Broadband and Universal Service

PRESENTED AT
The Future of Broadband: Wired and Wireless?
University of FLORIDA
February 24, 2005

DAVID J. GABEL

QUEENS COLLEGE

AND

INTERNET AND TELECOMMUNICATIONS CONVERGENCE CONSORTIUM

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JANUARY 24, 2005

Abstract

Section 254(b)(3) of the 1996 Telecommunications Act states that residents of rural areas should have access to advanced telecommunications and information services comparable to services in urban areas. Pursuant to the passage of the Act, the Federal Communications Commission (FCC) established a new universal fund that provides explicit support to high-cost rural areas. This paper addresses the question of if people in rural areas have similar access due to the support provided through the Commission's new high cost fund? I focus on the telephone platform because cable companies often do not serve rural areas due to the high cost of service and since there is no mechanism for the federal or state government to subsidize the provision of advanced telecommunications services via cable. Here I find that the Act's objectives are not being met as it is clear that the people living in rural areas are much less likely to have qualified lines that could be used to access advanced telecommunications services.

The Commission's high-cost mechanism only provides support to large telephone companies. In the second part of the paper, I show that an implicit rate-base rate-of-return mechanism is more effective for providing support for advanced telecommunications services to rural areas than explicit USF support.

Background on Universal Service

Section 254 of the Telecommunications Act of 1996 (*The Act*, *Telco 96*) directs the Federal Communications Commission (*FCC*) and the states to establish support mechanisms to ensure the delivery of affordable telecommunications service to all Americans, including low-income consumers, eligible schools and libraries, and rural health care providers. Section 254(b) of the Act established a number of principles upon which policies for the preservation and advancement of universal service should be based.

The most important objectives are to ensure:

1. The provision of high quality service;
2. Reasonable and affordable prices for consumers;
3. Access to advanced services in all regions of the nation;
4. Consumers in rural and high cost areas have access to all telecommunications services that are provided in urban areas at reasonably comparable rates;
5. Providers of telecommunications services make equitable and nondiscriminatory contributions to the preservation and advancement of universal service;
6. Specific, predictable, and sufficient federal and state mechanisms to preserve and advance universal service; and
7. Universal service support mechanisms and rules that are competitively neutral.

The Commission's realization of these principles was shaped by its commitment to meet the following four goals, which it saw as critical:

1. Implementation of all of the universal service objectives established by the Act;
2. The maintenance of rates for basic residential service at affordable levels;
3. Ensuring affordable basic service for all through an explicit universal service funding mechanism; and
4. Bringing the benefits of competition to as many consumers as possible.[1]

The Commission was required to turn these principles into a list of services that would receive support. Somewhat surprisingly, the list excluded advanced services. The law enables the Commission to promote access to advanced services, but it does not require that advanced services are a supported service (see the list of supported services below on page 3). Moreover, the provision of advanced telecommunications services was also not included in the list of supported services because advanced services have not historically been subscribed to by a majority of households.[2]

Although DSL is not a supported service, the Commission does provide support for the cost of a network that could provide DSL service. It would be less expensive to build a voice-only network that used load coils but the Commission decided to model a network that excluded this legacy equipment. Hence, the Commission is providing support for a network that is capable of providing DSL, but it does not provide for the actual cost of the DSL equipment – this is because the unloaded lines are capable of providing DSL service but additional circuit investment in a DSLAM would have to be made in order to provide the DSL service. By making the distinction between supporting access lines that are capable of providing DSL and providing support for the special circuit equipment needed for DSL, the COMMISSION arguably abides by the Act's requirement that consumers in rural areas have access to advanced telecommunications services.

Types of Supported Services

A Federal-State Joint Board on Universal Service was established to assist the Commission in the implementation of the universal service provisions of the Act. Working in conjunction, the Joint-Board and the Commission devised a list of telecommunications services eligible for universal service fund support. This list of services was devised following the directives sited earlier as well those found in Section 254(c)(1)(A)-(D) of the Act, which require the Joint Board and the Commission to consider the extent to which telecommunications services included in the definition of universal service:

1. Are essential to education, public health, or public safety;

---

[1] Id. at ¶2.

[2] citation check 254 (c)

2. Have, through the operation of market choices by customers, been subscribed to by a substantial majority of residential customers;
3. Are being deployed in public telecommunications networks by telecommunications carriers; and
4. Are consistent with the public interest, convenience and necessity.

The Joint-Board and the Commission established a list of core or designated services that should be supported by universal service support mechanisms. The included services are those we associate with plain-old-telephone service (POTS), such as voice grade access to the local and toll network, emergency services, as well as toll limitation services for low-income consumers.[3]

Types of Support Fund

Four Universal Service Support funds have been established by the Commission. These are:

1. **Low-income support**: In 1984, the Commission established a Lifeline program to promote universal service by providing low-income individuals with discounts on the monthly cost of telephone service.[4] Since then, the Commission has expanded the rules to help low-income households pay the initial costs of commencing service, and expand the federal default eligibility criteria to include an income-based criterion and additional means-tested programs. [5]

---

[3] This list of services is to be found in: Before the Federal Communications Commission, In the Matter of Federal-State Joint Board on Universal Service, Report and Order, CC Docket No. 96-45, FCC 97-157, Adopted: May 7, 1997, Released: May 8, 1997, at ¶22,¶56, and ¶61.

[4] MTS and WATS Market Structure, and Amendment of Part 67 of the Commission's Rules and Establishment of a Joint Board, Recommended Decision, CC Docket Nos. 78-72 and 80-286, 49 Fed. Reg. 48325 (rel. Nov. 23, 1984) (recommending the adoption of federal Lifeline assistance measures); MTS and WATS Market Structure, and Amendment of Part 67 of the Commission's Rules and Establishment of a Joint Board, Decision and Order, CC Docket Nos. 78-72 and 80-286, FCC 84-637, 50 Fed. Reg. 939 (rel. Dec. 28, 1984) (adopting the Joint Board's recommendation).

