Ex Parte

July 19, 2005

Ms. Marlene H. Dortch
Office of the Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: CC Docket No. 96-45.

Dear Ms. Dortch:
On July 18, 2005 I met with Alex Belinfante, William Sharkey, Theodore Burmeister, Carol Pomponio, Stephen Burnett, Geoff Waldau, Barbara Cherry, Mark Stephens, Michael Goldstein, Thomas Buckley, Jay Atkinson, and Katie King to discuss CC Docket No. 96-45. I hereby submit the slides and paper from my presentation for use in the above referenced proceeding.

Should you have any questions please feel free to contact me at (617) 243-0093.

Sincerely,

David J. Gabel

Broadband and Universal Service

David Gabel

Queens College

July 18, 2005

Section 254 Objectives

- Section 254(b) of the Act established seven principles upon which policies for the preservation and advancement of universal service should be based.
- Congress asked the Federal Communications Commission to adopt policies that promote "[a]ccess to advanced telecommunications and information services…in all regions of the Nation".
- Congress added that access to advanced telecommunications and information services "in rural, insular, and high cost areas ... should … [be] 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".

Identifying Services that Receive Support

- The Commission was required to turn these principles into a list of services that would receive support. Somewhat surprisingly, the list excluded advanced services.
- Support provided to POTS.
- The Commission does provide support for the cost of a network that could provide DSL service or other advanced services.
- Does the federal support raise the likelihood that a line is capable of providing DSL service after accounting for relevant economic, demographic, and regulatory variables?

Forms of 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.
- There are seven types of high cost support mechanisms.
- 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 comparatively large geographic areas.
- Congress recognized 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."

States Responsible for Verifying Money is Appropriately Used

- FCC concluded that the "…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).'"
- The Commission added 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 [emphasis added].* 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.

Unusual Support Mechanism

- States have little incentive to make a finding of non-compliance.
- Different mechanism than used in education.
- Lack of assessment.

Table 1 Descriptive Statistics and Definitions of Variables

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
Qualified_ access	DSL qualified loops in wire center	2343	11,378	16,305	85	146,490
Access_ lines	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	Median household income	2343	48,221	18,930	14,423	157,679
medhval	Medium housing value	2343	135,537	85,454	0	737,206
Rural_pop	Persons in rural area	2262	3,907	4,223	0	38,962
employees	Number of employees of firms or government agencies located in the wire center	2343	9,650	16,919	0	288,502
UNE/emb_ $	Ratio of UNE loop price to embedded cost of loop	2341	.82	.15	.59	1.37
Loop_$	Embedded cost of loop	2341	18.2845	3.02	7.88	25.24
USF_$	Universal service quarterly payment (high cost model support)	2343	3,509	14,802	0	167,312
ror	1 if rate-of-return regulation; 0 otherwise	2343	.0495	.22	0	1

Table 2 Correlation of Variables

Variable	Qualified_access	Access_lines	msa	density	medhhinc	medhval	Rural_pop	employees	UNE_emb_$	USF_$	ror
Qualified_access	1										
Access_lines	0.98	1									
Msa	0.39	0.39	1								
Density	0.66	0.62	0.19	1							
Medhhinc	0.18	0.21	0.45	-0.01	1						
Medhval	0.26	0.27	0.34	0.09	0.84	1					
Rural_pop	-0.21	-0.15	-0.07	-0.22	-0.07	-0.1	1				
Employees	0.8	0.81	0.32	0.45	0.21	0.22	-0.15	1			
UNE_emb_$	-0.12	-0.13	-0.04	-0.07	-0.03	0.09	0.02	-0.07	1		
USF_$	-0.15	-0.15	-0.27	-0.07	-0.22	-0.2	0.05	-0.12	0.1	1	
Ror	-0.11	-0.11	-0.18	-0.06	-0.01	-0	0.01	-0.07	0.06	-0.05	1

Table 3 Qualified Line – Coefficient Estimates*

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

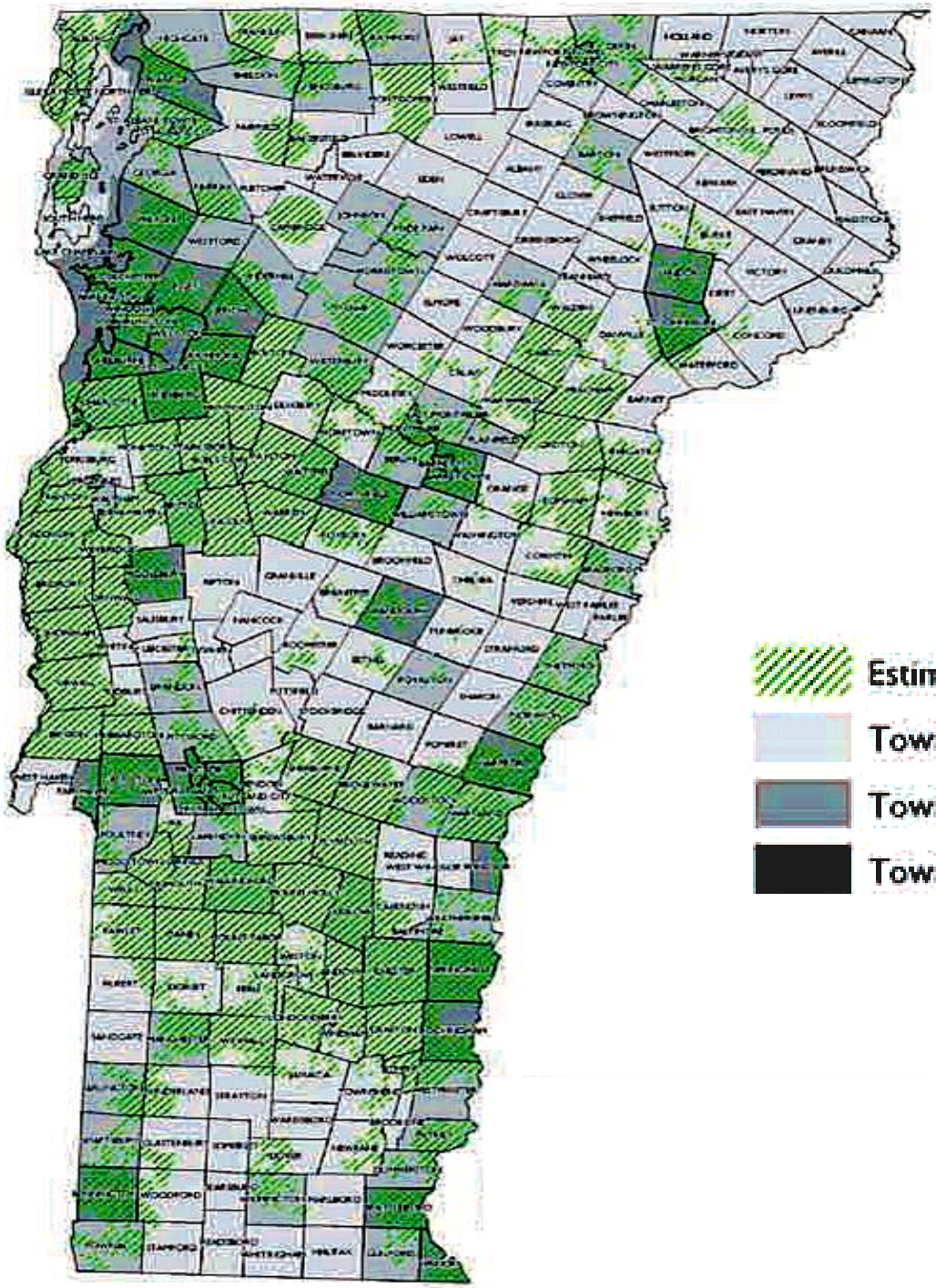
qualified_access	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
access_lines	.7626175	.0607974	12.54	0.000	.6433923	.8818427
msa	259.4512	119.205	2.18	0.030	25.68527	493.2172
density	.1737985	.0082196	21.14	0.000	.1576797	.1899174
medhhinc	-.031619	.0049449	-6.39	0.000	-.041316	-.021922
medhval	.0038405	.0010792	3.56	0.000	.0017241	.0059568
rural_pop	-.1995926	.0112056	-17.81	0.000	-.2215671	-.177618
employees	.036999	.0050369	7.35	0.000	.0271215	.0468765
UNE_emb_$	1059.988	292.9244	3.62	0.000	485.5557	1634.42
Loop_$	-.6503927	12.82802	-0.05	0.960	-25.80645	24.50567
USF_$	-.0035671	.0033545	-1.06	0.288	-.0101454	.0030111
zoz	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
access_lines	.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
rural_pop	-.0705012	.00397	-17.76	0.000	-.078282	-.062721	3907.02
employees	.0309682	.00422	7.34	0.000	.022701	.039235	9258.06
UNE/emb_$	.0789448	.0218	3.62	0.000	.036226	.121663	.823789
Loop_$	-.0010749	.0212	-0.05	0.960	-.042627	.040478	18.2799
USF_$	-.0011623	.00109	-1.06	0.288	-.003304	.00098	3604.02
ror	.0012213	.00113	1.08	0.279	-.000989	.003432	.049072



