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What is the Price of Universal Service? Impact of Deaveraging Nationwide Urban/Rural Rates

July 26, 1993

Presentation at the July 1993 NARUC Meeting, San Francisco, CA

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Project Information

Telecommunications Industries Analysis Project:
What is the Price of Universal Service?
Impact of Deaveraging Nationwide Urban/Rural Rates

Carol Weinhaus, Sandra Makeeff, Peter Copeland et al.
July 25, 1993.

The Telecommunications Industries Analysis Project is associated with the Center for Telecommunications Management at the University of Southern California School of Business Administration.

For information on this research, contact Carol Weinhaus at:
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List of Participants in the Telecommunications Industries Analysis Project, 1993

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State Regulators	NARUC representatives from: Iowa Utilities Board New York Public Service Commission Washington Transportation Commission
Regional Holding Companies	Ameritech Bell Atlantic BellSouth NYNEX Pacific Telesis Southwestern Bell U S WEST
Large Independents	GTE Sprint Local Telecom Division Anchorage Telephone Utility
Small Telephone Company Representative	OPASTCO NTCA
Interexchange Carrier	AT&T Sprint
Cable Television	Tele-Communications, Inc.
Foreign Domestic	NTT America
Switch Manufacturers	Northern Telecom
Materials Manufacturers	Corning
Center for Telecommunications Management, University of Southern California	

Assisting with *public* data:

Federal Communications Commission
National Exchange Carrier Association

List of Figures

List of Acronyms

ARMIS	Automated Reporting Management Information System
CAP	Competitive Access Provider
CATV	Cable Television
DEM	Dial Equipment Minutes
EUCL	End User Common Line
IXC	Interexchange Carrier
FCC	Federal Communications Commission
FIT	Federal Income Tax
LATA	Local Access and Transport Area
LEC	Local Exchange Carrier
MOU	Minutes of Use
NARUC	National Association of Regulatory Utility Commissioners
NECA	National Exchange Carrier Association
PCN	Private Communications Network
RBOC	Regional Bell Operating Company
REA	Rural Electrification Administration
SLC	Subscriber Line Charge
U.S.	United States
USDA	United States Department of Agriculture
USF	Universal Services Fund
WATS	Wide Area Telecommunications Services

I. Introduction

Introduction

What is the cost to a rural customer if the customer has to pay the full cost of providing service? This paper sizes this issue on a nationwide basis looking at urban/rural deaveraging and high-cost supports. This paper provides an outer bound by assuming that all support mechanisms and rate averaging disappear for both local and long distance services. In reality, deaveraging will fall somewhere between the current situation and the extreme. Individual companies will fall above and below the average.

The data in this paper are from a variety of sources. **Figure 1** lists general assumptions and caveats used in the development of the data. While the patterns in the figures in this paper paint an accurate picture, the data may not be comparable across figures. For example, **Figure 2** (page 6) uses 1991 residential data for telephone bills and **Figure 3** (page 11) uses both business and residential 1991 data for customer costs and payments.

The remaining sections size and define the issue by examining the outer bound of deaveraging - *total* deaveraging nationwide between urban and rural areas. The sections are as follows:

- **Section II** indicates the size of urban and rural local and toll residential bills and gives a brief description of current averaging practices.

- **Section III** explains the pressures to change averaging practices.

- **Section IV** looks at the potential impact of deaveraging on nationwide urban and rural customer (business and residential) payments per line and as a percent of residential customer budgets.

- **Section V** illustrates two potential alternatives to the current system. One alternative covers who receives support. In this case, only those rural households that drop off from the current penetration level receive support. All other rural customers would pay their full costs. The second alternative covers who pays for the support. This alternative illustrates some potential effects of having several industries fund at current support amounts instead of just the traditional telephone industry.

Figure 1
Development of Data: General Assumptions and Caveats

- Data is for a nationwide total. Some of the calculations are for averages. Indevidual urban and rural areas will fall above and below ehte national average. In addition, some urban rural areas high cost, while others are not.
- Rural Electrification Administration (REA) customers and costs as the standard for examining nationwide rural characteristics.
- While the patterns in the figures are accurate, the data may not be comparable across figures
- The dollar amounts are on an annual basis
- Calculations use assumption that large local exchange carrier (LEC) rural areas have the same cost characteristics and customer usage as the REA company study areas, i.e. small LEC rural areas.
- The urban/rural split used in the calculations represents an outer boundary for deaveraging. In reality, deaveraging is more likely to occur at a level somewhere between the current status and this limit. For example, deaveraging may occur only in some markets and even then may not necessarily occur along urban/rural lines.
- By using the historical cost structures, this analysis assumes that there is no rural competition. To the extent that rural rates are below costs, competition may not exist.
- Nationwide rural access lines are estimated from eight large LECs: Ameritech, Bell Atlantic, BellSouth, NYNEX, Southwestern Bell, Pacific Telesis, U S WEST, and GTE.
- Rural residential and business local rates are estimated from rural rates charged year end 1991 in operating territories of seven Regional Bell Operating Companies (RBOCs): Ameritech, Bell Atlantic, BellSouth, NYNEX, Southwestern Bell, Pacific Telesis, U S WEST.

*For a discussion on underlying costs and their reasons, see Weinhaus, *New Wine and Old Wineskins;* and see Weinhaus, *Support Mechanisms*.

- **Section VI, Appendix A** lists potential research topics since this paper covers deaveraging in only the broadest terms.

- **Section VII, Appendix B** provides the calculations used for the figures and lists the data sources.

Background on the Telecommunications Industries Analysis Project

This paper builds on previous research on rate and cost deaveraging and on support mechanisms by the Telecommunications Industries Analysis Project. [1] The goal of this project is to provide information to support the development of alternative telecommunications policies to meet the needs of stakeholders in an environment that includes competitive and non-competitive markets, federal and state regulatory jurisdictions, and a proliferation of new services made possible by technological advances. The purpose of the project is to produce research and analysis which will assist policy makers in making informed decisions.

The project is a neutral forum of communications industry stakeholders exploring multiple viewpoints of selected issues. This forum incorporates the following elements:

[1] For rate and cost deaveraging examples, see Weinhaus, Carol; Jamison, Mark; et al., *New Wine and Old Wineskins: Modeling Effects of Competition and Expanded Interconnection in the Local Exchange,* Presentation at the National Association of Regulatory Utility Commissioners (NARUC) Meeting, Seattle, Washington, Program on Information Resources Policy, Harvard University, July 27, 1992; and see Weinhaus, Carol; Jamison, Mark, et al., *Current Status, Alternative Costing Methods Project: Examples of Modeling - Transport and Other Issues,* presentation at the NARUC Meeting, San Francisco, California, Program on Information Resources Policy, Harvard University, July 21, 1991.

For magnitude and examples of support mechanisms, see Weinhaus, Carol; Makeeff, Sandra; et al., *Who Pays Whom Cash Flow For Some Support Mechanisms and Potential Modeling of Alternative Telecommunications Policies,* Presentation at the NARUC Commissioners Meeting, Loas Angeles, California, Program on Information Resources Policy, Harvard University, Novemeber 15, 1992: and Weinhaus, Carol; Makeeff, Sandra; et al., *Support Mechanisms: Issues and an Example of Potential Problems in the Future,* Presentation at the NARUC Meeting, Seattle, Washington, Program on Information Resources Policy, Harvard University, July 27, 1992.

I. Introduction, cont.

- **Broad representation:**
  The current forum includes large and small local exchange carriers (LECs), interexchange carriers (IXCs), a cable television company (CATV), equipment and materials manufacturers, and federal and state regulators. In the next phase, this forum would be expanded to include other communications industry representatives, such as competitive access providers, companies, or publishers.

- **Multiple viewpoints:**
  Each participant is required to have an active role in the research and analysis, to represent their own interests, to understand and to assist in developing others' perspectives, and to work toward the common goal of representing multiple views.

- **Analysis and results of alternative policies:**
  Research tools, including a jointly-produced data base and computer software models, and data analysis developed by this forum create a common language for examining issues. The common language allows the participants to focus on underlying issues. Appropriate computer software tools are developed, including modifications to existing tools.

- **All data, analysis methods, and results are public:**
  Data used by this project must be publicly available on a nationwide basis. Research products become public domain information. The current database will be updated to meet the research requirements of this forum.

- **Neutral setting:**
  The project resides in a neutral setting, free of partiality, thereby ensuring objective and independent research.

II. Current Averaging Practices

Averaging and Supports

Figure 2 indicates 1991 annual residential bills were, on average, $621 in urban areas and $601 in rural areas. Therefore, on a nationwide average, urban residential customers pay approximately 3% more on their telephone bills than rural residential customers.

