Stakes in Telecommunications Cost and Prices

Anthony G. Oettinger
Kurt Borchardt
with
Carol L. Weinhaus

Part 2 of
Basic Data on the Politics and Economics of the Information Evolution
Telecommunications Costs and Prices in the United States

Program on Information Resources Policy

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BASIC DATA ON THE POLITICS AND ECONOMICS OF THE INFORMATION EVOLUTION:
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Carol L. Weinhaus

EXECUTIVE SUMMARY

• Until the late 1970s, active players came mainly from the relatively small family of the traditional domestic telecommunications industry and its regulators. A few heavy business customers and an occasional consumer activist weighed in now and then.

• Today's participants include a widening circle of competing international suppliers with labels reflecting their origins in the traditional newspaper, postal, computer and other industries purveying information content or conduits. The circle of interested commercial, industrial and household consumers is also widening.

• As internal automation of information resources and external electronic retail activities--such as shopping or paying by phone--continue to grow in all enterprises, their costs will grow not only in the administrative budget, but in the production and the marketing budgets as well. Hence it seems likely that debates over telecommunications policy will capture the attention of top line managers and strategic planners throughout commerce and industry, just as mushrooming data processing costs and attendant organizational questions began to do a decade or so back.

• Part 2 of the multi-volume overview describes both traditional and emerging telecommunications players and their stakes with emphasis on the traditional, who still hold the high ground. Also sketched are traditional services and facilities, prevalent labor and capital structures and also regulatory jurisdictions and price/cost relationships.

• Differing segments of supplier industries have differing stakes, as do different types of consumers. State-by-state data show great heterogeneity, pointing to a high likelihood of differing state attitudes toward deviations from the *status quo*, hence to continuing local and state roles in the face of pressures toward federal preemption. There is a remarkable prevalence of "20/80 phenomena", whereby, for example, 20 percent of the customers in some category account for 80 percent of the revenues for some service.

• This implies widely differing degrees of leverage on differing sectors as changes make themselves felt. The stakes of any given consuming institution, be it corporation or family, therefore depend significantly on the mix of its purchases--current or prospective. For example, outcomes envisaged by a large corporation based on looking only at its highly concentrated intra-corporate or inter-corporate services, may turn out different if in fact it also makes or plans to make use of services that link it to highly diffuse households, small businesses or even internal work stations.

• Much extremist rhetoric about the virtues of either regulated monopoly or unfettered markets has been vented during the ongoing public debates over telecommunications policy. But ardors are cooling, even

at AT&T. Hence, though the procedural details may change, the articulation through the administration of cost allocations of political compromises about pricing efficiency and equity will remain the central factor in telecommunications policy for the foreseeable future.

· The data in this part and in parts 3 and 4 should help each institution assess the trends and how they are likely to impact its particular situation. On the thesis that determination of price/cost relationships is the key to the game as it is still played in 1980, parts 3 and 4 detail both the mechanisms for administering cost allocations and the underlying political compromises of the past and present among players in federal and state jurisdictions respectively.

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Additional Background Documents

TABLE B

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Competitive Carrier (79-252)

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CATV Cross Ownership Waiver (78-219)

Local Exchange Substitutes/Facilities and Services for Transmission and Switching and Alternative "Pipelines"

Cellular Communications Systems (79-318/18262)

Multi-Point Distribution Service (MDS) and Direct Broadcast Satelliite (DBS)

Spectrum Utilization: Digital Electronic Message Services (DEMS)

Merger/Consolidation (GTE/TELENET 80-197)

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Multi-Schedule Private Line Service (MPL/AT&T/20814)

Customer Premises Terminal Equipment (20981/20828)

Rate of Return/Earnings Interstate (AT&T Interstate and Foreign Services, 79-63/187)

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Cost Allocation Manual (AT&T/79-245)

Exchange Network Facilities for Interstate Access (ENFIA) Access Charge (78-371)

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A. Introduction

Part 1 broadly sketched the stakes in changing information resources, among them compunications-based facilities and services. Henceforward, the focus narrows to the impacts of growing competition among suppliers of compunications facilities and services. Specifically, we examine how the growing diversity of services and suppliers, hence the growing range of choices available to consumers, impact policy concerning the traditional telephone industry and its traditional regulated monopoly. Our ultimate purpose is to outline the context within which policy alternatives and their likely consequences must be developed and evaluated. First, however, we need to identify major stakes, persistent forces in action and the resulting perennial policy issues.

The principal effects of competition on a traditionally monopolistic market are widely understood to stem from the force competition applies toward relating prices more directly to costs than is the tendency under monopoly. The relevant forces are not, however, exclusively economic forces due to market competition. As will be made evident in Parts 3 and 4, the history of telecommunications costing and pricing reflects continuing clashes between diverse forces pushing toward greater price averaging and those pushing toward deaveraging, that is toward relating prices more directly to costs. Present practices are intelligible only on such terms.

Moreover, while a revival of faith in market competition was highly evident in the seventies, traditional geopolitical claims in favor of

averaging have hardly disappeared, witness the pressures, still significant in early 1980, toward including Hawaii, Alaska, Puerto Rico and the Virgin Islands[1] in the averaging system described in Parts 3 and 4. The varying geopolitical incidence of costs therefore will remain an important, if not necessarily the dominant factor in determining the extent of averaging. It must be considered alongside any economic analysis of competitive/monopolistic pressures, and will be in Parts 3 and 4.

In this part, however, the preliminary aims are to identify the shares of revenues derived by traditional telecommunications industries from principal categories of consumers, to characterize the principal categories of suppliers, to spot gaps in available data, and otherwise to lay the groundwork for continuing illumination of the likely impacts both of changes in the level of averaging, whatever their causes--assuming constant total costs and revenues--and of changes in the absolute level of revenues and costs owing to changes in market scope and industry structure, however induced.

B. Consumers: Players and Stakes

1. Business and Residential Geographic Concentration

In the U.S. nearly everyone is a consumer of traditional voice telephone service. It is generally accepted that all businesses have a telephone. Although the Communications Act of 1934 speaks of making available "so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges,"[2] Figure

2.1 shows that at the onset of World War II, possibility meant only 37% of households. By 1978 telephone service to 97% of U. S. households had become "possible." This contrasts with 75% penetration in the Netherlands, 53% in Great Britain and 50% in West Germany. However, state-by-state data (Figure 2.2, Table 2.1) show considerable variation in the penetration of households even as of 1976.

As one benchmark against which to evaluate the cost, price and consumption data to be presented in the remainder of this paper, Figure 2.3 and Table 2.2 show state-by-state populations and population densities. Another benchmark is the nationwide annual volume of local (exchange) and interexchange (state and interstate toll) messages. In 1978, of 180 billion messages carried by the Bell System, 165 billion (91.7%) were local (exchange) messages and 15 billion (8.3%) were long distance (interexchange, toll) messages. Of that 15 billion, 10 billion (5.5% of all messages; 67% of toll messages) were state toll messages and 5 billion (2.8% of all messages; 33% of toll messages) were interstate toll messages. Since local messages travel tens of miles or less (see Figure 2.3, for example), state toll messages an average of 50 miles and interstate toll messages an average of 560 miles (1978), it is evident that message traffic is highly concentrated geographically. However, since the length of messages tends to increase with length of haul (LOH), the distributions of message minutes and of message minute miles differ from the distribution of messages. Industry wide, the total number of messages was 239 billion in 1978, with 180 billion (75%) handled by the Bell System and 49 billion (25%) handled by Independents, mostly local messages in the latter case, since interexchange message traffic was carried principally by the

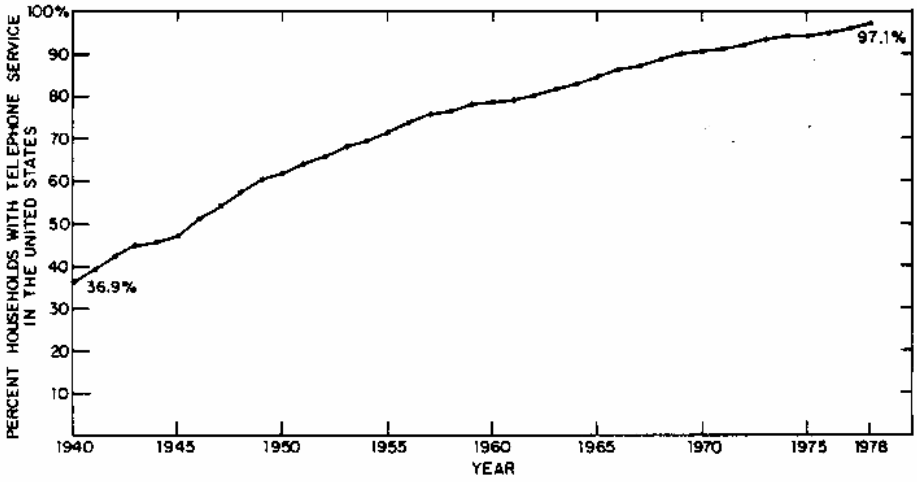


Figure 2.1

Diffusion of Telephones in U.S. Households, 1940-1978

Source[S1]

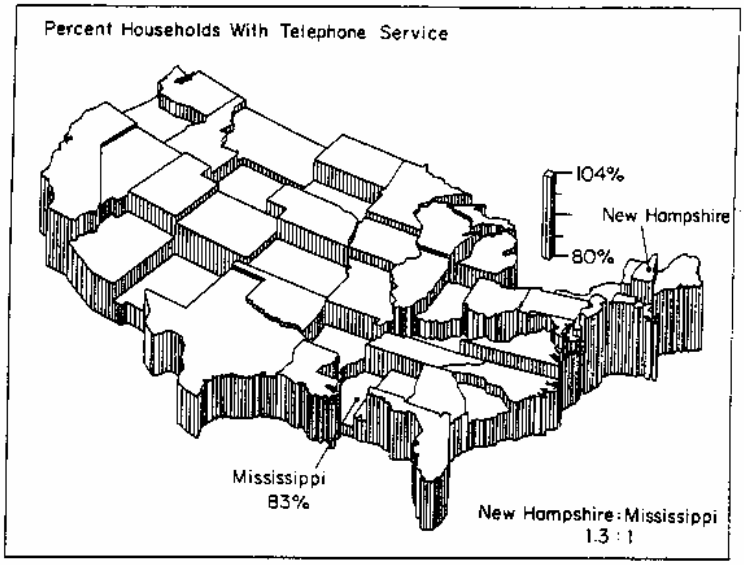


Figure 2.2

Percent of Households with Telephone Service
in the United States, 1976

Source[S2]

Percent Households with Telephone Service	
AL	86
AZ	91
AR	87
CA	97
CO	95
CT	101
DE	100
FL	94
GA	91
ID	95
IL	97
IN	93
IA	97
KS	93
KY	88
LA	93
ME	99
MD	98
MA	97
MI	99
MN	99
MS	83
MO	94
MT	93
NE	99
NV	96
NH	104
NJ	102
NM	86
NY	94
NC	91
ND	99
OH	97
OK	93
OR	91
PA	97
RI	100
SC	88
SD	93
TN	91
TX	92
UT	97
VT	102
VA	95
WA	95
WV	87
WI	98
WY	91

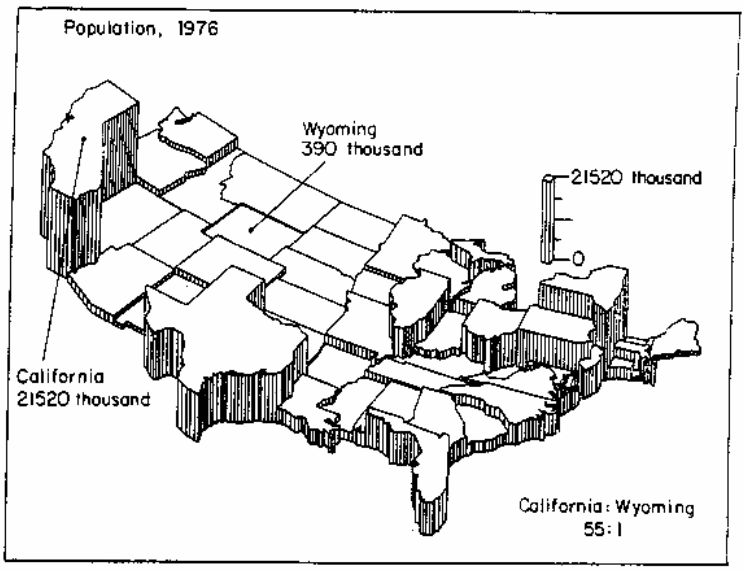
Ranked

Percent Households with Telephone Service	
NH	104
NJ	102
VT	102
CT	101
RI	100
DE	100
MN	99
MI	99
ND	99
ME	99
NE	99
WI	98
MD	98
OH	97
CA	97
MA	97
LA	97
IL	97
UT	97
PA	97
NV	96
ID	95
WA	95
VA	95
CO	95
MO	94
NY	94
FL	94
LA	93
IN	93
OK	93
MT	93
KS	93
SD	93
TX	92
AZ	91
WY	91
OR	91
GA	91
NC	91
TN	91
KY	88
SC	88
AR	87
WV	87
AL	86
NM	86
MS	83

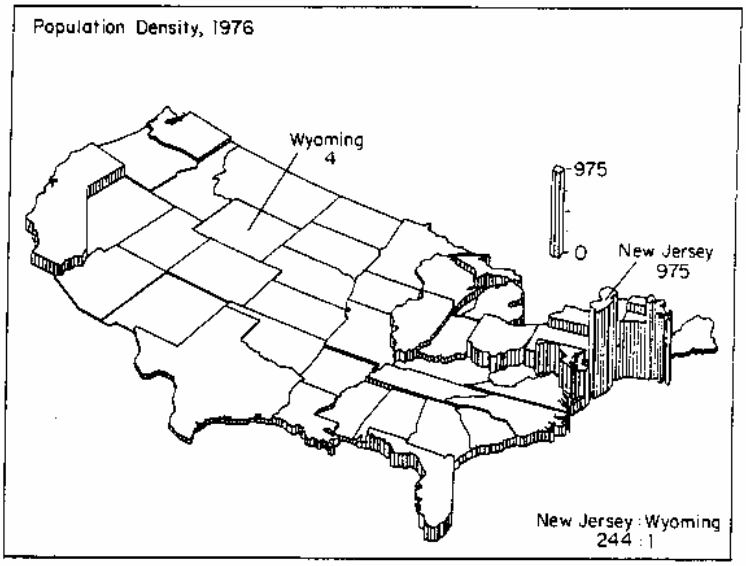
Table 2.1

Percent of Households with Telephone Service in the United States, 1976

Source[S3]



(a)



(b)

Figure 2.3

State-by-State Population (thousands) and Population Density (persons per square mile), 1976

Source[S4]

	Total Population	Population Density	Ranked Total Population		Ranked Population Density	
AL	3665	72.3	CA	21520	NJ	975.4
AZ	2270	20.0	NY	18084	RI	883.7
AR	2109	40.6	TX	12487	MA	742.3
CA	21520	137.6	PA	11862	CT	641.1
CO	2853	24.9	IL	11229	MD	419.0
CT	3117	641.1	OH	10690	NY	378.1
DE	582	293.6	MI	9104	DE	293.6
FL	8421	155.7	FL	8421	PA	263.8
GA	4970	85.6	NJ	7336	OH	260.9
ID	831	10.1	MA	5809	IL	201.4
IL	11229	201.4	NC	5469	MI	160.2
IN	5302	146.9	IN	5302	FL	155.7
IA	2870	51.3	VA	5032	IN	146.9
KS	2310	28.2	GA	4970	CA	137.6
KY	3428	86.5	MO	4778	VA	126.5
LA	3841	85.5	WI	4609	NC	112.1
ME	1070	34.6	TN	4214	TN	102.0
MD	4144	419.0	MD	4144	SC	94.2
MA	5809	742.3	MN	3965	NH	91.1
MI	9104	160.2	LA	3841	KY	86.5
MN	3965	50.0	AL	3665	GA	85.6
MS	2354	49.8	WA	3612	LA	85.5
MO	4778	69.3	KY	3428	WI	84.6
MT	753	5.2	CT	3117	WV	75.7
NE	1553	20.3	IA	2870	AL	72.3
NV	610	5.6	CO	2853	MO	69.3
NH	822	91.1	SC	2848	WA	54.3
NJ	7336	975.4	OK	2766	VT	51.4
NM	1168	9.6	MS	2354	IA	51.3
NY	18084	378.1	OR	2329	MN	50.0
NC	5469	112.1	KS	2310	MS	49.8
ND	643	9.3	AZ	2270	TX	47.6
OH	10690	260.9	AR	2109	AR	40.6
OK	2766	40.2	WV	1821	OK	40.2
OR	2329	24.2	NE	1553	ME	34.6
PA	11862	263.8	UT	1228	KS	28.2
RI	927	883.7	NM	1168	CO	24.9
SC	2848	94.2	ME	1070	OR	24.2
SD	686	9.0	RI	927	NE	20.3
TN	4214	102.0	ID	831	AZ	20.0
TX	12487	47.6	NH	822	UT	15.0
UT	1228	15.0	MT	753	ID	10.1
VT	476	51.4	SD	686	NM	9.6
VA	5032	126.5	ND	643	ND	9.3
WA	3612	54.3	NV	610	SD	9.0
WV	1821	75.7	DE	582	NV	5.6
WI	4609	84.6	VT	476	MT	5.2
WY	390	4.0	WY	390	WY	4.0

Table 2.2

State-by-State Population (thousands) and Population Density (persons per square mile), 1976

Source[S5]

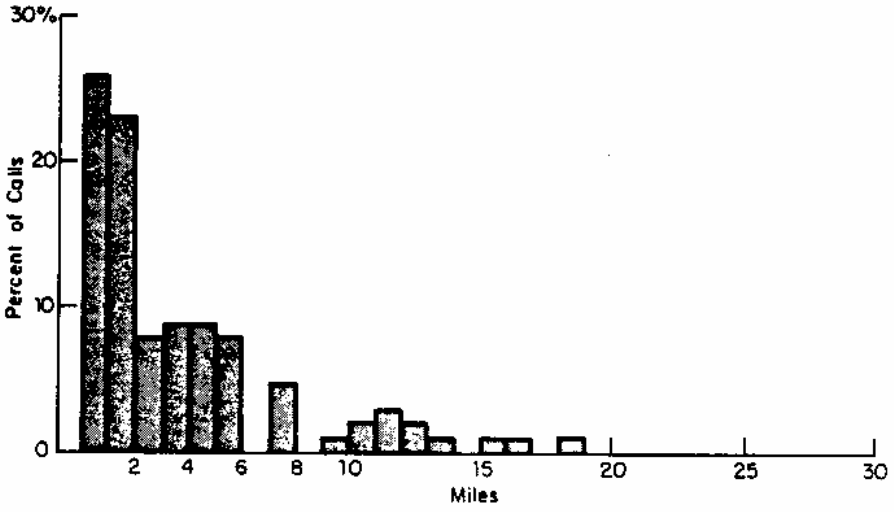


Figure 2.4

Distances Traveled by 1-Party Flat Rate Local Calls, Mid-1970's

Source[S6]

Bell System.[3]

Another type of geographic usage concentration is indicated by Figure 2.5. Interstate message traffic carried by the Bell System is shown in Figure 2.5(a). Industry-wide (Bell System and Independents) data on revenue from business customers are shown in Figure 2.5(b). Since Figures 2.5(a), 2.5(b) are not directly comparable, the inference that revenues are more concentrated than message traffic volumes is not warranted on this basis alone. As might be expected, business message traffic is more highly concentrated than residence message traffic (Figure 2.5(a)). As WATS traffic (Figure 2.20) and Extended Area (Local) Service (Section 4-E) grow, the significance of these differential concentrations will tend to diminish. Calls to Area Code 800 numbers (inward-WATS) are originated by residences as well as businesses, but generally paid for by businesses, hence counted as business traffic.

The rough classification of consumers as business or residential is inadequate, as suggested by Figure 2.6. There is considerable controversy as to whether or not the finer categories in Figure 2.6 each pay a "fair" share of "costs" of service or, put another way, as to what direction any "subsidies" symbolized by the lines in Figure 2.6 actually flow and how they net out for each category.

How the members of each category see themselves and how they are perceived by others is outlined in the following descriptions.