Estimated broadband availability May 2004

Towns with 0 - 50 persons per square mile

Towns with 51 - 100 persons per square mile

Towns with greater than 100 persons per square mile

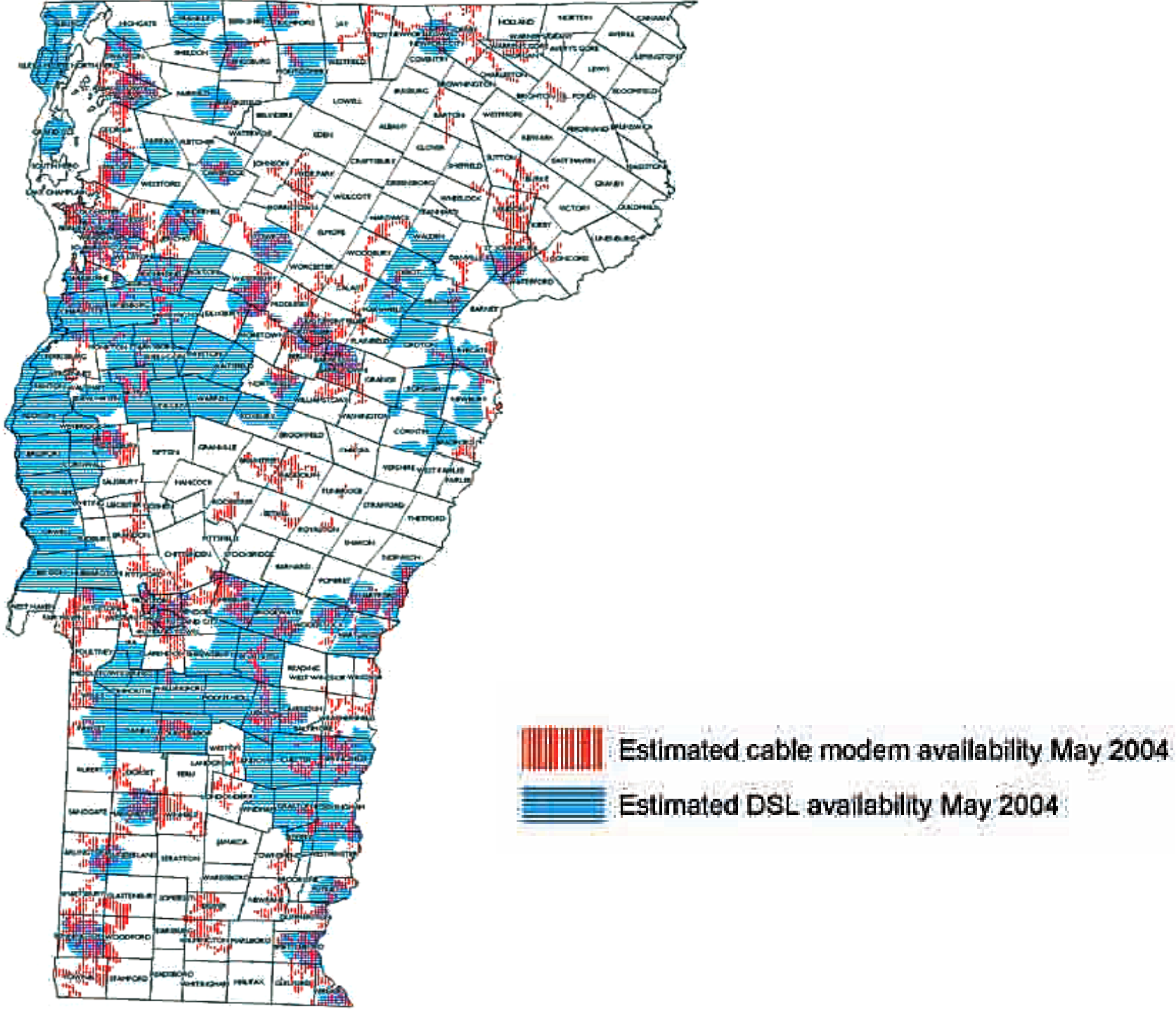

Estimated cable modem availability May 2004
Estimated DSL availability May 2004

Table 5 Percentage of E911 Points Within Reach of High-Speed Internet Access in Vermont Wire centers

	Rural Wirecenters		Non-Rural Wire	
	Verizon	Independent Telephone Companies	Verizon	Independent Telephone Companies
Only DSL available	6.30%	75.20%	17.00%	56.70%
Cable and DSL available	1.90%	8.90%	36.20%	35.20%
Only Cable Available	11.70%	1.10%	17.80%	2.30%
Neither available	80.00%	14.80%	29.10%	5.90%

Wirecenters designated rural for the purposes of this analysis were those Vermont wirecenters that had an E911 data point density of less than 22 E911 points per square mile.

Source: Analysis based on data provided by the Vermont Department Public Service (E911 data, DSL serving areas, and Cable Modem serving areas). Data from May 2004.