[5] MTS and WATS Market Structure, and Amendment of Part 67 of the Commission's Rules and Establishment of a Joint Board, Decision and Order, CC Docket Nos. 78-72 and 80-286, FCC 85-643, 51 Fed. Reg. 1371 (rel. Dec. 27, 1985).

MTS and WATS Market Structure, and Amendment of Part 67 of the Commission's Rules and Establishment of a Joint Board, Report and Order, CC Docket Nos. 78-72 and 80-286, 2 FCC Rcd 2953 (1987), Memorandum Opinion and Order on Reconsideration, 3 FCC Rcd 4543 (1988).

Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996 Act), codified at 47 U.S.C. §§ 151 et seq. We refer to the Communications Act of 1934, as amended, as "the Communications Act" or "the Act" or "the 1934 Act."

Federal-State Joint Board on Universal Service, Report and Order, CC Docket No. 96-45, FCC 97-157, 12 FCC Rcd 8776, 8952-94, Paragraphs. 326-409 (1997) (1997 Universal Service Order).

Federal-State Joint Board on Universal Service; Promoting Deployment and Subscribership in Unserved

2. **High-cost support**: "The high-cost support mechanisms enable areas with very high costs to recover some of these costs from the federal universal service support mechanisms, leaving a smaller remainder of the costs to be recovered through end-user rates or state universal service support mechanisms. In this manner, the high-cost support mechanisms are intended to hold down rates and thereby further one of the most important goals of federal and state regulation -- the preservation and advancement of universal telephone service."[6]

3. **Schools and libraries support**: "Eligible schools, school districts, and libraries, may receive discounts of 20-90% for eligible telecommunications services, voicemail, Internet access, and internal connections under the schools and libraries universal service support mechanism."[7]

4. **Rural health care support**: The 1996 Act requires telecommunications carriers to provide telecommunications services to public or non-profit health care providers at rates comparable to those charged for similar services.[8] The Commission's universal service rules also permit eligible health care providers[9] to receive support for any telecommunications service.[10]

In the analysis that follows, I focus on the High-Cost Support fund -- particularly on those targeted to the wire center. This form of support is distinctive because it is based on forward-looking economic costs targeted to specific areas of a company's operations, rather than the firm as a whole.

High-Cost Support

---

and Underserved Areas, Including Tribal and Insular Areas, Twelfth Report and Order and Memorandum Opinion and Order, and Further Notice of Proposed Rulemaking, CC Docket No. 96-45, FCC 00-208, 15 FCC Rcd 12,208 (2000).

Lifeline and Link-Up, WC Docket No. 03-109, Report and Order and Further Notice of Proposed Rulemaking, 19 FCC Rcd 8302 (2004).

[6] Universal Service Monitoring Report CC Docket No. 98-202 2004 (Data Received Through May 2004) pages 3-1 to 3-2

[7] Id. at pages 4-1 to 4-2

[8] 47 U.S.C. § 254(h)(1)(A).

[9] 47 C.F.R. § 54.601.

[10] A 1.544 Mbps (T1) maximum bandwidth cap was employed in Funding Years 1 and 2. See Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Report and Order, 12 FCC Rcd 8776, 8952-94 (1997). The Commission removed the bandwidth cap for year three and beyond. See Federal-State Joint Board on Universal Service, CC Docket Nos. 97-21 and 96-45, Sixth Order on Reconsideration in CC Docket No. 97-21, Fifteenth Order on Reconsideration in CC Docket No. 96-45, 14 FCC Rcd 18756 (1999) (Fifteenth Order on Reconsideration).

There are seven types of high cost support mechanisms.[11] Most are based on the recovery of embedded costs (Items 1, 4, 5, 6, and 7 in footnote 11 below). Safety Net Additive Support (SNAS) is designed to provide for support for small, rural companies where they undertake new major investment projects while High-Cost Model Support (HCMS) is distinctive because it is based on targeting support to high cost wire centers that are identified using an economic cost model. While other forms of support are targeted to high cost areas, the determination is based on embedded costs, and largely large study-areas.

To be eligible to receive support from any of these mechanisms, a carrier must be designated as an eligible telecommunications carrier (ETC) by the state regulatory commission of the state in which it operates or by the Commission where the state commission lacks jurisdiction.[12] The Commission and the Joint-Board also recognized

---

[11] See Federal-State Joint Board on Universal Service, CC Docket Nos. 97-21 and 96-45, Sixth Order on Reconsideration in CC Docket No. 97-21, Fifteenth Order on Reconsideration in CC Docket No. 96-45, 14 FCC Rcd 18756 (1999) (Fifteenth Order on Reconsideration), 3-2 through 3-8.