2. Principal Types and Stakes[4]

a. Big Business

Self Perception

See themselves as special category among users and as deserving

	% Of Total Traffic (Minutes)	
Cities	Business	Residence
25	35%	15%
50	50%	30%
100	75%	50%

Geographic Market Concentration:
Interstate MTS and WATS

(a)

Proportion of Interstate Business MTS and WATS Revenues Generated by Largest Metropolitan Areas	
Calls Among Largest Metropolitan Areas	Proportion of Total Revenue
16	1/3
32	1/2
144	7/8
400	9/10

Proportion of Interstate Business
MTS and WATS Revenues Generated by
Largest Metropolitan Areas

(b)

Figure 2.5

MTS and WATS Market Concentration
and Revenues, 1976

Source[S7]

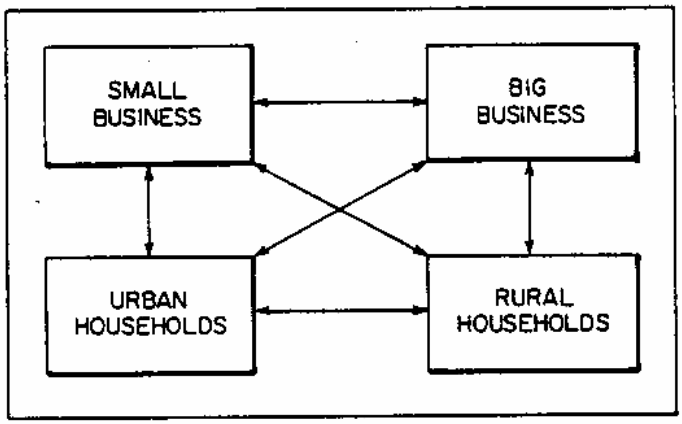


Figure 2.6

Equities and Cross-Subsidies

adequate consideration of their special needs. They insist upon their needs being met at wholesale prices which they deem reasonable, either by AT&T and Independent Telephone Companies or by "Specialized" or "Other" Common Carriers. They further insist upon liberal "foreign attachment" policies. Thus, they favor competition among compunication companies.

Since their methods of conducting their businesses often depend on the use of private networks furnishing internal and external compunication services at very low rates, they oppose any limitations on the use of such networks in conjunction with switched services offered by AT&T and Independent Telephone Companies. Compunication services often are used not only for profit maximization but are highlighted in advertising, stressing advantages which such compunication services offer to customers.

Others' Perceptions

Telephone companies fear that the de-averaging of rates (resulting in lower rates to big business and government users) will lead to the eventual drying up of the pool of revenues from which local services are presently said to be subsidized. Small business users fear that such de-averaging will affect them adversely in competing with big business.

b. Small Business and Professional

Self Perception

If aware at all of their compunication problems, see themselves as positioned in the middle between Big Business Users on the one hand and Urban and Rural Household Users on the other hand: not being sufficiently large to take advantage of private networks, yet not getting the kinds of switched services needed by them, they are charged higher rates than household users. Thus, they see themselves at a disadvantage vis-a-vis big business competitors. They look to compunications hardware which will provide needed services at reasonable costs.

Others' Perceptions

At present, AT&T and Independent Telephone Companies see them as one of two main sources of revenues (the other being Household Users) which depend on switched services rendered by them and not sufficiently large to take advantage of offerings by "Specialized" and "Other" Common Carriers. There is some apprehension that in the future "Specialized" and "Other" Common Carriers may offer competition regarding Small Business and Professional as well as Big Business.

c. Urban Householders

Self Perception

Usually taking uninterrupted functioning of their household phones for granted, they do not perceive how dependent they are on their phones until service is interrupted. Then they realize that they are as dependent on phones for urban living as they are on electricity, using phones for socializing as much if not more than for other household activities. Suburban and exurban calls are perceived as excessively expensive when area-wide rates are not available.

Others' Perceptions

AT&T and Independent Telephone Companies see urban household users along with business and professional users as two main sources of revenues. They contend that competition will force the lowering of MTS (long distance calls) prices hence, by reducing the contributions of MTS revenues to total cost coverage, tend to drive up rates for basic residential services. They also are fearful that purchase of phones from hardware suppliers instead of rental from phone companies will drive up rates for household services and will lead to customer dissatisfaction in case purchased equipment malfunctions. Householders are looked to by phone companies as allies in phone companies' fight to maintain status quo, since phone companies claim that changes in policies are likely to lead to increased rates for overwhelming majority of householders.

d. Rural Householders

Self Perception

Perceive themselves as being absolutely dependent on uninterrupted telephone service, especially in emergencies and to a considerable extent for socializing. Take for granted low rates and do not mind that the rates are not based on cost but being subsidized from other telephone services and government loans to rural telephone companies.

Others' Perceptions

AT&T and Independent Telephone Companies see rural householders as most potent political allies in their fight to maintain status quo. Therefore, want to continue averaging of rates (which results in low rates to rural householders). Congress and regulatory commissions (FCC and states) similarly support low rates to rural householders as a desirable social public policy objective.

e. Government

The U. S. government presents a special case owing, in the first

instance, to its large scale as a customer. Some of the implications of scale are detailed in a report by the General Accounting Office to the effect that "Economic and Operational Benefits in Local Telephone Services Can Be Achieved Through Government-Wide Coordination" issued in November 1979.[5]

Besides being an ordinary, albeit large customer, the government also has special relationships with the telecommunications and related industries as a major source of dollars for research and development. And it has unique responsibilities for national defense and security, as spelled out in the following excerpt from a memorandum by the National Telecommunications and Information Administration on national defense and security and emergency preparedness issued in connection with legislative debates before the 96th Congress:[6]

> Present Situation and Problem. In discussions of the current legislative efforts to amend the Communications Act of 1934, questions have arisen about the impact of these initiatives on national defense and security and the emergency preparedness posture of the Nation. While some of these initiatives may create new problems in these areas, some problems have already appeared due to the evolving competitive environment embodied in the recent actions of the Federal Communications Commission (FCC) and the courts. A major consequence of these problems is to place a much greater planning burden on national security agencies to ensure the integrity of communications in times of stress in an increasingly competitive market. We believe that some specific legislative actions, described below, would be helpful in the future in dealing with these problems.
>
> Analysis. The Congress is now considering a number of amendments to foster competition and deregulation where feasible, while also protecting the existing national network from unacceptable technical or operational harm. Without some legislative safeguards, however, deregulation of some telecommunication services may not give adequate consideration to national defense to achieve an efficient allocation of private resources which will not necessarily serve our collective interests in the national defense and security and emergency preparedness.

Historically, because of the current industry structure and partially as a result of our national emergency preparedness policy, some of the major common carriers have viewed the Nation's telecommunications facilities as national resources to be protected both from natural disasters and military attack. This has resulted in some unilateral protection of facilities through employment of diverse routing and other protective measures built into the system by the telephone industry. In addition, a system management structure has evolved, tying telecommunications resources together in a manner that gives this Nation a higher assurance of effective response to the private and public telecommunications needs during periods of national emergency or natural disaster. Maintenance and improvement of this capability to respond is essential to national defense and security and emergency preparedness. Any dramatic change in the manner in which our telecommuncations resources are developed, maintained and managed could result in a diminution of this capability. On the other hand, increased competiton may well lead to alternative networks, and the availability of such alternatives could enhance, depending in part on the degree of cooperative management and interconnectability of such networks, the likelihood that our telecommunications system can be reconstituted in the event of a natural disaster or national emergency.

Specifically, the national security community is concerned that the total reliance on competitive forces, absent legislative safeguards, may result in the impairment of the carriers' ability to maintain a national network management structure. Carriers facing competitive pressure may not have the incentive to jointly plan for the purposes of enhancing interconnectability and route restorability in time of national emergency or natural disaster. On the other hand, carriers may, simply as good business practices, have the incentive to jointly plan in such a way that national security and emergency preparedness needs may be largely met.

We recognize that the Federal and state governments also have significant responsibilities to ensure that effective telecommunications are available during periods of national emergency or natural disaster. Telecommunications carriers may also develop mutual support and management plans on their own initiative. We believe it necessary, however, to set up some safeguard mechanism, to be used in the event that increased competition threatens to cause significant adverse impact upon the telecommunications network's capacity to respond to a national emergency or natural disaster. If the appropriate Executive Branch agencies determine that such adverse impact has occurred or is imminent, we believe they should be authorized to request the FCC to evaluate the need for and take the regulatory action necessary to preserve the national interest. This is not to say that

carriers should be required to provide services and facilities which they would not otherwise provide at no cost to the government. We simply believe the FCC should be given the authority to act, upon request of the appropriate Executive Branch agencies, to avoid significant adverse impact upon the ability of the Nation's telecommunications facilities to effectively respond to the national needs in time of a national emergency or natural disaster.

It is the view of the Administration that Congress should separately recognize and declare the vital importance of the Nation's telecommunications resources to national defense and security and emergency preparedness. The promotion of national security and emergency preparedness should be included as an objective equal to any other. In the event that the authority of the FCC to guard against significant adverse impact upon the Nation's telecommunications resources is called upon by the Executive Branch agencies, the FCC must then consider any conflict between national security and defense and emergency preparedness needs and the promotion of competition. The possibility exists that regulation that serves national defense and security and emergency preparedness needs will in fact conflict with the other purposes of this Act, particularly the promotion of competition. The Commission must recognize that imposing significant costs on all carriers can raise entry barriers and choke off competition and that imposing costs on some carriers and not others can unfairly hamper the ability of some to compete. Thus we recommend that Congress state explicitly that the Commission's regulatory authority here cannot be exercised if doing so would significantly impair its promotion of the other purposes of the Act. The legislative history could emphasize that in general, the Commission's regulatory authority should be used to facilitate negotiations and planning and not as a substitute for budgetary allocations that pay for the defense and security measures that the carriers are asked to undertake. We would also recommend that the Commission undertake an ongoing study of this problem and report annually to Congress on the extent of the conflicts it finds. Any fundamental decisions about major conflicts between, for example, national security and competition, can then be made, as they should, by the Congress.

We would also urge the Congress to clarify the Commission's authority to establish and enforce technical standards, so as to include explicitly the national defense and security and emergency preparedness as an equally important objective. While we believe that the Congress ought to continue its approach of granting the Commission broad discretionary powers to balance all considerations in carrying out its mission, it is crucial that Congress clearly identify the key objectives it intends the Commission to focus upon.

In addition, we consider it important that the President have emergency powers relating to telecommunications. To this end, we believe it essential to retain the provisions now contained in Section 606 of the Communications Act. Further, we wish to ensure that the President can exercise authority to obtain telecommunications services in time of crisis, upon just compensation, should the competitive market mechanism fail to provide for the availability of the required services.

We view the above considerations as essential to the development of a complete amended Communications Act. With such provisions, the basic law will be more valuable than ever in ensuring that the important national defense and security and emergency preparedness objectives are taken into account at a realistic and reasonable level.

3. Stakes in Growing Compunications Competition

It is evident from the foregoing description of consumer categories that different consumers have differing stakes in the prices they see for services, whatever the relationship of those prices to costs of service might be. But, in addition to intrinsically quantified prices, there are also more or less explicitly articulated stakes in other more or less quantifiable attributes of products and services. Equity, of course, is a universal concern sometimes consonant with economic (price) efficiency, sometimes not. Diversity of choice--its scope and direction of change--is another common stake. More specifically germane to compunications facilities and services are stakes in such yardsticks of performance as responsiveness, reliability, accessibility, confidentiality and security. And industrial consumers may have different stakes according to whether they buy for their own internal use or as part of a service package for delivery to households.

How forces for change affect all these dimensions is therefore of policy concern.

4. Relative Consumption of Services and Contributions to Revenues

What follows is a preliminary sketch of the price structures and demand patterns that account for revenue shares from diverse consumers for diverse telecommunications services. It is meant to provide some basic scenery before which our further and more detailed analysis can unfold. A more detailed analysis of certain facets of relative demand for telecommunications and postal services has been developed by John McLaughlin.[7]

Figure 2.7 illustrates the patterns of prices for basic local flat rate telephone service discussed in more detail in Section 4-E. Historically, these prices have been related--not to costs--but to concepts derived from so-called "value-of-service" justifications. Accounting for one tendency evident in Figure 2.7, value of service is taken as proportional to the number of other telephones that can be reached from a given telephone within a local service area. The logic is: the more phones can be reached, the greater the value, hence the greater the price. Second, basic flat rate service is taken to be of greater value to businesses than to residences: business calling rates are higher than residential, they define the peak central office traffic, and businesses have a stake in universal local service to households that otherwise might not reach them. Hence the generally higher prices for business service. Although both the outcomes and the justifications are controversial, such classifications and rate differentials are explicitly sanctioned by the Communications Act of 1934, provided they are "just and reasonable." Finally, the variability around these general trends reflects state-by-state differences detailed in Section 4-E.

In 1978, of 133.4 million Bell System telephones in the U.S., 35.3 million (26.5%) were in businesses and 98.1 (73.5%) million in residences.

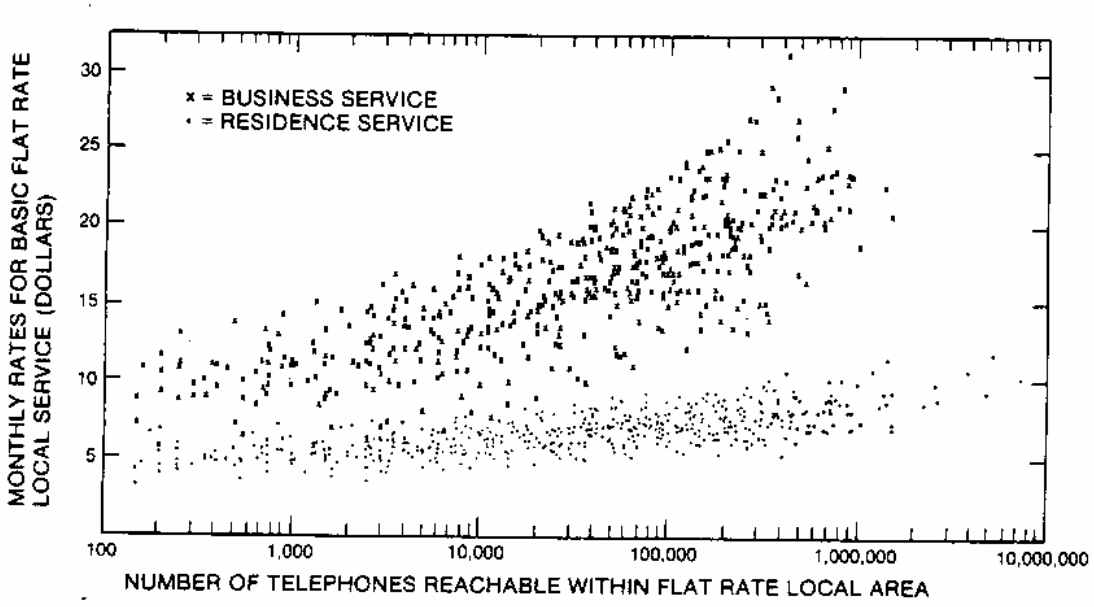


Figure 2.7

Variability in Basic Local Rates (1974)

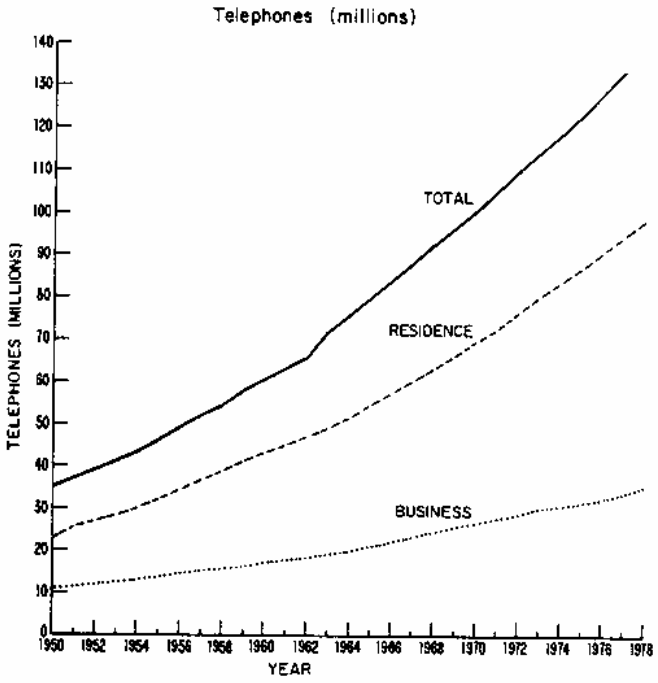
Source[S8]

Historical trends are shown in Figure 2.8(a),(b). As Figure 2.8(c),(d) shows, about 90% of residences are on flat rate basic service (Section 4-E) but less than 50% of businesses, averaging out to 80% of all phones on flat rate basic service. The other 50% of businesses are subject to usage-sensitive (distance and/or time dependent) pricing for local services. Moreover, most businesses avail themselves more heavily than residences of additional so-called vertical services ranging from simple extensions through multi-line telephones with push buttons to private branch exchanges (PBX's), as partly illustrated by Figure 2.8(e). Data for Independents reporting to USITA are given in Figure 2.9.

Comparison of total business and residence revenues for local service is therefore difficult. In the aggregate, however, 1978 local revenues were $9.1 billion for businesses and $8.7 billion for residences served by the Bell System. Comparable figures for those served by Independents are not available.

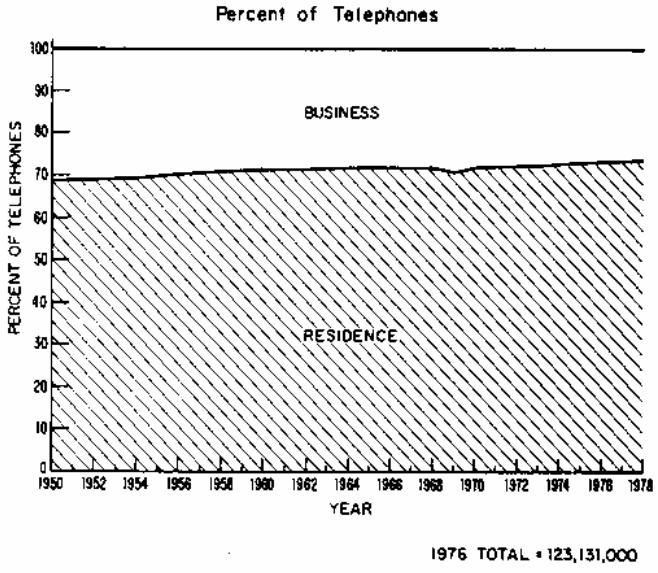
As for toll (interexchange) services, Figure 2.10(a) shows the relative contributions by residential and business consumers to industry-wide interstate MTS, WATS and PLS revenues. Similar data for state toll and total toll (interexchange) services are shown in Figures 2.10(b) and 2.10(c) respectively.

Table 2.3 shows that about $5.6 billion of 1975 interstate revenues was generated by about 4,000 large customers. Among these, between 100 and 1,000, or less than 25% of them, generated 50% of the revenues from that group. From another perspective, Table 2.4 suggests that the 4% of customers with interstate billings of over $200 per month in 1976 accounted for over 60% of interstate revenues. Locational concentration of inter-



Number of Telephones

(a)



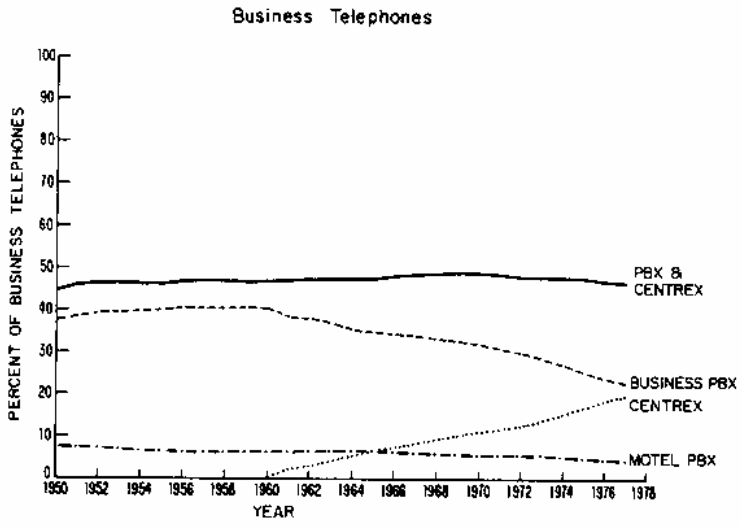
Business and Residence Telephones
as a Percent of Total

(b)

Figure 2.8

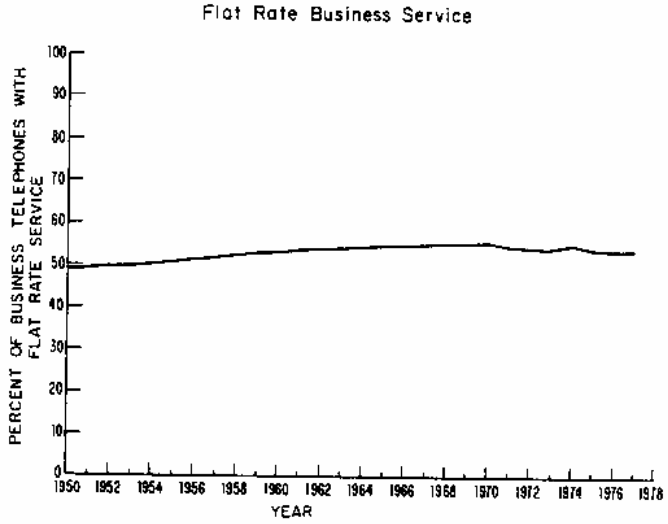
Bell System Business and Residence Telephones,
1950 - 1978

Source[S9]



