Broadband's Effect on the Rural Economy

Measuring the rural economic effects resulting from investment in broadband is challenging. Separating out the broadband effect from other causal factors in economic growth is difficult, especially given that broadband has not been available for long and its use has grown rapidly. The methodological approach that we take is called quasi-experimental design, and what is undertaken here may be considered an initial step toward ferreting out a causal relationship.

Quasi-experimental design (QED) is a statistical approach that simulates an ex-post laboratory experiment (Cook and Campbell, 1979). Like a laboratory or medical experiment, QED features both a treatment and control group. The treatment group is the group undergoing the "cure," which in this case includes 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 "cure." 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) is not perfectly random, hence the term "quasi." Treatment groups are self-selected. Control groups are selected based on their characteristic similarity with the initial, or pre-treatment, characteristics of the treatment group.

QED has been utilized in a large body of regional science research. It has been used in airport impact studies such as Farnsworth (1972) and Wheat (1970), fiscal policies such as Bender and Shwiff (1982), highway infrastructure studies such as Blum (1982) and Isserman (1987), and military base closure research such as Isserman and Stenberg (1994).

We use the year 2000 broadband density surface developed from the FCC broadband access data (see appendix C, specifically the section on enhancing the FCC data). In 2000, broadband was only starting to become widely available and it is the first year a broadband likelihood database could be constructed. Broadband access is based on the earliest reliable set of data from the FCC (according to our discussions with the FCC). Our 2000 likelihood data allow some effect resulting from broadband investment to start to appear in rural communities. Information technology takes time to be fully utilized after the technology's introduction (Greenstein, 2000; Bresnahan et al., 1999; Greenstein and Prince, 2006).

We selected 228 rural counties for our treatment group that had relatively high broadband availability in 2000. For each of these counties, we found a rural "twin," a county that most closely resembles the treatment county (outside of broadband availability) based on economic structure (farming, manufacturing, retail trade, Federal Government, and State/local government income as a percent of total income); spatial structure (population density, distance from various city sizes, and presence of interstate highway); and income (per capita, unearned, and transfer income) in 2000; as well as the growth in population and income from 1990 to 2000. Duplicate counties

were not allowed in the control group (see appendix E for further discussion of the methodology used).

Our post-treatment period is 2002 through 2006. Year 2006 is the last year for which broadband data are available, and the 5-year period provides time for an economic effect from broadband service to manifest itself. Due to the rapid spread of broadband Internet access, the initial short period may be the only period when we are able to detect differences in economic outcomes resulting from the availability of broadband access.

We investigate changes in county employment and income in our QED analysis, and find that total employment grew faster in counties that had greater broadband Internet access sooner than in similarly situated rural counties without broadband access (table 11). Previous studies (Crandall et al., 2007) suggest that employment is not expected to be greatly influenced by broadband access. Simply put, the issue becomes whether the use of broadband Internet in business increases productivity, which subsequently either reduces actual employment (due to the productivity gain) or increases employment (as market share increases). At the county level, however, broadband availability may mean that the county's employers are more competitive with employers in other counties. This would attract both new jobs and potentially new employers.

Wage and salary jobs, as well as number of proprietors, grew faster in counties with early broadband Internet access. The farm sector seems largely to have been unaffected by broadband Internet access. The farm sector, however, seems more likely to embed broadband Internet access into productivity as its basic inputs are more fixed than other sectors of the economy. Subsectors of the counties' economies (not shown here), like wholesale trade, generally showed no significant effect from broadband access, though further analysis is warranted. The difference in nonfarm jobs starts to disappear as other counties get increased broadband access.

Income showed a mixed picture (table 12), though population showed greater growth in treatment counties than control counties. The normal year-to-year volatility of farm earnings due to weather and other causal factors not accounted for in the QED approach taken here may have been a factor in this outcome. Nonfarm earnings showed greater growth corresponding to

Table 11

Difference in employment growth rates between early broadband and control counties

	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

Note: * significant at 10%.

Source: ERS using selected data from Bureau of the Census and Bureau of Economic Analysis data.

Table 12

Difference in income and population growth rates between early broadband and control counties

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

Note: * significant at 10%.

Source: ERS using selected data from Bureau of the Census and Bureau of Economic Analysis data.

broadband availability. The difference between control and treatment counties lessens over time as other counties get better broadband access.

Private earnings—all earnings, excluding farm earnings and Federal, State and local government earnings—were greater for the treatment counties than for the control counties. The results we obtained are consistent with the argument that broadband Internet access has a positive effect on rural communities.

Our analysis supports the hypothesis that investment in broadband Internet access leads to a more competitive economy. Further analysis, however, is needed to address the issue of causality more completely. Why and how broadband may lead to the results of the QED analysis was the subject of other ERS research at the ERS Broadband Workshop. It is the subject of the rest of the report.