High-Cost support consists of the following mechanisms:

1. *High-cost loop support (HCLS)*— HCLS is provided to all ILECs based on their embedded costs, and "provides assistance for non-traffic sensitive (NTS) local loop costs"[11]

2. *Safety net additive support (SNAS)* —SNAS was created to encourage new investment in rural infrastructure, and is made available to those rural carriers who increase their per loop telephone plant in service by over 14% in one year.[11]

3. *High-cost model support (HCMS)*—HCMS is available to non-rural carriers based on forward-looking costs, and is targeted to wire centers with forward-looking costs above a national benchmark as determined by the Commission's cost model.[11]

4. *Long-term support (LTS)*—LTS relates to interstate non-traffic sensitive costs, and provides support to members of the NECA common line pool. It allows them to charge a below-cost carrier common line (CCL) rate that is uniform for all companies in the pool.[11]

5. *Interstate common line support (ICLS)*—ICLS for rate-of-return carriers converts implicit support in the access rate structure to explicit support. ICLS recovers any shortfall between allowed common line revenues of rate-of-return carriers and their subscriber line charge revenues and gradually replaces the carrier common line charge.[11]

6. *Interstate access support (IAS)*—IAS for price-cap carriers replaces the implicit support previously collected through interstate access charges. It provides explicit support to ensure reasonably affordable interstate rates.[11]

7. *Local switching support (LSS)*—LSS provides support for traffic sensitive local switching costs, and is recovered through the universal service support mechanisms instead of higher traffic-sensitive access charges. LSS provides support to ILECs with study areas of 50,000 or fewer access lines, to help defray the higher switching costs of small ILECs.[11]

[12] 47 C.F.R. § 54.201.

In the Matter of Federal-State Joint Board on Universal Service, Report and Order, CC Docket No. 96-45,

the need to ensure that carriers use federal high-cost support "only for the provision, maintenance and upgrading of facilities and services for which the support is intended."[13] The next section will talk about the accountability criteria and measures, or lack thereof, which the Commission put in place to guarantee that this would occur.

Accountability Criteria Utilized in High-Cost Support Mechanisms

In developing its accountability criteria, the Commission initially considered distributing universal service funding directly to state commissions instead of to carriers. However, the Commission rejected this approach on the grounds that it violated the long standing pre Act practice of distributing universal service funding directly to those carriers providing the supported services. Furthermore, the Commission recognized that such a fundamental shift in distribution of funds had no supporting evidence in either the Act or the legislative history leading up to the creation of the Act. Additionally, it was recognized that distributing funding directly to state commissions would place substantial administrative burdens on those state commissions lacking the resources to handle the oversight and distribution of those funds.[14]

The Commission eventually concluded:

> "…states should be required to file annual certifications with the Commission to ensure that carriers use universal service support "only for the provision, maintenance and upgrading of facilities and services for which the support is intended" consistent with section 254(e). we have identified what 254(e) entails We conclude that the mandate in section 254(e) applies to *all* carriers, rural and non-rural, that are designated as eligible to receive support under section 214(e) of the Act.[15] As we

---

FCC 97-157, Adopted: May 7, 1997, Released: May 8, 1997, Paragraphs 134 and 174

The Commission determined that only common carriers may be designated as Eligible Telecommunications Carrier (ETCs). In order to receive an ETC designation a carrier must: (1) Offer services deemed eligible for universal funding support by the Commission and the Joint Board; (2) Offer these USF eligible services using either its own facilities or a combination of its own facilities and resale of another carrier's services, including the services offered by another eligible telecommunications carrier; and (3) advertise the availability of and charges for such services using media of general distribution. To reduce potential gaming of this system by competitive entrants, the Commission further determined that carriers serving customers by reselling wholesale service may not receive universal service support for those customers that it serves through resale alone. The Commission went on to conclude that CLECs exclusively relying on unbundled network elements to provide services eligible for USF support are only eligible for receipt of a level of support not to exceed the price of the UNEs that it has purchased to provide those services.

[13] 47 U.S.C. § 254(e).

[14] Before the Federal Communications Commission, In the Matter of Federal-State Joint Board on Universal Service, Second Recommended Decision, CC Docket No. 96-45, FCC 98J-7, Adopted: November 23, 1998, Released: November 25, 1998 at ¶61.

[15] See 47 U.S.C. § 254(e).

> concluded with regard to non-rural carriers, the federal high-cost support that is provided to rural carriers is intended to enable the reasonable comparability of intrastate rates, and states have jurisdiction over intrastate rates. Given that states generally have primary authority over carriers' intrastate activities, we believe that the state certification process provides the most reliable means of determining whether carriers are using support in a manner consistent with section 254(e)."[16]

However, the Commission also recognized that some state commissions, Wisconsin for example, lack the direct regulatory oversight necessary to ensure that federal support is reflected in intrastate rates. For instances such as these, the Commission asserted that "…the state need not initiate the certification process itself. Instead, in such states, non-rural LECs, and competitive eligible telecommunications carriers serving lines in the service area of a non-rural LEC, may formulate plans to ensure compliance with section 254(e), and present those plans to the state, so that the state may make the appropriate certification to the Commission."[17] The Commission went on to find that, in those instances where a carrier might not be subject to oversight by state regulatory authorities, a carrier could certify directly to the Commission that federal high-cost support will be used in a manner consistent with section 254(e). This certification must be filed in the form of a sworn affidavit executed by a corporate officer attesting to the use of the support only for the provision, maintenance, and upgrading of facilities and services for which the support is intended pursuant to section 254(e) of the 1996 Act. A copy of this letter must also be submitted to USAC.[18]

---

[16] Before the Federal Communications Commission, In the Matters of Federal-State Joint Board on Universal Service, CC Docket No. 96-45 and Multi-Association Group (MAG) Plan for Regulation of Interstate Services of Non-Price Cap Incumbent Local Exchange Carriers and Interexchange Carriers, CC Docket No. 00-256, Fourteenth Report And Order, Twenty-Second Order On Reconsideration, And Further Notice Of Proposed Rulemaking In CC Docket No. 96-45, And Report And Order In CC Docket No. 00-256, FCC 01-157, Adopted: May 10, 2001 Released: May 23, 2001, at ¶187.

[17] Before the Federal Communications Commission, In the Matter of Federal-State Joint Board on Universal Service, Ninth Report & Order And Eighteenth Order On Reconsideration, CC Docket No. 96-45, FCC 99-306, Adopted: October 21, 1999, Released: November 2, 1999, at ¶97.