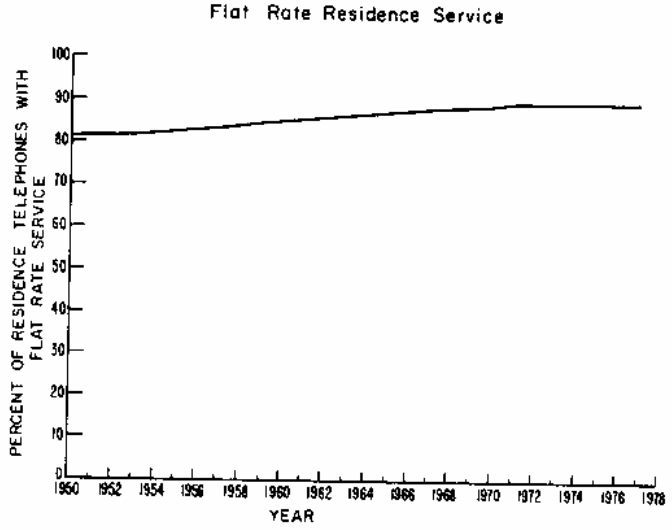
Flat Rate Residence Service

(c)



Flat Rate Business Service

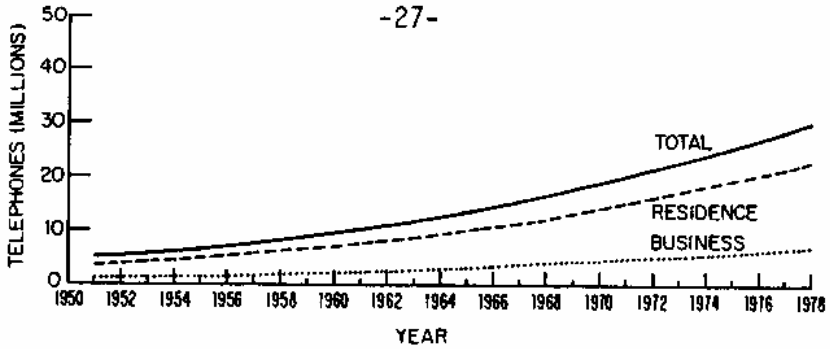
(d)



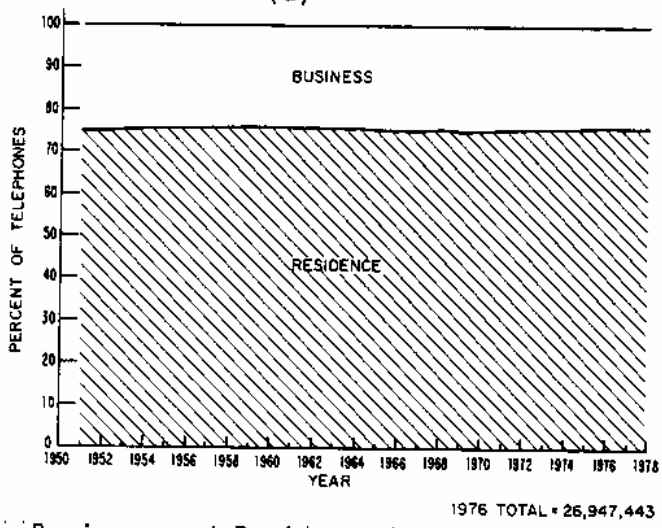
PBX and Centrex as Percent of
Total Business Telephones

(e)

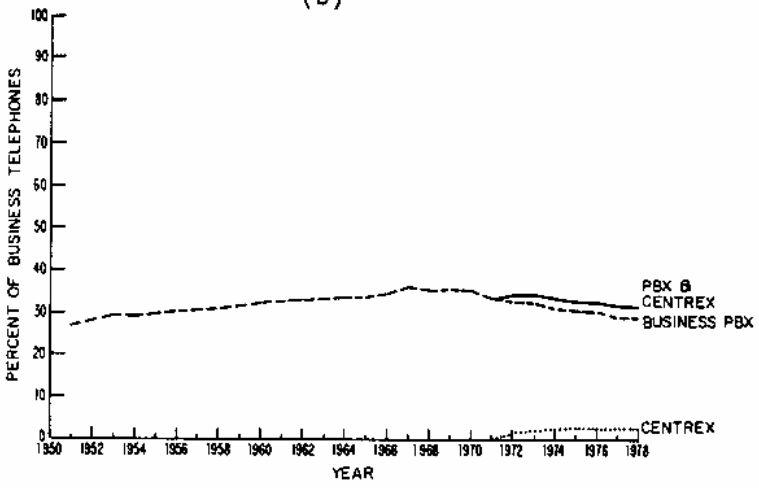
Figure 2.8 (continued)



Number of Telephones
(a)



Business and Residence Telephones
as Percent of Total
(b)



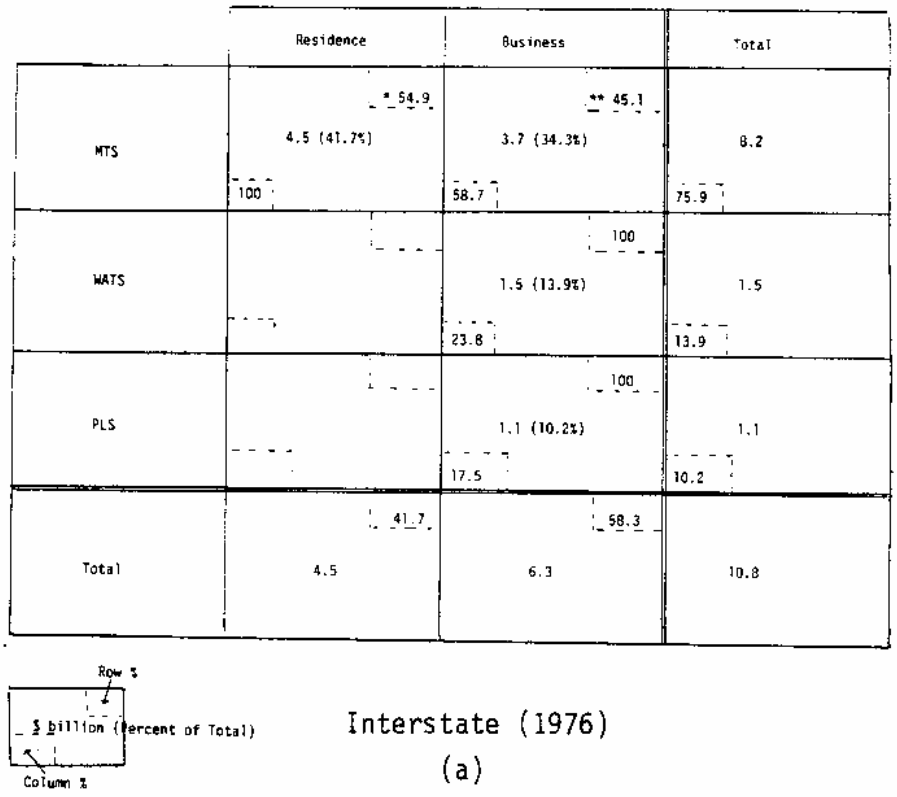
PBX and Centrex as Percent of
Total Business Telephones
(c)

Note: Flat rate residence service and flat rate business service figures not available for independent companies.

Figure 2.9

Independent Companies' Business and Residence Telephones
1951-1978

Source[S10]



Interstate (1976)

(a)

* 67% of traffic (messages)
** 33% of traffic (messages)

Figure 2.10

Distribution of Domestic Toll Revenues

Source[S11]

	Residence	Business	Total
MTS	*54.2 3.2 (?) 100	**45.8 2.7 (?)	5.9 (?)
WATS			
PLS			
Total			

Row %
$ billion (Percent of Total)
Column %

State (Bell System only, 1977)
(b)

* 51% of traffic (messages)
** 49% of traffic (messages)

	Residence	Business	Total
MTS			
WATS			
PLS			
Total			

Row %
$ billion (Percent of Total)
Column %

Total (Interexchange)
(c)

Figure 2.10 (continued)

	Number of Customers	%	Cumulative %		Approximate Annual Interstate Revenues, 1975 (in $ millions)	%	Cumulative %	
	25	.6	.6	100.0	$850	15	15	100
	100	2.4	3.0	99.4	$1000	20	35	85
	1000	24.2	27.2	97.0	$1600	30	65	55
	3000	72.8	100	72.8	$2000	35	100	35
Total	4125	100			$5600	100		

Table 2.3

Proportion of Interstate Business MTS, WATS, and PLS Revenues Generated by Largest Customers, 1976

Source[S12]

Average Monthly Billing ($)	% of Total Customers	Cumulative %		% of Total Revenue	Cumulative %	
0.00	14.1	100	14.1	.0	100	0
2.00	28.5	85.9	42.6	.6	100	0.6
4.00	10.8	57.4	53.4	.8	99.4	1.4
7.00	8.7	46.6	62.1	1.2	98.6	2.6
10.00	5.3	37.9	67.4	1.1	97.4	3.9
15.00	6.1	32.6	73.5	1.9	96.3	5.6
20.00	3.7	26.5	77.2	1.7	94.4	7.3
30.00	4.7	22.8	81.9	2.9	92.7	10.1
50.00	5.3	18.1	87.2	5.2	89.8	15.4
100.00	5.2	12.8	92.4	9.4	84.6	24.8
200.00	3.7	7.6	96.1	13.5	75.2	38.3
200.00+	3.9	3.9	100.0	61.7	61.7	100.0

Mean = $39.31

Excludes Centrex customers and federal government

Table 2.4

Distribution of Interstate Long Distance Business Billing, 1976

Source[SI3]

state revenues is shown by Figure 2.11.

As for residential customers, Table 2.5 indicates that the 10% of them with monthly billings of $25 or more account for about 50% of interstate residential billings, a finding consistent with another estimate shown in Figure 2.12. The data in Figure 2.13(a), (b) attempt to relate telephone rates to various economic indicators. More revealing, however, are the data in Figure 2.14 relating residential expenditures for various categories of service to family income in 1975.

Local usage by businesses also differs from local usage by residences as summarized in Table 2.6 and detailed in Figure 2.15. Figures 2.15(a) and (c) compare the number of residence and business calls (flat rate) across a sampling of central offices. Figures 2.15(b) and (d) compare holding times. Figures 2.15(e) and (f) further detail residential holding times across customers and across calls respectively.

C. Traditional Services

1. Traditional Services Definitions

Traditionally, telecommunications services have been categorized according to various criteria, including the jurisdiction by which they are regulated. Local (exchange calls) were under exclusive state jurisdictions as of early 1980. As noted above, they are further differentiated in price according to whether they are made from residences or businesses and according to state regulatory policies regarding flat rate versus usage sensitive pricing. Some long distance, toll or interexchange services fall under state jurisdiction, but in general those that cross state lines fall under federal jurisdiction. They are further

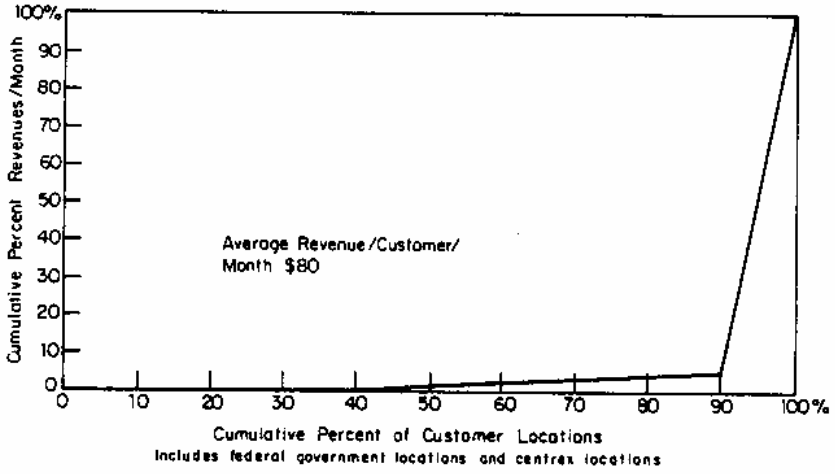


Figure 2.11

Interstate MTS/WATS Business Market Distribution, 1976

Source[S14]

Average Monthly Billing ($)	% of Total Customers	Cumulative %		% of Total Revenues	Cumulative %	
.00	15.5	100.0	15.5	.0	100.0	0
.50	13.8	84.5	29.3	.6	100.0	0.5
1.00	9.2	70.7	38.5	1.3	99.5	1.8
2.00	12.2	61.5	50.7	3.3	98.2	5.1
3.00	8.1	49.3	58.8	3.7	94.9	8.8
4.00	6.2	41.2	65.0	4.0	91.2	12.8
5.00	4.6	35.0	69.6	3.9	87.2	16.7
7.50	8.6	30.4	78.2	9.8	83.3	26.5
10.00	5.7	21.8	83.9	9.2	73.5	35.7
15.00	6.5	16.1	90.4	14.8	64.3	50.5
25.00	5.6	9.6	96.0	19.6	49.5	70.1
25.00+	4.0	4.0	100.0	29.9	29.9	100.0

Mean = $5.39

Table 2.5

Distribution of Interstate Long Distance
Residential Billing, 1976

Source[S15]

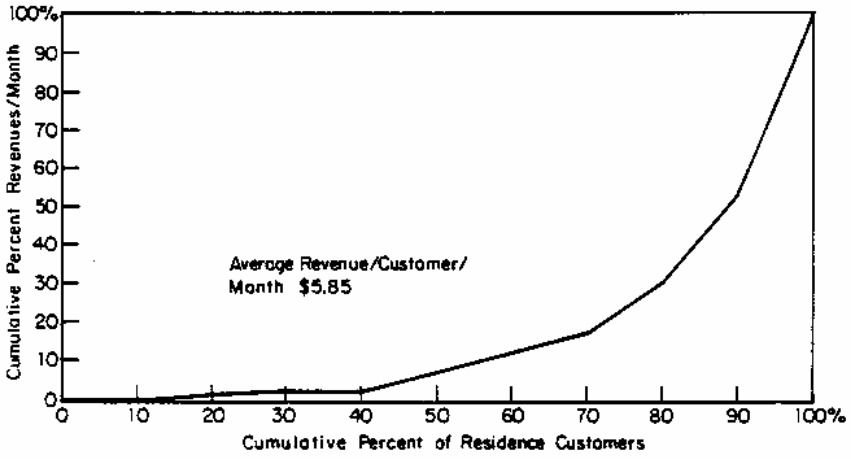
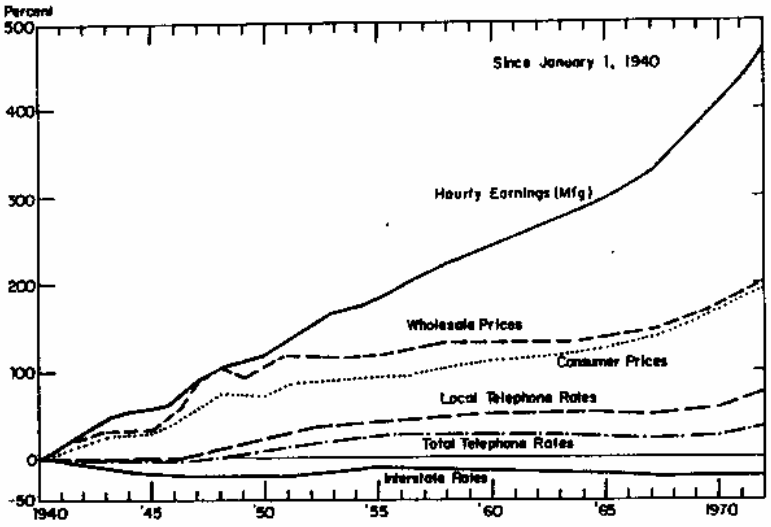


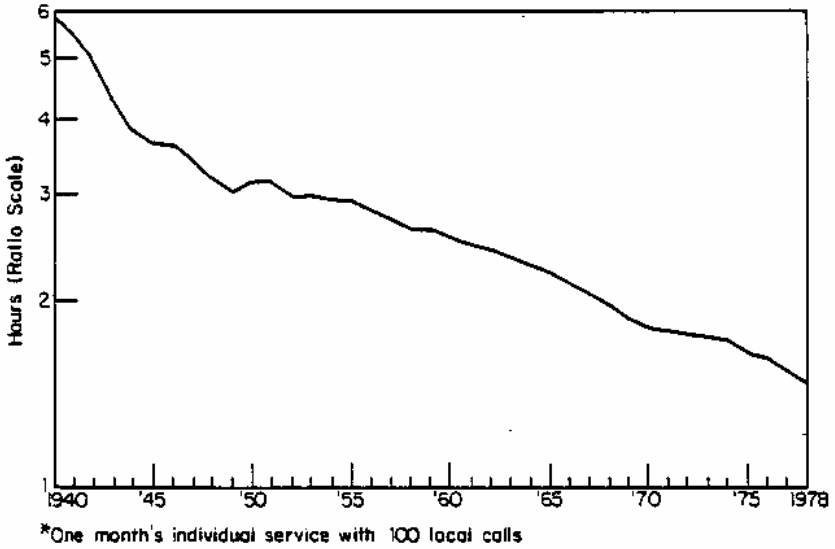
Figure 2.12

Interstate MTS Residence
Market Revenue Distribution, 1976

Source[S16]



Telephone Rates Versus Price Indexes, 1940-1972
(a)

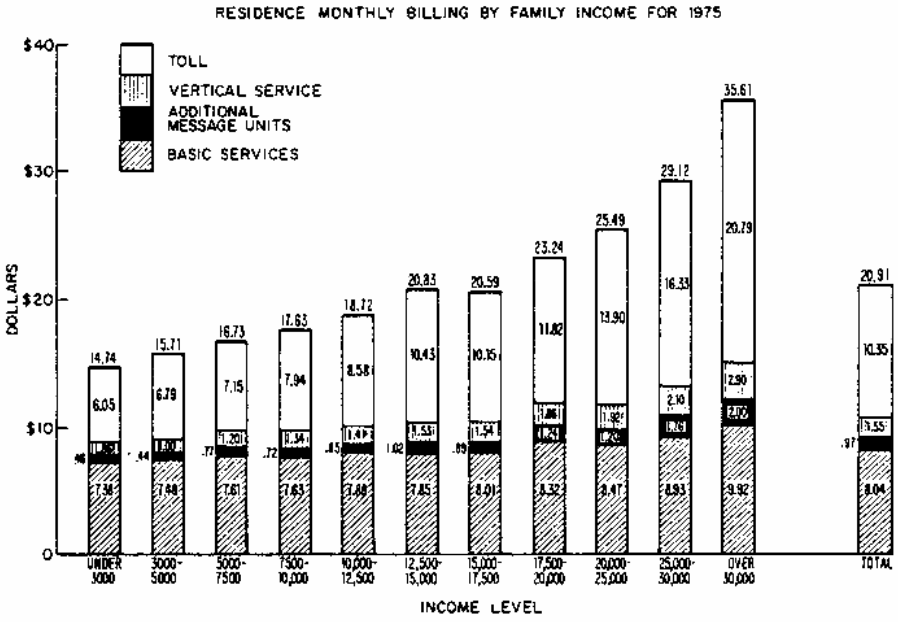


Hours of Work Required to Pay
for Residential Telephone Service, 1940-1978
(b)

Figure 2.13

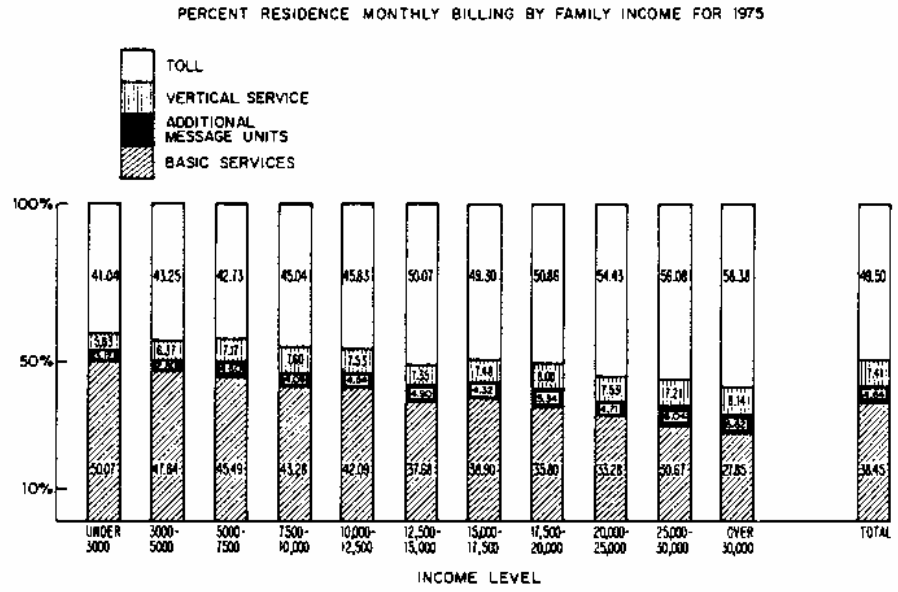
Hourly Earnings, Price Indexes and Telephone Rates

Source[S17]



Residence Monthly Billing for Service

(a)



Percent Residence Monthly Billing for Service

(b)

