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ECONOMIC POLICY / BRIEFING PAPER

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The Economic Impact of Rural Telecommunications: The Greater Gains

Hanns Kuttner

October 11, 2011

Prepared for the
Foundation for Rural Service

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Executive Summary

- Rural telecommunications companies contributed $14.5 billion to the economies of the states in which they operated in 2009. Of this, $10.3 billion was through their own operations and $4.2 billion was through the follow-on impact of their operations. The cumulative $14.5 billion can be referred to as "final economic demand."

- While the industry's output is telecommunications services in rural areas, the economic activity it generates accrues both to the rural areas served and also to urban areas as well.

    - Surprisingly, only one-third (34 percent or $4.97 billion) of the $14.5 billion final economic demand generated by rural telecom companies accrues to rural areas; the other two-thirds (66 percent or $9.57 billion) redounds to the benefit of urban areas.

- The rural telecommunications sector supported 70,700 jobs in 2009, both through its own employment and the employment that its purchases of goods and services generated.

    - Jobs supported by economic activity created by rural telecommunications companies are more concentrated in urban areas: 54.3 percent are in rural areas; 45.7 percent are in urban areas. Relatively higher wages in the telecommunications sector drive this result.

- This level of economic activity and employment is consistent with the values underpinning access to advanced telecommunications and advanced services in all regions of the nation, as supported by the Universal Service Fund (USF).

    - If USF support declined or disappeared, the result would draw from two scenarios. In one, companies would raise prices paid by customers and rural users would pay more for telecommunications service. In the other, companies would cut capital investment and the network would shrink over time.

Introduction

This study presents evidence about the direct and indirect economic effects of the rural telecommunications industry. The direct effects consider the industry from the perspective of national income accounting (the approach used to calculate the Gross Domestic Product (GDP) measure). The indirect economic effects are not measured in income accounting. They reflect telecommunication's role as a catalyst and limiting factor in the production of other goods and services. Another set of indirect effects stem from the nature of rural economies where rural telecommunications companies are some of the relatively largest and most complex companies.

The economic effects reflect the industry's current scale. This scale follows from the level of support it receives from the Universal Service Fund (USF). If USF support declined or disappeared, the industry would change. The nature of that change would draw from two scenarios the study presents. In one, companies respond by raising prices. In the other, companies cut capital investment, a step that would lead to shrinkage of the network over time.

All companies have direct effects on the economy. They employ workers and they buy goods and services from other parts of the economy. One way rural telecommunications companies have an impact on the economy is through these direct effects.

Other impacts are indirect. Models of economic markets often employ the simplifying assumption that markets costlessly link buyers and sellers. However, the real economy is distributed across space; in the case of the United States economy, this space is 3.79 million square miles that includes densely populated cities and sparsely populated regions.[1] The indirect effects reflect how geography and the economy interact. Telecommunications enable other goods and services to be sold. Another indirect effect is the role that telecommunications providers play in rural communities. This report presents evidence on both the direct and indirect economic impacts of rural telecommunications.

The size of the economic impacts reflects the commitment Congress has made to universal telecommunications service, a commitment that "quality services . . . be available at just, reasonable, and affordable rates;" that "[a]ccess to advanced telecommunications and information services should be provided in all regions of the Nation;" and, that "[c]onsumers in all regions of the Nation . . . should have access to telecommunications and information services . . . that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."[2] The statutory mandate reflects the reality that in thinly populated places, the cost of delivering service—the cost for each household or business or school or hospital—is higher than in urban or suburban areas.

Without the policies that flow from our current commitment, the scale and scope of rural

[1] At the state level, the most densely populated state (New Jersey) is almost 1,000 times more densely populated than the least densely populated state (Alaska) and is more than 200 times as densely populated as the second least densely populated state (Wyoming). U.S. Census Bureau, "Resident Population Data," September 2011, http://2010.census.gov/2010census/data/apportionment-dens-text.php.
[2] 47 U.S.C. § 254(b).

telecommunications would be smaller, as would its economic impact. Without the policies, service would cost more in rural areas. With current policies, household spending on telephone service is similar across urban and rural areas.[3]

The short-run impact of higher prices would be higher costs for consumers. The long-run impact would be fewer people served by the telecommunications network as some consumers respond by dropping services. Unfolding price spirals or capital spending decreases could threaten the end of viability for parts of the network in rural areas. The diminished network would reduce the value of the telecommunications network. Those who lose access would lose the most. Those who retain access would lose the value of connecting to those no longer on the network.

The mechanism for making good on the commitment to universal access is a set of policies administered through the Universal Service Fund (USF). The USF is funded by companies that provide access to the network. The USF then distributes funds through multiple mechanisms to increase access to the network. (The details of how the fund works appear in Appendix A.)

The services supported by the USF have an economic impact on both rural and urban areas. When looking at rural providers as companies that buy goods and services to produce their services, the larger share of the direct economic impact of rural telecomm providers results in economic activity in urban rather than rural areas. This urban-favoring result arises because much of the services and equipment that local-service telephone companies require are produced in urban areas. Rural local-service telephone companies spend a good deal of their revenues to buy services and equipment that comes from distant cities. USF disbursements to rural providers, made to support universal service at comparable prices, thus flow to urban areas, sometimes to places within the same state, sometimes to neighboring states, and sometimes to distant regions of the United States.

This report quantifies the current size of these impacts, as measured by economic activity and jobs. While the report focuses on current impact, technology change is rapid in the telecommunications sector. The future economic impact will be different. Understanding the economic impact of rural telecommunications requires both looking at flows within the current economy and the role telecommunications might play in the future.

Expanded telecommunications capacity in rural places will also increase the ability of urban areas to sell services to rural customers and vice versa. In this way, the economic linkages between rural and urban areas will deepen, enhancing communications, commerce and employment. “Telehealth” and distance learning are two examples of how this effect already works. “Telehealth” allows images and clinical data to flow from patients in rural areas to doctors in cities, making it possible for patients to receive diagnoses and advice without traveling long distances. Distance learning allows students in rural—and urban—places to take online courses at distant schools. The doctors provide their services to additional patients, and the

[3] In 2010, the average expenditure for telephone service across consumer units (roughly, households) was $1,184 in urban areas and $1,113 in rural areas, amounting to 2.4 percent of total expenditures for urban and 2.8 percent for rural consumers. Bureau of Labor Statistics, “Housing Tenure and Type of Area: Average Annual Expenditures and Characteristics, Consumer Expenditure Survey, 2010,” Washington, DC, 2011, http://www.bls.gov/cex/2010/Standard/tenure.pdf.

schools enroll more students. The consumers of these services benefit from having opportunities to improve their health and pursue learning opportunities that they otherwise could not pursue. In these cases, fees paid to health-care professionals and to schools represent economic activity made possible by telecommunications. These cases where telecommunications provides the catalyst for other economic activity are not measured in the direct economic effects of rural telecommunications.

The Impact

Rural telecommunications providers directly added $10.4 billion dollars to the U.S. economy in 2009 (Table 1).[4] Taking account of spending by telecom employees of their wages and the impact of purchases by telecom companies of goods and services, the total economic effect was $14.5 billion of annual final demand in the states where the companies are located. The "multiplier effect" takes account of secondary and subsequent spending. For example, a telecom employee spends a dollar at the bakery and the baker spends an additional sum that is less than a dollar at the hardware store. In this way, an infusion of outside money—the transfers to the telecom company—generates economic activity that is greater than the initial sum. This multiplier effect can be seen in Table 1 in the difference between "direct impact" and "total impact."

[4] Rural telecommunications providers are, in this report, the incumbent exchange carriers who serve areas that the Federal Communications Commission has designated as "rural." While other companies provide service in these areas, there is no data available about the expenses these firms have in rural areas and thus it is not possible to distinguish their impact across rural and urban areas. Appendix B, "Analyzing Economic Impacts," discusses data sources and their limitations.

