy. Like the Greenstein and McDevitt 2011 study, an earlier period was used, in this case 2000 to 2006 (Greenstein and McDevitt's period started in 1999) to analyze the impact.

Historical data on broadband availability is severely limited. The only historical national data available come from the Federal Communications Commission (FCC) Form 477 survey. Form 477 provides data collected from high-speed Internet service providers and indicates whether they have customers in any given zip-code. Broadband was often unavailable in rural areas in 2000. Broadband, of course, has increasingly become available throughout the country, though its availability has been less in rural areas, especially in more isolated communities (Stenberg [2013]).

Measuring rural economic impact

The methodological approach that Stenberg et al took is called quasi-experimental design (QED). The approach allowed them to separate out the broadband effect from other causal factors in economic growth and is an initial step toward ferreting out the causal relationship. QED is a statistical approach that simulates an ex-post laboratory experiment (Cook and Campbell). Like a laboratory or medical experiment, QED features both a treatment and control group. The treatment group is the group undergoing the remedy, in this case areas with some minimum level of broadband availability.

The control group, or the untreated group, serves as the counterfactual to the treatment group. In theory the counterfactual is what would have happened to the treatment group if they had not undergone the remedy. The control group provides the baseline forecast. Divergence in the post treatment period is attributed to the effect resulting from the treatment.

Selection of control and treatment in QED, unlike a true laboratory experiment or the medical experiments that use experimental design, are not perfectly random, hence the term "quasi." Treatment groups are self-selected. Control groups are selected based on their representativeness with, or similarity to, the initial, or pre-remedy, treatment groups.

QED has been utilized in a large body of regional science research, such as airport impact studies by Farnsworth or Wheat, fiscal policies by Bender and Shwiff, highway infrastructure studies by Blum or Isserman, and military base closures by Isserman and Stenberg. QED, however, had until this point in time, never been used in a study of the regional effect of broadband investment. In a more recent study, Whitacre et al, use a variant of QED, but on a much smaller region of the country.

Broadband was only starting to become widely available in 2000 and, fortunately, was the first year that a broadband likelihood data base could be built as reliable broadband data does not exist prior to 2000. The data is based on the earliest reliable set of data from the FCC, reliable according to our discussions with the FCC. The 2000 likelihood data allows some effect resulting from broadband investment to start to appear in rural communities; research such as Greenstein and Prince's suggest that information technology takes time to be fully utilized after the technology's introduction.

For QED analysis, counties are used as the basic geographic unit; rural economic time series are available primarily at the county level. Rural areas were defined using the Economic Research Service's rural-urban continuum code.[3] The 2002 rural-urban continuum code was used to differentiate rural from urban counties. The 2000 broadband likelihood statistics were used to select our treatment counties. The building block data, however, needed to be further

[3] The terms rural and nonmetropolitan are used synonymously in the paper.

refined primarily by reconstituting the data for county-level analysis resulting in measures of means and standard deviations for each of the counties.

The selection of treatment for the broadband analysis is not the traditional yes or no for treatment. First, all metropolitan counties were eliminated from our data base. Broadband had been widely available, though nowhere near universal across the country. The cutoff on likelihood measure for treatment was based on inflection points. As the likelihood of broadband availability increases, the number of counties meeting the threshold probability starts to increase exponentially.

We have 228 rural counties in our treatment group. For each of these counties a “twin,” i.e. the county that most closely resembles the treatment county before its selection was matched to each treatment county. The selection was based on economic structure (farming, manufacturing, retail trade, federal government, state and local government income as a percent of total income), spatial structure (population density, distance from various city sizes, and presence of interstate highway), income (per capita, unearned, and transfer income), and previous growth in population and income for the period 1990-2000.