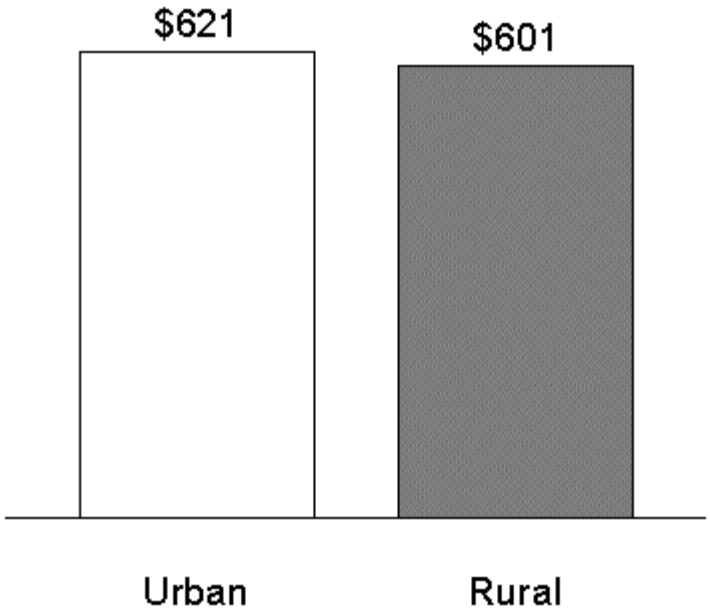
In general, the prices paid by customers - business and residential, urban and rural - for telephone service are based on two practices:[2]

- ***Rate and cost averages:***
  Rate and cost averaging is a method to achieve reasonable rates for broad geographic areas regardless of high cost communities within the area. [3] One aspect of rate and cost averaging is that within a group of customers, some pay rates that exceed their cost of service, while others pay rates that are below their cost of service. In a monopoly environment, this benefited all customers by allowing companies to recover their overall costs, by providing services to all customers at reasonable rates, and by providing all customers with interconnection with one another. Another aspect of rate and cost averaging is that it may reduce a company's marketing and administrative costs.

[2] Although as a percent of their consumer budget, urban customers pay slightly less than rural customers for telephone service (see **Section IV, Figure 5**).

[3] Historically, local service pricing is based on a "value of service" concept. Rates are often determined by population density. The rationale is that urban exchanges local calling area, provide more "value", and therefore should have higher rates. Conversely rural exchanges have fewer people, provide less "value", and therefore should have lower rates. Rural customers incur toll charges to reach populations equivalent to an urban exchange. However, local service costs generally follow the reverse pattern: low costs for urban areas, high costs for rural areas.

Figure 2
1991 Annual Urban/Rural Residential Bills



Source: Federal Communications Commission (FCC), Common Carrier Bureau, *Reference Book: Rates, Price Indices, and Household Expenditures for Telephone Service,* Washington, DC, May 1993, Table 7, page 34.

- ***Targeted support for high-cost areas:***
  Through various mechanisms, IXC customers' prices include support payments to cover local exchange carrier LEC high-cost areas. IXC prices also include support to LECs for installation and for services to low-income households. [4]

[4] For a description of these IXC support mechanisms paid to LECs, see Weinhaus, *Who Pays Whom?*

III. Pressures to Change Averaging Practices

Pressures to Deaverage

While there are economic and political reasons why a company may average prices, there are also pressures to deaverage prices:

- ***Competition:***
  When competition enters a market, the original service provider may need to lower prices for customers in that market instead of averaging prices across many markets. [5]

- ***Technology:***
  Advances in technology may make it technically or economically possible to target customers on the basis of their calling patterns, service requirements, or other characteristics. [6]

- ***Different costs in different areas:***
  Different geographic requirements, company policies, regulatory policies, and/or technology deployment patterns produce different costs for serving various territories.

- ***Customer sensitivity to prices:***
  Some customers are sensitive to changes in prices and some are not.

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[5] For a discussion of the impact of competition from a broad cross-industry perspective, see Weinhaus, Carol; Jamison, Mark; et al., *Square Pegs and Round Holes: Mismatches between Government Policies and Converging Communications Markets,* Telecommunications Industries Analysis Project, Boston, MA, 02108. For discussions of specific impacts, see the following papers: *New Wine and Old Wineskins* and *Support Mechanisms*.

[6] For example, the ability to measure calling patterns and volume allow various IXCs to provide residential customers with services based on minimum levels of volume and frequency of locations called under names such as "Reach Out America," "Friends and Family", "The i Plan," or "The Most". In addition, high-volume business customers have long been given volume-sensitive discounts through services such as WATS, private networks, or high volume private lines.

A hypothetical example might have an IXC choose to initiate a surcharge to their customers in areas where IXC costs are extremely high.

III. Pressures to Change Averaging Practices, cont.

This paper explores one response to the above pressures - deaveraging rates and costs on a geographic (rural/urban/ basis. The competitive market is a major force behind this trend.

IV. Deaveraging: National Impact

Urban/Rural Customer Costs and Payments

On a nationwide basis, rural customer (business and residential) payments on average are less than the cost of providing service. **Figure 3** uses Rural Electrification Administration (REA) rural usage patterns and cost characteristics in order to estimate the national rural costs and customer payments (revenues). [7]

The nationwide total data in **Figure 3** provide an overall picture of the traditional telephone industry. This paper covers only the broad industry picture and its effect on the customer and does not cover the complex interplay among large LECs, small LECs, and IXCs. See **Section VI, Appendix A**, for a discussion of potential research topics.

In **Figure 3**, the left-hand side shows national rural customer costs of $30.9 billion and nationwide customer payments of $22.2 billion. This translates into a difference of $8.7 billion. Rural customer bills would have to increase by 39% to cover costs. Currently this rural support includes internal averaging between rural and urban areas for large LECs as well as toll averaging for IXCs.

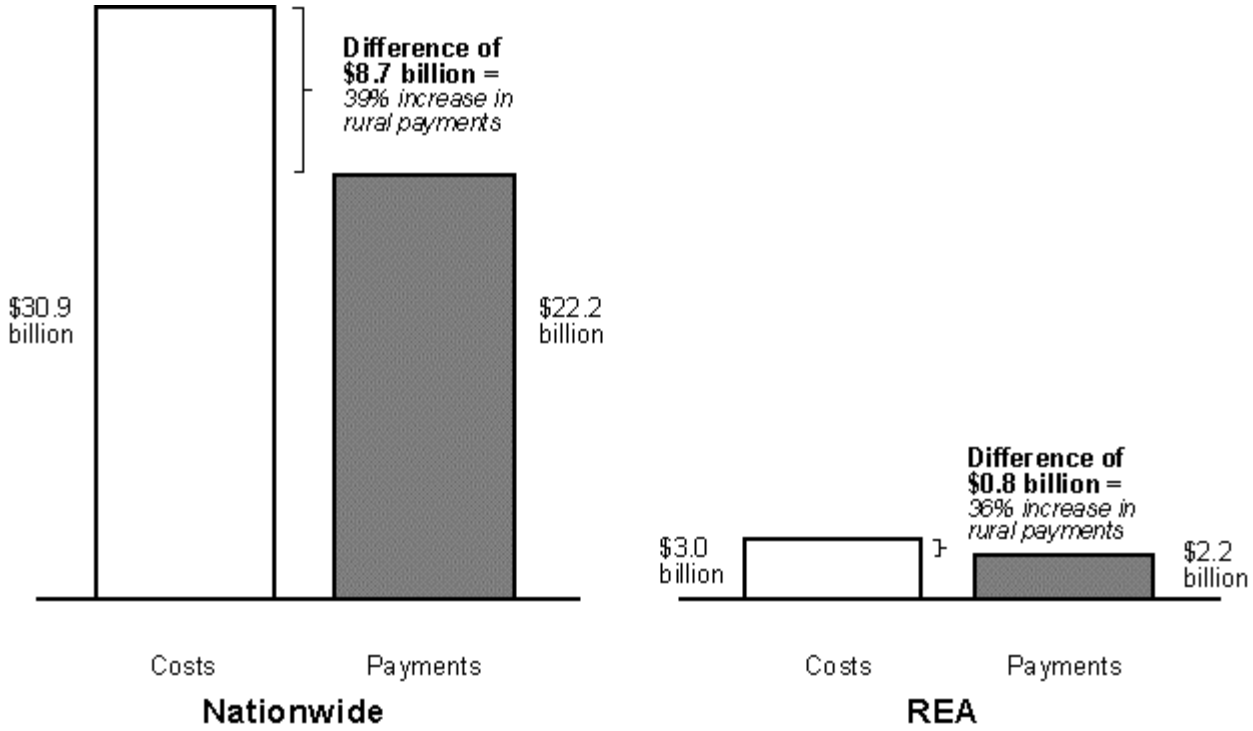
The right-hand side of **Figure 3** shows the same comparison for customers of approximately 400 REA telephone company study areas. The REA customer costs are $3.0 billion and their payments are $2.2 billion, producing a difference of $0.8 billion. The REA rural customer bills would have to increase 36% to cover costs.