Figure 2.14

1975 Residence Monthly Billing for Services by Family Income

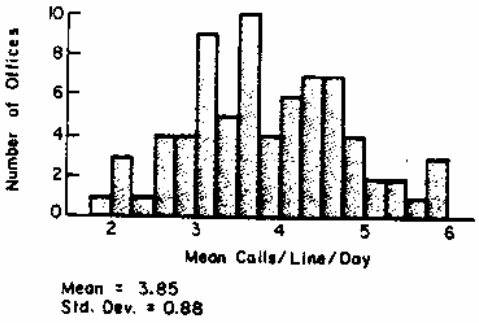
Source S18

Residence	13% Of The Lines Make Less Than Or 1 Call Per Day 61% Call Less Than Or The Mean Of 3.85 Calls Per Day 20% Of The Lines Make 45% Of The Calls 50% Of The Lines Make 79% Of The Calls
Business	6.5% Of The Lines Make Less Than Or One Call Per Day 59% Call Less Than Or The Mean Of 7.04 Calls Per Day 5% Of The Lines Make 16% Of The Calls 10% Of The Lines Make 26% Of The Calls

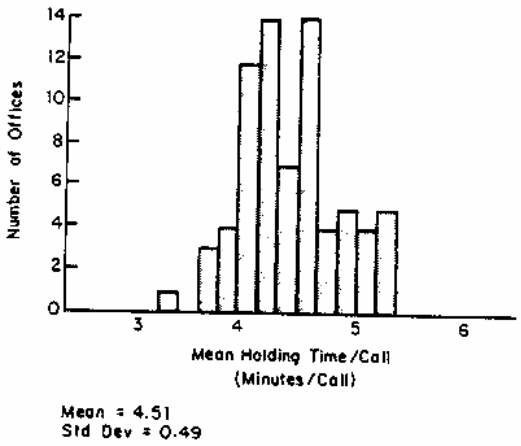
Table 2.6

Characteristics of Local Usage
Mid-1970's

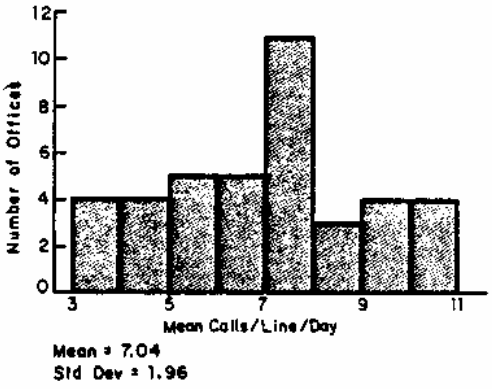
Source[S19]



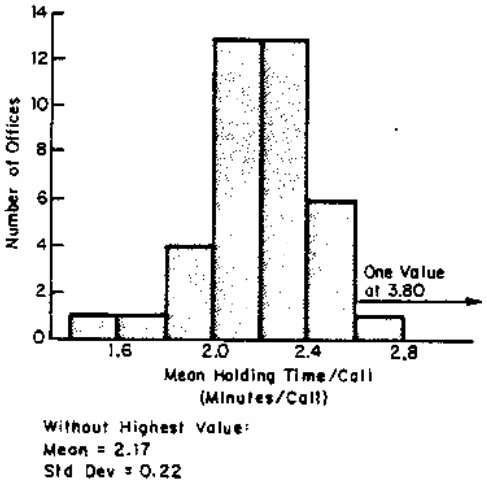
Flat Rate Residence Usage
(a)



Flat Rate Residence Usage
(b)



Flat Rate Business Usage
(c)

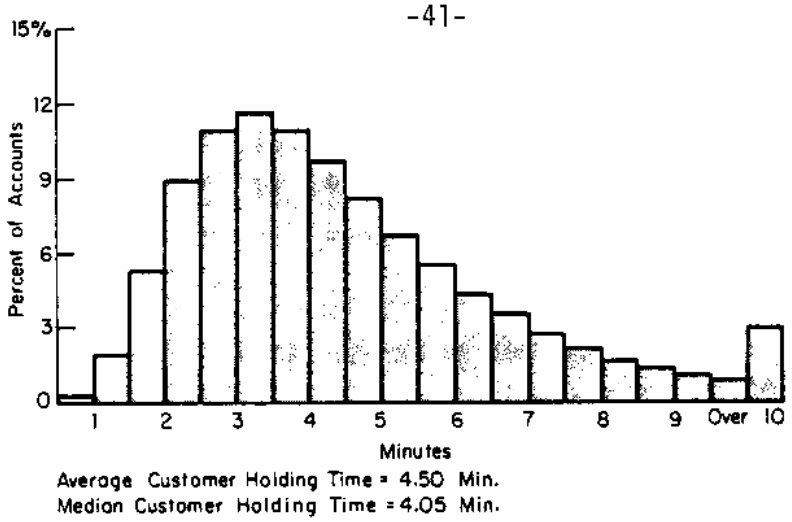


Flat Rate Business Usage
(d)

Figure 2.15

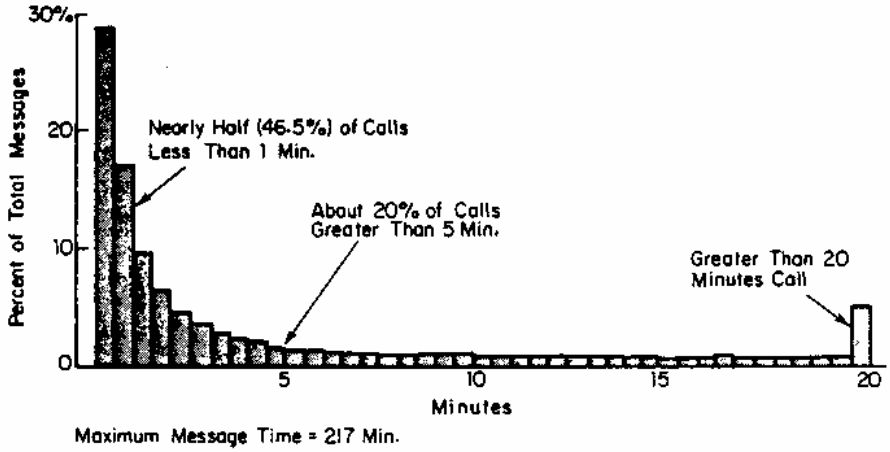
Flat Rate Residence and Business Usage, Mid-1970's

Source[S20]



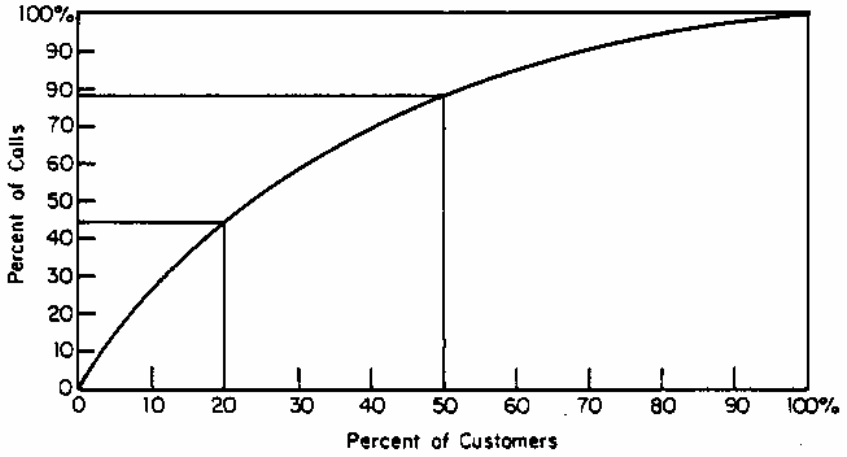
One-Party Flat Rate Local Service: Customer Holding Time

(e)



One-Party Flat Rate Local Service: Message Holding Time

(f)



Flat Rate Residence: Percent Calls vs. Percent Customers

(g)

Figure 2.15 (continued)

differentiated into private line and (non-local) message services. The message services include the ordinary long distance calls (Message Telecommunications Service or MTS) and the Wide Area Telecommunications Services, Outward WATS and Inward WATS, the latter familiar as 800-area-code calls. Much more detail on these services is given in Parts 3 and 4.

2. Traditional Service Differentiations: Time, Distance, Implementation

That averages can be misleading as indicators of consumer characteristics is evident from the sharp differences between residential consumers and business consumers and within these categories as viewed in Section 2-B in the context of "traditional" services and price structures.

Useful insights into the likely consequences for the future of exercising various policy options will also require more detailed analysis of service characteristics as these interplay with the definition of market segments or, equivalently, categories of consumers. Although ordinary telephone calls are a homogeneous and statistically stable commodity in terms of the physiology of the human mouth and ear and certain counterpart engineering viewpoints, they are differentiated or differentiable along other important traditional dimensions.

Figure 2.16 illustrates the differentiation of calls by price according to the distance, duration and implementation of a conventional daytime call. With similar internal differentiations, evening and night rates are differentiated from daytime calls by generally lower price levels. Associated with these differentiations are differential calling patterns that manifest themselves in measurable differences in consumer behavior as indicated, for example, by the differing peaks in Figure 2.17.

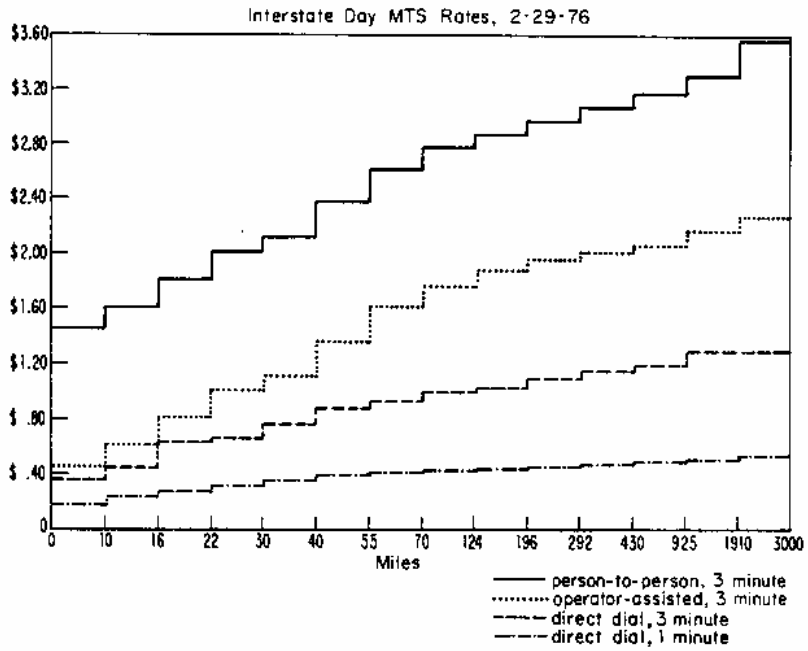


Figure 2.16

Interstate Day MTS Rates, February 1976

Source[S21]

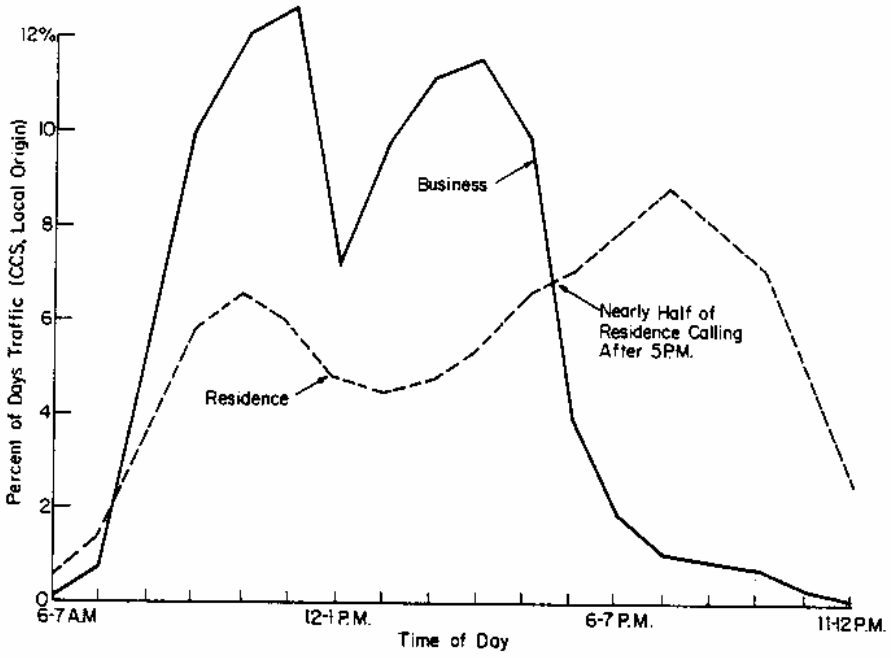


Figure 2.17

Calling Patterns by Time of Day, Mid-1970's

Source[S22]

As Table 2.7 shows, these differences are also associated with different business/residential calling patterns and different relationships between traffic and revenue in each of these categories.

"Traffic" is not an unambiguous term. Its significance varies according to definitional details. One widely applied definition takes the "message" as the unit of traffic, where message is interpreted as a completed call, excluding tries that reach a busy signal. This definition can be related to average revenues per message, but it is not wholly indicative of network facility activities, since uncompleted calls also draw on network resources; it also treats all calls alike, whatever their duration or the distance called. Traffic defined in terms of "message minutes" accords more weight to messages of longer duration. Traffic defined in terms of "message minute miles" accords still more weight to messages traveling farther.

Figure 2.18 illustrates the different images of "traffic" resulting from applying these different definitions to interstate Message Telecommunications Service (MTS) traffic for October 1977. 50% of the message traffic travels less than 250 miles, 50% of the message minutes traffic is accounted for by messages traveling less than 430 miles, and 50% of the message minute miles traffic encompasses messages traveling less than 1360 miles.

3. Relative Service Revenues

Figure 3.1 (Boxes 15 and 16) puts 1976 revenues for gross service categories in context. Together with Figure 2.19, these data indicate that over 70% of revenues comes from messages travelling 100

	Day	Evening	Night/ Weekend
Traffic (Minutes)	35%	34%	31%
Revenue	49%	33%	18%
Percent Bus./Res.	70/30	10/90	10/90

Table 2.7

Time of Day: Calling Versus Revenues for Direct Distance Dialing, 1976

Source[S23]

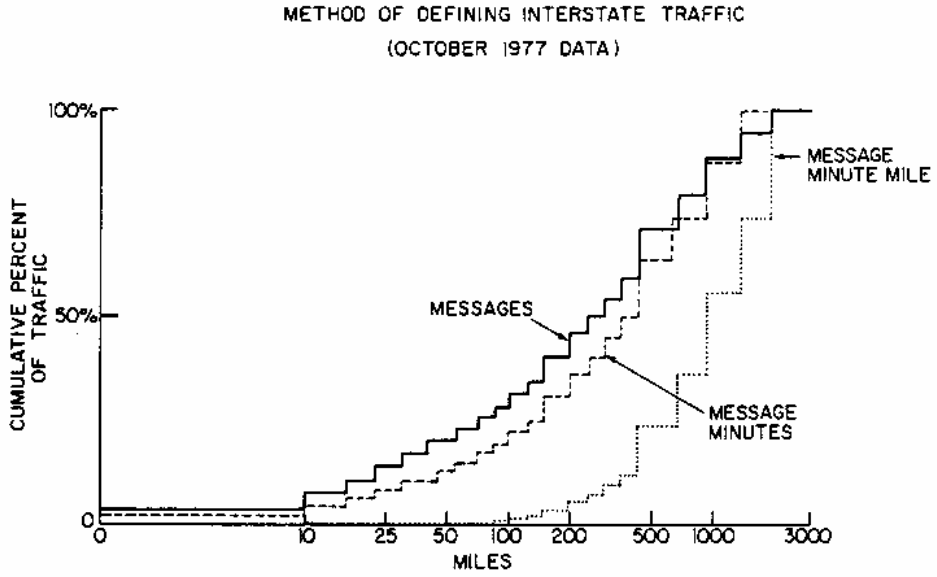
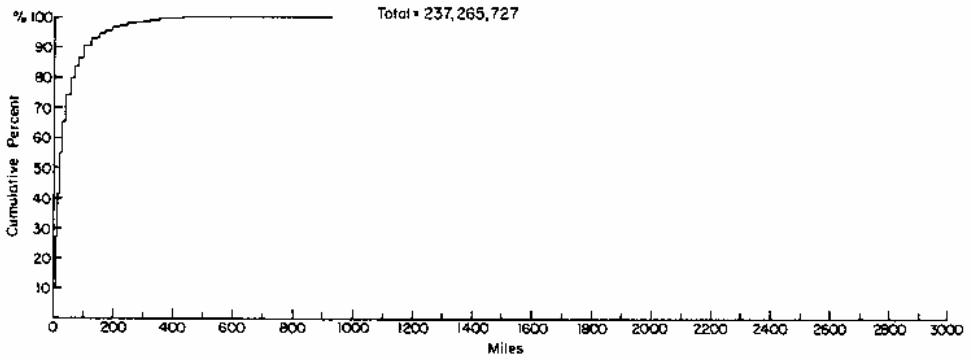


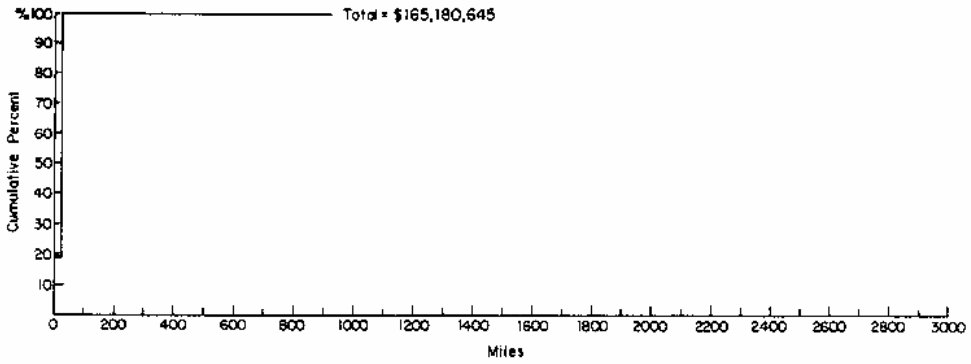
Figure 2.18

Methods of Defining Interstate Traffic
October 1977 Data

Source[S24]



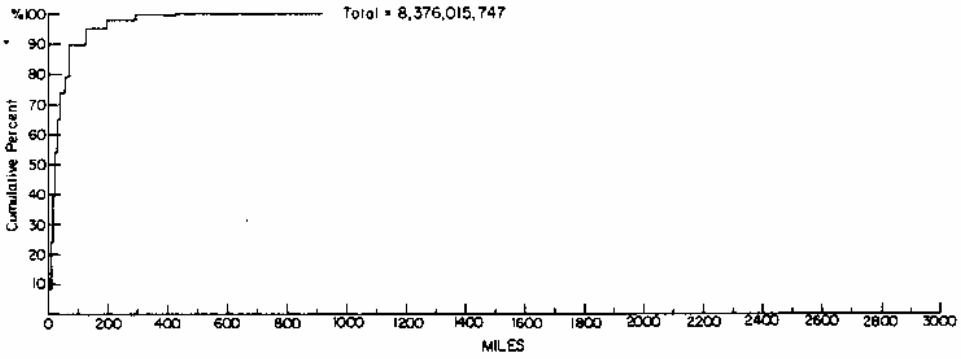
State Toll Messages: Cumulative Percent
(October 1968, 21 Rate Steps)
(a)



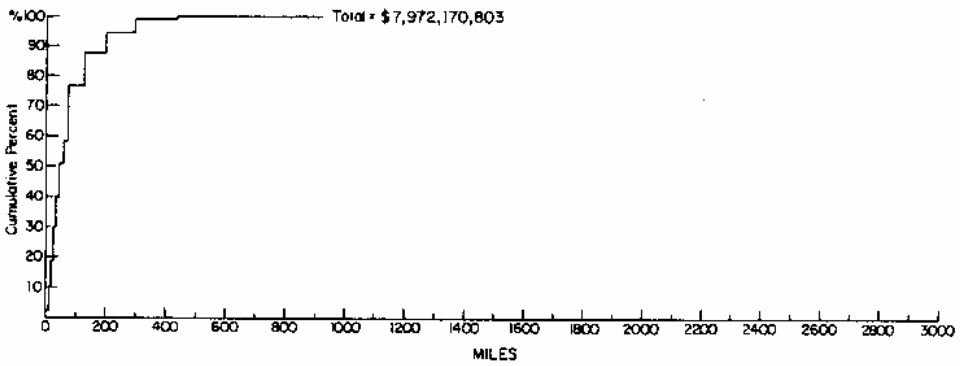
State Toll Revenues: Cumulative Percent
(October 1968, 2 Rate Steps)
(b)