Total employment grew faster in counties that had greater broadband Internet access sooner than other counties (table 1a). This was a new finding as a number of articles such as Crandall et al seemed to suggest that employment is not expected to be greatly influenced by broadband access. Simply put, the issue had become which of two effects of broadband Internet use in business was dominate: (1) increases in productivity that subsequently reduce actual employment due to the productivity gain; or (2) decreases of production costs incurred by the firm vis-à-vis other firms in the industry that subsequently increase employment as market share increases.

At the county-level, however, broadband availability may mean that the county's employers may be more competitive vis-à-vis employers in other counties and as a consequence increasing relative employment growth vis-à-vis other counties. As a result, local employment could increase whether or not the availability of broadband increases the location's desirability for new employers.

Table 1a: Difference in mean employment growth rates

	2002	2003	2004	2005	2006
Total number of jobs	0.003	0.0079***	0.0104***	0.0114***	0.0113**
Total number of proprietors	-0.0068***	0.0072***	0.0199***	0.0280***	0.0363***
Farm proprietors	-0.0001	0.0001	0.0009	0.00197	0.0058**
Nonfarm proprietors	-0.0075**	0.0048	0.0152***	0.0195***	0.0224***
Wage and salary jobs	0.0062***	0.0092***	0.0088***	0.0075***	0.0053***
Farm jobs	-0.0052**	-0.0028	-0.004	-0.0050	-0.0010
Nonfarm jobs	0.00343	0.0076***	0.0096**	0.0101**	0.0087**

Source: Stenberg et al (2009)

Note: *** significant at 10%, ** significant at 20%, * significant at 30%

Wage and salary jobs as well as number of proprietors grew faster in counties with early broadband Internet access. The farm sector, though, seems largely to have been unaffected by broadband Internet access. The farm sector seems more likely to embed broadband Internet access into productivity as its basic inputs are more fixed than other sectors of the economy. Sub-sectors of the counties' economies (not shown here) generally were not significant.

In much more recent research we disaggregated the data, breaking the employment data into industrial sectors. The disaggregation into the employment industrial sectors showed a more mixed message (table 1b). Only construction and wholesale trade showed significantly greater growth in counties with early broadband availability. The increase may indicate increased desirability of the community as a result of broadband availability. For rural areas increased construction may be an indication of greater in-migration of households. The other employment sectors showed no significant difference between the control and treatment groups. Again results are consistent with Internet as a causal factor.

Table 1b: Difference in mean employment growth rates in selected industries

	2002	2003	2004	2005	2006
Total number of jobs	0.003	0.0079***	0.0104***	0.0114***	0.0113**
Construction	0.008	0.036**	0.046***	0.045*	0.040
Manufacturing	0.014	0.011	0.0001	-0.009	-0.002
Wholesale Trade	0.054**	0.041	0.050**	-0.011	-0.078
Retail Trade	-0.002	0.001	0.018	0.016	0.019
Finance and Insurance	0.001	0.020	0.029	0.010	0.047**
Professional and Technical Services	0.022	0.010	-0.005	-0.004	-0.031
Education Services	0.002	0.024	0.079	0.083	0.085
Health Services	0.003	0.045	0.60	0.057	0.060

Source: author

Note: *** significant at 10%, ** significant at 20%, * significant at 30%

The earlier research found a mixed picture for income (table 2a), while population grew faster in treatment counties than control counties. The population growth further buttressed the result for construction employment. The volatility of farm earnings may have been a factor in this outcome as the QED approach that was used did not take into account the variance in crop and farm structure in treatment and control counties.

Table 2a: Difference in mean income and population growth rates

	2002	2003	2004	2005	2006
Population (number of persons)	0.0041***	0.0063***	0.0065***	0.0076***	0.0093***
Per capita personal income (dollars)	0.0100***	-0.0002	-0.0047	-0.0049	-0.012
Personal income	0.0141***	0.0064*	0.0028	0.0037	-0.0012
Farm earnings	0.7545	0.0568	0.2863	0.4327	0.5483
Nonfarm earnings	0.0114***	0.0114*	0.0126*	0.0068	0.0009
Private earnings	0.0163***	0.0234***	0.0274***	0.0206***	0.0192**

Source: Stenberg et al (2009)

Note: *** significant at 10%, ** significant at 20%, * significant at 30%

Private earnings are all earnings excluding farm earnings and federal, state and local government earnings. Private earnings were greater for the treatment counties than for the control counties. This is consistent with the hypothesis that broadband Internet access has a positive effect on a rural county's economy.

