Achieving Rural Universal Service in a Broadband Era: Emergent Evidence from the Evolution of Telephone Demand

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INTRODUCTION

Since the earliest days of telephony, academics, policymakers and industry practitioners have wrestled with economic issues caused by observed disparities in the availability and adoption of telecommunications services in rural areas. Far from peripheral, these issues have often shaped the heart of telecommunications policy. Indeed, the first calls for the promotion of “Universal Service” were embedded in a larger evolution of changes in industrial structure and public-private partnership to promote telephone service ubiquity throughout the United States. Subsequently, an enduring feature of telecommunications policy has been a focus on efforts to promote universal service to rural areas.

As the nation transitions today from a telecommunications infrastructure that was primarily narrowband to one that is increasingly broadband, it is once again confronted with both opportunities and challenges of promoting the deployment and adoption of telecommunications services throughout the entire (i.e., urban and rural) country. As noted in the National Broadband Plan, broadband availability eliminates time and space barriers, allowing rural consumers to purchase goods and services and rural businesses to transact with customers and suppliers at any time and in any place.

In light of the dramatic transformation of the industry from narrowband to broadband, combined with the shifting demand from wireline to wireless, it is perhaps an ideal moment to reflect upon both the telecommunications industry evolution and the implications of that evolution for future policymaking to achieve broadband universal service in rural areas.

This policy vignette is organized as follows. We first consider the backdrop against which the challenge of broadband deployment in rural economies is set. We then describe the basic economics of both the supply and demand of broadband in rural areas. Finally, we consider the implications of the basic economics for policymaking.

RURAL ECONOMIES – Challenges and Opportunities

While “Rural America” often evokes a vision of an idyllic and stress-free life, the economic reality of many rural Americans is quite different. In particular, economic challenges to Rural America have historically manifested along two principal dimensions: geographic isolation and
economic specialization. Each has acted to impede the path to improved economic welfare in America’s more sparsely populated areas.

A key driver to economic growth for businesses centers on their ready access to both suppliers and customers. In this dimension, rural communities have historically been economically challenged. Because businesses (especially entrepreneurial-based businesses) have traditionally relied upon proximity to economically-related entities and critical infrastructure to underscore that proximity, it has been especially difficult for rural areas to attract both the quality and quantity of jobs necessary to raise living standards on par with urban areas. The resulting risk from the spatial isolation of rural communities is that these areas become bereft of both job creation and economic development. In short, isolation leaves rural areas without a foundation for future economic growth.

And whether it is a single manufacturing facility, a large agricultural coop or a major coal mine, the specialization of employment by one or a few significant employers in rural areas creates a lack of economic diversity that, in turn, limits economic growth and makes rural areas more vulnerable when these sectors fall victim to larger global demand shifts. A principal impediment to economic diversification in rural areas has been attracting diverse and entrepreneurial labor that is prone to start and grow new and varied businesses.

Despite these challenges, rural America is not without comparative advantages. Lower land costs, wages and taxes have historically served as attractions to businesses that might consider relocating to rural areas. But as companies increasingly widen their perspective in the search for a lower cost basis, rural America’s advantages are increasingly pitted against even lower cost locations in developing countries. The result is a new emphasis on endogenous, home-grown economic growth if rural America is to advance economically. In this regard, a critical and essential step that emerges is the ability of rural citizens and businesses to procure ready and timely access to society’s broad knowledge that traditionally has been asymmetrically available in urban areas. Indeed, in his seminal contributions to endogenous growth theory, Stanford economist Paul Romer indicated that a firm’s economic output, productivity growth and, by inference, employment is best seen as driven by its access to a set of firm-specific knowledge and the prevailing stock of knowledge in society.\(^1\) But access to society’s stock of knowledge has not historically been distributed in a geographically uniform manner. Rather, access to knowledge has been held in urban areas both as a result of physical and labor concentrations of knowledge. Recently, however, John Mayo and Scott Wallsten adapted Romer’s model by including broadband deployment and adoption as a “lubricant” that facilitates the flow of society’s stock of knowledge to firms (both extant and start-up

\(^1\) See Romer (1986).
entrepreneurs). Greater broadband deployment is in this regard not only a tremendous equalizer to rural areas, but also especially beneficial to rural areas by ameliorating or eliminating the economic challenges of geographic isolation and economic specialization. The deployment and adoption of broadband then is likely to serve as a critical link in the chain of economic development in rural America. The National Broadband Plan explicitly recognizes the enabling characteristics of broadband:

Broadband is the great infrastructure challenge of the early 21st century. But as with electricity and telephony, ubiquitous connections are means, not ends. It is what those connections enable that matters. Broadband is a platform to create today’s high-performance America—an America of universal opportunity and unceasing innovation, an America that can continue to lead the global economy, an America with world-leading, broadband-enabled health care, education, energy, job training, civic engagement, government performance and public safety.