Figure 2.19

Distribution of State Toll and Interstate
Messages and Revenues

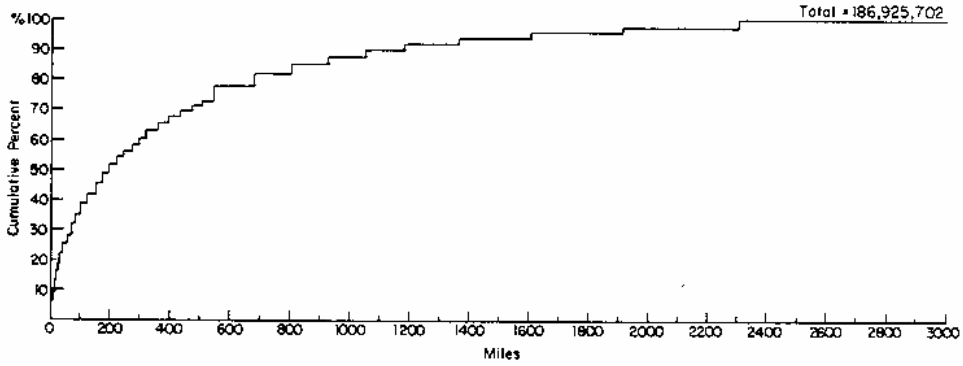


State Toll Messages: Cumulative Percent
(Year ending March 1977, 12 Rate Steps)
(c)

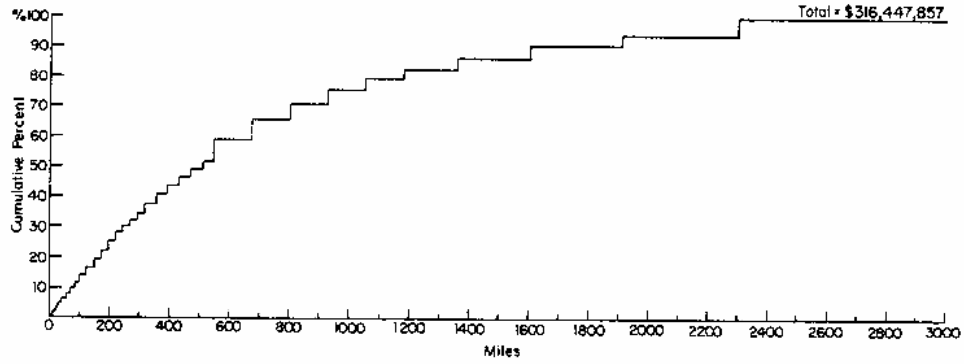


State Toll Revenues: Cumulative Percent
(Year ending March 1977, 12 Rate Steps)
(d)

Figure 2.19 (continued)

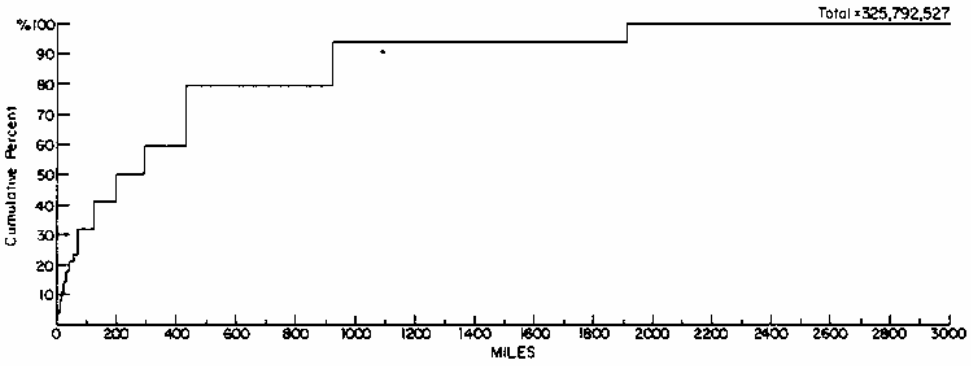


Interstate Messages: Cumulative Percent
(October 1968, 35 Rate Steps)
(e)

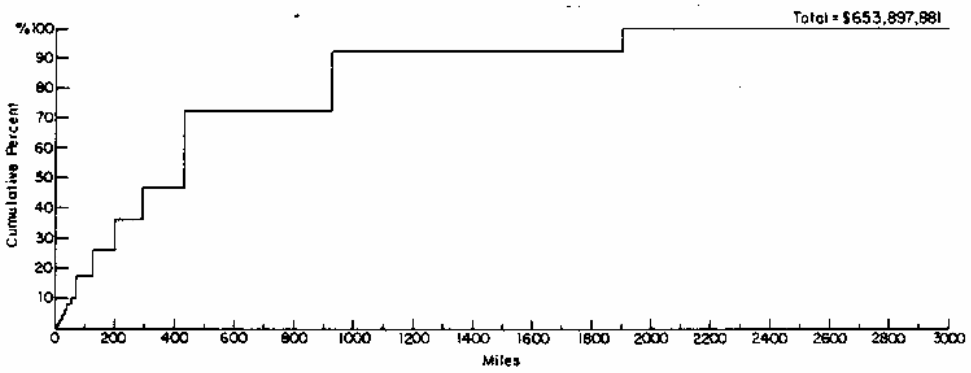


Interstate Revenues: Cumulative Percent
(October 1968, 34 Rate Steps)
(f)

Figure 2.19 (continued)



Interstate Messages: Cumulative Percent
(October 1977, 14 Rate Steps)
(g)



Interstate Revenues: Cumulative Percent
(October 1977, 14 Rate Steps)
(h)

Figure 2.19 (continued)

miles or less, both in 1968 and as recently as 1977.

Alongside this apparent stability of the demand profile, there are the changes in service revenue patterns illustrated in Figure 2.20 and changes in underlying plant and service potential illustrated for Independents in Figure 2.21. In 1978, 19 percent of the United System's two and a half million (main and equivalent) telephones had the capacity for Touch-Tone service and of these 63 percent used that capability. Detailed trend figures for the Bell System are not available. However, as of June 1979, "business and residence Touch-Tone stations totalled 28.1 million or 36% of the combined rotary dial-Touch-Tone service of 76 million..."while" 84% of the remaining rotary stations are in areas where Touch-Tone is available, and central offices are being upgraded to the latter service at the rate of 3% per year... At this rate... Touch-Tone should encompass 57.4 million stations or 64% of all dialing service by 1984. The residence area is expected to account for 42.5 million Touch-Tone stations in five years (compared to 22.4 million in 1979) and the business sector for 14.9 million (vs. 8.2 million this year)."[8]

D. Producers: Players and Stakes

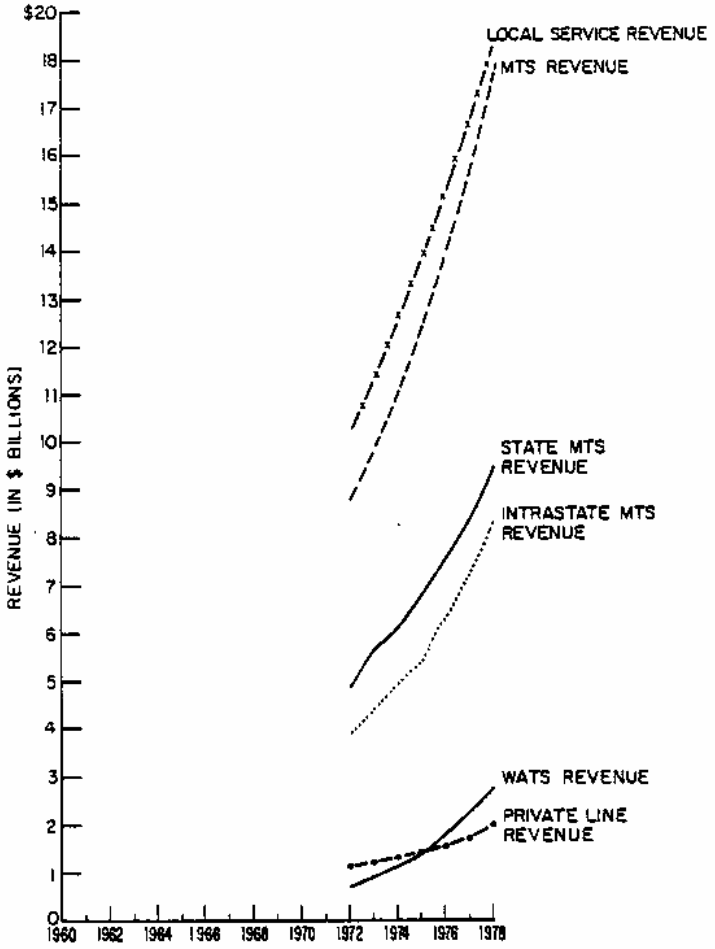
1. Principal Types and Stakes[9]

a. Telecommunication Companies

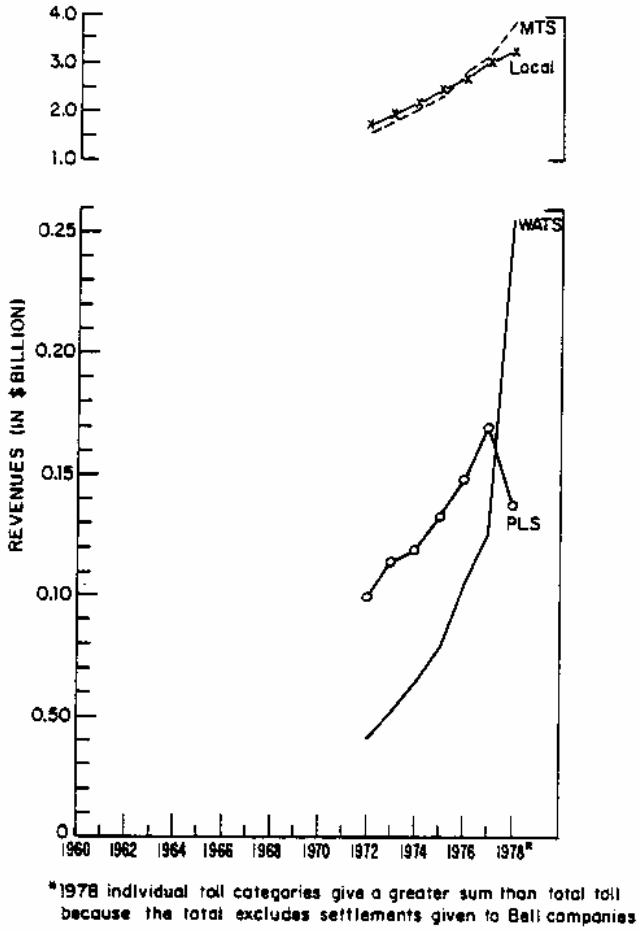
AT&T/WESTERN ELECTRIC/BELL LABS

Self Perception

> Has been seeing itself as a public service company dedicated, as required by Federal and State law, to rendering indispensable, universal, social services to the public as an entirety. Has maintained that the general public interest is served best if such such universal services (rather than special services tailored to meet the diverse needs of different classes of customers) are



Bell System
Revenues by Type of Service
(a)



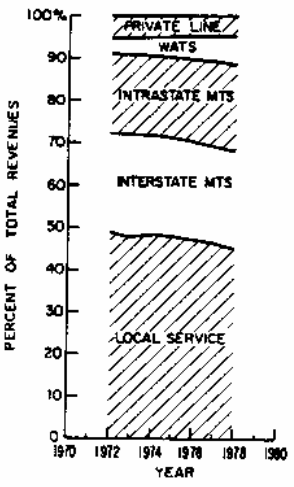
*1978 individual toll categories give a greater sum than total toll because the total excludes settlements given to Bell companies

Independent Companies
Revenues by Type of Service
(b)

Figure 2.20

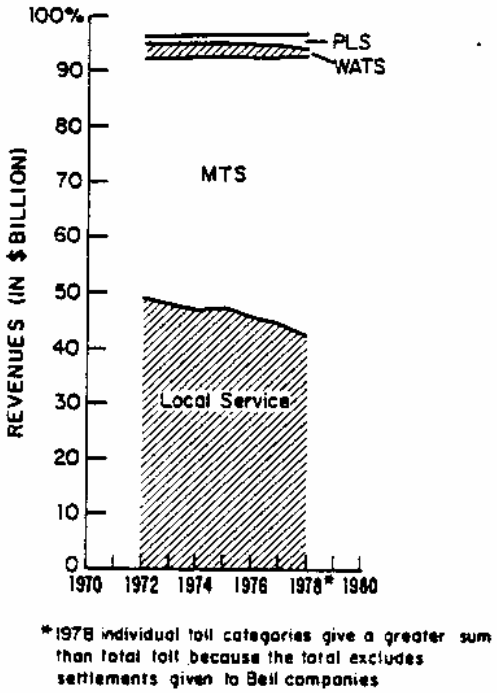
Bell System and Independent Companies
Revenues by Type of Service, 1972-1978,
and Telephone Message Volume, 1950-1978

Source[S26]



Bell System
Distribution of Total
Revenues by Type of
Service

(c)

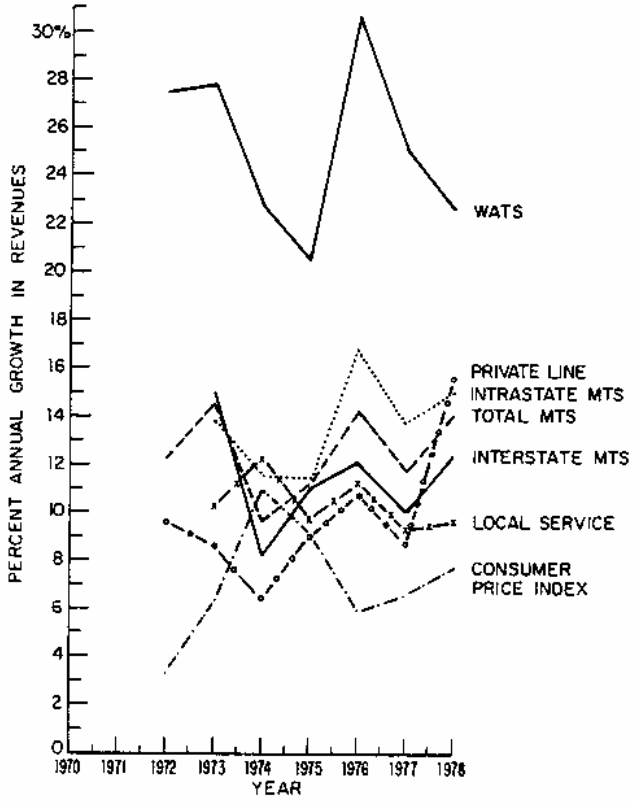


*1978 individual toll categories give a greater sum than total toll because the total excludes settlements given to Bell companies

Independent Companies
Distribution of Total
Revenues by Type of
Service

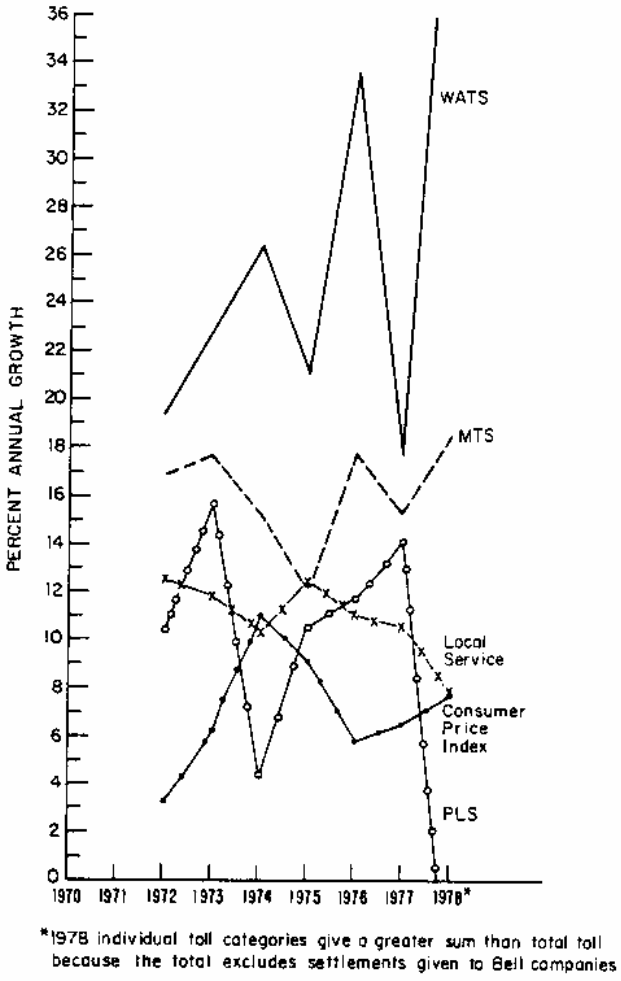
(d)

Figure 2.20 (continued)



Bell System
Rate of Growth in Revenues

(e)

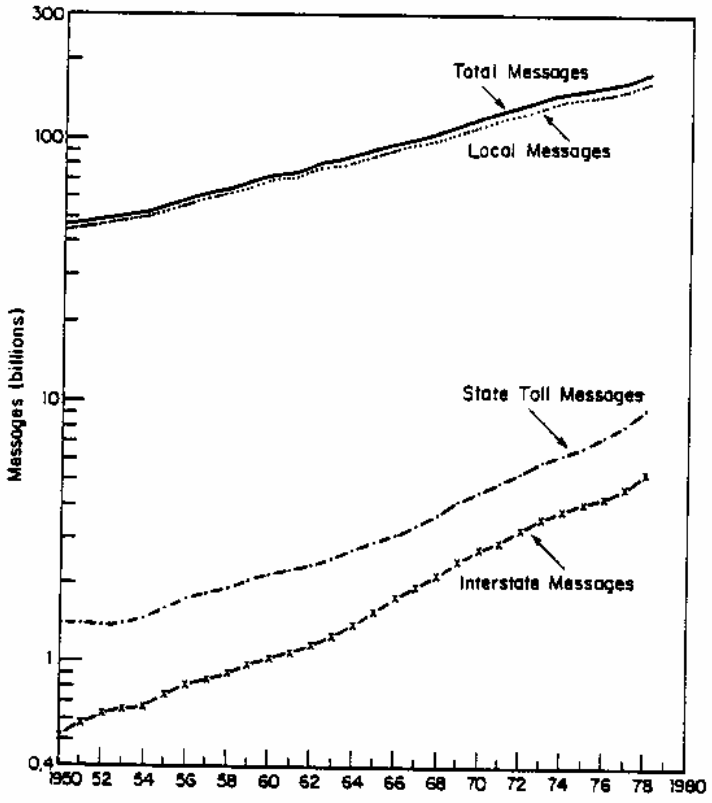


*1978 individual toll categories give a greater sum than total toll because the total excludes settlements given to Bell companies

Independent Companies
Rate of Growth in Revenues

(f)

Figure 2.20 (continued)



Telephone Message Volume:
Interstate Toll, State Toll, and Local
(g)

Figure 2.20 (continued)

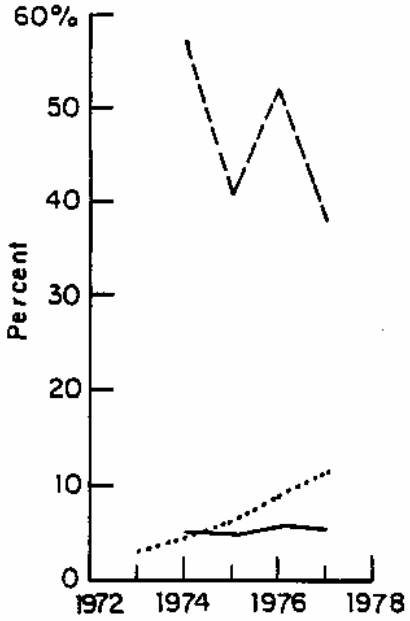


Figure 2.21

Introduction of Touch Tone® Telephones by Independent Companies

Source[S27]

planned and executed by a single entity on an end-to-end basis with appropriate control of hardware (in order to protect the integrity of the network) and without the competition of cream-skimming operations of specialized common carriers (which jeopardize AT&T's universal services by offering intercity services that are cross-elastic with AT&T's message telephone services (MTS)). Seeks public airing of consequences of competition mandated by FCC and courts, and re-affirmation by Congress of AT&T's universal service philosophy. At the same time, is preparing for eventuality that its position may not be upheld by Congress in toto or in time, thus requiring AT&T's entry into open market competition with regard to hardware and services. Finds itself compelled to fight FCC's efforts to protect AT&T's competitors by circumscribing AT&T's right to compete effectively. Sees itself as being engaged in a growing conflict with IBM in the compunications (computers-and-communications) arena.

Others' Perceptions

See it as failing to meet adequately the needs of large consumers and as using its huge financial resources to thwart competition which offers more suitable hardware and services to such consumers. View AT&T's stance as self-serving effort to perpetuate status quo through large-scale lobbying effort. View AT&T's huge investment in older facilities as its Achilles' heel which keeps it from introducing new technologies expeditiously and thus compete effectively.

LARGER INDEPENDENT TELEPHONE COMPANIES

Self Perception

See themselves as partners of AT&T in providing universal services subject to Federal and State regulation but play increasingly influential roles in developing alternatives to AT&T's responses to FCC's pro-competitive policies. Objectives: introducing measure of competition without changing basic structure; removing all constraints on service offerings of which independents are capable (such as CATV, broadband, etc.); and cooperative planning with AT&T of introduction of new technologies and rate of speed with which such introduction should occur.

Others' Perceptions

Increased reliance possible on industry-government dialogue participated in by larger Independents to explore policy alternatives to extremes of (a) single system planned and executed by single entity and (b) open market competition without central industry or government-industry planning.