[18] Before the Federal Communications Commission, In the Matters of Federal-State Joint Board on Universal Service, CC Docket No. 96-45 and Multi-Association Group (MAG) Plan for Regulation of Interstate Services of Non-Price Cap Incumbent Local Exchange Carriers and Interexchange Carriers, CC Docket No. 00-256, Fourteenth Report And Order, Twenty-Second Order On Reconsideration, And Further Notice Of Proposed Rulemaking In CC Docket No. 96-45, And Report And Order In CC Docket No. 00-256, FCC 01-157, Adopted: May 10, 2001 Released: May 23, 2001, at ¶189. It is worthwhile to note here that some state Commissions have determined that the Commission has not provided adequate guidance concerning the types and kinds of information which the Commission would deem sufficient for a grant of state certification. For example, Washington determined that, because it had been provided with "…no guidance by the FCC, and because the FCC accepts certifications from corporate officers concerning the intended use of federal high-cost support funds as sufficient for those companies that must certify to the FCC, we will certify compliance with 47 C.F.R. 54.314(a) based on the corporate officer certifications."(See Before The Washington Utilities And Transportation Commission, In the Matter of State Certification of Support as Required by 47 C.F.R. § 54.314, Docket No. UT-01304, Order Requiring Filing By Eligible Telecommunications Carriers Receiving Federal High Cost Support, July 25, 2001, at

In establishing these accountability criteria, the Commission pointed out that it was "…not attempting to direct the manner in which states incorporate federal high-cost support into their ratemaking processes"[19] nor did it intend to impose "…elaborate rules for compliance with section 254(e)."[20] Instead, the Commission found that more "…appropriate for states to determine how the support is used to advance the goals set out in section 254(e)."[21] In this vein, the Commission went on to opine that:

> "…a state could adjust intrastate rates, or otherwise direct carriers to use the federal support to replace implicit intrastate universal service support to high-cost rural areas, which was formerly generated by above-cost rates in low-cost urban areas, that has been eroded through competition. A state could also require carriers to use the federal support to upgrade facilities in rural areas to ensure that services provided in those areas are reasonably comparable to services provided in urban areas of the state. These examples are intended to be illustrative, not exhaustive. As long as the uses prescribed by the state are consistent with section 254(e), we believe that the states should have the flexibility to decide how carriers use support provided by the federal mechanism."[22]

In a later Order, the Commission expanded the annual universal service fund certification process to include a rate review. The intent behind this move was to "…induce states to achieve reasonably comparable rates and to assess how successfully the non-rural high-cost support mechanism ensures reasonably comparable rural and urban rates."[23] To ensure this result, the Commission now requires states to "…certify that the basic service rates in their rural, high-cost areas served by non-rural carriers are reasonably comparable to a national urban rate benchmark or explain why they are not."[24] The Commission intends to use this annual comparison to "…determine whether federal and state universal service mechanisms

---

¶12)

[19] Before the Federal Communications Commission, In the Matter of Federal-State Joint Board on Universal Service, Ninth Report & Order And Eighteenth Order On Reconsideration, CC Docket No. 96-45, FCC 99-306, Adopted: October 21, 1999, Released: November 2, 1999, at ¶95.

[20] Id.

[21] Id.

[22] Id. at ¶96.

[23] Before the Federal Communications Commission, In the Matter of Federal-State Joint Board on Universal Service, Order On Remand, Further Notice Of Proposed Rulemaking, And Memorandum Opinion And Order, CC Docket No. 96-45, FCC 03-249, Adopted: October 16, 2003, Released: October 27, 2003, at ¶ 2.

[24] Id. Wimmer and Rosston report that urban and rural rates are comparable. Bradley S. Wimmer and Gregory L. Rosston, "Local Telephone Rate Structures: Before and After the Act," Information Economics and Policy 17 (2005): 13-34. The FCC's order contained a similar finding.

are resulting in reasonably comparable rural and urban rates as competition develops and erodes implicit support mechanisms."[25]

What is especially noteworthy here is just how light the Commission's accountability regime is. All a company must do to receive federal high-cost support funds is to file a letter with a state public utility commission, to be passed on to the Commission, certifying that the money received has been spent appropriately. No reports detailing how the universal funds received have been spent are required, nor has the Commission tied support to anything other than very broadly articulated policy objectives.

This is in sharp contrast to what is found in other federally funded programs. For example, under the now defunct *Goals 2000: Educate America Act (Goals 2000)*, participating school boards were required to develop and submit local improvement plans.[26] These plans had to contain detailed descriptions of how the specific programs mandated by *Goals 2000* were to be implemented along with the projected costs of implementation. School boards were expected to review implementation plans annually, report on the progress made under the plan and funding spent, and propose revisions to the plan as deemed necessary.[27] Ultimately, many states opted out of the plan because of the high cost of implementing the federal mandates related to special education, gender-role discrimination education, asbestos removal, school recycling programs, an arbitrage rebate on local bonds, and safe drinking water tests". This is perplexing since it indicates that although the federal government has strict rules for government to government transfers, it has far fewer for a government to private firm transfer regarding receipt of federal high-cost support funds.

Non-rural ILECs are provided support from the High Cost contingent on a showing that the funds "will be used only for the provision, maintenance, and upgrading of facilities and services for which the support is intended."[28] As stated above, the allocation of money to high-cost areas is done by reviewing cost estimates from an economic cost model. I now proceed to test if the USF high-cost money has been used to upgrade facilities that are used to provide supported services, or for the provision of advanced services that are "reasonably comparable to services provided in urban areas of the state."[29] This test naturally follows from the Commission's criterion that a forward-

---

[25] Id.