Table 6 Vermont Verizon vs. Independents Rural Service Territory

	DSL E911 Qualifying Points (DSL Supply)	Cable E911 Qualifying Points (Cable Supply)	E911 points per Square Mile (e11_sq_mile)	Average Household Income (medhhinc)	Number of Employees in Service Territory (employees)
Independents					
–average	830	99	15	40,443	455
Standard deviation	770	217	3	4,394	526
Verizon—					
average	106	167	15	35,825	653
Standard deviation	296	311	5	5,587	643
Total—					
average	398	139	15	37,704	572
Standard deviation	643	277	4	5,585	601

Table 7 Descriptive Statistics – Vermont Regression Analysis

Variable	Definition	Obs.	Mean	Std. Dev.	Min	Max
DSL Supply	number of E911 points where DSL available	62	398	643	0	4,184
Cable Supply	number of E911 points where cable modem available	62	139	277	0	1,233
e911_sq_mile	E911 points per square mile	62	1,145	841	86	4,287
medhhinc	median household income	59	37,704	5,585	26,677	49,685
employees	number of employees of firms or government agencies located in the wire center	59	572	601	21	2,687
pooling	value of 1 if participate in NECA switching cost pool	62	0.4	0.49	0	1
USF support	universal service monthly support (high cost model support)	62	6,807	8,243	0	34,294
adelphia	value of 1 if territory served by Adelphia, 0 otherwise	62	0.27	0.45	0	1
charter	value of 1 if territory served by Charter, 0 otherwise	62	0.13	0.34	0	1
vz_adelphia	value of 1 if territory served by Verizon and Adelphia, 0 otherwise	62	0.16	0.37	0	1
vz_charter	value of 1 if territory served by Verizon and Charter, 0 otherwise	62	0.06	0.25	0	1

Table 8 Factors Influencing the Supply of Broadband in Rural Areas of Vermont

	(1) DSL Supply	(2) Cable Supply	(3) DSL Supply	(4) Cable Supply
Cable supply	-0.038		-0.037	
	[0.223]		[0.693]	
e911_sq_mile	19.355*	3.993	21.431*	-3.175
	[10.031]	[6.475]	[12.051]	[6.320]
medhhinc	0.001	-0.004	-0.002	-0.001
	[0.008]	[0.006]	[0.008]	[0.005]
employees	0.081	0.111		
	[0.058]		[0.072]	
pooling	529.206*		541.737*	
	[118.345]		[139.035]	
USF support	-0.005		-0.001	
	[0.007]		[0.008]	
DSL supply		-0.150		-0.006
		[0.104]		[0.115]
adelphia		410.606*		183.651*
		[62.476]		[86.410]
charter		-26.396		-56.761
		[69.285]		[93.727]
vz_charter			-182.462	30.663
			[177.098]	[145.905]
vz_adelphia			-77.175	374.956*
			[421.829]	[117.301]
Constant	-197.765	155.399	-158.920	115.181
	[295.909]	[203.037]	[301.680]	[170.961]
Observations	59	59	59	59

Standard errors in brackets

* Statistically significant at the 5% level of significance

Table 9 Vermont Elasticities

Elasticities for Column 1 of Table 8

```
y  = Fitted values:  DSL (predict)
     =  347.28814
------------------------------------------------------------
            variable |       ey/ex                     X
---------------------+--------------------------------------
       cable_current |       -.014                129.763
        e911_sq_mile |       .844                 15.1455
            medhhinc |       .083                 37703.7
           employees |       .133                 572.456
             pooling |       .620                  .40678
         USF support |       -.096                6933.94
------------------------------------------------------------
```

Table 9 (continued) Vermont Elasticities

Elasticities for Column 3 of Table 8

```
y  = Fitted values:  DSL (predict)
             =  347.28814
```

variable	ey/ex	X
cable_current	-.014	129.763
e911_sq_mile	.935	15.1455
medhhinc	-.182	37703.7
employees	.184	572.456
pooling	.635	.40678
USF support	-.030	6933.94
vz_charter	-.0356198	.067797
vz_adelphia	-.0338984	.152542

Conclusion

- The FCC should use line qualification data as a metric to determine if a carrier qualifies for high-cost model support.
- This test would be methodologically consistent with the sizing of the fund.
- Pooling, a form of rate-of-return regulation, is providing significant implicit support for advanced services in rural areas served by Independents.

BROADBAND AND UNIVERSAL SERVICE[1]

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July 18, 2005

[1] This is a revised version of a paper initially presented at "The Future of Broadband: Wired and wireless,?", University of Florida, February 2005. This research was sponsored in part with a research grant from the Russell Sage Foundation.

Abstract

Section 254(b)(3) of the 1996 Telecommunications Act established the objective 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 whether people in rural areas have similar access due to the support provided through the Commission's new high cost fund. This paper focuses 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. The Act's objectives are apparently not being met in rural areas served by large companies since people living in these areas are much less likely to have qualified lines that could be used to access advanced telecommunications services. On the other hand, small companies are much closer to satisfying the statutory requirement as a result of the implicit support received through cost sharing.

Introduction

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 seven principles upon which policies for the preservation and advancement of universal service should be based. With the respect to the provision of advanced telecommunications services, Congress asked the Federal Communications Commission to adopt policies that promote "[a]ccess to advanced telecommunications and information services…in all regions of the Nation".[2] Congress added that access to advanced telecommunications and information services "in rural, insular, and high cost areas ... should … [be] 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".[3]

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

[2] 47 U.S.C. §254(b)(2)

[3] 47 U.S.C. §254(b)(3)

4. Bringing the benefits of competition to as many consumers as possible.[4]

The Commission was required to turn these principles into a list of services that would receive support. Somewhat surprisingly, the list excluded advanced services.[5] The law enables the Commission to promote access to advanced services, but it does not require that advanced services are a supported service.

High-speed access to the Internet, a form of advanced telecommunications service, is provided by telephone companies using digital subscribe line (DSL) technology. Although DSL is not a supported service, the Commission does provide support for the cost of a network that could provide DSL service or other advanced services. 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.[6] 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.

Section 254(b)(3) states that rural areas should have access to advanced telecommunications and information services that is comparable to what is available in urban areas. Many organizations and studies have expressed their concern that rural and high-cost areas do not have equal access to advanced telecommunications services.[7] Hence, the purpose of this paper is to test if universal service funds make a statistically significant difference in the provision of qualified (capable) DSL lines. Specifically, I test to see if the federal support raises the likelihood that a line is capable of providing DSL service after accounting for relevant economic, demographic, and

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[4] Before The Federal Communications Commission, In The Matter Of Federal-State Joint Board On Universal Service, CC Docket No. 96-45 Universal Service, Report And Order, Adopted: May 7, 1997, Released: May 8, 1997 at ¶2.

[5] Id pars. 61-87

[6] "The loop design incorporated into a forward-looking economic cost study or model should not impede the provision of advanced services. For example, loading coils should not be used because they impede the provision of advanced services [footnote omitted]." Id. at ¶Par. 250.

Furthermore, the Commission uses a forward-looking cost model to identify the cost of serving high-cost areas. The cost model presumes that on a forward-looking basis a supplier will use the GR-303 digital line hardware. *Federal-State Joint Board on Universal Service,* CC Docket No. 96-45, Tenth Report and Order, 14 FCC Rcd 20156 (USF Inputs Order) at footnote 593. The GR-303 platform is compatible with both voice and DSL service. http://www.telcordia.com/services/testing/integrated-access/gr/gr303/

[7] See, for example, United States Department of Commerce, *A Nation Online: How American Are Expanding Their Use of the Interne (2002)t,* p. 36.

regulatory variables. I focus on the provision of DSL via the telephone network because in many rural areas, telephone companies, rather than cable carriers, are more likely to provide high-speed access to the Internet. Cable companies often do not serve rural areas due to the economies of scale associated with building a cable network[8] and because there is no mechanism for the federal or state government to subsidize the provision of advanced telecommunications services via cable.

Before turning to my statistical test of the effectiveness of the Universal Service Fund (USF) program, I first provide a brief review of how the USF operates.