SMALLER INDEPENDENT TELEPHONE COMPANIES

Self Perception

See themselves threatened economically even more than larger Independents by erosion of hardware revenues from foreign attachments; erosion of long-distance toll revenues through special common carrier competition; need for increased borrowing to update facilities and services technologically.

Others' Perceptions

Unlike Larger Independents, Smaller Independents, with rare exceptions, are incapable of participating effectively in dialogue concerning policy alternatives. Legislators stress the importance of the Smaller Independents since they largely serve rural areas.

CATV COMPANIES

Self Perception

Most CATV companies see themselves exclusively as transmitters by cable of over-the-air television programs and to a lesser degree as originators of TV programs. They see themselves as over-regulated by FCC and state and local authorities. Some ambitious CATV companies see themselves as potential broad-band, local communication companies which might be in competition with television stations and local telephone companies and which might even take the place of such stations and companies. The ambitious companies seek to use their facilities for any services which they are technologically capable of performing subject to whatever federal, state, or local regulations may be imposed upon them which will limit their competition in the open market.

Others' Perceptions

See them as competitors of television stations, particularly in smaller communities. Insofar as future plans to render broad-band services (using fiber optics technology) are concerned, some telephone companies perceive the potential competitive threats posed by the more aggressive CATV companies and are prepared to fight or meet that threat before federal, state, and local bodies, and if necessary, in the open market.

"SPECIALIZED" OR "OTHER" COMMON CARRIERS

Self Perception

See themselves as called upon to meet rapidly growing demand for selective intercity communications not only by large business and governmental consumers, but, increasingly, by ordinary users of conventional long distance calls. Services include voice, data, video and facsimile. Feel that they must fight a two-front war before FCC: (1) attempts by FCC to narrow authorized boundaries of their markets; and (2) attempts by FCC to abandon protective regulation to prevent unfair competition between AT&T and Independent Telephone Companies on the one hand and Specialized Carriers on the other.

Others' Perceptions

AT&T and Independent Telephone Companies see them (1) as cream-skimming operators who serve rich markets without being required to serve other less financially rewarding markets, thus ultimately requiring AT&T and Independents to de-average and to raise rates for residential and small business services; (2) as unfair competitors under the umbrella of FCC's rules of regulated competition which keep AT&T and Independents from competing effectively by meeting Specialized Carriers' lower rates while at the same time requiring AT&T and Independents to let Specialized Carriers use AT&T's and Independents' local networks, and (3) invading the telephone companies' switched message market serving not only large businesses and government but also affluent residences.

MOBILE PHONE COMPANIES (RADIO COMMON CARRIERS - RCCs)

Self Perception

See themselves as rendering a much needed, highly personalized service with large growth potential if sufficient radio frequencies are allocated for land mobile services. See themselves beset by numerous competitive problems: competition among themselves; competition with wireline carriers (AT&T and Independents) on whom RCCs have to depend for interconnections with public telephone network; competition with oneway paging services offered by AT&T and Independents; future competition with Specialized Mobile Radio (SMR) services offering dispatch services on a non-common carrier basis which FCC considers preferable both financially and in relation to spectrum space to private dispatch systems operated by a single company for expediting its non-communication activities.

Others' Perceptions

AT&T and Independents see future mobile operations using high capacity cellular system as good example of communication services which could more economically (both financially and in relation to spectrum space) be offered by single, nationwide system. Present operations with existing technologies do not provide an adequate service at sufficiently low rates to make possible mass marketing. New technologies may lead to a restructuring of industry consisting of small businesses.

WESTERN UNION

Self Perception

Sees itself as a rejuvenated company taking advantage of new technologies (particularly satellites) to render new services (including data and facsimile) superimposed on old technologies, facilities, and services, some of which are used in conjunction with postal service ("Mailgrams").

Others' Perceptions

Are skeptical that market for traditional services will survive, but they are watching WU's transformation with more or less attention, depending on the significance of Western Union's potential in offering competitive services.

HARDWARE SUPPLIERS

Self Perception

See themselves as the principal beneficiaries of market opportunities brought about by a combination of advances in technologies and changes in public policies. See themselves also as the principal protagonists of competition in the compunications arena before Congress, FCC, Executive, and courts with regard to "foreign attachment" policies, federal rather than state control of such policies, and antitrust suits against AT&T and the Larger Independents.

Others' Perceptions

See them as threatening the traditional, exclusive control exercised by AT&T and the Larger Independents over hardware in the hands of users and hardware used in telephone companies' own facilities. This threat is seen partly in economic terms and

partly in service terms (potential harm to integrity of network). In particular, AT&T fears that government regulatory standards governing hardware will not be adequate regarding installation and maintenance to assure that customers will be reached when called and that hardware manufacturers will challenge AT&T's right to introduce technological changes in the telephone network if such changes affect the market for hardware in the hands of telephone subscribers.

b. International Carriers

RECORD CARRIERS

Self Perception

See themselves as being engaged in a struggle for survival with AT&T on the one hand (the FCC having decided to let AT&T offer international data as well as voice services over its international switched telephone network) and with providers of satellite circuits on the other hand (which cut into full use of cables in which record carriers have heavy investments). One of the competitive tools is the provision of innovative communication services, such as "Telenet" (international packet switching) and "Graphnet" (international facsimile reproduction).

Others' Perceptions

See them as presenting a continuing problem in restructuring the compunications industry.

COMSAT

Self Perception

Until recently, saw itself as the Congressionally franchised, exclusive provider of satellite services domestically as well as internationally. When it failed to gain acceptance for its claim of exclusiveness, it began to enter the domestic market for satellite facilities and services in competition or in partnership with other companies, while attempting to hold on to its international manager role for Intelsat.

Others' Perceptions

Creation by Congress of Comsat was seen as an anomaly: a compromise designed to achieve U. S. foreign policy objectives through a

quasi-private corporate instrumentality instead of a government agency, and a compromise between AT&T's position that satellites were equivalent from a regulatory point of view to undersea cables and therefore not requiring the creation of a new entity, and the position of satellite hardware manufacturers which sought better access to markets for their products through the creation of a new entity separate and apart from (and competitive with) AT&T's Western Electric.

c. Computer Companies

i. Hardware Suppliers

IBM

Self Perception

Sees itself as the ongoing leader of the computer industry relying on research and marketing strategies. Because of its preference for large, centralized compunication systems, sees entry into communications, though indirectly, as unavoidable due to evolving compunications technologies, demands of big business users, and failure of communication companies to provide technologically up-to-date services at sufficiently low costs. Realizing that involvement with communications will present special problems, IBM decided to create (together with Comsat and Aetna) a separate entity (SBS). Seeks to win antitrust suits brought by government and competitors by appropriate legal tactics and by creating public opinion favorable to IBM as exponent of principle that to the industry leader belong the just rewards coming with such leadership.

Others' Perceptions

See IBM as striving not only for preeminence with regard to large centralized compunications systems but for exclusivity by driving out competitors. SBS's entry into communications reinforces such apprehension. Therefore, competitors resort to antitrust laws along with opposition to SBS before FCC as one way of fighting IBM's aspirations.

OTHERS

Self Perception

See themselves as being engaged in an ongoing life and death struggle with IBM with regard to large computers--several large companies having already withdrawn in recent years from competing with IBM. Competitors offering a specialized, high technology hardware, par-

ticularly in conjunction with specialized software, are in a preferred position while competitors offering mass production product lines similar to IBM's are in an inferior position. While Independent Telephone Companies with their geographical monopolies coexist comfortably with AT&T, IBM's competitors in the worldwide computer hardware market are fearful for their survival and resort to antitrust suits as one way of combating some of IBM's marketing strategies and tactics which they consider illegal (The reduction in the number of competitors, in turn, increases IBM's risk of being found in violation of the antitrust laws). See themselves at a disadvantage competitively, particularly with customers' top managements, because of IBM's high prestige, especially in promptly servicing hardware sold or leased by them. (Purchasing personnel buying or leasing non-IBM products have to carry the burden of proving themselves right and many prefer not to carry that burden). See themselves necessarily allied with IBM in fighting AT&T and Independent Telephone Companies with regard to restrictive foreign attachment conditions and are concerned over equal access with IBM to SBS's communications system in order to avoid suffering further competitive disadvantages in the worldwide marketplace.

Others' Perceptions

Depending on the degree of their sophistication regarding hardware and software, customers will take advantage of competition between IBM and others or will enter into standard purchase of lease package deals.

c. Computer Companies

ii. Software Suppliers

Self Perception

See themselves as intellectual elite of the computer industry and often as having expertise superior to that of hardware suppliers who supply software as part of a package deal which includes both hard and software. If such package deals could be found to be in violation of antitrust laws, software suppliers would stand to gain substantially. Therefore, they pursue efforts to require hardware suppliers to "unbundle" hardware and software by pricing them separately and without cross-subsidization.

Others' Perceptions

Users see hardware and software as parts of single system. Hardware suppliers who supply combinations of hard and software through package deals see software suppliers ambivalently as competitive and complementary. Suppliers are frequently engaged in disputes over degrees of separability of software and hardware. Users of computers often resort to software suppliers only when software

supplied by hardware suppliers turns out to be inadequate for particular purposes.

c. Computer Companies

iii. Compunication Service Companies

Self Perception

Compunication service companies see other companies as competitive or complementary in whole or in part, depending on the purity or mix of several services which they offer: data base services, data processing services, and data transmission services.

"Pure" Data Base Service Companies, for example, see other "pure" Data Base Service Companies as well as publishers and libraries as competitors. They see data base services as providing a rapid means by which non-computer oriented consumers are enabled to gain access to extensive data (stored in computers) needed in connection with their professional or business activities. They see companies offering only data processing or only data transmission services as complementary. Companies offering a mix of all three services are seen as partly competitive and partly complementary. Publishers and libraries are seen as offering less rapid and less extensive information services which are receiving government benefits in the form of tax advantages and subsidized postal services. "Pure" Data Processing Service Companies see themselves in competition with computer hardware companies which sell or lease computer hardware.

"Pure" Data Transmission Service Companies see themselves in competition with Data Processing Service Companies to the extent that the latter companies use their computer processing service networks incidentally for the transmission of data.

Others' Perceptions

Publishers, librarians, and other data suppliers as well as various classes of middle and low level professionals who have been retrieving and processing information in connection with top level business and professional activities see data base and data processing services as threatening their livelihood. Therefore, specialized data suppliers, both in private and public sectors, either withhold their data or make substantial charges for their data.

Data Transmission Service Companies nervously watch their turf being invaded by Data Processing and Data Base Networks which transmit data incidentally to supplying and processing data.

2. Telecommunications Companies

Figure 2.22 and Table 2.8 summarize salient characteristics of the two principal components of the traditional telecommunications industry, the Bell System and the Independent companies.

a. Bell System

The Bell System (AT&T and the Bell Operating Companies) accounted for about 84% of telecommunications revenues in 1976 (Figure 3.1, Box 14). AT&T's Long Lines Division operates interstate facilities only, while the operating companies supply local and state toll facilities and contribute to supplying interstate facilities. The territories served by the various operating companies are outlined in Figure 2.23, and the distribution of Bell System telephones among them is shown in Table 2.9.

b. Independents Reporting to USITA

Of about 1,600 independent telephone companies, some 750 report data about themselves to USITA, the United States Independent Telephone Association. In 1976 Independents reporting to USITA accounted for about 15% of telecommunications industry revenues (Figure 3.1, Box 14). Although they are only 49% of the independent companies, they account for over 96% of independent revenues.[10]

c. Rural Telephone Borrowers

Most of the Independents that do not report to USITA are small companies operating in rural areas and among the companies eligible for low interest loans from the Rural Electrification Administration (REA) of the U. S. Department of Agriculture. Descriptive data about rural telephone borrowers are available,[11] but since this category overlaps with that of Independents reporting to USITA, it is difficult to sort out data

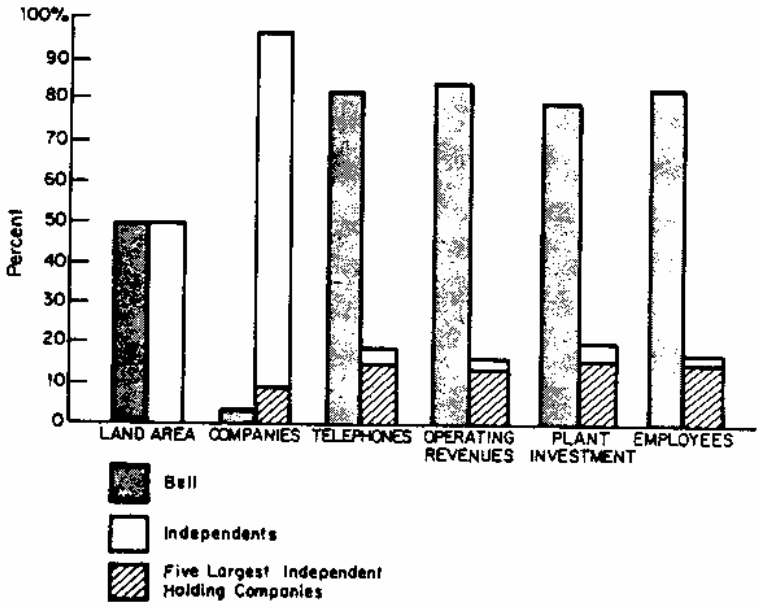


Figure 2.22

Comparative Statistics:
Bell System and Independent Telephone Companies, 1978

Source[S28]

	Bell	% of Total	Independent	% of Total	Total
Telephones	126,963,000	82	28,209,000	18	155,172,000
Exchanges	6,712	38	11,040	62	17,752
Investment (000 omitted)	$96,340,000	81	$23,000,000	19	$119,340,000
Revenues (000 omitted)	$33,518,000	84	6,300,000	16	$39,818,000
Employees	778,000	83	160,000	17	938,000
Geography Served* (sq. mi.)	1,265,310	35	1,427,035	39	3,615,211

* 922,866 sq. mi. (26%) is unassigned over half of which is in Alaska.

(a)

	Bell	Independent
Average Telephones Per Exchange	18,916	2,555
Investment Per Telephone	$758	$815
Revenues Per Telephone	$264	$223
Average Square Miles Per Exchange	188	129
Average Telephone Density Per Square Mile	100	20

(b)

Table 2.8

Comparison of Bell System and Independent Telephone Companies, 1976

Source[S29]

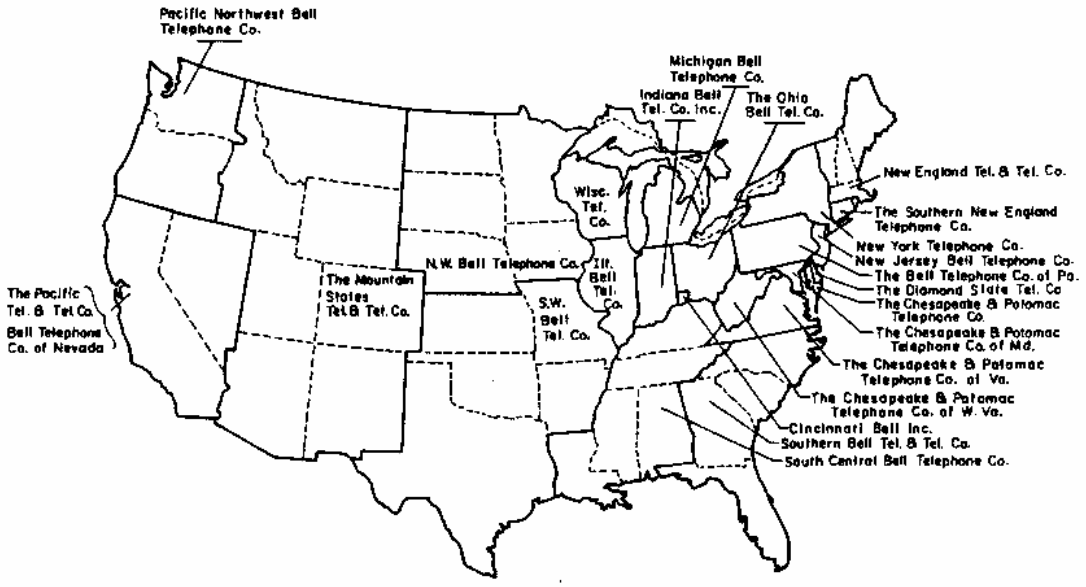


Figure 2.23

Operating Areas of Bell Telephone Companies, 1971

Source[S30]

Principal Bell System Telephone Companies	Percent of Bell System Telephones
New England Telephone & Telegraph Co.	4.9 %
New York Telephone Co.	8.7
The Southern New England Telephone Co.	1.8
New Jersey Bell Telephone Co.	4.5
The Bell Telephone Co. of Pennsylvania	5.6
The Diamond State Telephone Co.	0.4
The Chesapeake & Potomac Telephone Co.	0.8
The Chesapeake & Potomac Telephone Co. of Maryland	2.5
The Chesapeake & Potomac Telephone Co. of Virginia	2.1
The Chesapeake & Potomac Telephone Co. of W. Virginia	0.7
Southern Bell Telephone & Telegraph Co.	8.4
South Central Bell Telephone Co.	7.2
The Ohio Bell Telephone Co.	3.6
Cincinnati Bell Inc.	0.8
Michigan Bell Telephone Co.	4.4
Indiana Bell Telephone Co., Inc.	1.9
Wisconsin Telephone Co.	1.7
Illinois Bell Telephone Co.	5.9
Northwestern Bell Telephone Co.	3.9
Southwestern Bell Telephone Co.	11.3
The Mountain States Telephone & Telegraph Co.	5.2
Pacific Northwest Bell Telephone Co.	2.6
The Pacific Telephone & Telegraph Co.	10.8
Bell Telephone Co. of Nevada*	-

* Wholly owned subsidiary of Pacific-Telephone and Telegraph Company. Telephones for this company are included in the totals for Pacific Telephone and Telegraph Company.

Table 2.9

Principal Subsidiaries and Associated Companies of the American Telephone and Telegraph Company, December 31, 1978

Source[S31]

about rural borrowers who do not also report to USITA. Since non-Bell, non-reporting to USITA companies account for only 0.6% of industry revenues (Figure 3.1, Box 14), they do not generally figure in the macroscopic analyses of the remainder of this paper. Shrinkage in the number of Independents is shown in Table 2.10. Figure 2.24 and Table 2.11 show the state-by-state distribution of Independents and their telephones.

d. Competitors of the Traditional Telecommunications Industry

Since the late sixties a revival of competition in the telecommunications field[12] had led to the emergence of numerous competing organizations classified as follows in regulatory proceedings: transmission facility and service companies, called Specialized Common Carriers by the Federal Communications Commission and Other Common Carriers by the traditional industry; "interconnect" companies including certain mobile radio services but also, principally, suppliers of telephone instruments and of digital devices whose categorization and regulatory regime was still deeply controversial as of early 1980;[13] and a category of companies variously called Resale Carriers, Value-Added Networks or Composite Data Service Vendors, that principally supply services using transmission facilities acquired from others. All of these are described under more generic headings in Section 2-D1.