[26] Quantifying Federal Regulatory Impact On Education, http://www.ncpa.org/pd/monthly/pd396g.html

[27] See, for example, Michelle Easton, "Virginia Has Avoided 2000 Strings", The Virginian-Pilot, Wednesday, May 1, 1996, available at http://scholar.lib.vt.edu/VA-news/VA-Pilot/issues/1996/vp960501/05010003.htm.

[28] ' 54.313(a)

[29] 9th Supp. Order at ¶96.

looking economic cost model should reflect a loop topology that "should not impede the provision of advanced services."[30]

Literature Review

Before continuing to my empirical analysis, it is useful to present a brief literature review to demonstrate how this study differs from, and builds on, previous work in the telecommunication economics research field. In short, little has been done to assess the effectiveness of the universal service program. Two notable exceptions are the papers by Rosston/Wimmer and Shuler discussed below. In the same vain as these two papers, my paper is intended to evaluate the effectiveness of the support program.

Gregory Rosston and Bradley Wimmer[31] look at the universal service program in terms of how it affects how many people are connected to the network. They address the issue of access for basic voice service, and aver that "the intention of the universal service program is to provide a subsidy to companies (and ultimately consumers) living in areas with high costs in order to keep rates down in these areas."[32] The article focuses on seeing if the Universal Service Fund helps with connectivity and evaluates variables such as income and race, but there is no discussion of infrastructure. In contrast, I am examining infrastructure used to provide advanced telecommunications services.

Among the more notable findings of Rosston and Wimmer are that USF programs do not have a significant effect on telephone service penetration, result in high taxes, and distort competitive market outcomes.[33] Moreover, cost-based programs poorly target subsidies to low-income households.[34]

John Shuler[35] makes the point that the government is giving away large sums of money through the E-rate program with little knowledge of the effectiveness of the program. He notes that the program contributed $620 million to over 17,000 E-Rate applications through January of 1999. Shuler notes that USAC is primarily a funding mechanism

---

[30] In the Matter of Federal-State Joint Board on Universal Service, Report and Order, CC Docket No. 96-45, FCC 97-157, May 8, 1997, ¶Par. 250, criterion one.

[31] Gregory L. Rosston and Bradley S. Wimmer, "The 'State' of Universal Service" in Information Economics and Policy 12 (2000) 261–283.

[32] Id. Page 266.

[33] Id. Page 261.

[34] Id. Page 264.

[35] John A. Shuler, "A Critique of Universal Service, E-Rate, and the Chimera of the Public's Interest", Government Information Quarterly, Volume 16, Number 4, 1999, Pages 359-369.

that collects funds from interstate telecommunication service providers, and then distributes the money to service providers that are under contract with the approved schools and libraries. Yet, there appears to be no information on whether or not this program improves the identified lack of institutional universal service. Finally, neither the USAC nor the grantees appear to have any obligation to follow-up or analyze if the universal goals of the telecommunication laws have been met.[36]

In short, Rosston and Wimmer and Shuler do not find much evidence that existing support mechanisms are an effective policy instrument -- they do not significantly affect subscriptions rates, and with e-rate there is no testing of effectiveness.

Empirical Analysis

The dependent variable in the regression analysis is the number of ILEC loops that are technically capable of providing DSL service. Such lines, for example, are within 18,000 feet of the central office and are free of load coils.[37] Included in the count of qualified lines are loops where no one is providing DSL, but could if the appropriate DSL equipment was placed in the central office.

The purpose of the regression analysis is to see if after controlling for such factors as density, the size of the wire center, income level, housing value, and regulatory factors, a wire center receiving federal high-cost support was more likely to have qualified loops as other service areas.

I explain the variation in the number of qualified access lines using a fixed effects model. Dummy variables are used to control for unobservable that vary between states.

The other variables control for such factors as density, market characteristics and regulatory environment. The size of the market is measured both in terms of the number of access lines in the wire center, qualified or unqualified for DSL, as well as the population per square mile (density). I expect the coefficients of both of these variables to be positive because as the number of access lines in a central office increases, there is a concomitant opportunity to have more qualified lines. The number of qualified lines should also increase with density. A higher density is associated with shorter loop lengths[38] and therefore should be positively correlated with loops not being impeded by either load coils or legacy digital carrier systems.[39]

---

[36] Id. Page 366.

[37] A loading coil is inserted into long loops to filter out high-frequency signals. These higher frequencies are not needed for POTS but are used by DSL service. Therefore, the load coils must be removed from the circuit if the loop is going to be used to provide DSL service.

[38] David Gabel and Mark Kennet, "Estimating the Cost Structure of the Local Telephone Exchange Network," 1991, National Regulatory Research Institute, NRRI Publication 91-16, p. 34.

[39] Only recently have digital line carrier (DLC) systems been deployed that used packet switching to provide DSL service. Earlier DLC systems were only used to provide voice services, are required

The decision to upgrade lines may also be a function of the location of the central office. Since residential DSL service is primary advertised through mass media, a supplier might decide to condition lines of customers that are most likely exposed to the advertisements for advanced telecommunications products. The supplier might do this in order to reduce the likelihood of having to explain to customers why the product is advertised on local television or newspapers but unavailable to the subscriber. Therefore, I postulate that the number of DSL capable lines should be positively associated with a wire center being located in a Metropolitan Statistical Area (MSA).