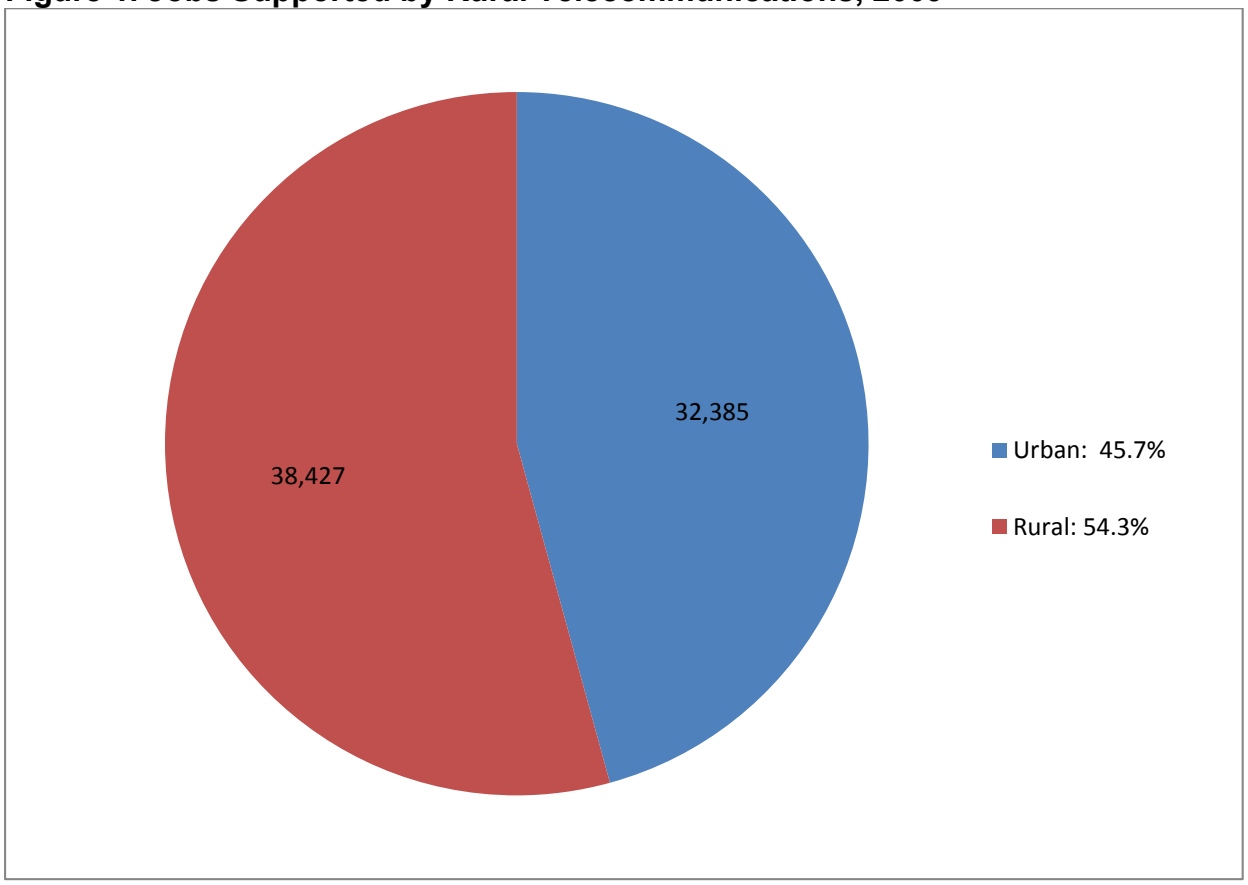
Table 1. Economic Impact of Rural Telecommunications, 2009

	Direct Impact ($, millions)	Additional Impact ($, millions)	Total Impact ($, millions)	Employment (number of jobs)
Alabama	144.8	52.1	196.9	1,031
Alaska	197.5	65.6	263.1	1,044
Arizona	154.8	60.0	214.8	1,103
Arkansas	287.5	88.9	376.3	1,535
California	217.9	127.6	345.5	1,643
Colorado	117.5	62.3	179.8	853
Connecticut	0.0	0.0	0.0	0
Delaware	0.0	0.0	0.0	0
DC	0.0	0.0	0.0	0
Florida	743.8	322.5	1,066.3	6,051
Georgia	431.7	221.0	652.8	3,263
Hawaii	26.5	10.4	36.8	178
Idaho	139.4	37.6	177.0	917
Illinois	187.6	91.7	279.4	1,339
Indiana	201.1	65.6	266.7	1,271
Iowa	257.0	57.5	314.4	1,454
Kansas	280.6	102.7	383.4	1,303
Kentucky	187.0	61.2	248.2	1,259
Louisiana	172.2	64.4	236.6	1,293
Maine	68.4	21.3	89.7	460
Maryland	4.1	2.0	6.1	29
Massachusetts	1.5	0.7	2.1	9
Michigan	140.5	51.2	191.6	976
Minnesota	395.0	150.8	545.8	2,567
Mississippi	79.1	21.5	100.6	499
Missouri	315.9	140.7	456.7	1,948
Montana	154.6	45.5	200.1	1,073
Nebraska	123.0	32.5	155.5	689
Nevada	52.2	16.9	69.1	332
New Hampshire	24.3	9.2	33.5	152
New Jersey	62.1	31.6	93.7	382
New Mexico	112.5	40.7	153.3	858
New York	265.8	123.6	389.4	1,442
North Carolina	746.7	285.9	1,032.6	5,324
North Dakota	136.5	29.0	165.6	626
Ohio	271.7	108.5	380.2	1,893
Oklahoma	252.3	106.3	358.6	2,002
Oregon	155.5	55.7	211.3	1,046
Pennsylvania	476.4	224.4	700.8	3,285
Rhode Island	0.0	0.0	0.0	0
South Carolina	370.2	137.9	508.1	2,768
South Dakota	141.4	30.1	171.5	746
Tennessee	318.9	148.2	467.1	2,648
Texas	800.6	431.2	1,231.7	6,491
Utah	65.7	29.2	94.9	601
Vermont	40.2	12.5	52.6	243
Virginia	241.2	117.5	358.8	1,477
Washington	185.8	81.6	267.3	1,148
West Virginia	92.9	27.2	120.2	527
Wisconsin	412.8	131.7	544.6	2,667
Wyoming	49.2	11.6	60.8	266
Total	10,304.0	4,148.0	14,452.0	70,712

Source: Hudson Institute modeling using data from Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010)*, Washington, DC: Federal-State Board on Universal Service, 2010; and an unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.

This economic activity created demand that supported 70,700 jobs spread throughout the economy.[5] While some are jobs held by people employed by telecom companies, more are jobs that rely on the goods and services purchased by telecom companies and their employees. The supplier sector, discussed in more detail below, ranges from companies that erect poles and string wire and fiber to engineers and lawyers who design network expansions and assure regulatory compliance. It is moreover extended through the actions of telecomm employees spending their wages and generating tax revenues.

Figure 1. Jobs Supported by Rural Telecommunications, 2009



Source: Hudson Institute modeling using data from Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010)* Washington, DC: Federal-State Board on Universal Service, 2010; and an unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.

