

***The Impact of High-Speed Internet
Access on Local Economic Growth***

August 2005

Peter F. Orazem, Ph.D.
Koch Visiting Professor of Business Economics
University of Kansas School of Business
pfo@iastate.edu

Prepared for:



Past research has found a link between infrastructure investments and economic growth. One line of research found that investments in highways, particularly the interstate highway system, helped to accelerate economic growth in the United States. Investments in telecommunications have accelerated growth across the OECD economies. Other research has linked increases in information technology investments overall to rising labor productivity growth in the United States. There is an expectation that expanding access to high speed Internet, sometimes referred to as the information superhighway, should also have an effect on growth, but that linkage has not been established convincingly.

There are several ways that high-speed (broadband) Internet access could lead to economic growth. One is that, by improving the efficiency of communication between firms and suppliers and between firms and their customers, firms may be able to reduce their sales and procurement staffs. They may also be able to enter new input and product markets because they are no longer as tied to geographically proximate suppliers or customers. Faster Internet access also speeds the transfer of information between firms. For many years, cities have grown faster than rural areas. Economists have explained the faster metropolitan growth in part by the presumed returns to more efficient communication of new innovations, products, and greater proximity to investors and customers. By lowering the disadvantage of distance, the Internet has the potential to extend some of these sources of growth to rural areas. Consequently, we would expect the largest impacts of high-speed Internet on growth would be experienced in rural markets.

Past research has been able to demonstrate that workers who use computers on the job are paid a premium over workers that don't. Research has also been able to show that manufacturing firms that have invested more in information technologies have experienced faster labor productivity growth and faster wage growth than have manufacturing firms that did not invest in information technologies. These results do not establish cause and effect, however, and some studies suggest that the firms and workers who use these new technologies had higher wages and productivity before the new information technologies were put in place. They also do not establish whether the apparent gains that go to technology users come at the expense of those who are not using the technology or if the net effect is positive for the economy as a whole.

This study will measure the impact of high-speed Internet access on local economic growth. We have a particular interest in testing whether the impact is larger or smaller in rural, urban or metropolitan areas. Our results suggest that high-speed Internet access increases growth in earnings per worker, aggregate earnings and the number of firms, but it lowers the rate of growth of employment. All of these are consistent with the presumption that Internet access can lower firm costs, improve information flows with suppliers and customers, and at the same time, lower the need for employees specializing in sales or procurement. All of these effects were larger in less densely populated areas, suggesting that rural areas do benefit disproportionately from high-speed internet access.

Background

The earliest information we have on local broadband access is from the December 1999 Federal Communications Commission (FCC) compilation of the number of High-Speed Internet Providers by zip code. That year, the FCC initiated a survey that required

that most Internet Service Providers report its presence in a given zip code as long as it served at least one customer in that zip code. There are two main types of broadband service, asymmetric digital subscriber lines (DSL) and cable modems using hybrid fiber-coaxial cable networks. These services have a significant advantage over satellite services which allow high speed downloading but depend on dial-up service for uploading information. Consequently, broadband has significant advantages for firms wanting to use a web site as a portal for their business. Dial-up service is just too slow to accommodate a web page.

We compiled county-level aggregations of the FCC zip code data. The county aggregates measure degrees of access: counties vary in services from 0% to 100% of zip codes having at least one provider.

As of December 1999, less than 2% of U.S. households had residential High-Speed Internet service. The early adopters were atypically in metropolitan areas because that is where the service was available. As shown in Table 1, 53% of zip codes in the largest cities had at least one High-Speed Internet provider, double the rate of the least populated counties in the U.S. Metropolitan areas of Kansas had better access than the U.S. with 71% of zip codes having at least one service provider. However, rural areas in Kansas lagged well behind the national average rate of service provision.

High-speed Internet access expanded rapidly in the U.S., and Kansas was no exception. By December 2001, 80% of large metropolitan zip codes in Kansas had broadband access compared to 65% for the U.S. large metropolitan average. Access rose rapidly in nonmetropolitan areas of Kansas as well, but still lagged Kansas metropolitan areas by a large amount, and also lagged the national averages for comparably sized

counties. By December 2003, rural areas in Kansas as elsewhere had largely closed the digital gap with metropolitan areas. Figures 1 demonstrates the rapid deployment of broadband service in the United States. The 1999 map shows many areas in the Midwest and West that had no service, but relatively few that lacked broadband access by 2003.

If broadband access is important for growth, then sparsely populated counties faced an easily observable disadvantage in technology access. Areas with early access may have had a competitive advantage relative to similarly sized counties that lacked broadband access. In the next section, we report the results of a test of that hypothesis.

What factors affect broadband deployment?

We examined the factors that led to early broadband deployment by county.