The impact of location is also controlled for by including an explanatory variable that measures the number of persons located in a wire center that live in a rural area. Rural areas may be less likely to obtain upgrades because rural business demand is typically lower than urban business demand. In rural areas, there is less concentration of small and medium scale businesses, and these are the business users who are more likely to require faster Internet speeds for their work. Notably, business accounts for 35% of lines in urban areas, but only 20% in rural areas.[40] Moreover, since rural enterprises have far fewer employees with 80% having fewer than 10 employees, there is much less need for sophisticated telephone systems and multiple lines.[41] Business such as finance, real estate, and information technology have roughly twice as much broadband access per employee,[42] but these sorts of services tend to be concentrated in urban and suburban areas whereas small retail services comprise as much as 30% of all business in rural areas.[43] Moreover, the demand for broadband services by business increases with the number of employees, for firms which are headquarter offices, and for companies with a large number of locations,[44] which works against business demand in rural areas. As a result, demand will be lower in rural areas even where customer density is the same as in more urban areas. Consequently, as noted by Legg Mason and Nortel, "there is not sufficient density to spread costs over many subscribers and per-unit loop costs are relatively high."[45]

The variable Monthly_to~s is an additional proxy, along with density, for loop length. Loop length is relevant because load coils and legacy digital line carrier systems are more likely to be found on long loops. Absent information on the distribution of loop

---

expensive additional equipment for private line data services.

[40] Reshaping Rural Telephone Markets: Financial Perspectives on Integrating Acquired Access Lines. Legg Mason Wood Walker, Inc., Equity Research, Industry Analysis, Fall 2001. (Legg Mason), Page 163.

[41] Legg Mason, Page 163.

[42] Kevin T. Duffy-Deno, "Business Demand for Broadband Access Capacity" Journal of Regulatory Economics, Volume 24:3, 2003, Page 361, Table 1.

[43] Legg Mason, Pages 164-165.

[44] Duffy-Deno, Page 366.

[45] Legg Mason, Page 170.

lengths at each wire center, I have used the statewide average embedded cost of the loop.[46]

Economic and Demographic Data

Turning now to economic variables, I postulate that the number of conditioned lines should be positively associated with consumer wealth and income. I make this assumption because the consumption of communications products is generally believed to be that of a normal good.[47] Whereas data on household wealth is not available, I use as a proxy for wealth the median value of housing for homes located in the wire center.

I further postulate that as the number of people employed by businesses located in the central office increases, so does the likelihood that lines will be DSL capable. This follows from the proposition that businesses have a strong commercial need for high-speed data services[48] and therefore the supplier will likely take this into account when deciding where it should upgrade its infrastructure for the provision of advanced telecommunications services.[49]

Regulatory Environments

I include three regulatory variables that control for the form of state regulation, UNE rates, and the level of targeted USF support. First, for each state included in the data set, I use a dummy variable to control for either price cap or rate-of-return state regulation.[50] There is no need to control for the form of federal regulation because all of the companies are regulated via price caps at the federal jurisdictional level.

---

[46] In future analysis I intend to substitute HCPM loop cost estimates for the statewide embedded cost of the loop.

[47] See, for example, Lester D. Taylor, Telecommunications Demand in Theory and Practice, pp. 283-84, (Boston: Kluwer Academic Publishers, 1994).

[48] Miller, Mark A. (1994), Analyzing Broadband Networks: Frame Relay, SMDS and ATM, New York: M&T Books, p. 4.

[49] The econometric specification does not explicitly control for the level of cable modem or data CLEC competition at each wire center. Unfortunately, such information is unavailable. The harm from this omission is mitigated by the high correlation between density, an included variable, and the extent of competition.

If the USF support is being used to provide access to advanced services to the same degree as is available in the comparatively competitive urban markets, the degree of competition should not be correlated with the number qualified access lines. That is, if competition stimulates network upgrades, the USF money should be used to provide equal access to advanced telecommunications services in rural areas.

[50] The Commission defines price cap and rate-base regulation as follows:

[R]ate-of-return regulation is designed to limit the profits an incumbent LEC may earn…, whereas price cap regulation focuses primarily on the prices that an incumbent LEC may charge and the revenues it

The 1996 Act requires non-rural incumbent local exchange carriers to provide unbundled network elements[51] (UNEs) at cost to their competitors.[52] Access to unbundled network elements is pro-competitive because it allows entrants to offer services over the incumbents' facilities and not be impaired by their inability to achieve the economies of scale that are achieved by the incumbents. Since facilities must be provided at cost, an entrant has an easier time competing than it would if not for this legislative requirement.[53]

While the Act states that UNEs be priced at cost, it provides little guidance regarding what is the appropriate costing methodology. In a subsequent rule-making proceeding, the Commission determined that cost should be determined using a forward-looking economic cost methodology, known as TELRIC (Total Element Long-Run Incremental Cost). The Commission pricing order described the guiding principles of TELRIC but left the implementation of the costing methodology to the states. [54] As noted by the DC Court of Appeals, the pricing rules only establish a range of reasonableness and it is up to the State Commissions to determine where to establish UNE prices within this range.

---

may generate...Under the …[rate-of-return regulation], revenue requirements are based on embedded or accounting costs allocated to individual services. Incumbent LECs are limited to earning a prescribed return on investment and are potentially obligated to provide refunds if their interstate rate of return exceeds the authorized level.

By contrast, although… the…LECs['s prices] originally were set at the levels that existed at the time they entered price caps, their prices have been limited ever since by price indices that have been adjusted annually pursuant to formulae…. Price cap carriers …charges are set by these pricing rules are permitted to earn returns significantly higher, or potentially lower, than the prescribed rate of return that incumbent LECs are allowed to earn under rate-of-return rules.

In the Matter of Access Charge Reform (CC Docket No. 96-262), Price Cap Performance Review for Local Exchange Carriers (CC Docket No. 94-1), Low-Volume Long-Distance Users (CC Docket No. 99-249), and Federal-State Joint Board On Universal Service (CC Docket No. 96-45). Sixth Report and Order in CC Docket Nos. 96-262 and 94-1, Report and Order in CC Docket No. 99-249, Eleventh Report and Order in CC Docket No. 96-45. Adopted: May 31, 2000, Released: May 31, 2000, pars. 15 and 16.