Again in more recent research we broke income down into industrial sectors. A positive relationship to dividends, interest, and rent income can be seen in table 2b. Mining exhibits a positive growth effect, a result we cannot yet explain. The result suggests further study. Construction earnings, like in the case of employment, show significantly greater growth. This may further add evidence that broadband Internet availability may make the locality a more attractive location for both businesses and households. The rest of the income effects show a more mixed message.

Table 2b: Difference in mean selected industry earnings growth rates

	2002	2003	2004	2005	2006
Dividends, interest, and rent	0.023***	0.032***	0.040***	0.016	0.012
Mining	0.260***	0.400*	0.558**	0.43	0.651
Construction	0.59***	0.084***	0.124***	0.134***	0.101**
Wholesale trade	0.045*	0.051*	0.067	-0.015	-0.158
Retail trade	0.7545	0.0568	0.2863	0.009	0.001
Transportation and warehousing	0.124***	0.130*	0.115	-0.055	0.094
Accommodations and food services	0.019	0.038**	-0.006	0.025	0.021

Source: author

Note: *** significant at 10%, ** significant at 20%, * significant at 30%

The Stiglitz Issue

Do these semi-traditional methods of economic analysis, such as the quasi-experimental design method, actually measure the full and complete impact of broadband investment? The simple answer, without qualifiers --- NO. The reason, the Internet has impacted more than employment and income, though some can be described as long term economic growth effect. This broader impact definition comes within corresponding discussion that Joseph Stiglitz and other economists have raised about the GNP, and that some have coined, perhaps with some tongue-in-cheek humor, as Gross National Happiness. Basically they argue that the well-being of a country is not measured solely by pure economic factors. Arguably the 3 other major factors that broadband Internet effects are: education, health care, and community cohesiveness, although, other factors have also been cited.

Advancements in on-line applications has taken rural communities along a number of, and not entirely predictable, paths. People have increasingly become reliant on the Internet for everyday activities, covering commercial, educational, and personal activities. The Internet has become a pervasive medium through which individuals can engage in everything from personal communication to civic participation. The Internet has served as a medium for formal communication, such as business or work-related communication, and informal communication, such as e-mailing friends and family, as well as being widely used for entertainment and social activities (Parker; Stenberg [2006]). Since people can use the Internet to engage socially and civically, the technology is recognized as an important tool for many different aspects of social life (Stern et al [2008]).

Education

Education, of course, has been well-documented by Gary Becker and others as contributing to long-term economic growth. Education benefits both the individual and the community. The Internet has become a source of information for students, a means to communicate between parents and teachers, principals and advisers, and a method to track and test students.

Internet returns to education, however, are not without controversy. A corollary to Solow's comment on the returns to computers exists here too. One can see the Internet used widely by schools and students, but where does it show in the education outcomes? The education discussion will be presented in future research so for now a short answer: like personal computers, the Internet, and its predecessor systems have been in use since the early seventies with T1 systems delivering live lectures for remotely located, but fully academically enrolled, students. The productivity gains, and results have been incorporated over this long period, with many other changes occurring along the way to lessen the measurable impact, including driving some of the cost of education delivery down from what it would have otherwise been.

Rural Telemedicine and Telehealth

Rural communities have long faced a short fall in doctors, and according the National Institute of Health will face an even greater short fall over the next couple of decades. Into this recognized rural challenge comes the promise of telemedicine and telehealth. And yes, there is a difference in the terms. Although no authority exists, such as in France in keeping the language pure, the terms have generally been used to connote two different actions: telemedicine has been used to connote activities between medical providers, medical industry, and medical professionals. Telehealth has been used to connote actions by individuals seeking information and using common health monitoring systems.