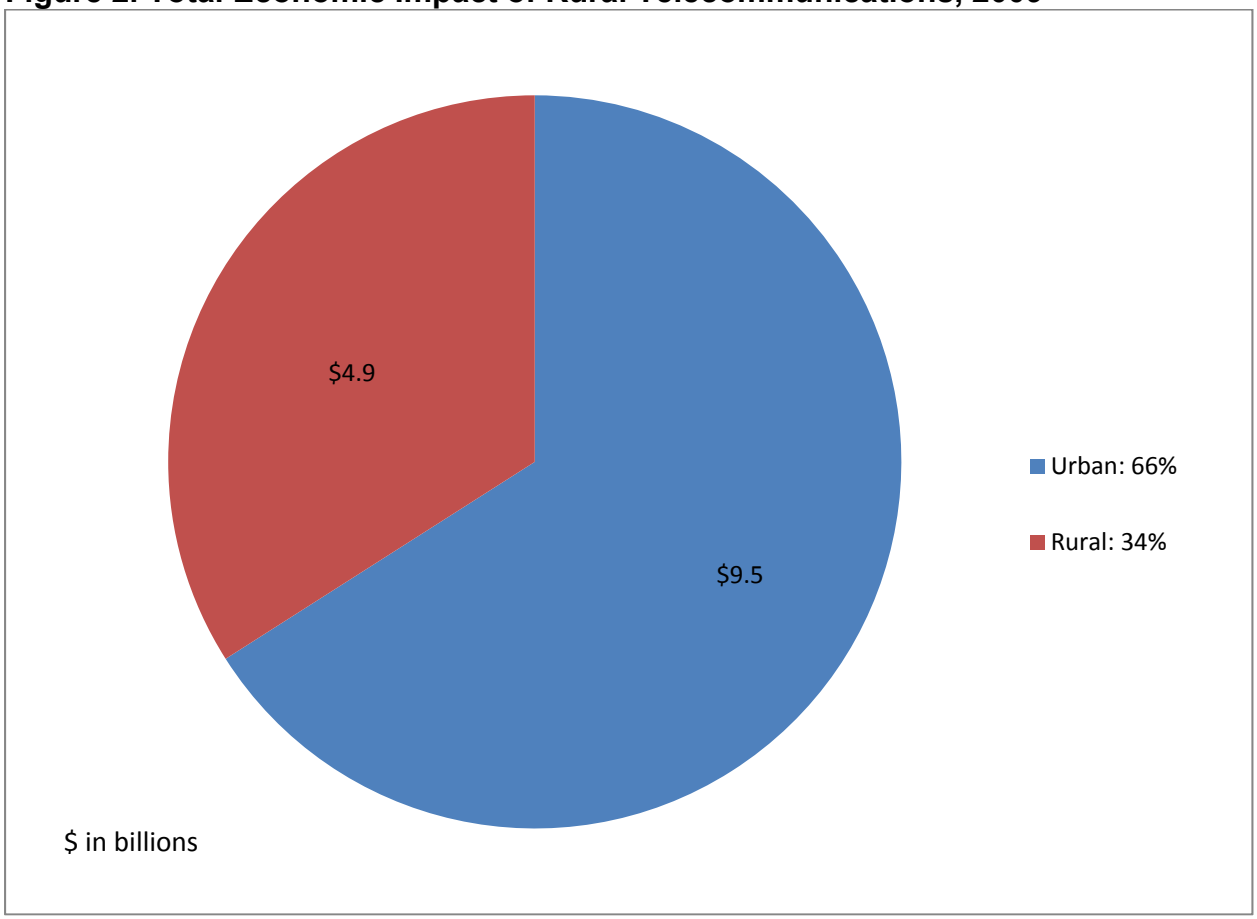
[5] This number of jobs reflects the observed relationship between the number of employees and the level of economic activity across the companies from which telecommunications providers purchase goods and services. The underlying assumption is that there is a stable relationship between the level of output and employment. Dividing output by employment produces an average amount of output per employee; the assumption is that if output is $X per employee, increasing output by $X will lead to one more employee in the industry. Appendix B, "Analyzing Economic Impacts," provides additional details about the methods used to make these calculations.

Jobs supported by the rural telecommunications industry are more concentrated in rural areas than the economic activity they create. Of all jobs, 54.3 percent are in rural areas and 45.7 percent are in urban areas.[6]

The economic activity generated by rural telecom companies accrues both to local areas where the services are produced and delivered to customers and to urban areas as well. Surprisingly, only one-third (34.0 percent) of final economic demand generated by rural telecom companies accrues to rural area; the other two-thirds (66.0 percent) redounds to the benefit of urban areas (Figure 2). This reflects the strength of the interactions between rural and urban economies. A job may be on the payroll of a rural seller of telecom services or of a rural construction company that installs poles and wires, but much of the goods and services those workers buy will come from outside the area.

[6] This difference reflects the relatively higher level of wages in the telecommunications sector. In data reported to the Bureau of Labor Statistics, average annual pay in 2009 in the wireline telephone sector was $73,730, while wages in the economy overall averaged $45,136 (Bureau of Labor Statistics, *Quarterly Census of Employment and Wages,* September 2011, http://www.bls.gov/cew/#databases).

Figure 2. Total Economic Impact of Rural Telecommunications, 2009



Source: Hudson Institute modeling using data from Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010)*, Washington, DC: Federal-State Board on Universal Service, 2010; and an unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.

States vary in how much total impact they get from economic activity in the rural telecommunications sector (Table 3). This reflects variation in capability in the local economy. The impact of one dollar added to or subtracted from the telecommunications sector is lowest in North Dakota and highest in California (Table B-1). This reflects the extent to which companies in those states generate the goods and services telecommunications companies require. For a company operating in North Dakota, a purchase of computer servers is more likely to mean buying from out-of-state than it is to a company operating in California.

Inputs Used in the Telecommunications Sector

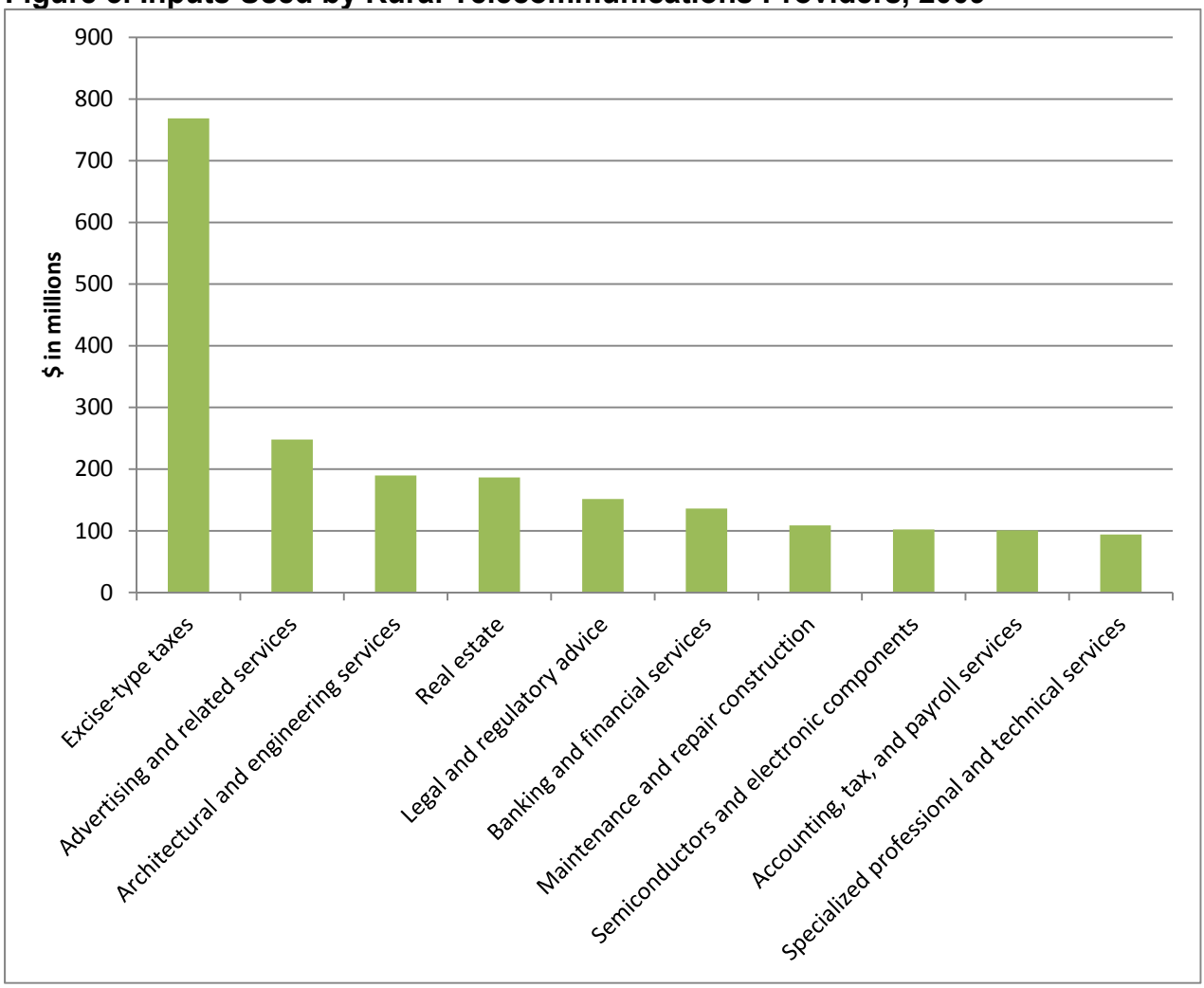
The geographic division of economic activity generated by rural telecom sellers between urban and rural areas reflects the nature of the inputs these companies must buy to produce and deliver their services. The largest single category, as in most industries, is compensation of labor, which represents about 21 percent of expenditures.[7]

Many of the inputs purchased by rural telecom service sellers are more likely to be found in urban settings. Figure 3 shows the ten largest categories of inputs that come from outside the telecommunications sector.