BROADBAND ECONOMICS – Supply and Demand

In light of the critical role that broadband deployment and adoption can serve in the process of enabling economic growth, the Administration has acted to prioritize the universal provision of broadband to all Americans. The economics of the universal deployment of broadband are, however, daunting. Deploying broadband has involved investments of tens of billions of dollars annually, and will ultimately require capital and operating expenditures in the hundreds of billions of dollars to provide full universal service. The resulting trend in private sector investment has been to focus the initial wave of investments in high density, low cost urban areas. The result, as noted in the National Broadband Plan, has been that the “broadband availability gap is greatest in areas with low population density”.

The daunting supply side makes it tempting to simply accept geographic asymmetry in broadband deployment. The economic costs are simply too big, some will say, to deploy broadband to rural America. But a careful focus on the economics of broadband point to a more optimistic conclusion. On the supply side, the longer loop lengths necessitated by lower population densities in rural areas create significantly elevated costs for deploying wireline broadband facilities. Wireless broadband solutions are, however, less sensitive to population density. The deployment of high quality wireless networks that afford broadband capability

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2 See Mayo and Wallsten (2011).
3 See National Broadband Plan (2010: 19).
thus have the potential to be more economically attractive, especially to private sector investment, than wireline solutions.

While the economics of deployment are improved by wireless solutions, another element also improves the supply-side economics of rural wireless deployment of broadband. The benefits of broadband wireless deployment extend not only to private sector suppliers, but also to the broader rural community. Indeed, recent research has documented the efficiency gains in rural areas that accompany the deployment of wireless telephony.\(^5\) Of particular importance, advanced wireless telecommunications in rural areas acts directly to eliminate the disadvantages traditionally faced by the geographic isolation of producers and consumers in rural areas.

More generally, economic studies that examine the impact of improved telecommunications on income, growth and efficiency most commonly find a positive association. While causality and data concerns are often challenging in research in this arena and sometimes prevent more specificity in connecting the economic dots, at least four possibilities have been put forth to explain these relationships.\(^5\) First, telecommunications offers increased investment and development opportunities, including those related to new business formation, employment and information-related activities. Second, telecommunications offers improved business management benefits, including more efficient communications and information handling. Third, telecommunications offers (generally unobserved) productivity benefits related to total factor productivity improvement and network externalities. Finally, telecommunications offers improved social and political connectedness, allowing greater checks and balances on political corruption and governmental institutional functionality.

Recent studies have attempted to further disaggregate the economic effects of telecommunications by comparing and contrasting wireline and wireless broadband telephony within the context of both high income and low income countries.\(^7\) The econometric evidence from this research indicates that wireless deployment of broadband, particularly in low income and rural areas, is a significantly more powerful economic growth stimulant than wireline technology deployment.\(^8\)

In short, both the direct costs associated with wireless broadband deployment in rural areas and the larger cost-reducing and efficiency-enhancing impacts that this deployment has on

\(^5\) See e.g., Jensen (2007) and Aker and Mbiti (2010).
\(^7\) See Thompson and Garbacz (2011).
\(^8\) See e.g., Garbacz and Thompson (2007).
rural economies should naturally focus society’s attention on wireless broadband’s potential to be the most efficient path to achieving universal service in rural America.

While economic research emphasizes the relative supply-side (cost and efficiency) merits of wireless solutions, far less attention has been given to the implications of consumers’ demand for wireline versus wireless telephony as they manifest across the country. In particular, an important question to ask is how, if at all, might the demand for mobility vary across the country? In this regard, we along with co-authors have recently developed a detailed econometric model of the portfolio of demand for wireline and wireless telecommunications by U.S. consumers in both urban and rural areas.\(^9\) We begin this effort by theorizing that the relative demands for wireline and wireless telephony are driven by both the “nodal” characteristics of the household and the relative quality of the competing wireline and wireless technologies. Households that are more yoked to their nodes (e.g., domiciles) will have higher demand for wireline telephony to satisfy their communications needs. On the other hand, households that are more “on the go” and spend more time away from their nodes will have higher demand for mobile solutions. This theory suggests that while there is a sheer “thinness” of demand in rural areas due to the presence of fewer customers in less populated areas; the relative demands for wireless telephony will be higher in rural areas where household members are more frequently away from their nodes. As recently described by a rural rancher:

> [L]et me paint you a picture of what I deal with on a regular basis as a cattle producer who ranches in a rural area. When I leave the house and head out to the high country, I have, at best, limited access to Internet and cellphone service. While out gathering cattle, I am virtually unreachable and must suspend all business communications—and as the executive vice president of the U.S. Cattlemen’s Association, that is not an ideal working situation.\(^{10}\)

In short, rural Americans have higher relative demands for wireless telecommunications and internet than do their more urban counterparts. The ability to observe this higher relative demand has historically been constrained, however, as the demand for wireless communications is sensitive to the quality of wireless networks relative to wireline networks.