These REA study area usage and cost characteristics serve as the model for the nationwide numbers. While both the REA and nationwide estimates include averaging effects of the IXC, only the nationwide estimates include internal averaging for the large LECs. [8]

[7] Estimate use REA companies as a nationalwide surrogate because there is no nationwide public data on large LEC rural areas.

[8] **Section VII, Appendix B,** explains the development of data for this and other figures in the paper.

Figure 3
1991 Rural Business and Residential Customers: Costs and Payments



Source: Section VII, Appendix B.

Figure 3 sets the stage for looking at the impact of deaveraging. This paper looks at one end of the spectrum of deaveraging making rural customers pay the entire cost of providing service with no support from urban customers or from several mechanisms.

Potential Impact of Deaveraging Urban/Rural Payments

Figure 4 shows the potential impact of deaveraging urban and rural customer (business and residential) payments on an annual per line basis.

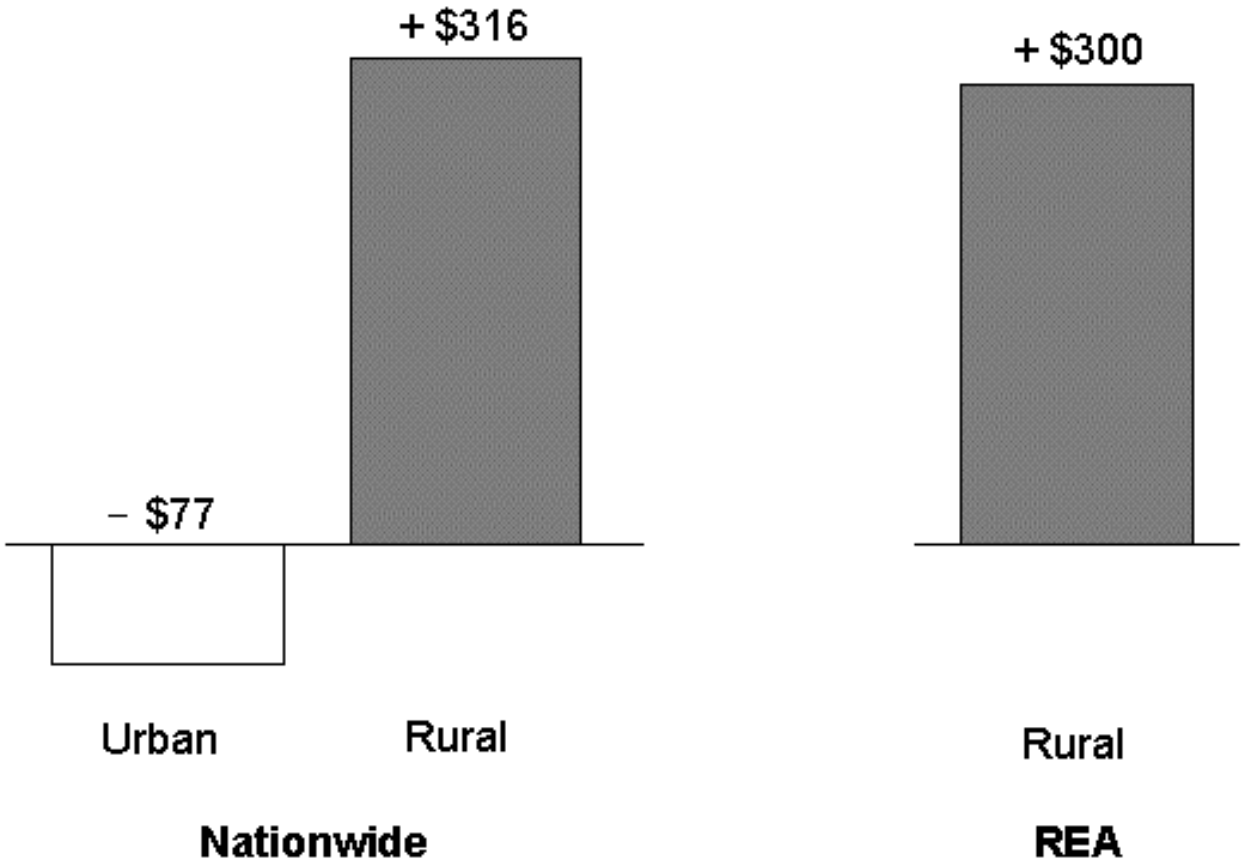
This figure illustrates that urban customer bills on a nationwide basis would decrease annually by $77 per line. In contrast, rural customer bills on a nationwide basis would increase annually by $316 per line. For the REA rural customers, bills would increase annually $300 per line. [9] It should be noted that the per line decrease for urban customers is relatively small because there are far more urban customers than their are rural customers.

If this particular urban/rural deaveraging were to occur evenly across all lines nationwide, the result is an average decrease for urban customers that is relatively small when compared to the average increase for rural customers.

Figure 5 shows the impact of urban/rural deaveraging in terms of 1991 residential customer budgets for all expenditures. This figure provides another viewpoint on customer impact. While **Figure 4** focuses on the dollar amounts and the impact on telephone bills, **Figure 5** looks at the same picture in terms of total customers expenditures. **Figure 5** shows telephone service as percentage of total expenditures is relatively small before and after deaveraging. Customer expenditures for urban residential telephone services decrease approximately 0.2% and those for rural residential telephone services increase approximately 1.3%.

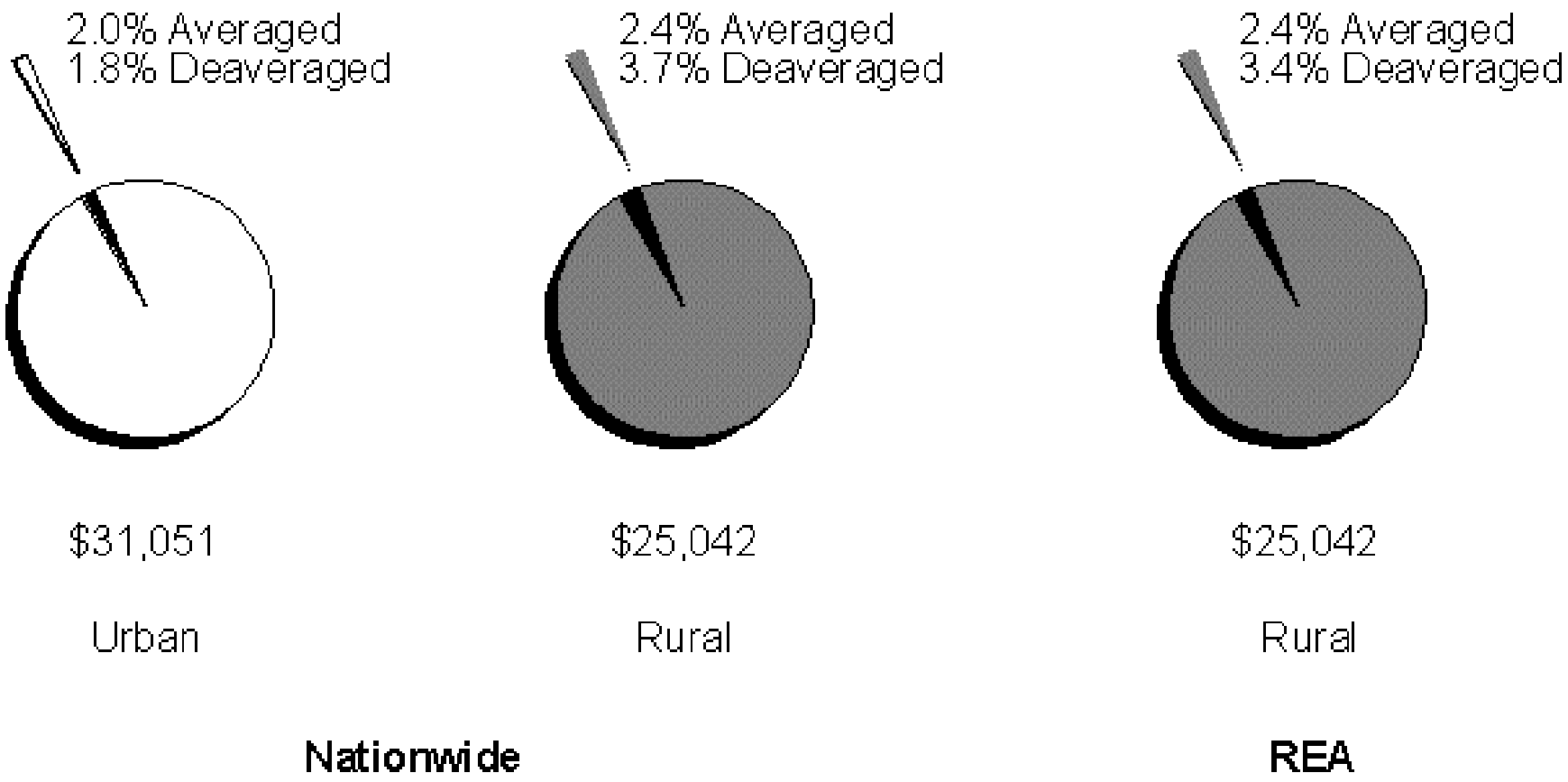
[9] The difference between the nationwide increase of $316 for rural bills and the REA increase of $300 is not significant given the broad nature of the ananlysis

Figure 4
1991 Potential Impact of Deaveraging Urban and Rural Annual Customer Payments per Line



Source: Section VII, Appendix B.