The largest "purchase" is an input required to produce telecommunications services that is required not by the technology of producing telecommunications services but rather the choices government has made about how to finance government spending. This largest category is the taxes that telecommunications sellers collect and remit to governments. The other categories of inputs are goods and services more likely to be produced outside the provider's service area, either in the state's urban areas or out-of-state. Many are specialized professional services (those of engineers, architects, lawyers, accounts, and bankers) that concentrate in urban areas, where overall demand is higher.

[7] Hudson Institute analysis using Bureau of Economic Analysis, *2002 Standard Make and Use Tables at the Detailed Level*, 2008, http://www.bea.gov/industry/io_benchmark.htm.

Figure 3. Inputs Used by Rural Telecommunications Providers, 2009



Source: Hudson Institute modeling using Bureau of Economic Analysis, *2002 Standard Make and Use Tables at the Detailed Level*, Washington, DC, 2008, http://www.bea.gov/industry/io_benchmark.htm.

Example of Goods and Services Purchased

Rural telecom companies often must draw on markets outside their own service areas to find the goods and services they require.

However, one service that is commonly sourced locally or from adjacent rural areas is construction services to install poles and wires.[8] This reflects the kind of service that involves techniques and methods that are not specific to the telecommunications sector and thus can achieve the minimally efficient size in a rural area.

Most other kinds of goods and services required by telecommunications companies simply are not available within the local market. For example, Hill Country Telephone Cooperative operates in the area west of Austin, Texas. It operates a vehicle fleet with 59 vehicles. Of these, 23 are cars and pickups; 20 were produced by Ford and three by GM. In addition, the company has four large GMC work trucks and nine Sterling bucket trucks. All were produced in urban areas. The Ford vehicles are leased through a credit facility offered by a bank based in an urban area. Other motorized equipment in the company's fleet includes two John Deere bulldozers and a John Deere backhoe, also produced in out-of-state urban areas.[9]

Hill Country's public reporting of its five largest outside contracts showed four of the five largest went to construction firms. While the largest amount went to a local firm, the next largest went to a Florida firm that specializes in telecommunications work.

Many categories of services come from sellers that target a statewide or national market. The same Texas provider uses regulatory consultants in Austin and near Washington, DC. These are examples of services where the demand in rural areas is not large enough to allow a firm providing those services to be economically viable.

The suppliers of capital equipment used by Skyline Membership Corp., a rural telecom company in western North Carolina, are scattered in nine states across the country. Skyline's purchases range from electronic telecommunications devices to general business equipment, such as trucks. Skyline purchased six vehicles in 2010; all were Chevrolets, five pick-ups and one truck. Skyline bought the vehicles from a dealer in one of North Carolina's urban areas. The dealer in turn had acquired them from General Motors which produced them in urban areas such as Flint, MI, and Arlington, TX. Technology purchases included mapping software from a company in Richmond, VA, and computers and servers purchased from Dell and Hewlett-Packard, all in urban areas.[10]

Pioneer Telephone Cooperative in Philomath, OR, regularly buys equipment such as modems, conduit for cabling systems, and protective devices for its network through Communications Supply Service Association (CSSA) located in Little Rock, AR.[11] Only the "value added" by

[8] Based on a sample of IRS Form 990 filings by rural telecommunications co-operatives, looking at what they report as the five largest outside contractors.
[9] Delbert Wilson, Hill Country Telephone Cooperative, personal communication, September 2011.
[10] Neal Tugman, Skyline Membership Corp., personal communication, September 2011.
[11] Jerry Schlachter, Pioneer Telephone Cooperative, personal communication, September 2011.

CSSA becomes part of Little Rock's economy; the balance goes to the places where the products CSSA sells are produced.

Current Role to Future Opportunities

The focus of this report thus far has been the level of current economic activity directly supported by rural telecommunications companies. This does not cover the full range of their economic impact, either now or what that impact could become as new technologies emerge.

Telecommunications can be a catalyst to economic activity. The measurement of economic activity, as reported in the Gross Domestic Product measure, for example, pays attention only to the dollars that flow to and from the telecommunications sector and from there further out into the economy. For some activities, telecommunications are a limiting or enabling factor. Dollarwise, telecommunications may be only a small part of the cost of a service. Without telecommunications, however, the service might either not be provided or be provided less efficiently. Effects of this type that would only be felt if capacity in the telecommunications sector expands or contracts are not part of the measures of economic activity that describe the economy as it is today.

Consider again the case of a medical specialist at an academic health center who "sees" a patient at a rural health facility via telehealth. Without the telecommunications service, the patient would not have had the encounter with the medical specialist. The telecommunications connection was a necessary catalyst for the service. The kind of income accounting which underlies Table 1 includes only the cost of the telecommunications component of the transaction. Changes in telecommunications capacity—whether they add to or diminish the range of services that are available in rural areas—are examples of indirect economic effects that are not captured by measures of direct effects that follow dollar flows to and from the telecommunications sector.

The economic activity of rural telecom companies, as measured by the inputs they purchase, also does not include the value of the support they provide to development of rural economies and institutions. To maintain and expand their own businesses, rural telecom organizations depend on what happens in the local economy. For example, in the late 1990s, the local hospital in Roosevelt County, New Mexico, closed. This county, along the Texas border, had a population of 19,846 in 2010. Compared to state-level population density, only three states—Montana, Wyoming, and Alaska—are less densely populated. The local telephone and electric cooperatives organized to support a special hospital district and impose a gross receipts tax to support the hospital. They also helped the hospital to obtain financing to obtain equipment, something they did again in 2004 to expand the medical office building and 2006 to acquire new imaging equipment.[12]

As the Roosevelt County example shows, the economy requires entrepreneurs who spot opportunities and pursue them. In areas where economic activity is denser, entrepreneurship is also more specialized. However, in less densely populated areas, like Roosevelt County,

[12] Foundation for Rural Service, *Rural Economic Development: Building a Sustainable Community*." (Arlington, VA: Foundation for Rural Service, 2008).

telephone and electric cooperatives are some of the largest local companies and thus most capable to engage in complex projects like organizing a hospital district.

Support for Rural Telecommunications: The Future

The nature of telecommunications makes population density an economic advantage and sparse population a disadvantage. Density determines the number of potential customers in a defined geographic area. More density allows the fixed cost of service to be spread over a larger customer base.

Many places in America are better characterized by distance than by dense population. With 97.7 percent of housing units having telephone service of some kind, telephone service is nearly ubiquitous.[13] This achievement continues in current technology the idea of a nation in which communications flows to and from all points, a concept embodied in the Constitution's reference to the communications technology of the time, the post office.[14] By the time of the introduction of the telephone, the post office had brought communication to the furthest point in the land, even to places where the cost of providing service exceeded the price charged to consumers. This commitment provided a model carried forward into a new era of technology through the establishment of a national telephone network.

Before the Telecommunications Act of 1996, support mechanisms were generally managed internally within the telecommunications sector. Since 1996, they have been made more visible through the operation of the Universal Service Fund (USF). Many local service companies identify payments into the USF in separate lines on bills to customers.

Of the USF's disbursements in 2010, 41.8 percent went to offset the higher cost of providing service in rural areas. (Appendix A offers more detail about the USF and where the rest of USF disbursements go.)

The Impact of Larger Change

The analysis in this paper presents the economic impacts of the rural telecommunications sector at its current scale. It does not capture what would happen under more disruptive scenarios.

Payments through the USF mechanisms are a substantial source of revenue to rural telecommunications companies. How would rural telecommunications companies respond if this support diminished or disappeared?

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[13] Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010),* Section 6. Washington, DC: Federal-State Board on Universal Service, 2010 Federal-State Board on Universal Service.

[14] In the enumerated powers given to Congress by the US Constitution, listing areas where Congress might properly assert national authority (Article I, Section 8), the framers included the power "To establish Post Offices and post Roads."

Two scenarios bracket the range of responses. In one, telecommunications companies which experienced loss of payments would continue to operate at the same scale and scope of services. They would replace lost USF revenue with higher charges to customers. In the other, companies would respond to a decline in expected return on investments by curtailing capital investment.