Both telemedicine and telehealth have been offered as essential for rural communities, with rural benefits ranging from the intangible, such as improving the perception of locally-provided health care quality, to the tangible such as offering a large variety of medical services that would otherwise be of limited local availability (Goetz and Debertin; Stenberg[2009]).

Retention or expansion of medical services in rural communities can also lead to real economic benefits to rural communities and their residents by reducing transportation time and expenses, treating emergencies more effectively, reducing time missed at work, increasing local lab and pharmacy work, and cost savings from health facilities from outsourcing specialized medical procedures (Capalbo; Whitacre [2008]). Broadband Internet access has been essential in driving down some of the costs inherent in rural telemedicine delivery (Capalbo; Center for Rural Health Practice).

As mentioned earlier, RUS administers a number of programs aimed at improving in-clinic medical technology as well as general rural broadband Internet access that will allow rural clinics fully utilize medical technologies. The programs have been reaffirmed and expanded by the farm bills since their initial development in the 1990's.

Telemedicine studies have primarily been case studies on how hospitals have adapted to telemedicine and cost benefit studies for hospitals adapting particular telemedicine applications. Many studies have tended to have disappointing results as expected cost savings failed to be ascertained (Whitacre[2008]). Whitacre [2008] and others, however, found that there were economic benefits to the local community from telemedicine investment.

Telehealth has not yet been shown to have positive effects, however, as many of the devices are only now coming onto the market. These include smart phones keeping real-time vitals on patients. They are expected to save lives as well as provide improvements in patient treatment over time. Broadband Internet connections are considered critical in their use.

Online vs offline community interaction

For the last 20 years, some researchers have warned that increased use of the Internet would lead to weakened community ties resulting in lessening of common interests and decreases in levels of voluntary or community participation (Stern et al [2008]; Stenberg et al[2009]). Local communities would be destroyed as people went on-line and found their own virtual communities of common interest and would no longer find a need to spend time in the local community.

Sociological research over the past decade, however, has found this concern largely unjustified. In fact Internet use has been shown in a number of cases to be positively related to active contributions to community vitality through various forms of civic engagement and community participation (Stern and Dillman [2006]; Stern et al [2008]; Wellman, Quan-Haase, Witte, and Hampton [2001]). The concern has now evolved into fear that those with antiquated or no connections to the Internet are systematically being left out of activities in their local communities (Stern et al [2008]). Stern et al showed that the use of the Internet has been associated with higher degrees of community participation across a variety of groups and organizations.

On the other hand, more recently, some have voiced concern that the Internet may allow some individuals to retreat into the Internet in a more harmful way, using it to voice frustrations that they may act out. The issue of community interaction is still not completely clear as issues of privacy and security have left the confines of the academic policy forums and come more into the real world.

Conclusion

Rural areas lagging in communication investment is not new. From the beginning of the technological revolution to the rapid rollout in broadband Internet access rural areas, investments came first to areas that earned higher returns on the investment. Universality in high-quality Internet service remains a dream and a goal of policy makers, articulated again by Congress in the 2014 Farm Bill.

Measuring the economic effect of broadband Internet access remains challenging. Notably, broadband Internet access data still leaves much to be desired for economic research analysis. QED methodology was a major step in sorting out the crosscurrents affecting economies and developing a better understanding of how broadband Internet access affects rural areas and further research has shown some additional positive economic impacts. More QED and other research, however, needs to be completed looking specifically at farm bill recipient areas now that time as progressed sufficiently to measure the economic effects of a few recipient communities. Most communities, however, remain in the fog of too recent adoption and no data yet released.

Direct economic benefits, as measured by employment and income, however, are not the only benefits. Education opportunity, education provision efficiency, telehealth, telemedicine, and community cohesiveness and involvement are among the other important measurable and non-measurable factors that contribute to rural individual and community well-being.

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