Figure 5
Impact of Urban/Rural Telephone Rate Deaveraging on 1991 Residential Customer Budgets



Source: Federal Communications Commission (FCC), Common Carrier Bureau, Reference Book: *Rates, Price Indices, and Household Expenditures for Telephone Service,* Washington, DC, May 1993, Table 7, page 34.

V. Deaveraging and Universal Service

Price and Penetration Levels for Telephone Service

Since the 1940s, both traditional telephone company and regulatory policies promoted widespread penetration of voice-grade telephone services throughout the United States. Historical practices of averaging and high-cost supports (discussed in **Section II**) helped promote universal service. In addition, the practice of keeping "basic" local service rates low also promoted universal service. [10] Underlying these policies is the possibility that if service rates increase some customers may no longer be able to afford telephone service and others may not be willing to pay the higher rates.

Advances in technology and non-traditional competitors have accelerated the need to reconsider "basic service" and "universal service" - to examine whether other approaches might be more appropriate for the new environment. This section of the paper assumes current universal service definitions.

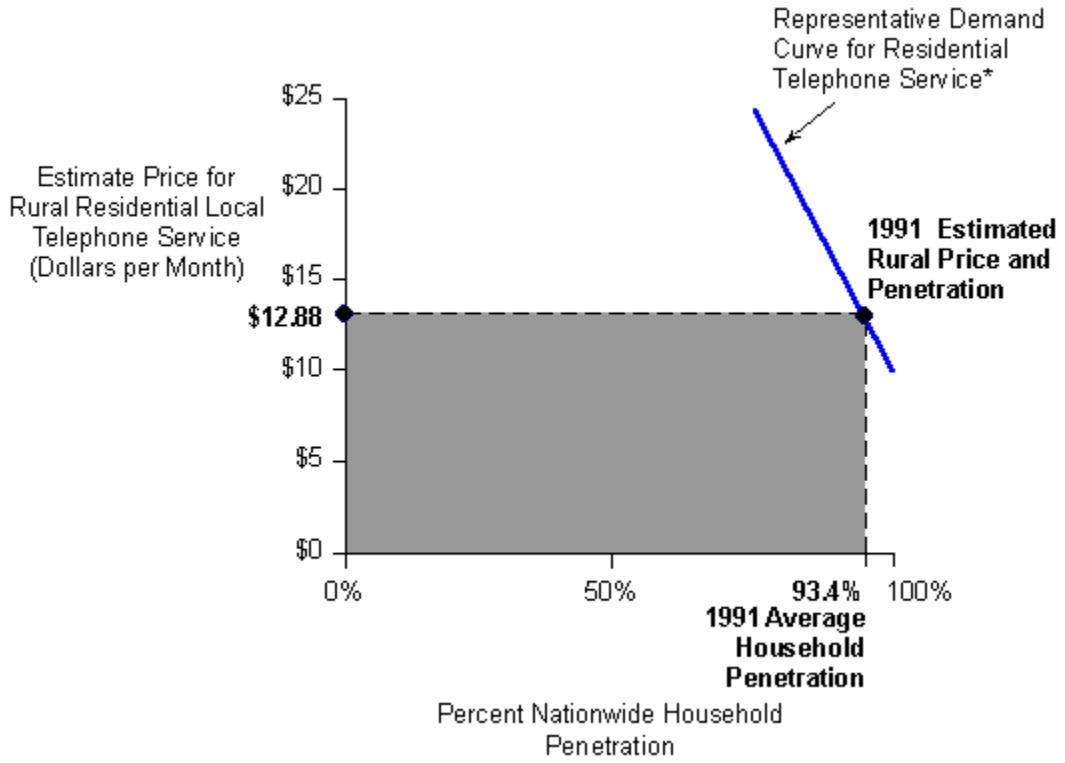
Price increases generally result in fewer customer purchases. **Figure 6** assumes this pattern for rural telephone service and illustrates an extreme case for rural residential customer response to price increases for rural telephone service. [11]

In 1991, approximately 93% of all United States households had telephone service. This penetration level is indicated by the vertical dashed line. It is estimated that rural residential telephone customers paid approximately $13 per month for basic local telephone

[10] Through a process called "residual pricing", rates for basic exchange service were raised only after increases in toll services, directory advertising, and vertical services (such as three-way calling). For further details, see Weinhaus, Carol; and Oettinger, Anthony; *Behind the Telephone Debates,* Ablex Publishing Corporation, Norwood, NJ, 1988 64-66.

[11] **Figure 6** assumes that a 10% increase in price results in a 2% decrease in purchases. This is the largest customer response and in survey of demand studies. The lowest customer response shown in the survey was one-fourth of this estimate - a 0.5% decrease in purchases in response to a 10% increase in price. For details, see Lester D. Taylor, *Telecommunications Demand: A Survey and Critique,* Ballinger Publishing Company, Cambridge, MA, 1980, Table 3-1, page 80.

Figure 6
Impact of Price Level on 1991 Rural Residential Customer Penetration of Telephone Service



* Assumes that rural and urban demand are the same

Sources:
Price Elasticity Estimates: Lester D. Taylor, *Telecommunications Demand: A Survey and Critique,* Ballinger Publishing Company, Cambridge, MA, 1980, Table 3-1, page 80.
Percent of Household with Telephones: Federal Communications Commission, Common Carrier Bureau, *Telephone Subscribership in the U.S.,* Novemeber 1992, page 18.

service, or $156 per year. This amount is indicated by the horizontal dashed line. Subscriber line charge (SLC)[12] revenues would add an addition of $3.50 per month, or $42 per year, to this figure. In **Figure 6**, the point where these two dashed lines intersect is the 1991 price and penetration level on the demand curve for rural residential telephone service.

A demand curve is the relationship between prices and customers buying services. As prices increase, the service penetration level drops; as prices decrease, the penetration level rises. At one extreme, the price may be so high that no one will buy service. At the other extreme, some people will not take the service even if it is free.

Potential Alternatives: Basic Questions

If deaveraging urban/rural rates occurs, and if a current financial support to rural telephone companies erodes:

- What actions might be taken?
- What public policy questions are raised?
- Are there policy goals that require support for rural areas?

If support is desirable, other questions to be answered include the following:

- Who should receive the support?
- Who should provide the support?
- What are the appropriate mechanisms for collecting and distributing the support?

The remainder of this section provides two potential alternatives that assume support for rural areas is needed. Note that these are just two of many possible alternatives. The

[12] The SLC is also referred to as the end user common line (EUCL) charge prescribed by the FCC

first example addresses the question: who should receive the support? The second example addresses the question: who should provide the support? Both examples assume that the 1991 level of households with telephone service should be maintained if deaveraging occurs.

Potential Alternative: Support Universal Service

Currently, some customers are able to purchase telephone service because their rates are supported through averaging and other support mechanisms. Other customers might be able to pay the increased price but may choose not to because, in their judgment, the service isn't worth the increased cost. **Figure 7** indicates that current customer bills ($22.2 billion) for rural areas are supplemented with additional revenues ($8.7 billion). Therefore, the total cost of providing nationwide rural telephone service is $30.9 billion.