Among the findings:

- 1) Broadband access was greatest in the most densely populated counties. There are apparently returns to scale in broadband deployment because many customers can be served by the same cable.
- 2) Counties that had grown faster in the past were the most likely to get high-speed service.
- 3) Access was positively related to the proportion of the population that had more than a high school education. The effect was even larger in the less populated counties.
- 4) Counties were more likely to get early deployment if they were in or adjacent to a metropolitan area. Interestingly, it also helped if the county was along an interstate highway route, presumably because in laying cable between major metropolitan areas, communities along the route could be serviced at lower cost.

5) Even after controlling for these and other factors, rural and small urban counties were less likely to get high-speed service.

Does broadband access affect measures of county growth?

We examined the impact of broadband access on four measures of economic growth from 1998 to 2001: growth in aggregate earnings, employment, earnings per worker, and the number of firms. We used 1998 as the base period because there was virtually no broadband deployment before that year. We compare growth between counties with and without broadband access, controlling for county growth before 1998. The results are:

- 1) Early broadband access caused aggregate earnings to grow about 1% faster per year. The effect was even larger in the small urban and rural counties.
- 2) Broadband access had no effect on employment growth across all counties, but caused employment to grow more slowly in the smallest counties. However, earnings per worker rose in all counties, and the effect was even larger in the smallest counties.
- 3) Early broadband access led to faster growth in the number of firms with the largest effect in the smallest counties.
- 4) The effect of broadband access was most apparent in earnings and firm growth in the rural retail sector. Manufacturing earnings also rose faster in rural counties with broadband access, although those counties experienced slower growth in the number of manufacturing firms.

Conclusion

It seems apparent that early broadband access led to accelerated county economic growth in both urban and rural counties with the largest effects on rural areas. It is too

early to tell whether these effects are temporary, leading to one time increases in production, or if broadband access will lead to a permanent increase in the rate of economic growth. These findings do not suggest that counties that lack broadband access will automatically get the same return. Broadband deployment was not random across counties, but occurred in counties that would expect to benefit most from high-speed Internet access. Consequently, the growth experienced by counties getting access earliest would be an upper-bound estimate of the growth that should be expected in the later recipients.

Table 1: Proportion of Zip Codes with High Speed Internet Access and Average Number of Providers, by Beale Code, December 1999, 2001

Beale Code	HSP: Present, U.S. Dec. 1999	HSP: Present, Kansas. Dec. 1999	HSP: Present, U.S. Dec. 2001	HSP: Present, Kansas, Dec. 2001
Metro				
1 Large Metro	0.53	0.71	0.65	0.80
2 Medium Metro	0.46	0.62	0.61	0.72
3 Small Metro	0.42	0.60	0.58	0.58
Large Urban				
4. Adjacent	0.41	0.34	0.57	0.48
5. Nonadjacent	0.32	0.36	0.52	0.64
Small Urban				
6. Adjacent	0.35	0.43	0.56	0.39
7. Nonadjacent	0.31	0.40	0.50	0.41
Rural				
8. Adjacent	0.28	0.03	0.55	0.33
9. Nonadjacent	0.21	0.17	0.46	0.48

Large Metro counties have over 1 million population, Medium have 250,000 to 1 million, and Small Metro have 100,000 to 250,000

Large urban counties have urban populations between 20,000 and 100,000

Small urban counties have urban populations between 2,500 and 20,000

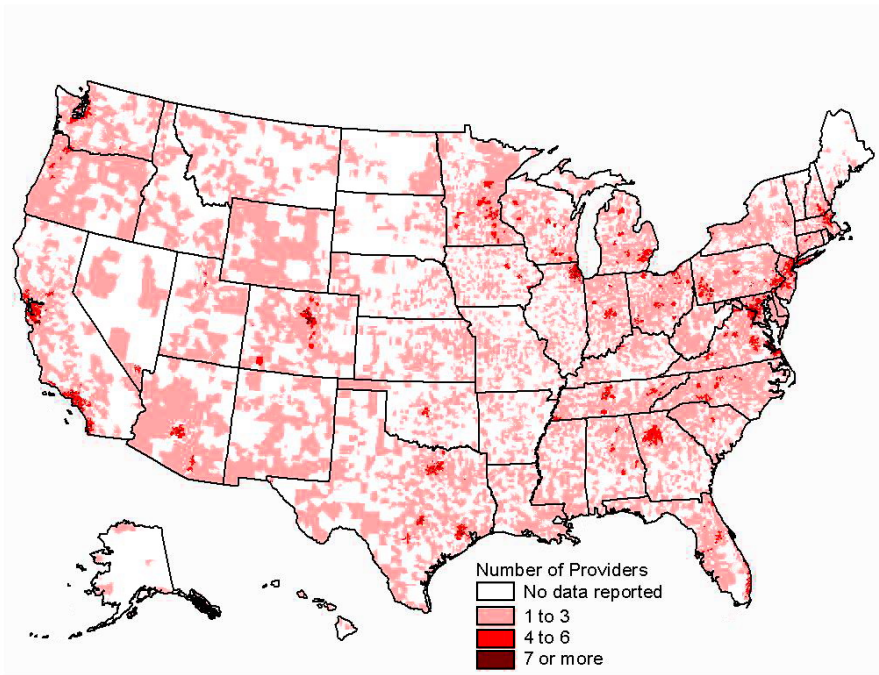
Rural counties have urban population below 2,500