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;
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.[9] The Commission declined proposals to include the provision of high-speed access to the Internet as a supported service. It noted that supporting high-speed access to the Internet could significantly increase the size of the universal service fund[10] and was not *"`essential* to education, public health, or public safety'

[8] See, for example, *Investigation into Petitions for Modification of Certificate of Public Good Obligations of Adelphia Cable Communications,* Vermont Public Service Board, Docket No. 6778, April 11, 2003, http://www.state.vt.us/psb/orders/2003/files/6778fnl.pdf.

[9] 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.

[10] Id par. 64

as set forth in section 254(c)(1)(A). [footnote omitted]" It suggested that high-speed access to the Internet would be more likely to qualify for support when it was subscribed to by a majority of residential customers. Add footnote Id. par. 83. But, as noted above, while declining to include high-speed access as a supported service, the Commission nonetheless established a mechanism that supports the provision of the more expensive data services, along with voice products, rather than one that is only used for voice services.

High-Cost Support

The Commission has established four types of Universal Service Support funds: (i) low-income, (ii) high-cost, (iii) schools and libraries, and (iv) rural health care support.[11] Only high cost support is addressed in this paper. According to the Commission:

> 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.[12]

There are seven types of high cost support mechanisms.[13] Most are based on the recovery of embedded costs (Items 1, 4, 5, 6, and 7 in footnote 13 below). Safety Net

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[11] http://www.fcc.gov/cgb/consumerfacts/universalservice.html

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

[13] 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"[13]

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.[13]

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.[13]

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 comparatively large geographic areas.

§254(e) of the Federal Telecommunications Act states that in order 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.[14] Congress also recognized 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."[15] The next section will talk about the

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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.[13]

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.[13]

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.[13]

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.[13]

[14] See, also, 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, 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.

[15] 47 U.S.C. § 254(e).

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 because 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.[16]

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 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.[footnote omitted] As we 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).[17]

However, the Commission also recognized that some state commissions, Wisconsin for example, lack the direct regulatory oversight necessary to ensure that federal support is

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[16] 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.

[17] 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.

reflected in intrastate rates. For instances such as these, the Commission asserted "…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."[18] 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 the Universal Service Administrative Company (USAC) that administers the Universal Service Fund.[19]

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"[20] nor did it intend to impose "…elaborate rules for compliance with section 254(e)."[21] 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)".[22] In this vein, the Commission went on to opine that:

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[18] 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.

[19] 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 ¶12)

[20] 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.

[21] Id.

[22] Id.

> …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.[23]

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".[24] 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."[25] The Commission intends to use this annual comparison to "…determine whether federal and state universal service mechanisms are resulting in reasonably comparable rural and urban rates as competition develops and erodes implicit support mechanisms".[26]

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. Furthermore, a state has little incentive to submit a finding of non-compliance since such a submission could lead to a reduction in the federal support provided to the state.

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[23] Id. at ¶96.

[24] 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.

[25] 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 Commission's order contained a similar finding.

[26] Id.

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.[27] 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.[28] 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".[29] 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".[30] This test naturally follows from the Commission's criterion that a forward-looking economic cost model should reflect a loop topology that "should not impede the provision of advanced services."[31]

Regression analysis allows me to compare two wire centers that are equivalent in all respects, with the exception that one receives support (because it is in a state that qualifies for USF support) and the other does not (because it is in a state that does not qualify for USF support), and to test if the wire center in the qualifying state was more likely to have more qualified lines. For example, suppose that Massachusetts is a low-cost state with an average cost less than the 135% national benchmark average for determining universal service support. No wire centers in Massachusetts would receive support because of the state's low average cost. On the other hand, assume that

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

[28] 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.

[29] ' 54.313(a)

[30] 9th Supp. Order at ¶96.

[31] 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.

Vermont's average cost exceeds the 135% benchmark. All wire centers in Vermont whose average cost exceeds the 135% would receive support according to the USF guidelines. In Massachusetts, however, there could be a high cost wire center whose cost exceeds the 135% national benchmark, but since the state average is less than the 135% benchmark, the high cost wire center would not receive any support even though its cost structure could be identical to one in Vermont. The wire center in Vermont should have more DSL qualified lines than an office in Massachusetts if the funds are being used to provide equal access to advanced telecommunications services.

Empirical Analysis of Qualified DSL Lines

The dependent variable in the regression analysis is the number of Verizon East[32] 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.[33] 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.

The Commission's mechanism for determining USF support is based on its economic cost model. The model determines the costs that an efficient competitive firm would incur to serve each wire center in its area of service. Based on the model results, the mechanism determines the national average cost per line, a benchmark that is 135% of the national average cost per line, and a state average cost per line. Where the state average cost is greater than the benchmark, non-rural carriers in these states are eligible for USF support, and the USF mechanism funds all costs in excess of the benchmark[34].

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[32] Verizon East is composed of operating companies that were previously owned by NYNEX and Bell Atlantic. Prior to their merger with GTE, these companies provided service in the District of Columbia, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, West Virginia, and Connecticut.

[33] 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.

[34] Petitions for Review of an Order of The Federal Communications Commission (Case Nos. 96-45 and 03-249), United States Court Of Appeals for the 10th Circuit, February 23rd, 2005, Page 7.

> The FCC further conditioned support on state certification that an eligible non-rural carrier would use the federal funds in compliance with 47 U.S.C. § 254(e) (mandating that federal funds only be used "for the provision, maintenance, and upgrading of facilities and services for which the support is intended").

The variation in the number of qualified access lines is explained 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). It is expected that the coefficients of both of these variables will 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[35] and therefore should be positively correlated with loops not being impeded by either load coils or legacy digital carrier systems.[36]

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, 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.[37] 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.[38] Business such as finance, real estate, and information technology have roughly twice as much broadband access per employee,[39] but these sorts of services tend to be concentrated in urban and

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[35] 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.

[36] 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 expensive additional equipment for private line data services.

[37] 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.

[38] Legg Mason, Page 163.

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

suburban areas whereas small retail services comprise as much as 30% of all business in rural areas.[40] 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,[41] 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".[42]

The variable Loop_$ 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 lengths at each wire center, I use the statewide average embedded cost of the loop.[43]

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 on the basis that the consumption of communications products is generally believed to be that of a normal good.[44] Since data on household wealth is not available, the median value of housing for homes located in the wire center as a proxy for wealth.

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.[45] This follows from the proposition that businesses have a strong commercial need for high-speed data services[46] and therefore the supplier will likely take this into account when

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[40] Legg Mason, Pages 164-165.

[41] Duffy-Deno, Page 366.

[42] Legg Mason, Page 170.

[43] I have also used HCPM wire center loop cost estimates as a proxy for loop length. The qualitative results reported on tables Table 3 and Table 4 did not change when I used this alternative explanatory variable.

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

[45] This hypothesis is consistent with Lestor Taylor's finding that 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.

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

deciding where it should upgrade its infrastructure for the provision of advanced telecommunications services.[47]

Regulatory Environments

The model includes 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, a dummy variable controls for either price cap or rate-of-return state regulation.[48] There is no need to control for the form of federal regulation because all of the Verizon operating companies included in the sample are regulated via price caps at the federal jurisdictional level.

The 1996 Act requires non-rural incumbent local exchange carriers to provide unbundled network elements[49] (UNEs) at cost to their competitors.[50] Access to

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[47] 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.

[48] 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 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.

[49] “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

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.[51]

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. [52] 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. The Court went on to note that State's may select rates on the lower end of reasonableness in order to promote competition.[53]

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.[54] Some Wall Street analysts have downgraded their ratings of RBOC stocks based on the lost profits associated with UNE rates.[55] This, in turn, raises the cost to the RBOC of raising funds for new investments.