[51] "The term network element means a facility or equipment used in the provision of a telecommunications service. Such term also includes features, functions, and capabilities that are provided by means of such facility or equipment, including subscriber numbers, databases, signaling systems, and information sufficient for billing and collection, or used in the transmission, routing, or other provision of a telecommunications service." 47 U.S.C. '153(29).

[52] 47 U.S.C. ' 252(d)(1)(A).

[53] Federal Communications Commission, In the Matter of Implementation of the Local Competition Provisions in the Telecommunications Act of 1996 ("Interconnection Order"), First Report and Order, August 8, 1996, CC Docket No. 96-98, FCC 96-325, pars. 10-15, 29.

[54] FCC, Interconnection Order, par. 29. Curiously when the Commission established its pricing rules, it identified three goals of the Act: opening markets, promoting competition in markets already subject to entry, and reforming universal service support. The Commission did not include promoting innovation as a goal of the Act. Id. at 3. As noted earlier, one of the objectives of the Act was to "encourage the rapid deployment of new telecommunications technologies." http://leahy.senate.gov/press/199601/s652.html

The Court went on to note that State's may select rates on the lower end of reasonableness in order to promote competition.[55]

In an effort to promote competition in the short-run, by selecting UNE rates on the low end of the range of reasonableness, incumbent local exchange carriers (ILECs) assert that state regulators are removing incentives for ILECs or competitive local exchange carriers (CLECs) to invest – ILECs have little incentive to invest because they have to rent out network elements at low rates to rivals, while CLECs have little incentive to invest because they will be able to rent from ILECs at low prices.[56] Some Wall Street analysts have downgraded their ratings of RBOC stocks based on the lost profits associated with UNE rates.[57] This, in turn, raises the cost to the RBOC of raising funds for new investments.

CLECs dispute the contention that unbundling inhibits investment. Proponents of such contention like Willig, Lehr, Bigelow, and Levinson (2002) contend that neither theory nor empirical data supports the ILEC argument that mandatory unbundling provision hinders ILEC investment.[58] These authors estimated that a 1% unbundled network element (UNE) rate reduction corresponds with approximately a 2.1% to 2.9% increase in ILEC investment, and concluded that unbundling of ILEC networks promotes competition -- thereby stimulating investment in telecommunications infrastructure by incumbents and entrants alike.

In order to test the hypothesis that investment is impeded by UNE pricing, I have included as an explanatory variable the ratio of the UNE loop price divided by the embedded loop cost This ratio is an appropriate measurement of how favorable the regulatory regime in the particular state is to the ILECs in terms of the unbundling mandate according to Section 251(c) of the 1996 Act. The higher the ratio, the more favorable the regulatory environment is to the incumbents. I postulate that when the ratio is high, ILECs are more likely to invest since the possibility of recouping their investment is higher. If the coefficient for this variable is positive, it provides support for

---

[55] United States Court of Appeals For The District of Columbia Circuit, No. 01-1076, Sprint Communications Company L.P., v. Federal Communications Commission, December 28, 2001.

[56] See, for example, Reply Comments of SBC Communications Inc. In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, CC Docket No. 01-338, July 17, 2002, pp. 24-45; 96-104.

[57] See, for example, UBS Warburg, "How Much Pain from UNE-P? Analysis of UNE-P Economics for the Bells," August 20, 2002; Dresdner Kleinwort Wasserstein Securities, "UNE-P: the Un-Profit: Regulation pressuring RBOC profits," August 21, 2002; and Commerce Capital Markets, "The Status of 271 and UNE-Platform in the Regional Bells' Territories," November 8, 2002. This last report includes a comparison of the UNE rates and embedded cost of service. Based upon this comparison, Capital Commerce concluded that UNE rates were not covering the cost of service and "pose a serious threat to the RBOCs' financials.". Ibid, p. 5, 6 (quote), 20.

[58] Willig, Robert D., William H. Lehr, John P. Bigelow, and Stephen B. Levinson (2002), Stimulating Investment and the Telecommunications Act of 1996

the proposition that low UNE prices relative to the embedded cost-of-service inhibit ILEC investment.

The final regulatory variable is the amount of quarterly high-cost support targeted to a wire center. If the money is being used to support the provision of advanced telecommunications services, the coefficient on this variable should be positive. On the other hand, if the loose guidelines for the use of the funds are non-binding, or if the money is used for other purposes, the coefficient will not have a statistically significant affect on the number of conditioned lines.

The variables included in the regression, and their descriptive statistics, are found in Table 1. As shown in Table 2, the variables are not highly correlated with the exception of the number of qualified lines and the number of access lines in a wire center, as well as a few other variables, such as income and household value.

Parameter Estimates and Economic Significance

The regression results from the reduced-form equation are provided in Table 3. The results suggest that the quarterly USF payments have no statistically significant effect on the likelihood that a line is qualified.

The sign of the parameters are largely consistent with my *a priori* expectations, the one notable exception being the negative sign on the income variable. . The perplexing result for the income variable may be due to high collinearity between household value and income, 0.84.[59]

Table 4 reports the elasticities for the different explanatory variables.[60] The elasticities provide a means of judging the economic significance, as opposed to the statistical significance, of the different explanatory variables included in the regression analysis. Other than the number of loops in the wire center, none of the explanatory variables has great economic significance -- as illustrated by their low elasticities.