Payment losses passed on to consumers as price hike scenario

The size of the rate increase would depend on the per customer size of payment lost. Among 8.8 million households in areas where companies serve fewer than 100,000 lines, 1.7 million would have faced increases of at least $485 in 2006 absent USF support.[15]

Customer response would depend on how much consumers valued telephone service relative to other things they could buy. Recent studies have placed the elasticity of demand for having telephone service range at between -.065 and -.25, suggesting that if the price of service doubled, between 6.5 and 25 percent of customers would drop service.[16]

The burden of higher costs would vary according to a consumer's income. A study which mapped the payments to rural telecommunications companies to the income distribution in rural areas defined households that would face increases that were greater than 1, 2, and 3 percent of income as "moderate," "high," and "severe" risk of losing affordable telephone service, respectively. One in three rural households faced some level of losing affordable service. Within this group, 45.4 percent faced moderate risk, 18.1 percent high risk, and 36.5 percent severe risk in 2006. A household in the lowest income quintile at severe risk would be looking at an increase in cost of telephone service that approached that group's average annual expenditure on fruits, vegetables, and dairy products.[17]

One result of the "pass it on to consumers" scenario could be a rate spiral. Companies could find themselves caught in a cycle of raising rates to keep revenue in line with costs and customers responding to increasing rates by dropping service.

Cut capital investment scenario

A reduction in support from the USF would have an immediate impact on expectations about future returns from investment in rural telecommunications infrastructure. Fewer investments could be expected to be economically worthwhile.

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[15] Robert F. Wescott, Robert Cohen, and Mark W. McNulty, *Consumers at Risk: The Impact of Reduced Universal Service Fund Support on Telephone Service Affordability in Rural America*, 2007 (Washington, DC: Keybridge Research LLC, 2007).

[16] The -.065 elasticity estimate is from Daniel A. Ackerberg, Michael H. Riordan, Gregory L. Rosston, and Bradley S. Wimmer "Low-Income Demand for Local Telephone Service: The Effects of Lifeline and Linkup," Paper presented at Telecommunications Policy Research Conference, Arlington, VA, September 23, 2003; revised March 28, 2005. The -.25 elasticity estimate is from M. H Riordan, "Universal Residential Telephone Service," in *Handbook of Telecommunications Economics* ed. M. Cave, S. Majumdar, and I. Vogelsand (Amsterdam: Elsevier Science, 2002). Both are cited in Wescott, Cohen, and McNulty, *Consumers at Risk*.

[17] Wescott, Cohen, and McNulty, *Consumers at Risk*.

Reduced investment would mean less spending for maintenance, replacement of old equipment and investment in new equipment to expand the range of services offered and the number of households served. The effect would be to pinch off improvements in service for continuing customers and allow the quality of service to degrade as providers face the difficult choices involved in avoiding costs while still providing service.

Some service companies, especially those organized as cooperatives and the smallest for-profit entities may have to consider their capital structure. If they carry significant debt on their books, they might be able to use the bankruptcy process to reduce their capital costs.

Losses from a diminished network

A loss of revenue from the USF would diminish the economic activity of rural telecommunications providers, causing negative ripple effects to spread outward locally, regionally, and nationally.

In addition to the direct economic effects from lower employment and lower levels of purchases of goods and services, responses that lead to contraction in the telecommunications network would make the network less valuable as it contracted through the loss of rural customers. The key insight from the economic analysis of network industries, like telecommunications, is that the value of the network goes up or comes down by more than one for each additional or fewer users.[18] For example, among ten telephone subscribers, there are 45 possible connections; among eleven, 55; and among 12, 66.

The degree of loss depends on the nature of the customer. For individuals, the impact would depend on proximity of the losses, either geographically or in their social network. For businesses, the loss would reduce the potential number of customers who it could reach through the network and the number of potential customers who could reach the business.

Conclusion: Measurable Direct Effects; Further Indirect Effects

The economic effects of the rural sector of the telecommunications industry are both direct and indirect. It was responsible for $14.5 billion in economic activity in 2009, an amount that supported 70,700 jobs. A majority of the economic effect is demand outside the service area of the telecommunications provider. The current patterns show how much change in economic activity could be expected if the sector expanded or contracted in response either to changes in demand or changes to the current mechanisms that support universal service.

The indirect economic effects are diverse and more difficult to quantify. They include the impact on consumer well-being from changes in the level and scope of telecommunications services, the

[18] Oz Shy, *The Economics of Networked Industries* (New York: Cambridge University Press, 2001). In addition to the economics literature, there are several more popular names that refer to the number of connections growing more rapidly than the number of users, such as "Metcalfe's Law," attributed to Robert Metcalfe, co-inventor of Ethernet.

impact of any change on economic activity that is feasible in the area, and the role of telephone companies as entrepreneurs.

Some of these indirect effects are suppressed by the assumptions in the accounting methods that measure direct economic effects. These methods assume that economic output goes up or down in fixed proportions. However, if telecommunications service is a necessary input, as, for example, in telehealth, then changes in telecommunications capability in an area make it technologically impossible to produce the service in that area.

Other effects may not be observed at the level of overall economic activity but only in the location of economic activity. For example, if the highest quality match between location and economic activity could no longer be sustained because telecommunications service withdrew, the activity might continue at another rural or urban location that offered a lower match quality. Location changes would not have an impact on the national economy.

Quantifying the indirect effects would require observations that compare differences between areas that have and do not have telecommunications service. While it is the case that some areas do not have or recently have not had access to telecommunications service, the USF has meant that these areas have not been as large as the smallest units in which economic data is measured in the U.S. As a result, indirect effects can be described but their magnitude is difficult to measure.

Table 2. Economic Impact, By State, and Urban/Rural Location (Dollars in Millions)

	Rural	Urban	Total
Alabama	63.4	133.5	196.9
Alaska	117.6	145.5	263.1
Arizona	41.3	173.5	214.8
Arkansas	230.2	146.1	376.3
California	48.6	296.9	345.5
Colorado	40.9	139.0	179.8
Connecticut	0.0	0.0	0.0
Delaware	0.0	0.0	0.0
DC	0.0	0.0	0.0
Florida	184.6	881.7	1,066.3
Georgia	183.9	468.9	652.8
Hawaii	12.7	24.1	36.8
Idaho	79.5	97.5	177.0
Illinois	55.6	223.7	279.4
Indiana	126.4	140.3	266.7
Iowa	172.5	142.0	314.4
Kansas	267.2	116.2	383.4
Kentucky	163.4	84.8	248.2
Louisiana	66.8	169.8	236.6
Maine	38.1	51.6	89.7
Maryland	1.3	4.8	6.1
Massachusetts	0.4	1.8	2.1
Michigan	49.3	142.3	191.6
Minnesota	167.1	378.7	545.8
Mississippi	59.8	40.7	100.6
Missouri	195.9	260.7	456.7
Montana	131.7	68.4	200.1
Nebraska	65.7	89.8	155.5
Nevada	16.8	52.4	69.1
New Hampshire	23.6	9.9	33.5
New Jersey	15.3	78.4	93.7
New Mexico	61.8	91.4	153.3
New York	62.0	327.4	389.4
North Carolina	305.3	727.3	1,032.6
North Dakota	145.9	19.7	165.6
Ohio	98.7	281.5	380.2
Oklahoma	134.2	224.4	358.6
Oregon	41.4	169.9	211.3
Pennsylvania	195.6	505.2	700.8
Rhode Island	0.0	0.0	0.0
South Carolina	189.9	318.2	508.1
South Dakota	94.9	76.6	171.5
Tennessee	163.0	304.1	467.1
Texas	241.0	990.7	1,231.7
Utah	22.7	72.2	94.9
Vermont	34.1	18.6	52.6
Virginia	110.4	248.4	358.8
Washington	62.3	205.1	267.3
West Virginia	86.7	33.5	120.2
Wisconsin	200.4	344.2	544.6
Wyoming	43.1	17.7	60.8
Total	4,913.1	9,538.9	14,452.0

Source: Hudson Institute modeling using data from Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010)*, Washington, DC: Federal-State Board on Universal Service, 2010; and an unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.