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telecommunications service." 47 U.S.C. '153(29).

[50] 47 U.S.C. ' 252(d)(1)(A).

[51] 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.

[52] 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

[53] 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.

[54] 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.

[55] 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

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.[56] 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, the model includes an explanatory variable for 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. 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 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 indicate that all else equal, a qualified line is more likely to be found in a densely

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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.

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

populated or within a metropolitan statistical area, rather than in a low density or rural market. The econometric results also suggest that the quarterly USF payments have no statistically significant effect on the likelihood that a line is qualified. Together these parameter estimates suggest that the Commission is failing to achieve the Congressional goal that access to advanced telecommunications and information services "in rural, insular, and high cost areas ... should … [be] reasonably comparable to those services provided in urban areas…"[57] Money is being distributed, to at least one company, Verizon, with there being no indication that the money is being used in a manner consistent with the principles established in §254(b)(2) and §254(b)(3).[58]

The sign of the other coefficient estimates are largely consistent with 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. 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.

The results reported in Table 3 and Table 4 are arguably econometrically biased due to the absence of any control for the degree of competition. I suspect that this may not be a serious problem because density has been included in the model specification and density is a good proxy for the likelihood of a competitor. In the next section of the paper, I show that my findings regarding the ineffectiveness of the high-cost support in promoting access to advanced telecommunications services is invariant to including the presence of a competitor as an explanatory variable. Unlike the results reported in the first half of the paper, the following results are based upon an analysis of data from one state—Vermont.

The Impact of Rivalry Between Cable and Telephone Suppliers on the Availability of Broadband

Vermont law directs the Vermont Public Service Commission (VPSC) to write a report on the status of the state's telecommunications market every four years. In the process

[57] 47 U.S.C. §254(b)(3)

[58] I hypothesize that the results from the Verizon service territory are not an aberration. The Commission is distributing the money to all firms without any meaningful mechanism to validate that the funds are being used in a manner consistent with the goals of §254.

[59] A regression that was run without the income variable, medhhinc, showed that 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.

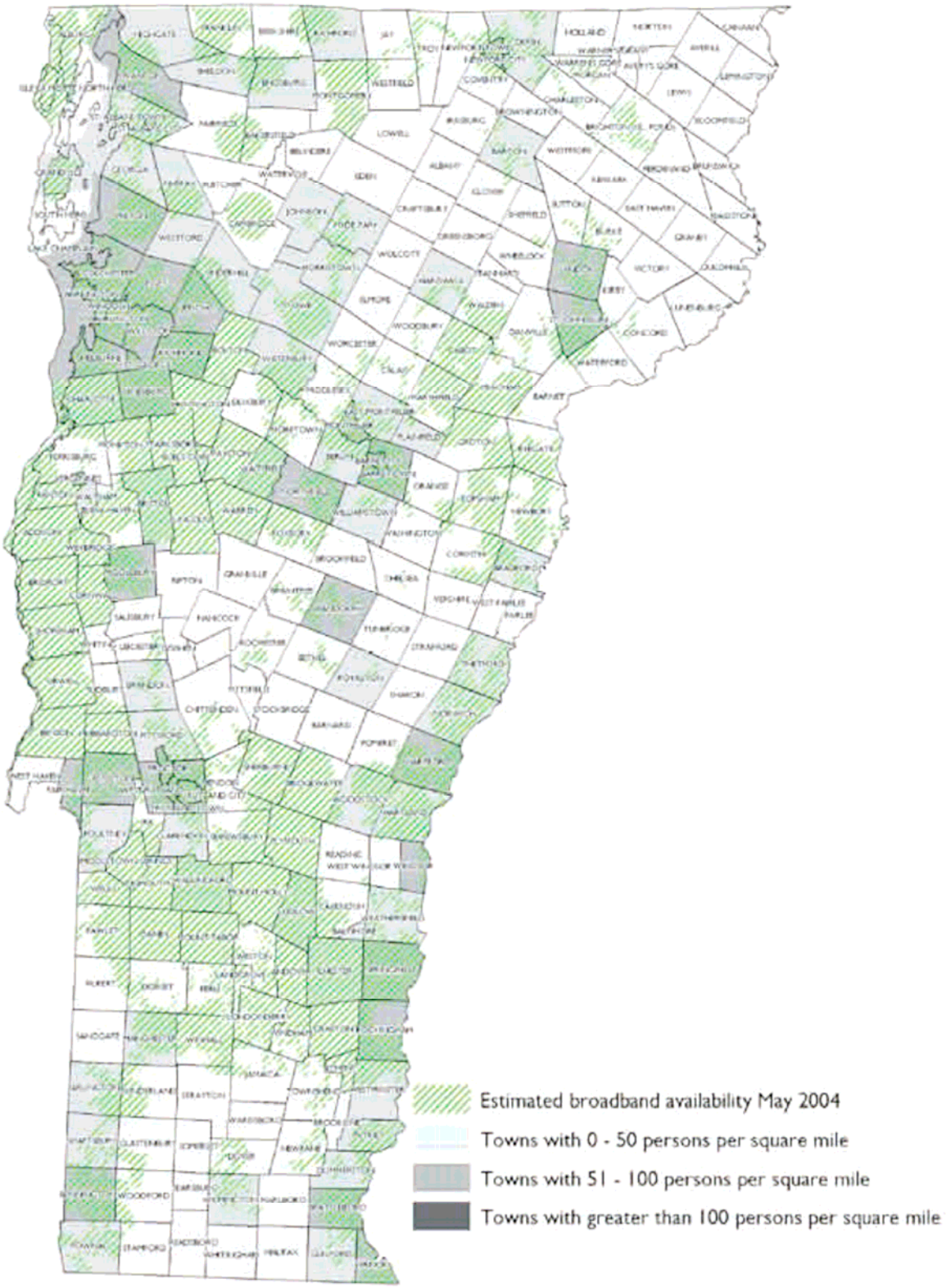
of preparing the 2004 edition of the report, the authors collected an enormous amount of information regarding the degree to which different localities have access to broadband via cable modem or digital subscriber line (DSL) service.[60] In this second data set, a subscriber has access to DSL service if the line in capable of providing service and a CLEC or ILEC has a DSLAM in the customer's central office. In the regression discussed in the first half of this paper I only considered if a line was qualified and I did not control for the presence of a DSLAM in the central office.[61]

As shown on the following map, broadband availability varies greatly throughout the state. While it is not surprising that the service is available in the state's largest city, Burlington, it is striking how many rural areas where the service is available. For example, broadband is widely available in the west-central portion of the state surrounding Shoreham.[62]

[60] Vermont Department of Public Service, Vermont Telecommunications Plan, September 2004.

[61] In this second data set a DSL enabled line must be line qualified and be served through an office that has a DSLAM. In the first data set my dependent variable was the number of lines in a wire center that had the potential to provide DSL service regardless if a supplier had placed a DSLAM in the central office.

[62] Id., p. 3-9.


Estimated broadband availability May 2004
Towns with 0 - 50 persons per square mile
Towns with 51 - 100 persons per square mile
Towns with greater than 100 persons per square mile

The Vermont Department of Public Service (VDPS) also reports that while there are some areas served by both cable and DSL providers, a significant number of areas are served by only one of these technologies. The following map shows that while some areas have access to both DSL and cable service, most of the territory is served by only one of the two technologies.[63]

[63] Id. p. 3-7.