If the extreme case for urban/rural deaveraging were to occur and if support mechanisms were to disappear, prices for rural services would increase. Given these two assumptions, approximately 7.3% of the rural households could either no longer afford residential service or may not choose to pay the higher price even though they could afford it. This loss is based on two assumptions:

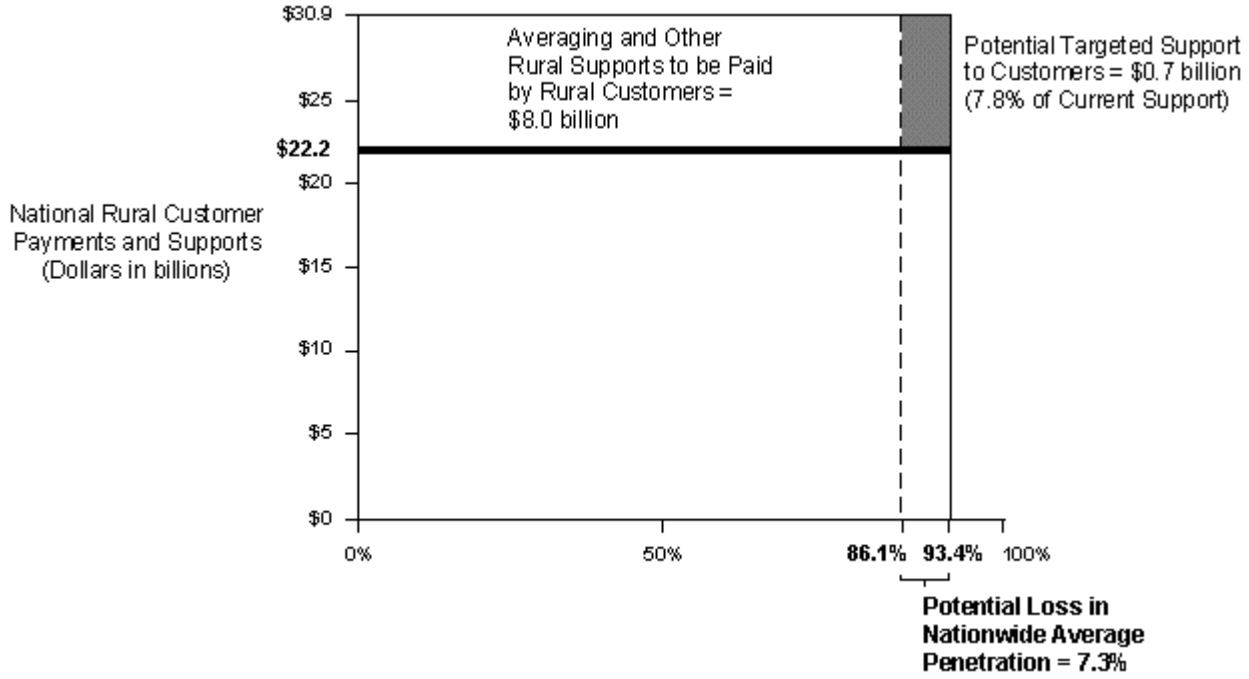
- Prices for rural residential telephone service would increase the same percent as the national average of 39% (**Figure 3**).

- The demand curve in Figure 6 is also representative of rural households.

The vertical dashed line in **Figure 7** indicates the lowered penetration level. Those customers to the left of this dashed line would still buy telephone service. Their prices increase to cover the previous support ($8.0 billion). However, those households to the right of the dashed line may need additional support from external sources ($0.7 billion) if these households are to keep residential service.

This alternative answers two questions - the level of rural support and who receives it. This example assumes that 92.7% of the 1991 rural customers would pay an additional $8.0 billion in increased rates for all their telephone services. In this alternative, support of $0.7 billion is paid to those rural customers who may no longer be able to afford service or

Figure 7
Potential Alternative: Deaverage and Target Support to Preserve 1991 Rural Service Penetration



Sources:
Price Elasticity Estimate: Lester D. Taylor, *Telecommunications Demand: Survey and Critique*, Ballinger Publishing Company, Cambridge, MA, 1980, Table 3-1, page 80.
Percent of Housholds with Telephones Federal Communications Commission, Common Carrier Bureau, *Telephone Subscribing in the U.S.,* Novemeber 1992, Table 2, page 18

may choose not to buy it. [13] This is in contrast to current policies which flow most supports to the high-cost companies.

Potential Alternative: Increase Sources for Rural Support

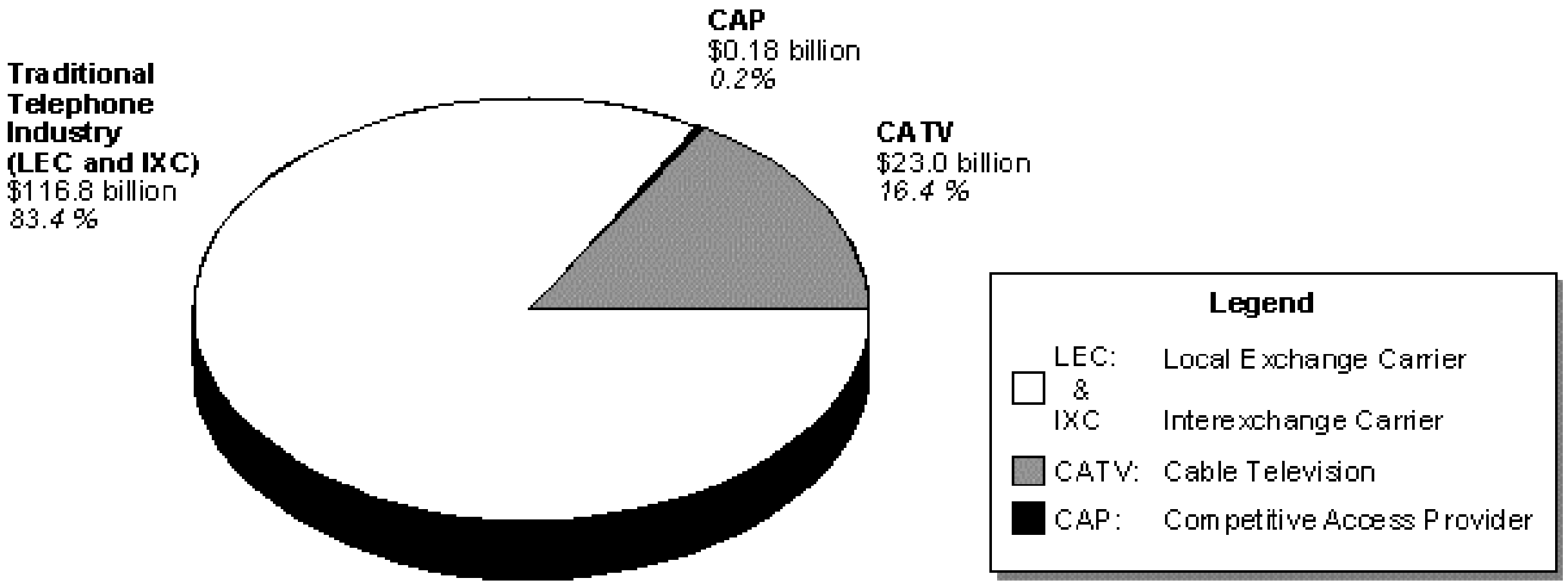
In the current structure, only traditional telephone companies (LEC and IXC) contribute support payments to rural telephone companies. **Figures 8 and 9** indicate an alternative to this process: spreading the current traditional telephone rural supports across additional industries that provide communications services. This example simplifies the picture by focusing on rural telephone supports. A more accurate analysis would include questions as to whether rural customers of these other industries might also be included in the support mechanism. Another simplification is that only two additional industries are used in the example: CATV and competitive access provider (CAP). Other potential contributors might include companies providing services such as cellular, personal communications network (PCN), and enhanced services.

Figure 8 sets the stage by showing the relative revenues for each industry in the example. 1991 traditional telephone industry (LEC and IXC) revenues are $116.8 billion, or 83.4% of total revenues. CATV industry revenues are considerably smaller, $23.0 billion, or 16.4% of total revenues. CAP industry revenues of $0.18 billion, or 0.2%, barely show up in the pie chart. It should be noted that this chart only looks at dollars in aggregate and not at individual markets.

Figure 9 shows the impact of study traditional telephone industry rural support of $8.7 billion across CATV and CAP industries. The bar on the left-hand side consists of traditional telephone industry rural supports and remaining revenues of $108.1 billion. The bar in the middle indicates the effect of spreading this $8.7 in rural support across telephone and CATV industries based on percent of revenues. In this case, the CATV industry picks up additional costs of $1.4 billion. The right-hand bar adds the CAP industry which barely makes an impact (picking up $0.011 billion in rural supports) when looked at in total. Even though the percent of rural contributions is the same for each industry (approximately 6%),