Table 3. Jobs Supported by Rural Telecommunications Providers, by State and Rural/Urban Status

	Rural	Urban	Total Employment
Alabama	545	486	1,031
Alaska	728	306	1,034
Arizona	458	618	1,076
Arkansas	1,214	321	1,535
California	648	995	1,643
Colorado	397	456	853
Connecticut	-	-	-
Delaware	-	-	-
District of Columbia	-	-	-
Florida	2,303	3,748	6,051
Georgia	1,597	1,667	3,264
Hawaii	100	77	177
Idaho	582	336	918
Illinois	603	736	1,339
Indiana	845	426	1,271
Iowa	1,072	382	1,454
Kansas	1,131	173	1,304
Kentucky	970	288	1,258
Louisiana	626	668	1,294
Maine	282	178	460
Maryland	14	15	29
Massachusetts	4	4	8
Michigan	481	495	976
Minnesota	1,414	1,154	2,568
Mississippi	370	130	500
Missouri	1,265	683	1,948
Montana	821	253	1,074
Nebraska	461	228	689
Nevada	171	161	332
New Hampshire	124	28	152
New Jersey	187	195	382
New Mexico	486	373	859
New York	790	652	1,442
North Carolina	2,720	2,604	5,324
North Dakota	593	33	626
Ohio	938	955	1,893
Oklahoma	1,075	926	2,001
Oregon	485	561	1,046
Pennsylvania	1,696	1,588	3,284
Rhode Island	-	-	-
South Carolina	1,524	1,244	2,768
South Dakota	567	179	746
Tennessee	1,346	1,301	2,647
Texas	2,631	3,859	6,490
Utah	238	363	601
Vermont	190	53	243
Virginia	856	621	1,477
Washington	605	542	1,147
West Virginia	442	85	527
Wisconsin	1,571	1,096	2,667
Wyoming	223	43	266
Total	**38,427**	**32,285**	**70,712**

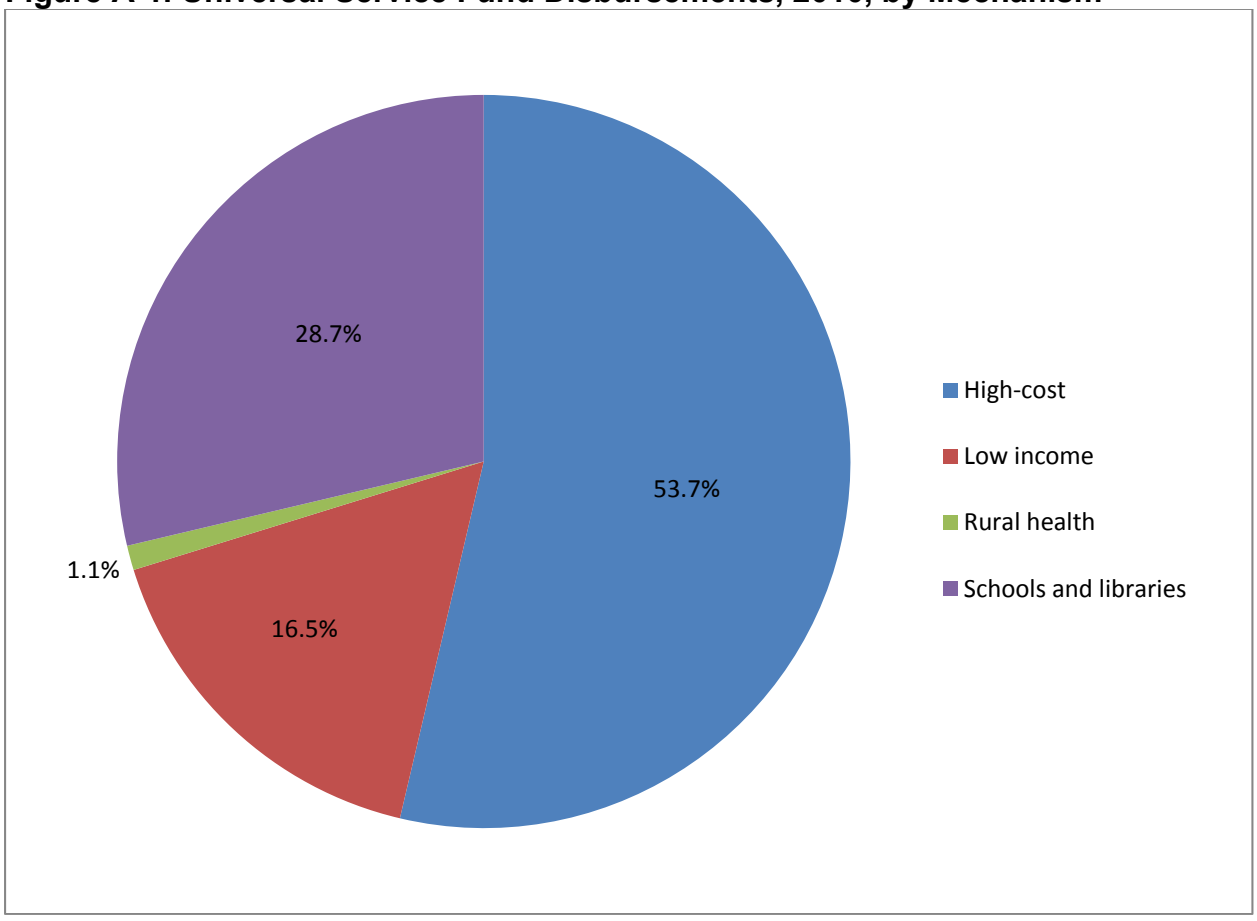
Source: Hudson Institute modeling using data from Federal-State Joint Board on Universal Service, *Universal Service Monitoring Report: CC Docket No. 98-202 (Data Received Through October 2010)*, Washington, DC: Federal-State Board on Universal Service, 2010; and an unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.

Appendix A:
The Universal Service Fund

The Universal Service Fund (USF) disbursed $8.0 billion in 2010 to entities in all 50 states and in U.S. territories and possessions to promote universal access to telecommunications services.

The USF works through four distinct and different mechanisms (Figure A-1). The largest amount goes to support access in high-cost, usually rural, areas. The next largest sum subsidizes purchase of telecommunications services and infrastructure by schools and libraries, often referred to as the "e-rate" program. The third-largest payment allows low-income households to obtain telecommunications services at a reduced price. The fourth and smallest provides funds to increase access to telecom services for health-care providers in rural places.

Figure A-1. Universal Service Fund Disbursements, 2010, by Mechanism



Source: Universal Service Administrative Company, *2010 Annual Report*, http://usac.org/about/governance/annual-reports/.

Universal Service Fund: One fund, four purposes[19]

After the Telecommunications Act of 1996 became law, the Federal Communications Commission developed four mechanisms to carry out the law's instruction to "preserve and advance universal service."[20] Each serves a particular need and works in its own way.

High-cost program. Payments from the high-cost program allow consumers in high-cost service areas to obtain service at rates reasonably comparable to those that prevail in lower-cost markets; the services in rural areas must also be "reasonably comparable" to those that are available in urban areas. In 2010, payments supported 22 million lines. An illustration: In some rural areas, a mile of telephone line might connect two households to the telephone network, while in an urban area the same length may connect 100. Obviously, the cost for each household is higher where there are fewer customers over the course of a mile.

Schools and libraries. This program, sometimes referred to as the "e-rate" program, helps schools and libraries pay for telecommunications, Internet access, maintenance, and internal connections. Support ranges from 20 to 90 percent of costs, depending on what share of the population served is poor and whether the school or library serves a rural or urban area. In 2010 these payments supported service at more than 115,000 schools and libraries.

Low income. The program supports discounted service rates for 10 million low-income households. One service, Lifeline, reduces the charge for basic telephone service. Another, Linkup, reduces the amount a new customer must pay to initiate service.

Rural health. This program supports comparable prices for service for rural health care providers. It also supports the Rural Health Care Pilot Program for state and regional telehealth networks.

High-Cost Support

The Federal Communications Commission has created a series of high-cost mechanisms, each to accommodate a different set of factors that lead to high costs.

The largest share is payments for interstate access charges. These payments go to local telephone companies that have higher costs and recognize the value they provide to the national telephone network through connection to their subscribers. Telephone networks increase in value with the number of points the network connects. Two mechanisms tied to interstate access charges are Interstate Common Line Support (ICLS) for carriers regulated at the state level under rate-of-return rules. The other, Interstate Access Support (IAS), goes to carriers regulated under price cap regulation. Together these mechanisms distributed $2.220 billion in 2010.