Conclusion

It appears that the Universal Service Fund program is maintaining the status quo in terms of keeping rural rates comparable with urban ones. The available evidence suggests, however, that the program is failing to provide people in rural areas served by large companies with comparable access to advanced telecommunications services.

---

[59] I did run a regression without the income variable, medhhinc, and the omission of this variable had little effect on the coefficient or elasticity for USF support. The omission of income did change the sign of MSA and the variable was no longer statistically significant.

[60] The primary determinant of usage (for a given technology and service configuration) is the number of people employed in the business. See Taylor, Page 83, Telecommunications Demand in Theory and Practice.

Table 1
Descriptive Statistics and Definitions of Variables

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
total_qual~s	DSL qualified loops in wire center	2343	11,378	16,305	85	146,490
xdsl		2343	0.85	0.36	0	1
total_acce~s	Total access loops in wire center	2343	14,657	18,645	124	147,796
msa	1 wire in metropolitan statistical area (MSA); otherwise 0	2343	0.66	0.47	0	1
density	Population / wire center service area	2343	2,382	8,331	1.12	118,022
medhhinc	Medium household income	2343	48,221	18,930	14,423	157,679
medhval	Medium housing value	2343	135,537	85,454	0	737,206
persons_in~l	Persons in rural area	2262	3,907	4,223	0	38,962
wc_templ	Number of employees of firms or government agencies located in the wire center	2343	9,650	16,919	0	288,502
ratio_of_l~t	Ratio of UNE loop price to embedded cost of loop	2341	.8230034	.1518646	.589839	1.371827
monthly_to~s	Embedded cost of loop	2341	18.2845	3.019996	7.88	25.24
total_quar~m	Universal service quarterly payment	2343	3508.746	14802.63	0	167312.3
ror	1 if rate-of-return regulation; 0 otherwise	2343	.0495092	.2169749	0	1

Table 2
Correlation of Variables

Variable	total_qual~s	Xdsl	total_acce~s	msa	density	medhhinc	medhval	persons_in~l	Wc_templ	ratio_of_l~t	total_quar~m	ror
total_qual~s	1											
xdsl	0.28	1										
total_acce~s	0.98	0.30	1									
msa	0.39	0.37	0.39	1								
density	0.66	0.12	0.62	0.19	1							
medhhinc	0.18	0.22	0.21	0.45	-0.01	1						
medhval	0.26	0.23	0.27	0.34	0.09	0.84	1					
persons_in~l	-0.21	0.11	-0.15	-0.07	-0.22	-0.07	-0.13	1				
wc_templ	0.80	0.23	0.81	0.32	0.45	0.21	0.22	-0.15	1			
ratio_of_l~t	-0.12	0.10	-0.13	-0.04	-0.07	-0.03	0.09	0.02	-0.07	1		
total_quar~m	-0.15	-0.24	-0.15	-0.27	-0.07	-0.22	-0.18	0.05	-0.12	0.10	1	
ror	-0.11	-0.02	-0.11	-0.18	-0.06	-0.01	-0.04	0.01	-0.07	0.06	-0.05	1

Table 3
Qualified Line – Coefficient Estimates*

Source	SS	df	MS	Number of obs =	2262
Model	8.2964e+11	24	3.4568e+10	F(24, 2238) =	7741.81
Residual	9.9930e+09	2238	4465148.26	Prob > F =	0.0000
Total	8.3963e+11	2262	371190304	R-squared =	0.9881
				Adj R-squared =	0.9880
				Root MSE =	2113.1

total_qual~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
total_acce~s	.7626175	.0607974	12.54	0.000	.6433923	.8818427
msa	259.4512	119.206	2.18	0.030	25.68527	493.2172
density	.1737985	.0082196	21.14	0.000	.1576797	.1899174
medhhinc	-.031619	.0049449	-6.39	0.000	-.041316	-.021922
medhval	.0038405	.0010792	3.56	0.000	.0017241	.0059568
persons_in~l	-.1995926	.0112056	-17.81	0.000	-.2215671	-.177618
wc_templ	.036999	.0050369	7.35	0.000	.0271215	.0468765
ratio_of_l~t	1059.988	292.9244	3.62	0.000	485.5557	1634.42
monthly_to~s	-.6503927	12.82802	-0.05	0.960	-25.80645	24.50567
total_quar~m	-.0035671	.0033545	-1.06	0.288	-.0101454	.0030111
ror	275.2768	254.1821	1.08	0.279	-223.1804	773.7341

*The coefficient estimates for the State variables are available upon request from the author. The variables are jointly significant.

Table 4
Elasticity Estimates for Qualified Lines

```
Elasticities after regress
      y  = Fitted values (predict)
         =  11060.977
------------------------------------------------------------------------------
variable |      ey/ex    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
total_a~ |   .9847826      .07861   12.53   0.000   .830714  1.13885   14283.3
     msa |   .0154717      .00711    2.18   0.030   .001539  .029404   .659593
 density |    .036078      .00171   21.07   0.000   .032723  .039433   2296.09
medhhinc |    -.13753      .02152   -6.39   0.000  -.179709 -.095351   48110.8
 medhval |   .0468847      .01318    3.56   0.000   .021059  .072711    135034
person~l |  -.0705012      .00397  -17.76   0.000  -.078282 -.062721   3907.02
wc_templ |   .0309682      .00422    7.34   0.000   .022701  .039235   9258.06
ratio_~t |   .0789448       .0218    3.62   0.000   .036226  .121663   .823789
monthl~s |  -.0010749       .0212   -0.05   0.960  -.042627  .040478   18.2799
total~em |  -.0011623      .00109   -1.06   0.288  -.003304   .00098   3604.02
     ror |   .0012213      .00113    1.08   0.279  -.000989  .003432   .049072
------------------------------------------------------------------------------
```