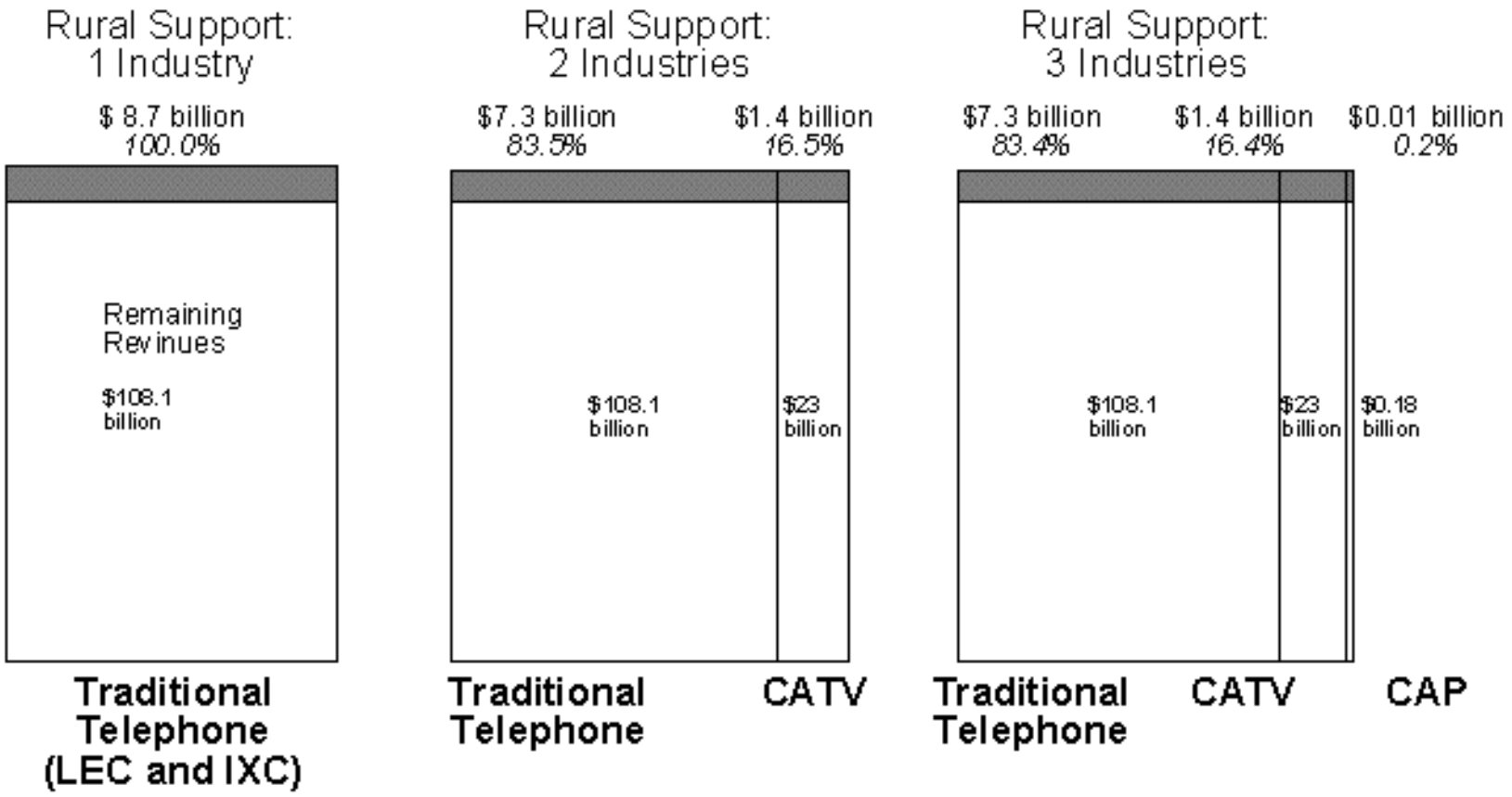
[13] This example only addresses rural customer support and does not provide a specific mechanism. In addition, this model maintains the status quo. It does not look at what it would take to increase or descease penetration levels.

Figure 8
1991 Industry Revenues: Traditional Telephone, CATV, and CAP



Source:
Traditional Telephone Industry: Weinhaus, *Who Pays Whom?,* Figure 7, page 14.
CATV Industry: National Cable Television Association, *Cable Television Developments,* May 1992, page 8-A.
CAP Industry: "Fiber-optic Flurry Quickens," Kansas City Star, June 13, 1993, page A-1.

Figure 9
Potential Alternative: Spread 1991 Traditional Telephone Industry Rural Support Proportionally across Other Industries



Source:
Traditional Telephone Industry: Weinhaus, *Who Pays Whom?,* Figure 7, page14.
CATV Industry: National Cable Television Association, *Cable Television Developments*, May 1992, page 8-A.
CAP Industry: "Fiber-optic Flurry Quickens," *Kansas City Star,* June 13, 1993, page A-1.

the impact of paying these supports may not be of the same magnitude for each industry. For example, the CAPs participate only in competitive markets and may have greater difficulty providing a contribution to rural service.

Development of **Figure 9** also points out a mismatch in industry structures. While it is possible to examine the traditional telephone industry and the CATV impact on a subscriber basis, equivalent data does not exist for the CAPs. Telephone and CATV companies have residential subscribers while the majority of the CAP customers are large businesses.

This alternative answers the question of who provides the support. In this case, multiple communications industries pay in addition to the traditional telephone industry.

Summary

This paper examines just one piece of the deaveraging and only provides two alternatives. The first alternative in this paper changes the amount of rural supports and the mechanism for targeting the support. The second alternative changes the source of rural supports. An alternative that might be acceptable to a wide variety of parties requires analysis of other components, such as internal deaveraging in large LECs or deaveraging of IXC toll rates. Any change is more likely to be accepted if there is a transition mechanism.

In order to derive solutions that fit multiple requirements traditional and non-traditional industry, government, and customer -, it is necessary to analyze more components and to develop solutions with input from all

VI. Appendix A: Potential Research Topics

Potential Research Topics

This paper only covers deaveraging in only the broadest terms. The following is a list of potential research topics that cover the complex interplay between service providers - large and small, LEC and IXC, traditional and non-traditional service providers:

- Large LEC internal deaveraging: interservice and urban/rural
- Pressures for IXCs to deaverage nationwide interstate toll rates.
- Further breakouts of LEC characteristics by size.
- Business/residential deaveraging.
- Impact of IXC interstate toll deaveraging.
- Indicate high and low extremes in deaveraging.

VII. Appendix B: Methods and Sources for Data

Assumptions, Calculations, and Data Sources

This appendix provides background information for the figures in this paper. Depending on the figure, this section provides assumptions and caveats, calculations, and data sources. Some calculations are used for more than one figure.

Background for Figure 2: Consumer Budgets

Source:

> *Consumer Budgets:* Federal Communications Commission (FCC), Common Carrier Bureau, *Reference Book: Rates, Price Indices, and Household Expenditures for Telephone Service*, Washington, DC, May 1993, Table 7, page 34.

Background for Figures 3 and 4: Customer Costs, Customer Payments, and Deaveraging Impact

Assumptions and Caveats:

> Note that **Figure 3** covers rural customer costs and payments and **Figure 4** covers both urban and rural deaveraged payments.
>
> The 398 study areas included in the REA estimate, met the following criteria:
>
> - Is in National Exchange Carrier Association (NECA) 1991 Common Line Pool.
> - Is a cost settlements company.
> - Submits complete data to REA for 1991.
> - Submits usage data to NECA for 1991 Network Usage Report.
> - Submits 1991 data to NECA for Universal Service Fund (USF).

Estimates use a rate of return of 11.25% for all companies, including those companies receiving REA loans at a smaller percentage.

Calculations:

See **Figure 10** for the development of total nationwide averaging affecting rural end users. This figure incorporates other calculations from **Figure 11** and those described as below:

REA rural costs per line (**Figure 10, Line 9**):

First collect data for the following categories:

Net Plant
Fixed Charges
Total Operating Expenses
State and Local Taxes
Other Taxes
Category 1.3 USF Loops

Then, calculate total company (study area) revenue requirements

Return = Net Plant * .1125
Federal Income Tax (FIT) = (Return - Fixed Charges) * .5151

Total Revenue Requirements = Return + FIT +
Total Operating Expenses +
State and Local Taxes + Other Taxes

Finally, calculate rural cost per line by dividing the Total Revenue Requirement by the number of Category 1.3 Loops.

The REA rural costs and payments in **Figure 3** contain the following revenues based on 1991 data:

Local and Miscellaneous revenues from REA submissions for the rural LECs.

EUCL revenues calculated from REA data for the rural LEC

Figure 10
Calculations for Figures 3 and 4: Total Nationwide Averaging Affecting Rural End Users

Line:	Description:	Data:	Source:
1	Year	1991	
2	Number of Non-MSA Access Lines	27,275,430	FCC, *ARMIS 43-07 Reports* and composite rural percent.
3	Total Number of Study Area Access Lines	139,552,000	FCC, *Monitoring Report*.
4	End User Common Line Rate		FCC, *Tariff Review Plan*.
	a. Residence (Single Line Rate)	$3.49	
	b. Business (Multi-Line Rate)	$4.73	
5	State Toll & Interstate Toll Revenues	$69,380,000,000	*FCC, Long Distance Market Share*.
6	Percent of Rural: Residential	82.82%	USDA, *REA Supertape*.
7	Percent of Rural: Single_Line Business	8.59%	USDA, *REA Supertape*.
8	Percent of Rural: Multi-Line Business	8.59%	USDA, *REA Supertape*.
9	Rural Cost per Line	$859.09	USDA, *REA Suptertape*.
10	Minutes of Use per Rural Line		
	a. State Toll and Access	2,964	
	b. Interstate Access	2,538	Composite of RBOC local rates for non-urban areas; see **Figure 11.**
11	Rural Residential Local Rate ($/Line/Month)	$12.88	Composite of RBOC local rates for non-urban areas; see **Figure 11.**
12	Rural Business Local Rate ($/Line/Month)	$31.26	*Monitoring Report*.
13	State Toll and Access DEM	296,713,543,000	

Figure 10
Calculations for Figures 3 and 4: Total Nationwide Averaging Affecting Rural End Users, cont.