Our empirical analysis builds upon a core set of data collected by the Centers for Disease Control which measures households’ decisions to adopt wireline telephony, wireless telephony, both types or neither type over the 2003-2009 period.\(^{11}\) The data and econometric modeling

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\(^{10}\) See [http://www.rollcall.com/news/-209132-1.html](http://www.rollcall.com/news/-209132-1.html).

\(^{11}\) See Blumberg et al. (2011) for a description of CDC’s data collection effort. See Macher, et al. (2011) for a complete description of the full database employed, which augments the CDC data with data from the Federal
provides several insights. For instance, consider Figure 1 which provides a color-coded map of the percentage of wireless-only households by U.S. state. While more than 25 percent of all U.S. households are now wireless-only, this percentage varies substantially across states. The top-five wireless-only household states are Arkansas (35.2%), Mississippi (35.1%), Texas (32.5%), North Dakota (32.3%) and Idaho (31.7%)—all of which are exceedingly rural. In contrast, the bottom-five wireless-only household states are New Hampshire (16.0%), South Dakota (15.6%), Connecticut (13.6%), New Jersey (12.8%) and Rhode Island (12.0%)—most of which are urban. Rural households appear to ascribe a higher economic valuation to wireless telephony than urban households.

Beyond these descriptive statistics, our research includes analysis of over 160,000 households over the 2003-2009 period. We find that, after controlling for a host of other demand determinants, population density of a household’s county is inversely related to the demand for wireless telephony. The heightened demand for wireless in rural areas, moreover, is augmented by improved quality of wireless service as proxied by cell site deployment. Rural households therefore ascribe higher value to both wireless telephony in general and to the quality of wireless networks, which have been more slowly developed in rural urban areas.

**POLICY IMPLICATIONS**

While the shift from wireline telephony to wireless telephony is certain to continue, its speed will likely be determined by two principal factors: first, the degree to which households affiliate with their domicile (i.e., node) or with being more “on the go”; and second, the quality of the wireless telephony network relative to wireline telephony network.

In this regard, our review of the opportunities for and threats to rural America indicate policies that promote the universal deployment of state-of-the-broadband will materially enhance U.S. economic welfare. Considerations of economic efficiency necessarily narrow the focus of broadband deployment to largely private-sector wireless technologies. Moreover, even with the relative advantages of wireless broadband in rural areas, spectrum constraints have slowed the private sector’s ability to deploy wireless broadband in sparsely populated areas. This lag is especially lamentable in light of the high demand for mobility by rural area consumers.

Certainly part of the policy solution is to accelerate efforts to allow spectrum to move from less highly-valued to more highly-valued users and uses. Recent focus by policymakers, including

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See Macher, Mayo, Ukhaneva and Woroch (2011).

Communications Commission, the U.S. Census Bureau, the U.S. Bureau of Labor and Statistics, and the U.S. Department of Agriculture.

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members of the so-called “Super-Committee”, for enhancing and regularizing spectrum supply is welcome. Another opportunity also presents itself with the proposed merger of AT&T and T-Mobile. While this merger is receiving considerable scrutiny regarding its possible impact on competition, our research brings into focus another economic consideration. Specifically, the heightened demand characteristics for mobility in rural areas together with the demand-enhancing nature of cell site deployment indicate that the accelerated quality and ubiquity of mobile broadband promised by the merger have the potential to create significant economic value. And, aside from creating economic value by satisfying inherent consumer demand, the economic literature also indicates that any accelerated deployment of broadband will ameliorate the traditional economic challenges of isolation and economic specialization that have historically limited economic growth in these areas. Thus, the accelerated deployment of broadband promised by the merger may not only facilitate the ability of the mobile telephone industry to better satisfy demand in rural areas, but also serve as an important platform and lubricant for future economic growth in these areas.

The transformation undergoing the telecommunications industry—in terms of shifts from wireline to wireless and from narrowband to broadband—is arguably the largest since the invention of the telephone itself. This transformation will require public policies that complement and enable this transformation. Today’s policymakers will serve the nation well by favorably considering measures that smartly enhance both spectrum supply and alterations in the industrial structure that enable the more efficient use of that spectrum. Doing so is surely the fastest path to the achievement of universal broadband service in rural America.

13 See http://republicans.energycommerce.house.gov/Media/file/Letters/112th/100711jscspectrum.pdf
FIGURE 1 – WIRELESS-ONLY HOUSEHOLDS BY U.S. STATE

REFERENCES