Another group of mechanisms recognizes the differences in cost per subscriber level for providing service in less densely populated areas for small companies that cannot realize scale

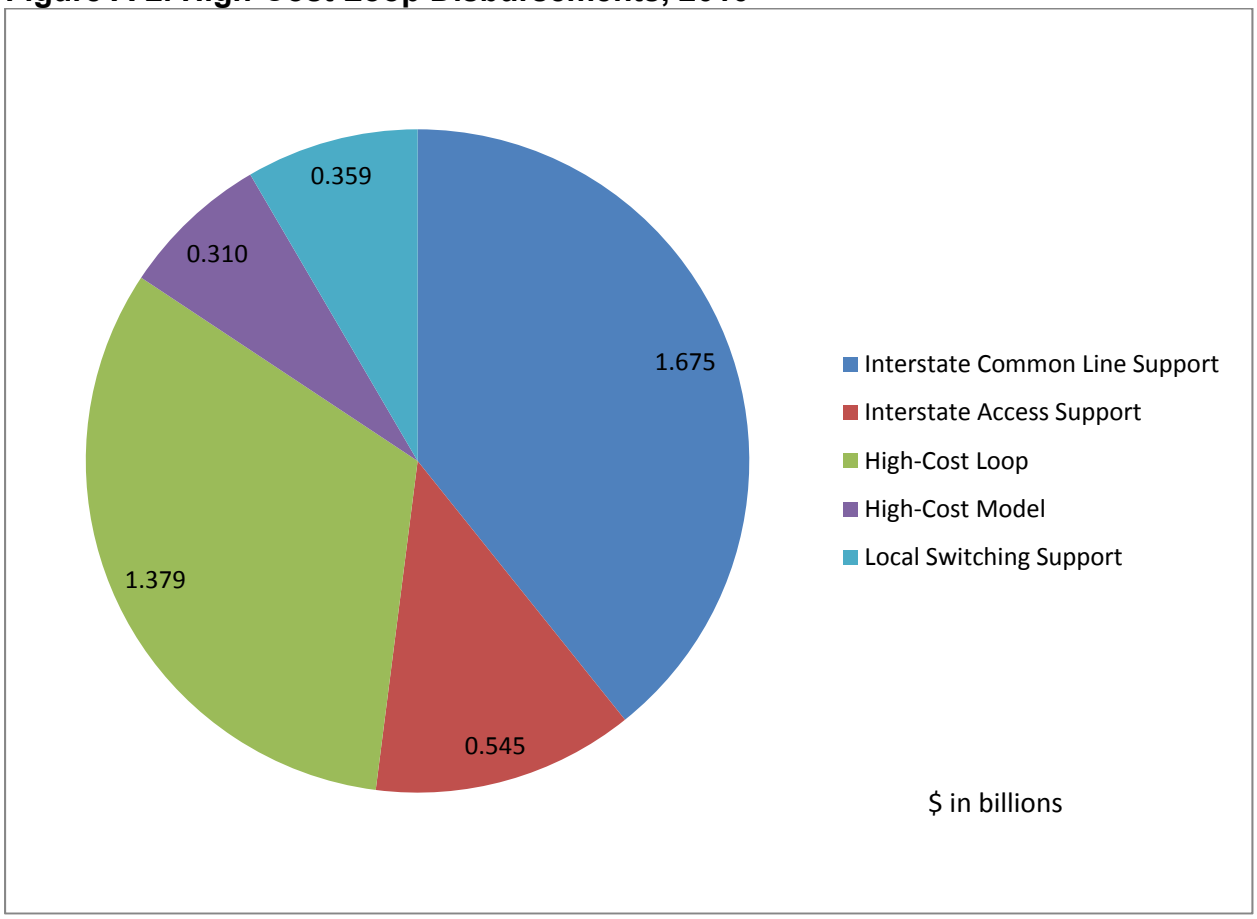
[19] The facts in this section are from the Universal Service Administrative Company, *2010 Annual Report*, http://www.usac.org/about/governance/annual-reports.
[20] 47 USC 254(b)(5).

economies. These mechanisms distributed $2.048 billion in 2010. The largest, high-cost loop support, recognizes some service areas have higher fixed costs such as for telephone wire outside the home and poles are examples. Carriers can recover a portion of their network costs when certain costs exceed 115 percent of the national average. The payments go up in steps as costs increase relative to the national average, reaching a maximum of 75 percent. The maximum goes to carriers with costs that are 150 percent or more of the national average if the area serves fewer than 200,000 customers (loops) or at least 250 percent of the national average if the area serves 200,000 or more. Not every company meets the high-cost test; for example, in New York, 13 out of 42 carriers in rural areas qualify.[21] Non-rural carriers can receive support based on a forward-looking cost model developed by the FCC. Finally, local switching support recognizes higher costs for equipment requirements that are sensitive to overall volume. Local switching support goes to carriers who serve 50,000 or fewer access lines.

Following the 1996 Act, the FCC has allowed new entrants (competitive eligible telecommunications carriers, or CETCs) to receive payments based on the per-line support amounts received by the incumbent local exchange carrier, or ILEC. The share of high-cost support paid to CETCs has grown from less than one percent in 2000 to 37.1 percent in 2010. It would be higher but for an order released by the FCC on May 1, 2008 that capped support at the March 2008 level.

[21] Federal-State Board on Universal Service, *Universal Service Monitoring Report,* Table 3-31.

Figure A-2. High-Cost Loop Disbursements, 2010



Source: Universal Service Administrative Company, *2010 Annual Report*, http://usac.org/about/governance/annual-reports/.

Where does the money come from?

Telecommunications companies make payments to the Universal Service Fund based on a percentage of revenues as prescribed by the FCC. Telephone companies then recoup this cost as a discrete line on customer bills. This percentage, or contribution factor, applies to interstate and international revenues including telephone, mobile wireless, and toll service.

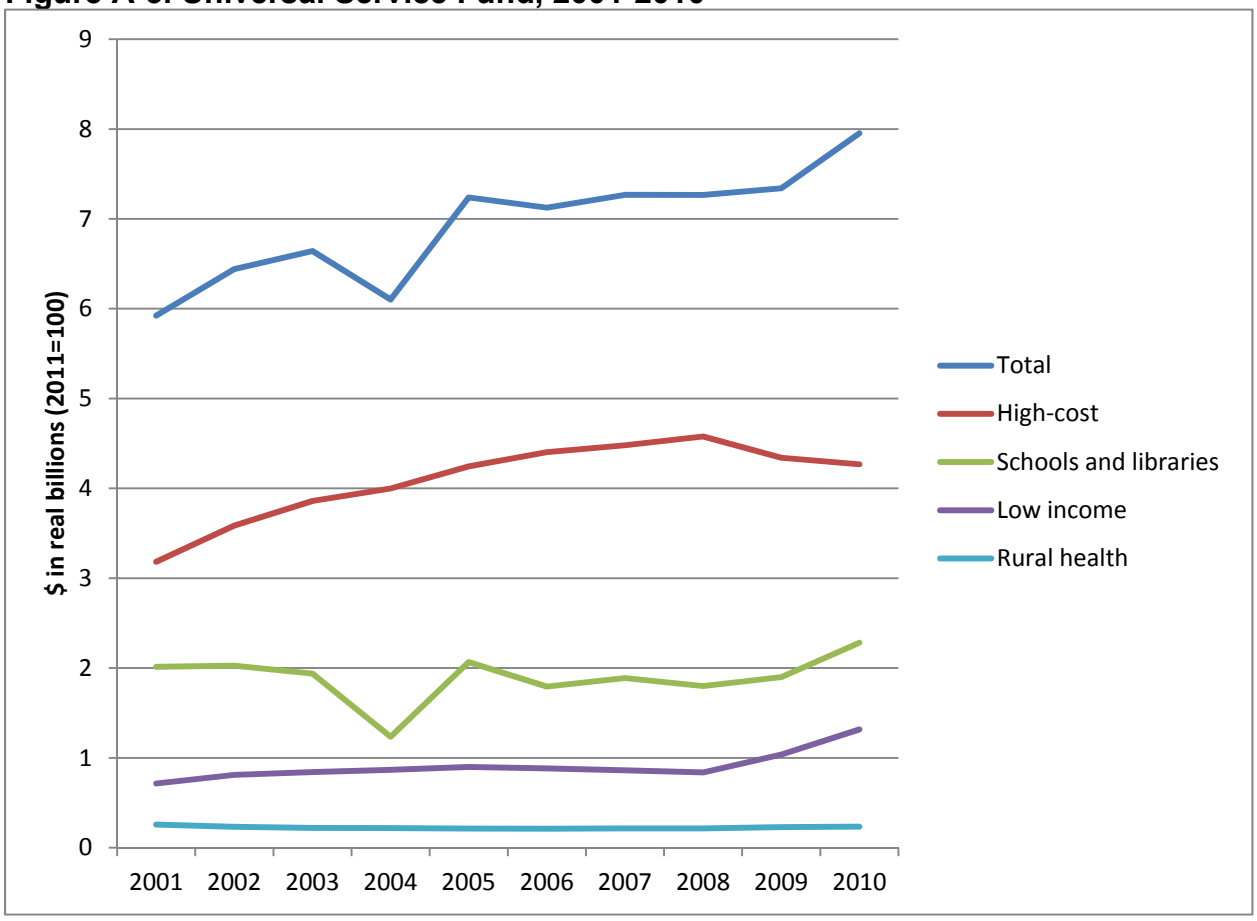
The Universal Service Administrative Corporation (USAC) makes quarterly estimates of how much money must be paid to satisfy the disbursement needs of the USF and how much revenue subject to the contribution factor will be generated in the telecommunications industry. USAC projected in September 2011 that the USF will need $2.2 billion in the fourth quarter of 2011.