Line:	Description:	Data:	Source:
14	Interstate Access DEM	361,345,168,000	*Monitoring Report*.
15	Local Rural Residential Revenues	$3,491,497,834	12 x (Ln 2 x Ln 6 x Ln 11)
16	Local Rural Single-Line Business Revenues	$878,814,500	12 x (Ln 2 x Ln 7 x Ln 12)
17	Local Rural Multi-Line Business Revenues	$878,814,500	12 x (Ln 2 x Ln 8 x Ln 12)
18	State and Interstate Toll ($/Minute)	$0.1054	Ln 5/(Ln 13 + Ln 14)
19	National Average Switched Access Rate	$0.0549	FCC, *Armis 43-04 Reports* and *Tariff Review Plan*.
20	Rural State and Interstate Toll Revenues	$15,819,917,689	Ln 2 x (Ln 10a + Ln 10b) x Ln 18
21	Rural EUCL Revenues	$1,177,155,212	12 x (Ln 4a x Ln2 x (Ln 6 + Ln 7) + Ln2 x Ln 4b x Ln 8)
22	Total Rural Revenues (Customer Payments)	$22,246,199,736	Ln 15 + Ln 16 + Ln 17 + Ln 20 +Ln 21; used in **Figure 3.**
23	Total Rural Costs	$30,877,871,885	Ln 9 x Ln 2 + (Ln 18 - Ln 19) * (Ln 10a + Ln 10b) * Ln 2; used in **Figure 3.**
24	Difference between Revenues and Costs	($8,631,672,149)	Ln 21 - Ln 22; used in **Figure 3.**
25	Annual Difference Per Non-MSA Line	$316.46	Ln 24/Ln 2; used in **Figure 4.**
26	Annual Difference Per MSA Line	($76.88)	Ln 24/(Ln 3 - Ln 2); used in **Figure 4.**

Figure 11
Background Calculations for Figure 10: Rural Local Rates

Study Area	Rural Rates		Non-MSA Lines		Weighted (Rate*Lines)	
	Residential	Business	Residential	Business	Residential	Business
AL	$15.91	$42.03	259	259	$4,121	$10,886
AZ	$12.40	$32.00	287	287	$5,559	$9,184
AR	$12.51	$26.11	345	345	$4,316	$9,008
CA	$8.35	$19.65	570	570	$4,760	$11,201
CO	$14.22	$34.63	320	320	$4,550	$11,082
DE	$8.48	$24.20	147	147	$1,247	$3,557
DC	$14.94		0	0	$0	$0
FL	$8.40	$22.90	182	182	$1,529	$4,168
GA	$13.00	$29.50	405	405	$5,265	$11,948
ID	$10.14	$26.09	243	243	$2,464	$6,340
IL	$12.46	$23.91	196	196	$2,442	$4,686
IN	$11.11	$37.75	269	269	$2,989	$10,155
IA	$13.95	$33.95	323	323	$4,506	$10,966
KS	$10.70	$21.00	371	371	$3,970	$7,791
KY	$12.69	$33.35	444	444	$5,634	$14,807
LA	$12.43	$33.49	323	323	$4,015	$10,817
ME	$11.27	$30.84	53	53	$597	$1,635
MD	$14.88		230	0	$3,422	$0
MA	$12.15	$30.35	223	223	$2,709	$6,768
MI	$10.42	$22.82	466	466	$4,856	$10,634
MN	$15.66	$46.98	324	324	$5,074	$15,222
MS	$16.90	$41.63	643	643	$10,867	$26,768
MO	$9.80	$24.90	353	353	$3,459	$8,790
MT	$13.84	$35.71	219	219	$3,031	$7,842
NE	$14.10	$36.40	155	155	$2,186	$5,642
NV	$10.00	$32.35	33	33	$330	$1,068

Figure 11
Background Calculations for Figure 10: Rural Local Rates, cont.

	Rural Rates		Non-MSA Lines		Weighted (Rate*Lines)	
Study Area	Residential	Business	Residential	Business	Residential	Business
NH	$12.68	$35.14	254	254	$3,221	$8,926
NJ	$6.75	$14.70	0	0	$0	$0
NM	$11.30	$36.73	217	217	$2,452	$7,970
NY	$15.28	$44.23	614	614	$9,382	$27,157
NC	$11.03	$30.13	283	283	$3,121	$8,527
ND	$10.82	$26.52	100	100	$1,082	$2,652
OH	$15.25		251	0	$3,828	$0
OH	$11.32	$31.04	431	431	$4,879	$13,378
OK	$13.68	$33.09	270	270	$3,694	$8,934
OR	$20.00	$23.00	396	396	$7,920	$9,108
PA	$12.20	$35.32	54	54	$659	$1,907
RI	$15.10	$37.45	187	187	$2,824	$7,003
SC		$28.80	0	160	$0	$4,608
SD	$8.50	$30.80	370	370	$3,145	$11,396
TN	$8.80	$20.65	621	621	$5,465	$12,824
TX	$7.98	$19.98	140	140	$1,117	$2,797
UT	$14.98	$36.87	215	215	$#,221	$7,927
VT	$11.57	$38.43	326	326	$3,772	$12,528
VA	$9.75	$24.10	220	220	$2,145	$5,302
WV	$36.15	$60.00	372	372	$13,448	$22,320
WI			251	251	$0	$0
WY	$10.49	$22.22	146	146	$1,532	$3,244
Composite	$12.88	$31.26	13,101	12,780	$168,801	$399,472

VII. Appendix B: Methods and Sources for Data, cont.

The REA rural customer costs (what the customer would pay without averaging and other supports) in **Figure 3** use state and interstate, interLATA (Local Access and Transport Area) and intraLATA toll revenues based on the following elements:

The LEC's own access costs from REA.

A nationwide composite access rate multiplied by state and interstate toll dial equipment minutes (DEM) minutes of use (MOU). This is a surrogate for IXC internal costs, based on the **AT&T** statement that half of their costs are access costs.

Booked toll revenues from REA.

The REA rural payments in **Figure 3** use toll revenues based on the following elements:

Nationwide state and interstate, interLATA and intraLATA revenues were obtained from the 1991 FCC *Long Distance Market Share* (**Line 5, Figure 10**).

Total industry DEM MOU were calculated using the 1991 Network Usage data from the *REA Supertape* **(Lines 6 through 8, Figure 10).**

A nationwide composite toll rate was developed by dividing all toll revenues by the minutes.

This rate was multiplied by the LECs state plus interstate DEM MOU (NECA Network Usage Report data) to determine toll revenues.

To determine the national average switched access rate (**Line 19, Figure 10**) was developed by first dividing the total common line costs for Tier 1 companies and for NECA companies by the common line minutes for these same companies. The next step divides the traffic-sensitive costs by the local switching demand. These two results are then summed.

VII. Appendix B: Methods and Sources for Data, cont.

Sources:

The following is a list of the sources for the data in **Figure 10** by line number and item:

Line #: **Source:**

Line 2 *Number of Non-MSA Access Lines:* 1991 data for the seven Regional Bell Operating Companies (RBOCs) (Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis, Southwestern Bell, and U S WEST) and GTE are from *Automated Reporting Management Information System (ARMIS) 43-07 Reports*, Table 1, Line 0120, Column c. Reporting requirements specified by the *Infrastructure Report* (FCC Report 43-07) are described in the *Automated Reporting Requirements for Certain Class A and Tier 1 Telephone Companies (Part 31, 43, 67, and 69 of the FCC's Rules),* CC Docket 87-313, DA 91-619, Released May 17, 1991. Data for companies not filing **ARMIS** Reports were estimated by using a composite rural percent from **ARMIS** companies.

Line 3 *Total Number of Study Area Access Lines:* "Total Industry Loops" data are from the FCC, Monitoring Report, *Prepared by the Staff of the Federal-State Joint Board in CC Docket 80-286,* CC Docket No. 87-339, Table 4.19, June 1, 1993. Data filed in accordance with the FCC's *Establishment of a Program to Monitor the Impact of Joint Board Decisions,* DA 89-503, Released May 12, 1989.

Line 4 *EUCL Rate:* Data for price cap carriers, Form RTE-1, providing the weighted average of current rates in effect at time of filing. Filed in 1992 in accordance with the FCC, *Commission Requirements for Cost Support Material to be Filed with 1989 Annual Access Tariffs*, 4 FCC Rcd 1662, Order (*Tariff Review Plan*), December 30, 1988.

Line 5 *State Toll & Interstate Toll Revenues:* FCC, Industry Analysis Division, *Long Distance Market Share*, Washington, DC, Table 5, page 12.