The principal transmission facility companies are listed in Table 2.12. The others encompass the whole electronics and computer industries--hardware, software and services--hence defy synoptic listing.

e. Geographical Coverage

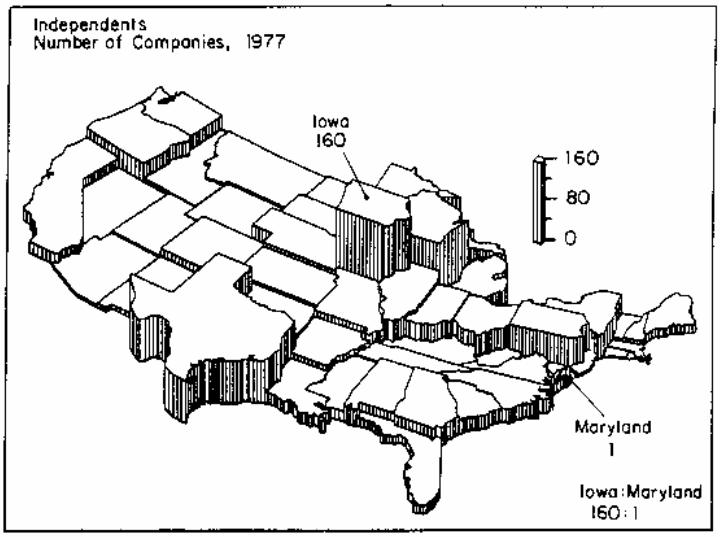
As indicated in Table 2.8, the Bell System serves over 80% of telephones and Independents less than 20%. Bell-franchised territories,

Year	Number of Independent Telephone Companies	Decrease
1932	6,800	
1942	6,200	600
1952	5,300	900
1962	2,800	2,500
1972	1,700	1,100
1975	1,618	82
1976	1,590	28
1977	1,556	34
1978	1,527	29
1979	1,488	39

Table 2.10

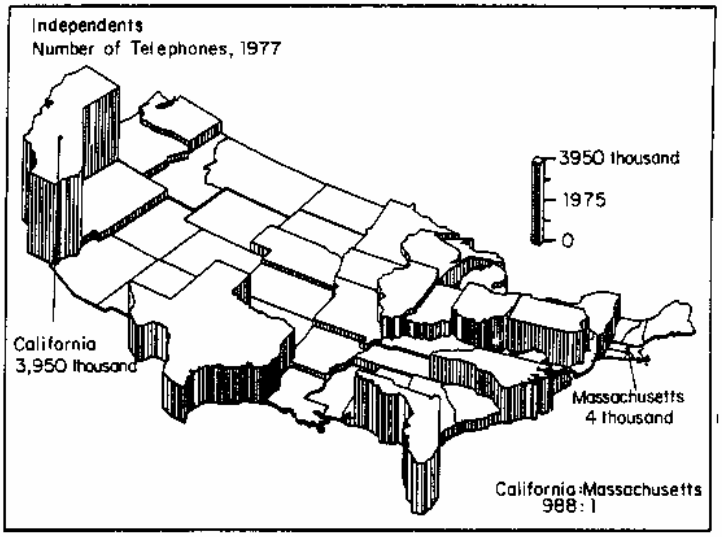
Shrinking Number of Independent Telephone Companies

Source[S32]



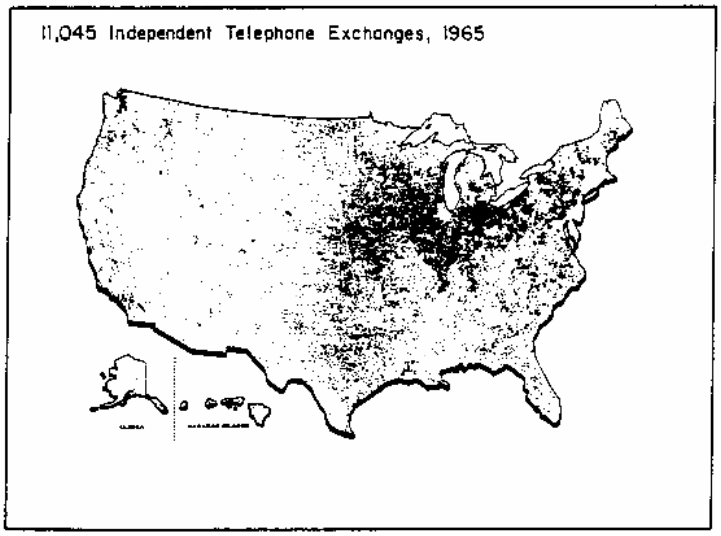
Delaware and Rhode Island do not have independents

(a)



Delaware and Rhode Island do not have independents

(b)



(c)

Figure 2.24

State-by-State Number of Independent Companies, Telephones and Exchanges, 1977

Source[S33]

	Number of Companies	Number of Telephones
AL	33	377300
AK	22	223000
AZ	6	63500
AR	33	384000
CA	23	3949900
CO	26	33700
CT	2	18000
DE	0	0
FL	16	2388300
GA	36	518000
HI	1	630000
ID	12	121500
IL	60	1613100
IN	53	1344000
IA	160	668600
KS	44	286700
KY	20	600500
LA	22	146300
ME	17	86800
MD	1	4100
MA	3	3800
MI	50	843800
MN	94	608800
MS	21	68300
MO	46	696800
MT	16	90300
NE	53	502300
NV	4	429600
NH	11	32300
NJ	5	133200
NM	10	97700
NY	46	1154400
NC	28	1719000
ND	20	132200
OH	49	1816800
OK	38	273400
OR	41	455100
PA	57	1720100
RI	0	0
SC	27	514600
SD	33	98000
TN	24	480900
TX	83	1716800
UT	10	33200
VT	8	44100
VA	21	742300
WA	39	690800
WV	7	138100
WI	114	961200
WY	11	19800

Ranked

	Number of Companies	Number of Telephones
IA	160	CA 3949900
WI	114	FL 2388300
MN	94	OH 1816800
TX	83	PA 1720100
IL	60	NC 1719000
PA	57	TX 1716800
IN	53	IL 1613100
NE	53	IN 1344000
MI	50	NY 1154400
OH	49	WI 961200
MO	46	MI 843800
NY	46	VA 742300
KS	44	MO 696800
OR	41	WA 690800
WA	39	IA 668600
OK	38	HI 630000
GA	36	MN 608800
SD	33	KY 600500
AL	33	GA 518000
AR	33	SC 514600
NC	28	NE 502300
SC	27	TN 480900
CO	26	OR 455100
TN	24	VN 429600
CA	23	AR 384000
LA	22	AL 377300
AK	22	KS 286700
MS	21	OK 273400
VA	21	AK 223000
ND	20	LA 146300
KY	20	WV 138100
ME	17	NJ 133200
MT	16	ND 132200
FL	16	ID 121500
ID	12	SD 98000
WY	11	NM 97700
NH	11	MT 90300
NM	10	ME 86800
UT	10	MS 68300
VT	8	AZ 63500
WV	7	VT 44100
AZ	6	CO 33700
NJ	5	UT 33200
NV	4	NH 32300
MA	3	WY 19800
CT	2	CT 18000
HI	1	MD 4100
MD	1	MA 3800
DE	0	DE 0
RI	0	RI 0

Table 2.11

State-by-State Number of Independent Companies and Telephones, 1977

Source[S34]

Millions of Dollars

	1980	1979	1978	1977	1976
Business Telecomm.		.9	.5	a	a
Hildreth[b]					
Maine Microwave		0.1	0.1	0.1	0.1
MCI[c]	144.3	95.2	74.0	62.8	28.4
Southern Pacific		99.0	49.0	32.0	25.6
USTS		21.0	8.9	3.5	0.4
Western Telecomm.		4.2	4.2	3.8	2.1
Western Union[b]					
Other[b]					

Terrestrial

(a)

	1980	1979	1978	1977	1976
Amsat[b]					
Comsat[b]					
CPI[b]					
RCA[b]					
SBS[d]					
Xten[d]					
Others[b]					

Satellite

(b)

[a]Not operational

[b]Not available

[c]For fiscal year ending March 31.

[d]Not operational

Table 2.12

Transmission Facility Companies: Annual Revenues

Source[S35]

however, encompass only 35% of U. S. land areas and Independent territories 39%, with 26% unassigned, over half of that in Alaska. By combining Bell franchises and unassigned areas, Figure 2.25 tends to exaggerate the extent of Bell territories. State-by-state service area shares are shown in Figure 2.26 and Table 2.13. State-by-state total population and population density data are available for comparison in Figure 2.3.

Table 2.8 indicates a nationwide average Bell System density of 100 telephones per square mile and an average Independent density of 20 telephones per square mile. The state-by-state data in Figure 2.27 and Table 2.14 show a range from 731 telephones per square mile for the Bell System in New Jersey to 0.4 telephones per square mile for Independents in Wyoming. GT&E's density of 254 telephones per square mile in California is more than double the Bell nationwide average. Relative numbers of Bell and Independent telephones are shown state-by-state in Figure 2.28 and Table 2.15.

Figure 2.29 shows the franchise areas of the four largest Independents. The fine grained detail shown for California and Missouri in Figure 2.30 shows a variety of Independent-Independent and Bell-Independent adjacencies which foreshadows the complexities of cost allocation and revenue settlements described in Part 4.

The footprint of the proposed Satellite Business Systems (SBS) satellite covers most of the continental United States, as indicated in Figure 2.31(a). Superficially, such broad coverage is radically different from the foregoing gerrymanders. In practice, however, direct coverage is limited to a small radius about each receiving earth station and SBS has proposed a service for intracompany communications among widely

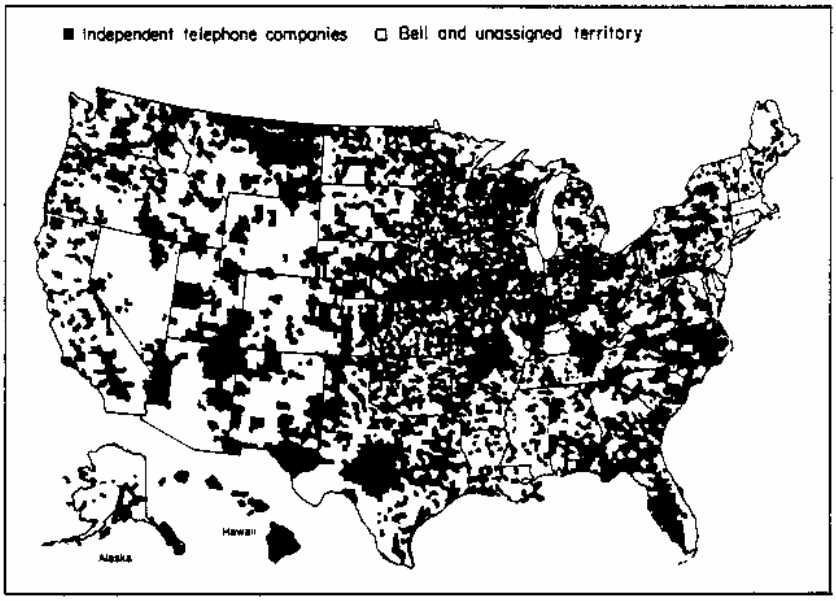
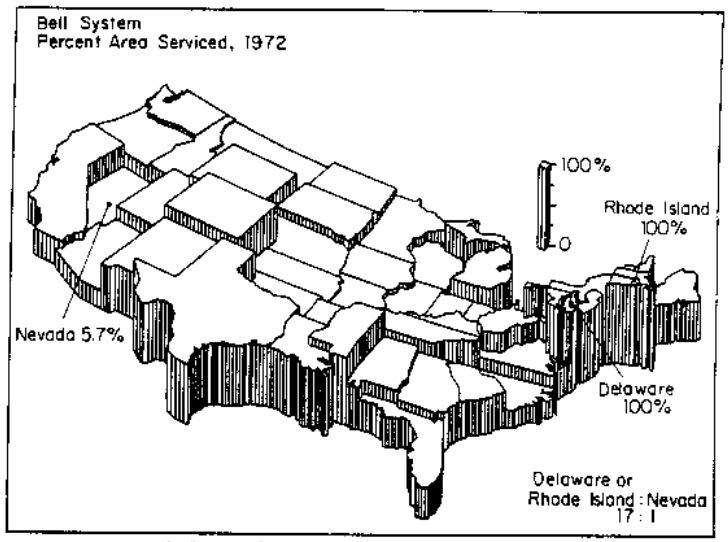


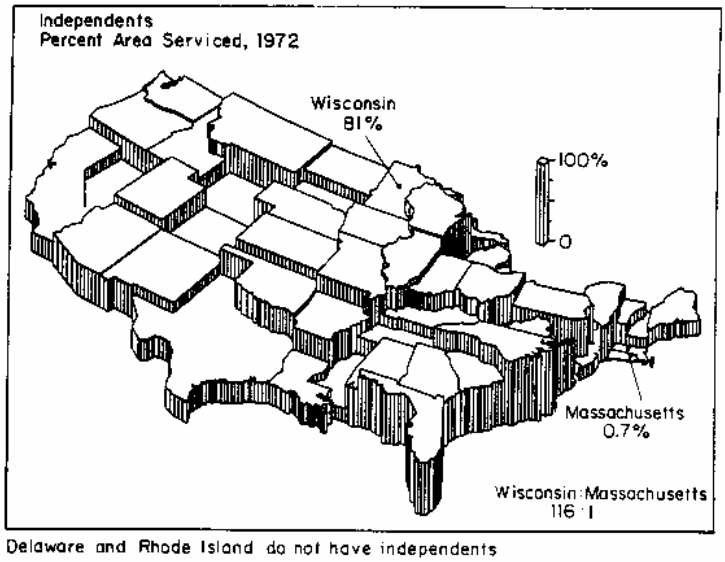
Figure 2.25

Operating Areas of Independent Telephone Companies, 1972

Source[S36]

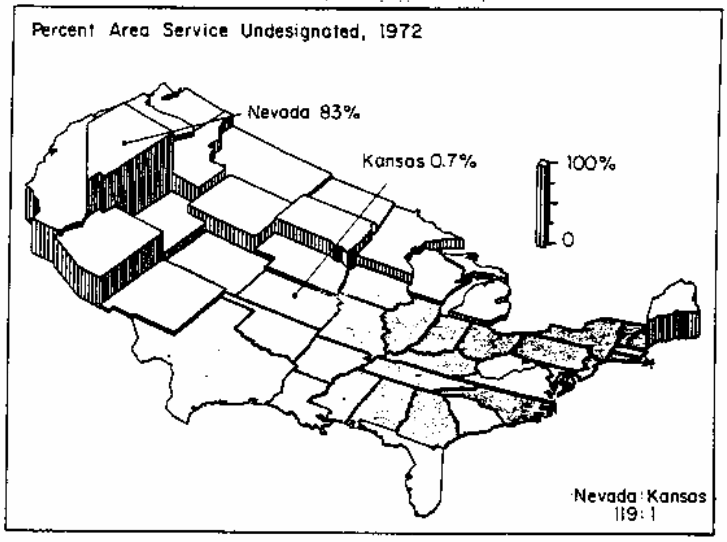


(a)



Delaware and Rhode Island do not have independents

(b)



☐ States have all areas designated

(c)

Figure 2.26

Bell System and Independent Companies State-by-State Percent of Square Miles Serviced Within Each State, 1972
Source[S37]

	Bell	Independents	Undesignated
AL	52.6	47.4	0.0
AZ	22.8	39.8	37.4
AR	47.3	52.7	0.0
CA	32.5	24.7	42.8
CO	73.1	26.9	0.0
CT	98.7	01.3	0.0
DE	100.0	00.0	0.0
FL	36.5	62.2	1.3
GA	46.0	54.0	0.0
ID	27.3	40.3	32.4
IL	21.1	78.9	0.0
IN	28.3	71.7	0.0
IA	27.1	72.9	0.0
KS	30.0	69.3	0.7
KY	48.2	51.8	0.0
LA	73.0	25.5	1.5
ME	48.7	19.3	32.0
MD	97.9	02.1	0.0
MA	99.3	00.7	0.0
MI	48.5	45.8	5.7
MN	26.1	62.6	11.3
MS	83.1	16.9	0.0
MO	26.8	73.2	0.0
MT	24.8	56.2	19.0
NE	29.0	65.9	5.1
NV	5.7	11.0	83.3
NH	87.2	12.8	0.0
NJ	85.2	14.8	0.0
NM	57.7	38.6	3.7
NY	57.3	42.7	0.0
NC	21.8	78.2	0.0
ND	34.3	51.3	14.4
OH	27.8	72.2	0.0
OK	43.0	57.0	0.0
OR	22.9	39.3	37.8
PA	38.7	61.3	0.0
RI	100.0	00.0	0.0
SC	43.7	54.6	1.7
SD	39.2	37.4	23.4
TN	61.8	38.2	0.0
TX	74.2	25.8	0.0
UT	39.5	50.3	10.2
VT	74.0	26.0	0.0
VA	37.0	60.8	2.2
WA	27.8	41.9	30.3
WV	60.7	37.8	1.5
WI	15.4	81.2	3.4
WY	58.9	20.5	20.6

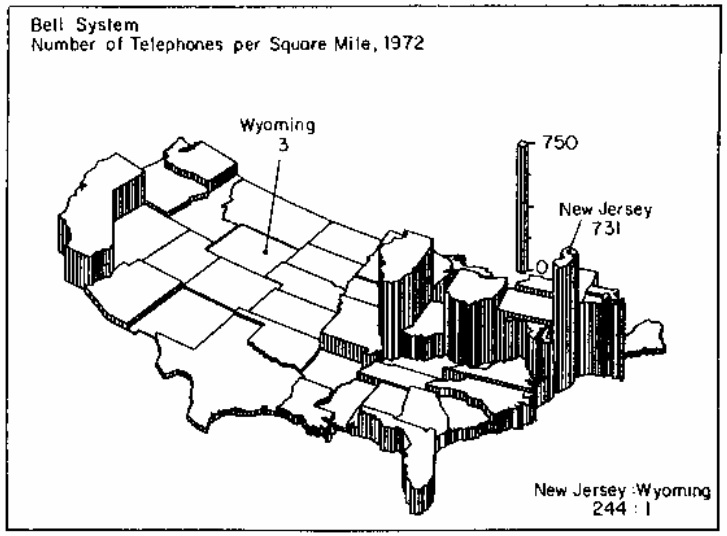
Ranked

Bell		Independents		Undesignated	
RI	100.0	WI	81.2	NV	83.3
DE	100.0	IL	78.9	CA	42.8
MA	99.3	NC	78.2	OR	37.8
CT	98.7	MO	73.2	AZ	37.4
MD	97.9	IA	72.9	ID	32.4
NH	87.2	OH	72.2	ME	32.0
NJ	85.2	IN	71.7	WA	30.3
MS	83.1	KS	69.3	SD	23.4
TX	74.2	NE	65.9	WY	20.6
VT	74.0	MN	62.6	MT	19.0
CO	73.1	FL	62.2	ND	14.4
LA	73.0	PA	61.3	MN	11.3
TN	61.8	VA	60.8	UT	10.2
WV	60.7	OK	57.0	MI	5.7
WY	58.9	MT	56.2	NE	5.1
MN	57.7	SC	54.6	NM	3.7
NY	57.3	GA	54.0	WI	3.4
AL	52.6	AR	52.7	VA	2.2
ME	48.7	KY	51.8	SC	1.7
MI	48.5	ND	51.3	WV	1.5
KY	48.2	UT	50.3	LA	1.5
AR	47.3	AL	47.4	FL	1.3
GA	46.0	MI	45.8	KS	0.7
SC	43.7	NY	42.7	IL	0.0
OK	43.0	WA	41.9	NC	0.0
UT	39.5	ID	40.3	IN	0.0
SD	39.2	AZ	39.8	OH	0.0
PA	38.7	OR	39.3	IA	0.0
VA	37.0	NM	38.6	PA	0.0
FL	36.5	TN	38.2	OK	0.0
ND	34.3	WV	37.8	GA	0.0
CA	32.5	SD	37.4	AR	0.0
KS	30.0	CO	26.9	KY	0.0
NE	29.0	VT	26.0	AL	0.0
IN	28.3	TX	25.8	NY	0.0
OH	27.8	LA	25.5	MO	0.0
WA	27.8	CA	24.7	TN	0.0
ID	27.3	WY	20.5	VT	0.0
IA	27.1	ME	19.3	TX	0.0
MO	26.8	MS	16.9	MS	0.0
MN	26.1	NJ	14.8	NJ	0.0
MT	24.8	NH	12.8	NH	0.0
OR	22.9	NV	11.0	MD	0.0
AZ	22.8	MD	02.1	CT	0.0
NC	21.8	CT	01.3	MA	0.0
IL	21.1	MA	0.7	RI	0.0
WI	15.4	RI	0.0	DE	0.0
NV	5.7	DE	0.0	CO	0.0

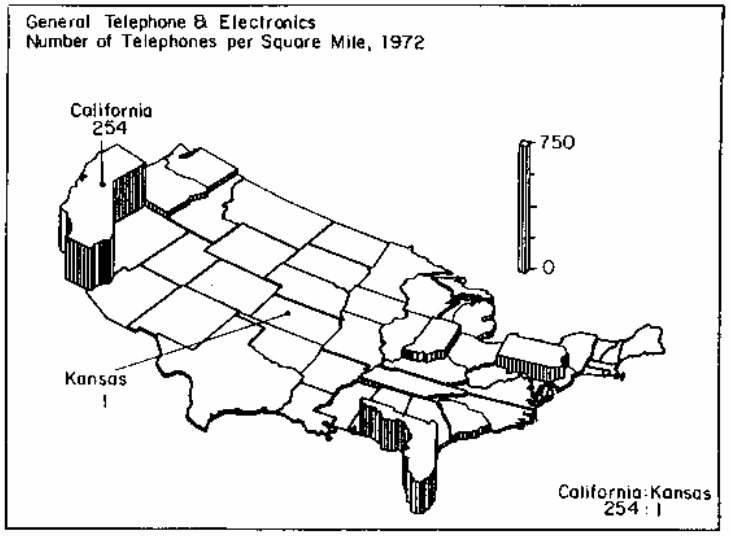
Table 2.13

Bell System and Independent Companies State-by-State
Percent of Square Miles Serviced Within Each State, 1972

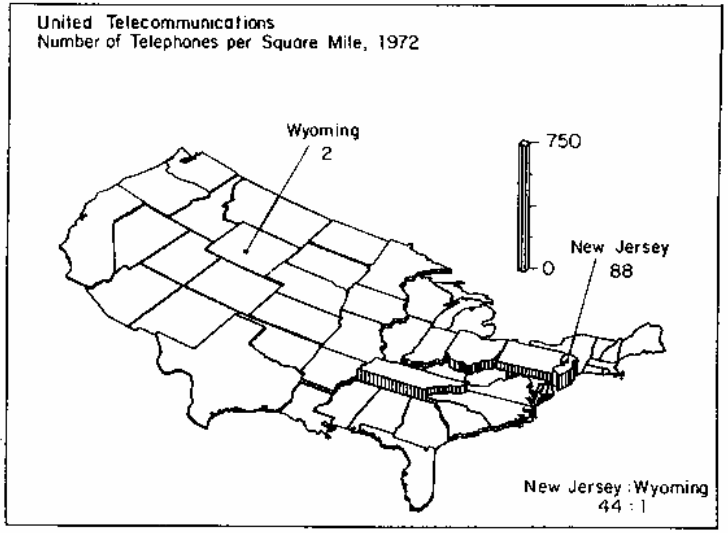
Source[S38]