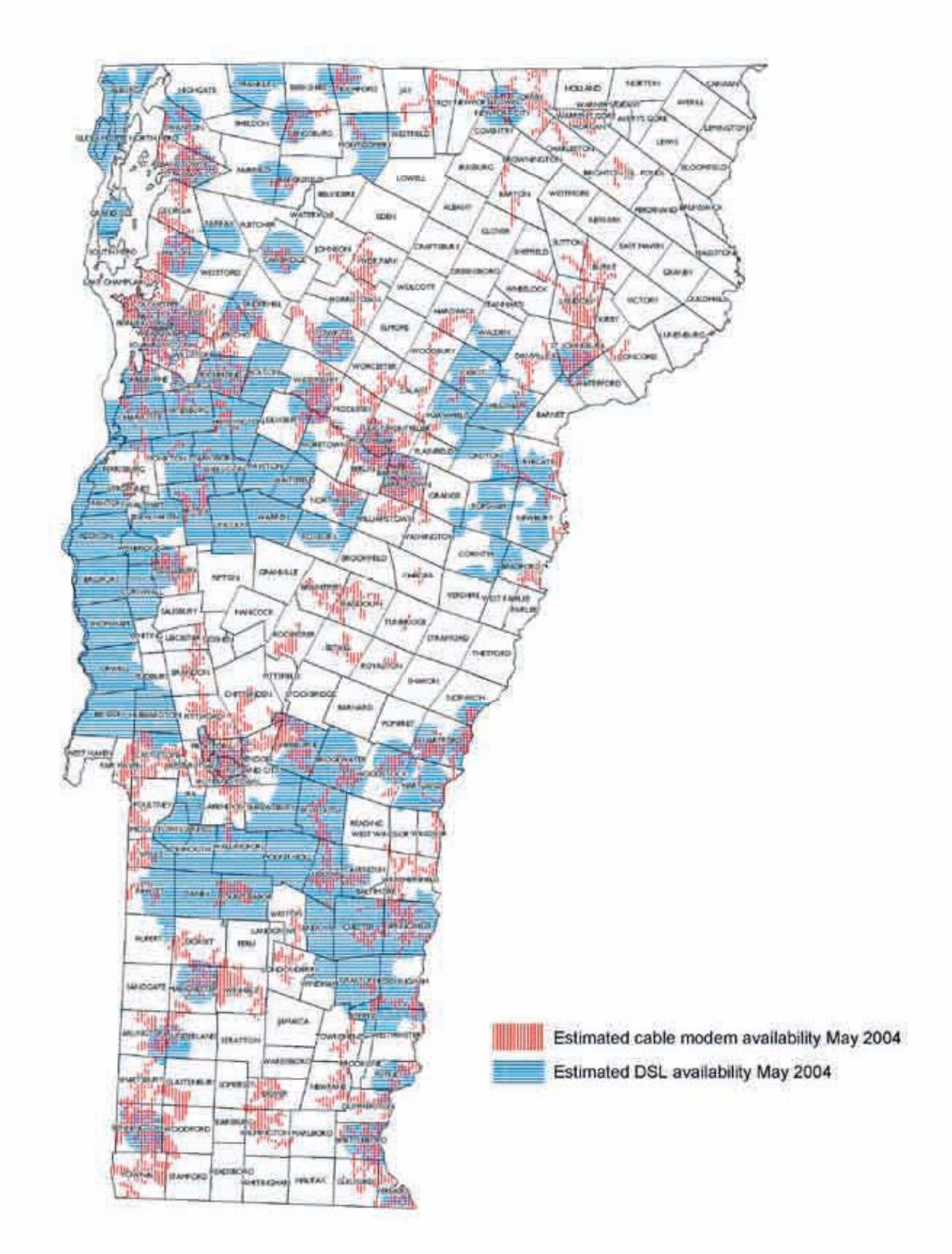

Estimated cable modem availability May 2004
Estimated DSL availability May 2004

Table 5 provides descriptive statistics regarding the availability of broadband service in Vermont. Not surprisingly, high-speed access is more likely to be available in non-rural areas. For example, in the Verizon service territory, 71% and 20% of the company's non-rural and rural customers, respectively, may obtain either DSL or cable modem service. Presumably, Verizon gives less attention to the rural areas of its service territory because these are less profitable. Verizon's fiduciary responsibility to its shareholders requires it to focus on the company's most important, that is, urban, markets. Moreover, financial markets would likely not look favorably on RBOCs such as Verizon pushing for expansion in rural markets. Historically the financial community believes that rural service is not economical for RBOCS such as Verizon.[64] High-speed services in rural areas do not benefit from the same economies of scale as similar services offered in urban areas.

The geographic variation in high-speed access is not so striking in the area served by the Independent telephone companies. 94% of the Independents' non-rural customers may obtain high-speed access, while the value is only nine percentage points lower in rural areas.

Table 5 also shows that customers in rural communities served by an Independent telephone company are four times more likely to have available high speed access to the Internet than subscribers served by Verizon. This difference is due to the widespread availability of DSL in the Independents' service territory.

The higher rate of availability in the Independents' territory may be due to the fact that the rural companies qualify for federal support that is not available to Verizon. The support comes in two forms; (I) rural operators may qualify for low cost loans from the Rural Utility Service (RUS)[65] of the Department of Agriculture; and (ii) the National Exchange Carrier Association (NECA) pooling arrangements essentially provide a 11.25% return on the DSL investments. Secondly, Verizon's cost structure for serving rural markets may be higher than the Independent's cost structure. For example, Verizon may be using engineering practices that are appropriate when judged in terms of the corporation, but might not be optimal for a particular market. When providing DSL service, it might require DS3 transport speed or higher, even though the DS1 speed may be sufficient for rural areas. There is a long history in the United States of the Independents finding it profitable to serve rural markets that were ignored by the RBOCs.[66]

The difference in high-speed access between the Verizon and Independents' territory cannot be explained by traditional economic variables. As shown in Table 6, the market

[64] See Legg Mason, Pages 7, 13, 21, 22, 25 for a discussion of issues presented in this paragraph.

[65] Since 1995 every telephone line constructed with RUS financing has been capable of providing broadband service with DSL technology, http://www.usda.gov/rus/telecom

[66] David Gabel, "Competition in a Network Industry: The Telephone Industry, 1894-1910," Journal of Economic History, Volume 54, September 1994, Pages 543-572.

conditions in the companies' service territories are quite similar. The number of E911 points per square mile is about equal and the difference in household income in not statistically different at a standard level of significance.

Empirical Analysis of Provision of Cable and DSL Services Model Description

In this section of the paper, I estimate the factors that influence the rollout of cable modem and DSL services in rural areas of Vermont. The variables are defined on Table 7. I allow for the possibility that the provision of one technology affects the deployment decisions of the suppliers of the competing technology. This is done by assuming that the decision to deploy DSL is affected by the availability of cable modem service. Conversely, I assume that the deployment of cable modem service is affected by the availability of DSL service.

The econometric specification includes corporate ownership variables for the cable companies.[67] Conceivably a large multiple system operator (MSO) will find it easier to manage the adoption of the technology associated with cable modem service and therefore their deployment decision will differ from that of smaller companies. On the other hand, the two large MSO that operate in Vermont, Charter and Adelphia, have experienced financial problems[68] and therefore may not be early adopters of the technology.