VII. Appendix B: Methods and Sources for Data, cont.

Lines 6 - 8 *Percent of Rural Lines by Type Service*: U.S. Department of Agriculture (USDA), REA, *Telephone Operations Manual [REA Supertape],* Section 1800, Washington, DC, November 29, September 1992.

Line 9 *Rural Costs per Line*: Data was pulled from the *REA Supertape* for these categories: Net Plant, Fixed Charges, Total Operating Expenses, State and Local Taxes, and Other Taxes.

Rural Costs per Line: Data for 1.3 USF loops for 1991 are from NECA *Monitoring Report* submissions to the FCC.

Line 10 *Minutes of Use per Rural Line*: Network usage divided by number of access lines from USDA, *REA Supertape*.

Lines 11 - 12 *Local Rates (Dollars per Line per Month)*: Composite of local rates for non-urban areas in the seven RBOC (Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis, Southwestern Bell, and U S WEST operating territories.

Line 13 *State Toll and Access DEM*: 1991 data for Total Cost Companies, *Monitoring Report*, Table 4.16, May 1993.

Line 14 *Interstate Access DEM*: 1991 data for Total Cost Companies, *Monitoring Report*, Table 4.17, May 1993.

Line 19 *National Average Switched Access Rate: Total Common Line and Traffic Sensitive Costs:* Data Specifications and reporting requirements for the *ARMIS Access Report (FCC Report 43-04)* are described in the *Automated Reporting Requirements for Certain Class A and Tier 1 Telephone Companies (Part 31, 43, 67, and 69 of the FCC's Rules), Errata*, CC Docket 86-182, DA 90-30, Released January 16, 1990.

National Average Switched Access Rate: Local Switching Demand and Common Line Demand: FCC Tariff Review Plan.

The source for **Figure 11** data is NARUC, 1991 Exchange Service Telephone Rates, July 1992.

Background for Figure 5: Impact on Consumer Budgets

Calculations:

See **Figure 12** for the calculations for the impact of deaveraging urban and rural telephone service on consumer budgets.

Source:

FCC, *Reference Book*.

Background for Figure 6: Price and Penetration Levels

Assumptions and Caveats:

Rural and urban consumers have similar demand curves for local telephone service.

Consumer purchases of residential telephone service are somewhat responsive to price. This assumption means that a high estimate of price elasticity (-0.20) was used.

Telephone penetration for rural households is the same has the national average.

Calculations:

See **Figure 13** for the derivation of the demand curve for residential telephone service. This figure uses results from **Figures 10 and 11** in the calculations.

Figure 12
Background Calculations for Figure 5: Impact on 1991 Urban/Rural Customer Budgets

	Rural			Urban		
	Budget	**Dollars**	**% Budget**	**Budget**	**Dollars**	**% Budget**
Nationwide						
Average	$25,042	$601	2.40%	$31,050	$621	2.00%
Deaverage	$25,042	$917	3.66%	$31,050	$544	1.75%
Difference		$316			($77)	
REA:						
Average	$25,042	$601	2.40%			
Deaverage	$25,042	$849	3.39%			
Difference		$248				

VII. Appendix B: Methods and Sources for Data, cont.

Figure 13
Calculations for Figure 6: Demand Curve for Residential Telephone Service

Line:	Description:	Data:	Source:
Data Inputs:			
1	Year	1991	
2	Rural Residential Local Rate ($/Line/Month)	$12.88	See **Figure 10, Line 21,** and **Figure 11.**
3	Percent U.S. Household Penetration	93.4%	FCC, *Telephone Subscribership.*
4	Elasticity	-0.2	Taylor, *Telecommunications Demand*
Calculations:			
5	Select a Monthly Rate (Price)	$17.90	Variable Amount
6	Percentage Difference between Selected Price and 1991 Price	39.0%	(Ln - Ln 2)/Ln 2
7	Percentage Change in Penetration	-7.3%	(Ln 6 * Ln 4) * Ln 3
8	New Penetration Rate: Outer Limit on Deaveraging	86.1%	Ln 7 + Ln 3

Variable Prices	Percent Penetration:
$10.00	97.6%
$12.88	93.4%
$14.00	91.8%
$16.00	88.9%
$17.90	86.1%
$20.00	83.1%
$22.00	80.2%
$24.00	77.3%

Sources:

Price Elasticity Estimate: Lester D. Taylor, *Telecommunications Demand: A Survey and Critique*, Ballinger Publishing Company, Cambridge, MA, 1980, Table 3-1, page 80.

Percent of Households with Telephones: Federal Communications Commission, Common Carrier Bureau, *Telephone Subscribership in the U.S.,* November 1992, Table 2, page 18.

Background for Figure 7: Potential Alternative on Universal Service

Assumptions and Caveats:

There would need to be a transition mechanism.

The only objective addressed is universal service. Income transfers and costs of doing business are not considered.

Figure 7 shows a nationwide average; it does not show extremes. Customers in areas that have higher than average costs would likely require support that exceeds this average. Customers in lower cost areas would likely required less support than the average, or perhaps no support.

The $0.7 billion represents an upper bound for the following reasons:

- The number of customers assumed to receive support is an upper bound. This assumption is based on the highest customer response to changes in local service prices found in Taylor's survey of telephone demand studies. [14] Using Taylor's data, the assumption is that a 10% increase in price results in a 2% decreases in purchases. The lowest customer response shown in Taylor's survey was one-fourth of this estimate - a 0.5% decrease in purchases in response to a 10% increase in price.

- Financial support for both local and toll were included. It is possible that both services would not need to be supported because customers can limit their toll bills themselves by placing fewer calls.

- All customers receiving financial support were assumed to need support at the current level. Some would probably need less support.

Rural and urban customers have similar demand curves for local telephone service.

Telephone penetration for rural households is the same as the national average.

[14] See Taylor, *Telecommunications Demand:,* Table 3-1, page 80.

A mechanism can be designed to target customers that need support similar to Lifeline and Link-up programs.

Calculations:

See **Figure 14** for the derivation of the support required to preserve the 1991 level of telephone service. This figure uses results from **Figures 10 and 13** in the calculations.

Sources:

Same as those for **Figure 6**.

Figure 14
Calculations for Figure 7: Support Required to Preserve 1991 Level of Telephone Service

Line:	Description:	Data:	Source:
Data Inputs:			
1	Year	1991	
2	Nationwide Rural Revenues (Customer Payments)	$22,246,199,736	See **Figure 10, Line 22.**
3	Nationwide Difference between Costs and Payments	$8,631,672,149	See **Figure 10, Line 24.**
4	Elasticity 1	-0.2	Taylor, *Telecommunications Demand.*
5	Elasticity 2	-0.05	Taylor, *Telecommunications Demand.*
6	Percent U.S. Household Penetration	93.4%	FCC, *Telephone Subscribership.*
7	Percent Household Penetration Based on Deaveraging Outer Limit	86.1%	See **Figure 13, Line 8.**
Calculations:			
8	Select a Monthly Rate (Price)	100.0%	Ln 2/Ln 2
9	Percentage Difference between Selected Price and 1991 Price	$30,877,871,885	Ln 2 + Ln 3; see **Figure 10, Line 23.**
10	Percentage Change in Penetration	138.8%	Ln 8/Ln 2
11	Percent Change	38.8%	Ln 10 - 1
12	Effect on Demand: High	-7.8%	Ln 11 * Ln 4
13	Resulting Penetration	86.2%	Ln 6 * (1 + Ln 12)
14	Effect on Demand: Low	-1.9%	Ln 11 * Ln 5
15	Resulting Penetration	91.6%	Ln 6 * (1 + Ln 14)

Figure 14
Calculations for Figure 7: Support Required to Preserve 1991 Level of Telephone Service, cont.

Line:	Description:	Data:	Source:
16	Customer Support Need:	$669,829,139	Ln 3 * |Ln 12|
17	Percent of Current 1991	7.8%	Ln 16/Ln 3
18	Customer Support Need:	$167,457,285	Ln 3 * |Ln 14|
19	Percent of Current 1991	1.9%	Ln 18/Ln 3
20	Percent Change in Current Payment	38.8%	Ln 3/Ln 2
21	Percent Change in Household Penetration Rate	-7.8%	Ln 20 * Ln 4
22	Percent Change in Household Penetration Level	-7.3%	Ln 7 - Ln 6
23	Amount of Support Needed for 1991 Penetration	$669,829,139	Ln 21 * Ln 3

X. Appendix B: Background for LEC Cost Categories

Background for Figures 8 and 9: Potential Alternative on Sources for Rural Support

Assumptions and Caveats:

These figures only show two industries that might provide support for rural customers. Other industries that provide communications services are computer, mobile radio, publishing, and broadcasting.

Sources:

Traditional Telephone Industry: Weinhaus, *Who Pays Whom?,* Figure 7, page 14.

CATV Industry: National Cable Television Association, *Cable Television Developments,* May 1992, page 8-A.

CAP Industry: "Fiber-optic Flurry Quickens," *Kansas City Star*, June 13, 1993, page A-1.