The FCC then determined that the contribution base would be $14.3 billion. The contribution rate is thus 15.3 percent.[22]

Financial trends

Disbursements under the four universal service mechanisms totaled $8.0 billion in 2010. In real, inflation-adjusted terms, the total disbursements were stable from 2005 to 2009. Each mechanism has followed a different pattern over the past decade. While high-cost support to incumbent carriers remained stable over the first half of the decade as CETCs entered the market, then slowed to a near stop once the FCC released its order capping the amount available for CETCs; low income grew rapidly then slowed, only to pick up again in the past year; the schools and libraries program shrank at times but grew rapidly in the last (2009 to 2010) year; the smallest, health care, has consistently grown (Figure A-3).

Figure A-3. Universal Service Fund, 2001-2010



Source: Universal Service Administrative Company, *Annual Report*, 2000-2010, http://usac.org/about/governance/annual-reports/.

[22] FCC Public Notice, "Proposed Fourth Quarter 2011 Universal Service Contribution Factor," DA 11-1543, Washington, DC, September 13, 2011, http://www.fcc.gov/document/proposed-fourth-quarter-2011-universal-service-contribution-factor.

Appendix B:
Analyzing Economic Impacts

The analysis of direct effects in this paper is based on national income accounting, a way of calculating the size of an economy. The most common national income accounting measure is Gross Domestic Product (GDP). In this approach, value added is summed across all producers to yield a comprehensive measure of national output. Value added is the difference between the value of a unit of output and the sum of intermediate inputs, or costs. Intermediate inputs include raw materials, services, and operating expenses of the producer.

The Bureau of Economic Analysis (BEA) of the Department of Commerce analyzes the input and output of producers across the economy to create a baseline understanding of what inputs are required to produce the observed level of output in each industry. The bureau compiles an input-output table that shows the requirements in each industry for goods and services produced elsewhere in the economy. These relationships can be thought of as a recipe: to produce $1 worth of output in a particular industry requires so many cents of labor, so many cents of electrical equipment, etc.

Data and sources

Regional Input-Output Modeling System. The estimates for direct effects of the rural telecommunications sector use a set of state-level analyses called the Regional Input-Output Modeling System, or RIMS. RIMS provides state-level analyses of the change in final demand that occurs for each dollar delivered by an industry. With RIMS, one can assess the relationship between change in one industry (for example, telecom) and state-level change in output, earnings, employment, and value-added.

BEA makes available RIMS multipliers for 406 sectors of the economy. The analysis in this Appendix are those for the telecommunications industry. Table B-1 shows these state-level RIMS multipliers for the telecommunications industry.

Inputs used by the telecommunications sector. The analysis of inputs used by rural telecommunications companies uses another BEA analytic product. The BEA's analytic product is its benchmark input-output table showing direct requirements of the telecommunications industry (industry code 517 in the North American Industry Classification System). (The "Supplementary Make, Use, and Direct Requirement Tables" are available from the BEA web site, http://www.bea.gov/industry/io_benchmark.htm.)

Expenses of rural telecommunications providers. The annual "Universal Service Monitoring Report" includes a number of useful tables. Table 3.31, "ILEC High-Cost Loop Support Data for 2009 by Study Area," presents an expense number for each carrier. The relationship between each company's total expenses (and thus demand for goods and services from elsewhere in the economy) was derived by comparing data from a survey of Kansas rural telephone companies reported in *Kansas Rural Local Exchange Carriers: Assessing the Impact of the National*

Broadband Plan, prepared by the Center for Economic Development and Business Research (CEDBR), W. Frank Barton School of Business, Wichita State University, June 2011, http://www.cedbr.org/content/KRLEC.pdf. The CEDBR value was 76.4 percent of the total expenses reported in *Universal Service Monitoring* Report, Table 3.31 for the same firms.

As noted in Appendix A, 37.1 percent of payments under the high-cost mechanism go to other companies, the competitive eligible telecommunications carriers (CETCs). These amounts are independent of actual expenses. With payments independent of expenses, it is not possible to use payment data to discern how much of the economic activity of the CETCs accrues to rural economies.

Gross product. The Bureau of Economic Analysis provides data on gross product at the state and metropolitan levels. Hudson Institute calculated rural output as gross state output minus the sum of metropolitan area gross product. For metropolitan areas which cross state lines, we allocated product to states proportional to the state's share of the metropolitan area's population.

Table B-1. State Level Multipliers

	Ouput	Earnings	Employment
Alabama	1.3599	0.2311	5.2348
Alaska	1.3323	0.2171	3.9672
Arizona	1.3878	0.2465	5.1329
Arkansas	1.3092	0.2107	4.0789
California	1.5856	0.3024	4.7556
Colorado	1.5302	0.2846	4.7443
Connecticut	1.4512	0.2450	4.0284
Delaware	1.3423	0.1777	3.6943
District of Columbia	1.3666	0.0493	0.7919
Florida	1.4335	0.2596	5.6746
Georgia	1.5120	0.2759	4.9995
Hawaii	1.3914	0.2368	4.8249
Idaho	1.2698	0.2122	5.1816
Illinois	1.4888	0.2667	4.7941
Indiana	1.3264	0.2165	4.7654
Iowa	1.2236	0.1901	4.6234
Kansas	1.3661	0.1893	3.4000
Kentucky	1.3270	0.2076	5.0711
Louisiana	1.3740	0.2407	5.4673
Maine	1.3113	0.2317	5.1280
Maryland	1.4816	0.2502	4.6503
Massachusetts	1.4604	0.2497	4.0516
Michigan	1.3642	0.2421	5.0925
Minnesota	1.3819	0.2373	4.7036
Mississippi	1.2721	0.2019	4.9653
Missouri	1.4455	0.2154	4.2658
Montana	1.2941	0.2143	5.3638
Nebraska	1.2644	0.2033	4.4299
Nevada	1.3249	0.2219	4.8072
New Hampshire	1.3776	0.2239	4.5526
New Jersey	1.5082	0.2557	4.0779
New Mexico	1.3620	0.2312	5.6003
New York	1.4651	0.2375	3.7038
North Carolina	1.3829	0.2412	5.1561
North Dakota	1.2124	0.1775	3.7809
Ohio	1.3993	0.2374	4.9791
Oklahoma	1.4212	0.2456	5.5817
Oregon	1.3585	0.2269	4.9517
Pennsylvania	1.4710	0.2500	4.6871
Rhode Island	1.3767	0.1864	3.7499
South Carolina	1.3726	0.2303	5.4487
South Dakota	1.2125	0.1866	4.3510
Tennessee	1.4647	0.2580	5.6686
Texas	1.5386	0.2829	5.2695
Utah	1.4449	0.2661	6.3310
Vermont	1.3105	0.2120	4.6136
Virginia	1.4873	0.2410	4.1160
Washington	1.4390	0.2439	4.2934
West Virginia	1.2932	0.1978	4.3826
Wisconsin	1.3191	0.2224	4.8975
Wyoming	1.2367	0.1934	4.3809

Source: Unpublished Bureau of Economic Analysis table containing Regional Input-Output Modeling System (RIMS II) data from 2008.
Note: BEA does not calculate multipliers for Puerto Rico, Virgin Islands, Guam, and American Samoa. These areas received 4.3 percent of USF disbursements in 2010.

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