Since Verizon, Adelphia, and Charter operate in multiple states, I include an alternative specification (columns 3 and 4) of Table 7 that reflects the possibility that multimarket conduct affects the firms' supply decisions. For example, a multi-market firm may make strategic investments in order to signal non-cooperative behavior. By establishing a reputation as an aggressive incumbent, further entry is deterred.[69]

Two regulatory variables are included in the DSL supply equation. First, I include the amount of wire-center targeted high-cost model support. High-cost model support is available to large companies and the amount of support is determined using a forward-looking cost model. The forward-looking cost model was designed to reflect the engineering requirements associated with the provision of advanced telecommunications services.

Smaller carriers receive high-cost support based on the extent to which their reported average embedded costs exceed nationwide benchmarks.[70] The amount of support is

[67] I have not included a dummy variable for Verizon in the DSL supply equation because the term would be collinear with the other explanatory variables.

[68] UBS Investment Research, "Cable Telephony Primer", September 15, 2003, p.4.

[69] Reinhard Selten, "Chain Store Paradox," Theory and Decision 9 (April 1978), p.127-59

[70] See, for example, 47 C.F.R. §§ 36.601-36.631.

not dependent on providing access to advance telecommunications services. One form of support, the safety net additive, is provided to firms who increase their per loop telephone plant in service by over 14% in one year. The Vermont companies are not withdrawing money from this fund.[71]

The second regulatory variable is if the company participates in the NECA traffic sensitive cost pool. Cost pooling is a form of rate-of-return regulation that essentially provides a return of 11.25% on any investment made in packet switching. The small carriers contend that rate-of-return regulation has "provided rural residents access to telecommunications services that are reasonably comparable to those provided in urban areas."[72] They add that their rural customers have access to DSL that is comparable to what is available to urban subscribers.[73]

I have included the median household income level in both the cable and DSL supply curve. The number of people working for firms located in the market is only included in the DSL market since cable is generally not available in the business market.

Results

The parameter estimates from the regression appear in Table 7, while the elasticity estimates appear in Table 9.

The parameter estimates suggest that in general the decision to supply a broadband technology in a rural area is independent of the presence of the potentially competing technology or household income. This result may be attributable to the economics of serving rural markets. In general, the cable and the telephone companies appear to feel that the expense of serving a low-density market trumps any strategic advantage of pre-empting a rival in the provision of high-speed access to the Internet. This result is consistent with the descriptive statistics that appear in Table 5 that shows that cables companies supply only slightly less of the market in the Independents territory despite the smaller companies having more widely deployed DSL service by a factor of ten relative to Verizon.

Neither does USF support affect the provision of DSL. This result is consistent with the parameter estimates provided in Table 3.

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[71] http://www.universalservice.org/overview/filings/2005/Q1/HC06%20-%20Safety%20Net%20Additive%20Support%20-%201Q2005.xls,and http://www.universalservice.org/overview/filings/2004/Q1/HC06%20-%20Safety%20Net%20Additive%20Support%20-%201Q2004.xls

[72] The Oklahoma Rural Telephone Companies, *In the Matter of Elimination of Rate-of-Return Regulation of Incumbent Local Exchange Carriers,* RM-10822, CC Docket No. 96-45, January 16, 2004, p.2.

[73] Id., p. 9. See, also, in the same docket, Reply Comments of the Ad Hoc Telecommunications Users Committee, pp. 3-4, February 13, 2004, citing the submissions of TCA, Inc. and the South Dakota Telecommunications Association.

The two primary determinants of DSL supply are density and pooling. The key driver for the provision of cable modem service is corporate ownership. Adelphia is more likely to offer cable modem service than other companies. As shown under column heading four, this is especially true in areas where Adelphia and Verizon serve the same community.

Prior Studies on the Effectiveness of the Universal Service Program

The regression results discussed above suggest that the USF money is not being used to effectively achieve the advanced telecommunications goals of the Act. This finding is consistent with the other literature that has addressed the effectiveness of the USF program.

Gregory Rosston and Bradley Wimmer[74] 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".[75] 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, this paper examines the 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.[76] Moreover, cost-based programs poorly target subsidies to low-income households.[77]

John Shuler[78] 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 that collects funds from interstate telecommunication service providers, and then

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

[75] Id. Page 266.

[76] Id. Page 261.

[77] Id. Page 264.

[78] 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.

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.[79]

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.

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. This is clearly contrary to the objectives of Section 254(b)(5) which states: "There should be specific, predictable and sufficient Federal and State mechanisms to preserve and advance universal service". Clearly, without a mechanism for ensuring if the funds are being used in the method desired by Congress it is not possible to determine if the money is being used to advance universal service. My findings indicate that the high cost fund has no positive effect on the provision of advanced telecommunication

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[79] Id. Page 366.

This argument is further supported by a recent study of the Government Accounting Office (GAO) which found that even though $13 billion in funding has been committed to the E-Rate program over the past seven years, the Commission did not develop useful performance goals and measures for assessing and managing the E-rate program, and that its oversight mechanisms are not fully effective in managing the E-rate program.

> FCC has not done enough to proactively manage and provide a framework of government accountability for the multibillion-dollar E-rate program. FCC established an unusual structure for the E-rate program but has never conducted a comprehensive assessment of which federal requirements, FCC has not developed specific and meaningful goals and measures to assess the impact of E-rate funding, address mission critical management problems, and establish the direction of the program as schools and libraries move beyond initial Internet connectivity to long-term maintenance concerns. Combined with the weaknesses in FCC's oversight mechanisms, these problems create barriers to enforcement, uncertainty about what the program's requirements really are, and questions about the soundness of the program's structure and accountability amid recent cases of fraud, waste, and abuse.

United States Government Accountability Office Report to the Chairman, Committee on Energy and Commerce, House of Representatives Telecommunications: Greater Involvement Needed by FCC in the Management and Oversight of the E-Rate Program, February 2005, Pages i, 36-37. http://www.gao.gov/new.items/d05151.pdf

services, and this is consistent with earlier research findings that money is handed out, but there is no mechanism for assessing performance.

The Commission would find it easy to implement an effective assessment program. The ILECs already possess information on the number of DSL qualified loops for each of their wire centers.[80] If the Commission obtained the data, which is already made available to the ILECs' competitors, the agency could test to see if the universal service fund has a statistically and economically significant impact on reducing the disparity in access that exists in rural areas relative to what is available elsewhere. Pursuant to §254(E) the distribution of funds should be contingent on a showing that the funds are being used to provide rural, insular, and high-cost areas with equal access to advanced telecommunications services. This is a reasonable requirement since the sizing of the fund reflects the cost of providing advanced telecommunications services.

Other policy options are less attractive. While pooling has had a demonstrable positive affect on the rollout of advanced telecommunications services in areas served by Independent telephone companies, I am reluctant to see the RBOCs return to rate-of-return regulation. The RBOCs are extending their product offerings to entertainment services and therefore we do not want to create an opportunity whereby they could subsidize their entertainment products with funds obtained from the cost pool. This is a market that is being well served by other modes, such as satellite, and therefore there is no need to provide a subsidy to the RBOCs' entertainment rollouts.

As previously stated, the size of the fund is designed to reflect the cost of providing advanced telecommunications services. The Commission could reduce the amount of support to reflect that today only voice services are supported services. I do not favor this option because of Congress's clear preference that the Commission takes actions to promote advanced telecommunications services.[81] The reduction in funding would not stimulate the rollout of advanced telecommunications services in rural markets.

Another possibility is to maintain the *status quo*. This is not an acceptable option because, as shown in Table 5, large companies appear to be not providing rural customers equal access to advanced telecommunications services. Whereas the fund was created to obtain the objectives of the Act, the Commission should take actions to insure that the funds are appropriately used in the future.