HSP:Present is the average number of zip codes with at least one high speed Internet provider

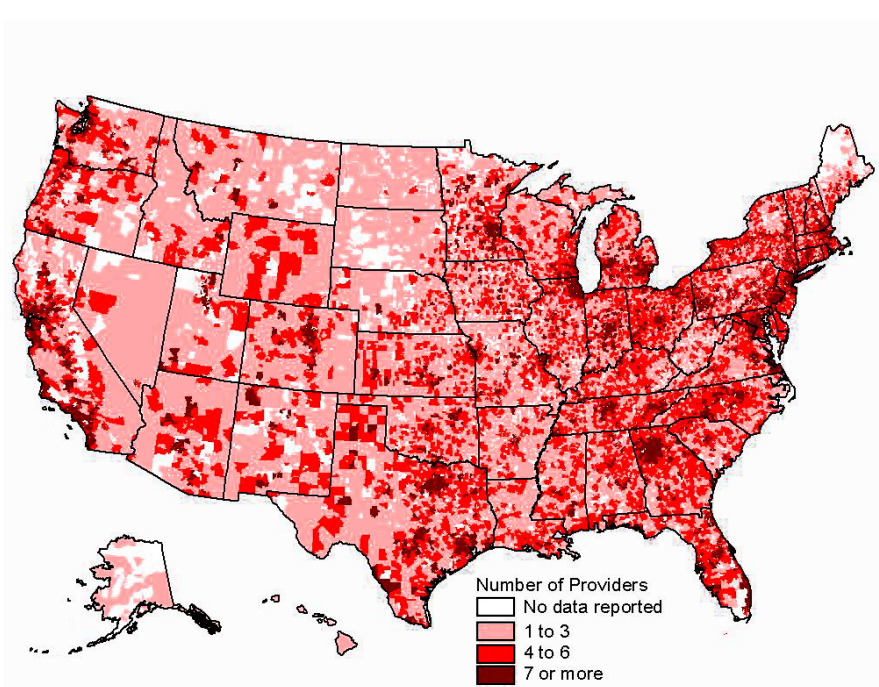
HSP:Number is the average number of high speed Internet providers per zip code in the county

Figure 1 **Broadband Distribution by Number of Providers per Zip Code**

December 1999



December 2003



KANSAS, INC.

Created by the 1986 Legislature, Kansas, Inc. is an independent, objective, and non-partisan agency designed to conduct economic development research and analysis with a goal of crafting policies and recommendations to insure the state's ongoing competitiveness for economic growth. This is achieved through these primary activities: 1) developing and implementing a proactive and aggressive research agenda; 2) identifying and promoting strategies and policies from the research; 3) conducting evaluation reviews and oversight of programs; and, 4) collaboration with economic development entities and outreach to potential partners. Kansas, Inc. is designed to be a public private partnership with expectations that state investments are leveraged with other funds to maintain a strong research portfolio.

A 17-member Board of Directors co-chaired by the Governor and a private sector representative governs Kansas, Inc. Nine Board members are representatives from identified industries in the private sector and other members are: the Secretary of Commerce, Legislative leadership, the Kansas Board of Regents, and a representative from labor.

BOARD OF DIRECTORS

CO-CHAIRS

Governor Kathleen Sebelius
Topeka

Patti Bossert
Key Staffing, Topeka

MEMBERS

Stan R. Ahlerich
Ahlerich Farms, Winfield

Gene Argo
American Rodeo Company, Hays

Rep. Tom Burroughs
State Representative, Kansas City

Secretary Howard Fricke
Kansas Department of Commerce, Topeka

Rep. Lana Gordon
State Representative, Topeka

Donna Johnson
Pinnacle Technology, Lawrence

Sen. Laura Kelly
State Senator, Topeka

Wil Leiker
AFL- CIO, Topeka

Lawrence L. McCants
First National Bank, Goodland

Sen. Stephen Morris
Senate President, Hugoton

Reginald Robinson
Kansas Board of Regents, Topeka

Donald P. Schnacke
Donald P. Schnacke, P.A., Topeka

Paul Stephenson
PDS Company, Wichita

Stephen L. Waite
Kansas Calvary, El Dorado

KANSAS, INC. STAFF

Stan R. Ahlerich
Interim President

Debby Fitzhugh
Director of Operations

Dan Korber
Senior Research Analyst



632 SW Van Buren, Suite 100
Topeka, KS 66603
(785) 296-1460
(785) 296-1463 (fax)
www.kansasinc.org
ksinc@ink.org



University of Kansas School of Business
Summerfield Hall, 1300 Sunnyside Avenue
Lawrence, KS 66045-7585
www.cae.business.ku.edu
(785) 864-5134