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[80] Application of Verizon New England Inc., Bell Atlantic Communications, Inc. (d/b/a Verizon Long Distance), NYNEX Long Distance Company (d/b/a Verizon Enterprise Solutions) and Verizon Global Networks Inc. for Authorization to Provide In-Region, InterLATA Services in Massachusetts, 16 FCC Rcd 8988, 9013, par. 50 (2001).

[81] Section 706 of the 1996 Act.

Table 1

Descriptive Statistics and Definitions of Variables

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
Qualified_access	DSL qualified loops in wire center	2343	11,378	16,305	85	146,490
Access_lines	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	Median household income	2343	48,221	18,930	14,423	157,679
medhval	Medium housing value	2343	135,537	85,454	0	737,206
Rural_pop	Persons in rural area	2262	3,907	4,223	0	38,962
employees	Number of employees of firms or government agencies located in the wire center	2343	9,650	16,919	0	288,502
UNE/emb_$	Ratio of UNE loop price to embedded cost of loop	2341	.8230034	.1518646	.589839	1.371827
Loop_$	Embedded cost of loop	2341	18.2845	3.019996	7.88	25.24
USF_$	Universal service quarterly payment (high cost model support)	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	Qualified_access	Access_lines	msa	density	medhhinc	medhval	Rural_pop	employees	UNE_emb_$	USF_$	
Qualified_access	1										
Access_lines	0.98	1									
Msa	0.39	0.39	1								
Density	0.66	0.62	0.19	1							
Medhhinc	0.18	0.21	0.45	-0.01	1						
Medhval	0.26	0.27	0.34	0.09	0.84	1					
Rural_pop	-0.21	-0.15	-0.07	-0.22	-0.07	-0.13	1				
Employees	0.80	0.81	0.32	0.45	0.21	0.22	-0.15	1			
UNE_emb_$	-0.12	-0.13	-0.04	-0.07	-0.03	0.09	0.02	-0.07	1		
USF_$	-0.15	-0.15	-0.27	-0.07	-0.22	-0.18	0.05	-0.12	0.10	1	
Ror	-0.11	-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
				R-squared =	0.9881
Total	8.3963e+11	2262	371190304	Adj R-squared =	0.9880
				Root MSE =	2113.1

qualified_access	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
access_lines	.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
rural_pop	-.1995926	.0112056	-17.81	0.000	-.2215671	-.177618
employees	.036999	.0050369	7.35	0.000	.0271215	.0468765
UNE_emb_$	1059.988	292.9244	3.62	0.000	485.5557	1634.42
Loop_$	-.6503927	12.82802	-0.05	0.960	-25.80645	24.50567
USF_$	-.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
access_lines	.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
rural_pop	-.0705012	.00397	-17.76	0.000	-.078282	-.062721	3907.02
employees	.0309682	.00422	7.34	0.000	.022701	.039235	9258.06
UNE/emb_$	.0789448	.0218	3.62	0.000	.036226	.121663	.823789
Loop_$	-.0010749	.0212	-0.05	0.960	-.042627	.040478	18.2799
USF_$	-.0011623	.00109	-1.06	0.288	-.003304	.00098	3604.02
ror	.0012213	.00113	1.08	0.279	-.000989	.003432	.049072

Table 6

Vermont Descriptive Statistics – Verizon versus Independents Service Territory

	DSL E911 Qualifying Points (DSL Supply)	Cable E911 Qualifying Points (Cable Supply)	E911 points per Square Mile (e11_sq_mile)	Average Household Income (medhhinc)	Number of Employees in Service Territory (employees)
Independents –average	830	99	15	40,443	455
Standard deviation	770	217	3	4,394	526
Verizon— average	106	167	15	35,825	653
Standard deviation	296	311	5	5,587	643
Total— average	398	139	15	37,704	572
Standard deviation	643	277	4	5,585	601

Table 7

Descriptive Statistics – Vermont Regression Analysis

Variable	Definition	Obs.	Mean	Std. Dev.	Min	Max
DSL Supply	number of E911 points where DSL available	62	398	643	0	4,184
Cable Supply	number of E911 points where cable modem available	62	139	277	0	1,233
e911_sq_mile	E911 points per square mile	62	1,145	841	86	4,287
medhhinc	median household income	59	37,704	5,585	26,677	49,685
employees	number of employees of firms or government agencies located in the wire center	59	572	601	21	2,687
pooling	value of 1 if participate in NECA switching cost pool	62	0.40	0.49	0	1
USF support	universal service monthly support (high cost model support)	62	6,807	8,243	0	34,294
adelphia	value of 1 if territory served by Adelphia, 0 otherwise	62	0.27	0.45	0	1
charter	value of 1 if territory served by Charter, 0 otherwise	62	0.13	0.34	0	1
vz_adelphia	value of 1 if territory served by Verizon and Adelphia, 0 otherwise	62	0.16	0.37	0	1
vz_charter	value of 1 if territory served by Verizon and Charter, 0 otherwise	62	0.06	0.25	0	1

Table 8

Factors Influencing the Supply of Broadband in Rural Areas of Vermont

	(1)	(2)	(3)	(4)
	DSL Supply	Cable Supply	DSL Supply	Cable Supply
Cable supply	-0.038		-0.037	
	[0.223]		[0.693]	
e911_sq_mile	19.355*	3.993	21.431*	-3.175
	[10.031]	[6.475]	[12.051]	[6.320]
medhhinc	0.001	-0.004	-0.002	-0.001
	[0.008]	[0.006]	[0.008]	[0.005]
employees	0.081	0.111		
	[0.058]		[0.072]	
pooling	529.206*		541.737*	
	[118.345]		[139.035]	
USF support	-0.005		-0.001	
	[0.007]		[0.008]	
DSL supply		-0.150		-0.006
		[0.104]		[0.115]
adelphia		410.606*		183.651*
		[62.476]		[86.410]
charter		-26.396		-56.761
		[69.285]		[93.727]
vz_charter			-182.462	30.663
			[177.098]	[145.905]
vz_adelphia			-77.175	374.956*
			[421.829]	[117.301]
Constant	-197.765	155.399	-158.920	115.181
	[295.909]	[203.037]	[301.680]	[170.961]
Observations	59	59	59	59

Standard errors in brackets

* Statistically significant at the 5% level of significance.

Table 9

Vermont Elasticities

Elasticities for Column 1 of Table 8

```
      y  = Fitted values:  DSL (predict)
         =  347.28814
------------------------------------------------------------------------------
                      variable |          ey/ex                  X
-------------------------------+----------------------------------------------
                  cable_current |        -.014               129.763
                   e911_sq_mile |        .844                15.1455
            medhhinc            |        .083                37703.7
                employees       |        .133                572.456
                         pooling |        .620                 .40678
USF support                     |        -.096               6933.94
------------------------------------------------------------------------------
```

Elasticities for Column 3 of Table 8

```
      y  = Fitted values:  DSL (predict)
         =  347.28814
------------------------------------------------------------------------------
                      variable |          ey/ex                  X
-------------------------------+----------------------------------------------
                  cable_current |       -.014               129.763
                   e911_sq_mile |        .935                15.1455
            medhhinc            |       -.182               37703.7
                employees       |        .184               572.456
                         pooling |        .635                 .40678
               USF support      |       -.030               6933.94
                     vz_charter |       -.0356198           .067797
                    vz_adelphia |       -.0338984           .152542
------------------------------------------------------------------------------
```