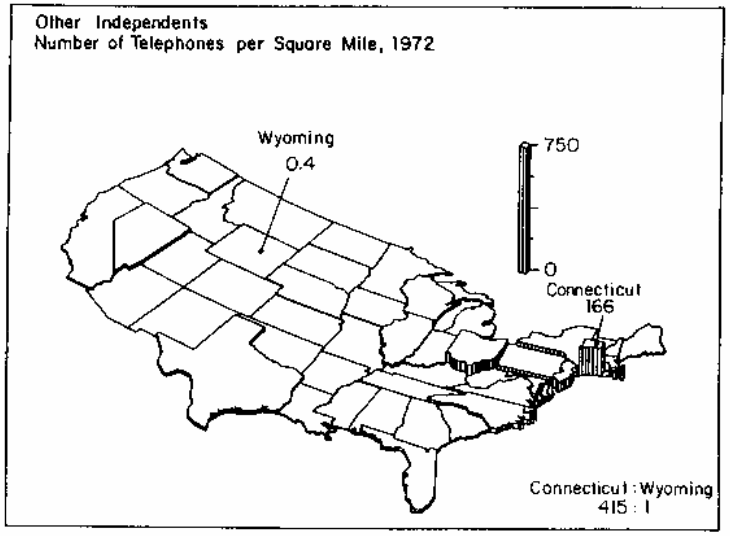
(a)



(b)



(c)



(d)

Figure 2.27

Bell System and Independent Companies State-by-State Number of Telephones per Square Mile, 1972

Source[S39]

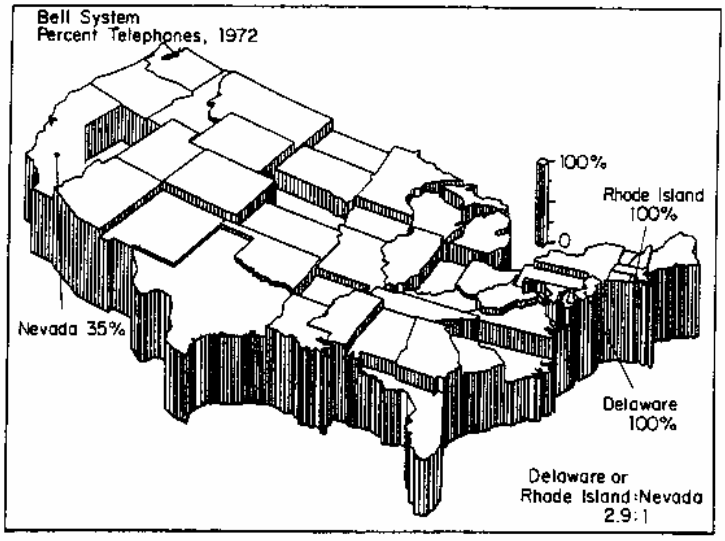
	Bell	GTE	United	Other Independents
AL	51.1	16.6	0.0	8.9
AZ	39.4	0.0	0.0	0.7
AR	26.6	14.2	24.0	7.3
CA	209.7	253.6	9.3	9.7
CO	19.0	0.0	0.0	0.8
CT	427.1	0.0	0.0	166.2
DE	188.3	0.0	0.0	0.0
FL	143.7	180.5	15.7	19.1
GA	81.9	18.8	0.0	8.9
ID	13.3	7.1	0.0	1.0
IL	511.5	30.7	0.0	26.0
IN	193.7	88.8	27.0	19.0
IA	77.1	14.0	20.9	11.0
KS	45.4	1.4	6.4	3.4
KY	56.5	40.5	0.0	9.6
LA	49.6	11.2	0.0	7.3
ME	28.8	0.0	0.0	8.5
MD	336.2	0.0	0.0	12.8
MA	443.4	0.0	0.0	50.0
MI	167.3	32.6	0.0	11.8
MN	87.5	10.2	21.5	7.4
MS	22.9	0.0	0.0	5.8
MO	125.7	21.3	18.7	6.9
MT	8.6	2.1	0.0	0.7
NE	24.3	8.1	8.6	7.4
NV	19.9	0.0	0.0	19.5
NH	53.1	0.0	0.0	17.8
NJ	731.4	19.0	88.3	60.3
NM	6.6	15.3	0.0	0.6
NY	397.9	17.9	0.0	62.6
NC	117.0	13.0	25.9	27.8
ND	9.7	0.0	5.5	2.7
OH	428.0	41.4	52.8	66.0
OK	45.6	9.9	0.0	3.6
OR	44.0	37.2	5.9	3.1
PA	364.1	91.3	46.7	35.0
RI	455.0	0.0	0.0	0.0
SC	68.3	40.6	21.7	13.2
SD	9.4	0.0	0.0	2.3
TN	66.7	30.2	69.0	10.7
TX	28.1	16.0	10.0	18.3
UT	18.3	0.0	0.0	0.5
VT	30.6	0.0	0.0	12.8
VA	139.1	20.9	21.8	22.4
WA	83.2	36.9	6.0	8.2
WV	47.1	25.5	0.0	6.5
WI	206.7	16.6	0.0	14.1
WY	3.3	0.0	2.1	0.4

Ranked									
Bell		GTE		United		Other Independents	
NJ	731.4	CA	253.6	NJ	88.3	CT	166.2
IL	511.5	FL	180.5	TN	69.0	OH	66.0
RI	455.0	PA	91.3	OH	52.8	NY	62.6
MA	443.4	IN	88.8	PA	46.7	NJ	60.3
OH	428.0	OH	41.4	IN	27.0	MA	50.0
CT	427.1	SC	40.6	NC	25.9	PA	35.0
NY	397.9	KY	40.5	AR	24.0	NC	27.8
PA	364.1	OR	37.2	VA	21.8	IL	26.0
MD	336.2	WA	36.9	SC	21.7	VA	22.4
CA	209.7	MI	32.6	MN	21.5	NV	19.5
WI	206.7	IL	30.7	IA	20.9	FL	19.1
IN	193.7	TN	30.2	MO	18.7	IN	19.0
DE	188.3	WV	25.5	FL	15.7	TX	18.3
MI	167.3	MO	21.3	TX	10.0	NH	17.8
FL	143.7	VA	20.9	CA	9.3	WI	14.1
VA	139.1	NJ	19.0	NE	8.6	SC	13.2
MO	125.7	GA	18.8	KS	6.4	MD	12.8
NC	117.0	NY	17.9	WA	6.0	VT	12.8
MN	87.5	WI	16.6	OR	5.9	MI	11.8
WA	83.2	AL	16.6	ND	5.5	IA	11.0
GA	81.9	TX	16.0	WY	2.1	TN	10.7
IA	77.1	NM	15.3	KY	0.0	CA	9.7
SC	68.3	AR	14.2	MI	0.0	KY	9.6
TN	66.7	IA	14.0	IL	0.0	GA	8.9
KY	56.5	NC	13.0	WV	0.0	AL	8.9
NH	53.1	LA	11.2	GA	0.0	ME	8.5
AL	51.1	MN	10.2	NY	0.0	WA	8.2
LA	49.6	OK	9.9	WI	0.0	MN	7.4
WV	47.1	NE	8.1	AL	0.0	NE	7.4
OK	45.6	ID	7.1	NM	0.0	AR	7.3
KS	45.4	MT	2.1	LA	0.0	LA	7.3
OR	44.0	KS	1.4	ID	0.0	MO	6.9
AZ	39.4	RI	0.0	MT	0.0	WV	6.5
VT	30.6	MA	0.0	RI	0.0	MS	5.8
ME	28.8	MD	0.0	MA	0.0	OK	3.6
TX	28.1	DE	0.0	MD	0.0	KS	3.4
AR	26.6	CT	0.0	DE	0.0	OR	3.1
NE	24.3	WY	0.0	CT	0.0	ND	2.7
MS	22.9	NH	0.0	NH	0.0	SD	2.3
NV	19.9	VT	0.0	VT	0.0	ID	1.0
CO	19.0	ME	0.0	ME	0.0	CO	0.8
UT	18.3	MS	0.0	MS	0.0	AZ	0.7
ID	13.3	NV	0.0	NV	0.0	MT	0.7
ND	9.7	CO	0.0	CO	0.0	NM	0.6
SD	9.4	UT	0.0	UT	0.0	UT	0.5
MT	8.6	ND	0.0	SD	0.0	WY	0.4
NM	6.6	SD	0.0	AZ	0.0	RI	0.0
WY	3.3	AZ	0.0	OK	0.0	DE	0.0

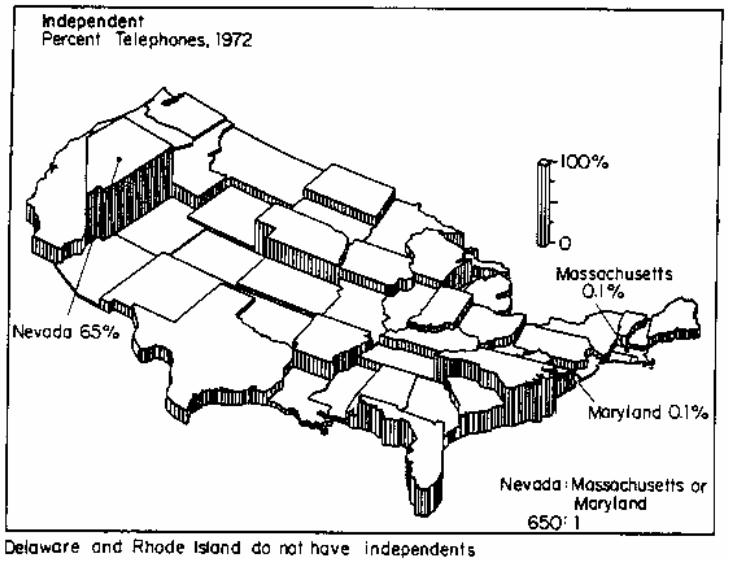
Table 2.14

Bell System and Independent Companies
State-by-State Number of Telephones
per Square Mile, 1972

Source[S40]



(a)



Delaware and Rhode Island do not have independents

(b)

Figure 2.28

Bell System and Independent Companies
State-by-State Percent of Telephones
Within Each State, 1972

Source[S41]

	Bell	Independents
AL	84.1	15.9
AZ	96.9	03.1
AR	72.7	27.3
CA	78.7	21.3
CO	98.4	01.6
CT	99.5	00.5
DE	100.0	00.0
FL	67.5	32.5
GA	85.7	14.3
ID	79.9	20.1
IL	82.9	17.1
IN	65.4	34.6
IA	69.8	30.2
KS	83.1	16.9
KY	72.5	27.5
LA	94.5	05.5
ME	89.6	10.4
MD	99.9	00.1
MA	99.9	00.1
MI	88.3	11.7
MN	81.5	18.5
MS	95.1	04.9
MO	82.2	17.8
MT	83.6	16.4
NE	58.7	41.3
NV	34.6	65.4
NH	95.3	04.7
NJ	98.2	01.8
NM	87.5	12.5
NY	91.6	08.4
NC	53.1	46.9
ND	69.8	30.2
OH	76.9	23.1
OK	88.1	11.9
OR	77.5	22.5
PA	82.8	11.2
RI	100.0	00.0
SC	74.2	25.8
SD	81.2	18.8
TN	84.2	15.8
TX	83.4	16.6
UT	96.7	03.3
VT	87.2	12.8
VA	79.2	20.8
WA	77.0	23.0
WV	87.2	12.8
WI	72.2	27.8
WY	93.8	06.2

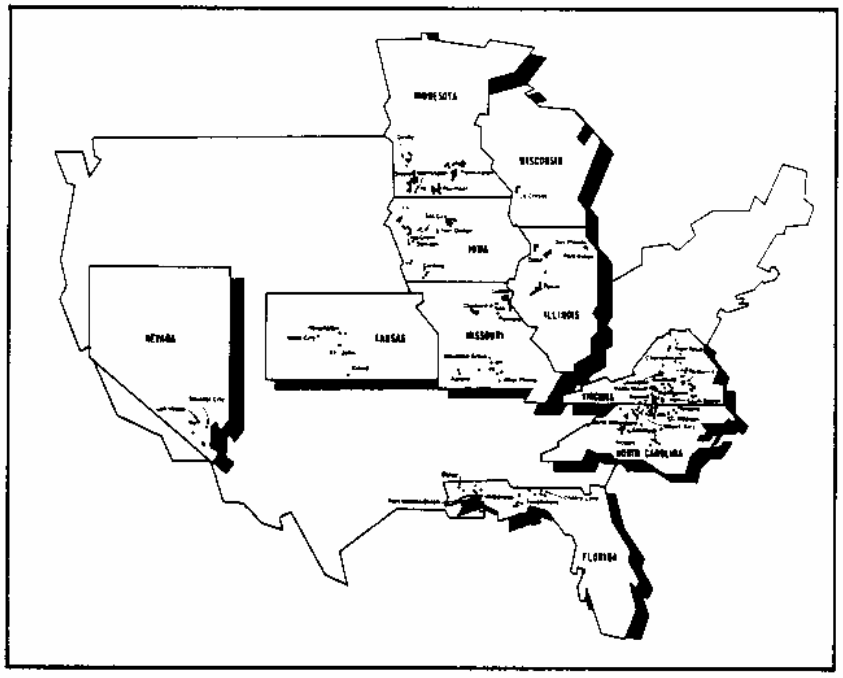
Ranked

	Bell		Independents
DE	100.0	NV	65.4
RI	100.0	NC	46.9
MD	99.9	NE	41.3
MA	99.9	IN	34.6
CT	99.5	FL	32.5
CO	98.4	IA	30.2
NJ	98.2	ND	30.2
AZ	96.9	WI	27.8
UT	96.7	KY	27.5
NH	95.3	AR	27.3
MS	95.1	SC	25.8
LA	94.5	OH	23.1
WY	93.8	WA	23.0
NY	91.6	OR	22.5
ME	89.6	CA	21.3
MI	88.3	VA	20.8
OK	88.1	ID	20.1
NM	87.5	SD	18.8
VT	87.2	MN	18.5
WV	87.2	MO	17.8
GA	85.7	IL	17.1
TN	84.2	KS	16.9
AL	84.1	TX	16.6
MT	83.6	MT	16.4
TX	83.4	AL	15.9
KS	83.1	TN	15.8
IL	82.9	GA	14.3
PA	82.8	VT	12.8
MO	82.2	WV	12.8
MN	81.5	NM	12.5
SD	81.2	OK	11.9
ID	79.9	MI	11.7
VA	79.2	PA	11.2
CA	78.7	ME	10.4
OR	77.5	NY	08.4
WA	77.0	WY	06.2
OH	76.9	LA	05.5
SC	74.2	MS	04.9
AR	72.7	NH	04.7
KY	72.5	UT	03.3
WI	72.2	AZ	03.1
IA	69.8	NJ	01.8
ND	69.8	CO	01.6
FL	67.5	CT	00.5
IN	65.4	MD	00.1
NE	58.7	MA	00.1
NC	53.1	DE	00.0
NV	34.6	RI	00.0

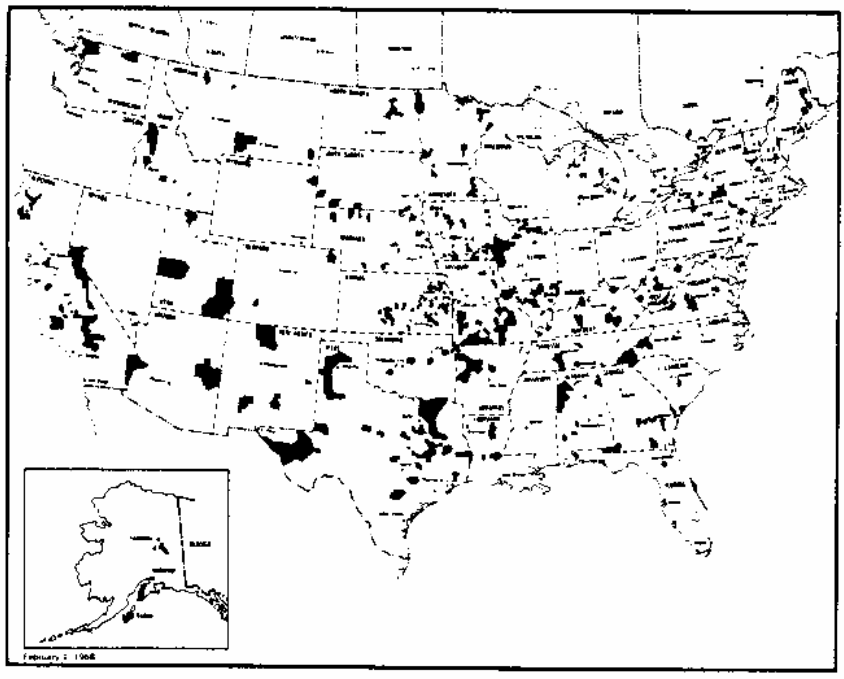
Table 2.15

Bell System and Independent Companies State-by-State
Percent of Telephones Within Each State, 1972

Source[S42]



Central Telephone and Utilities Corporation: Exchanges in the U.S. as of December 31, 1970
(a)

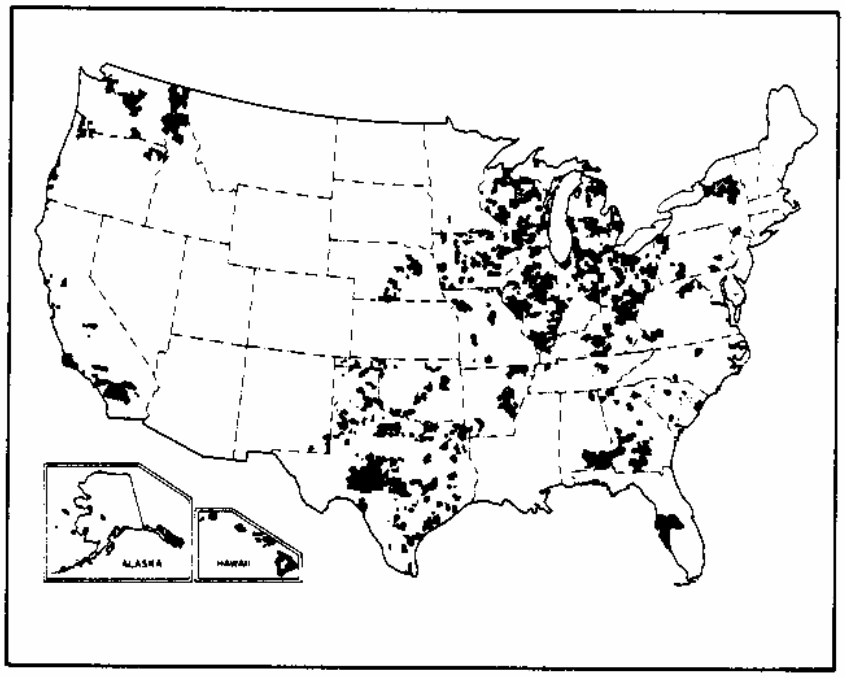


Continental Telephone Corporation Operating Areas: February 1, 1968
(b)

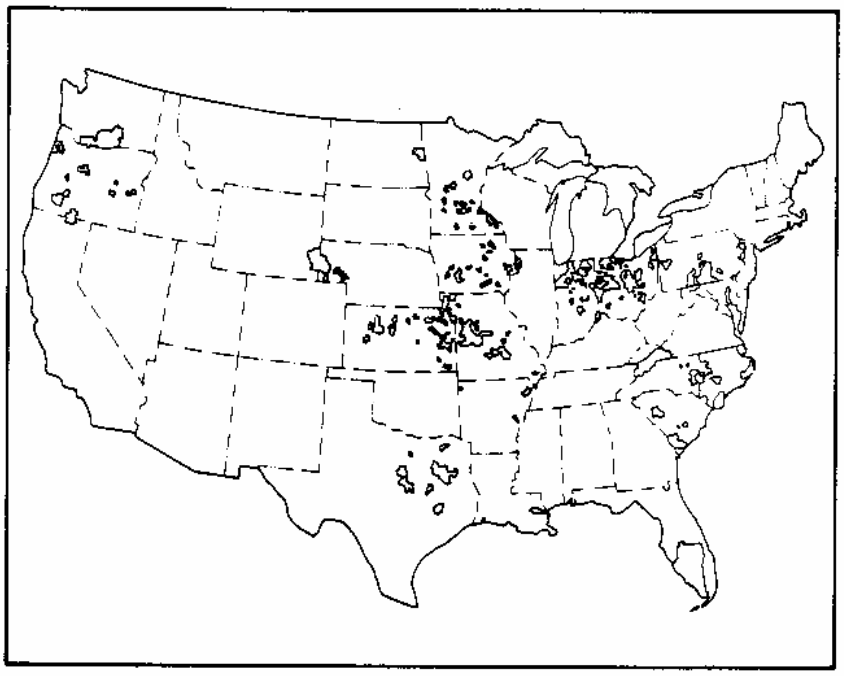
Figure 2.29

Operating Areas of the Major Independent Telephone Companies

Source[S43]

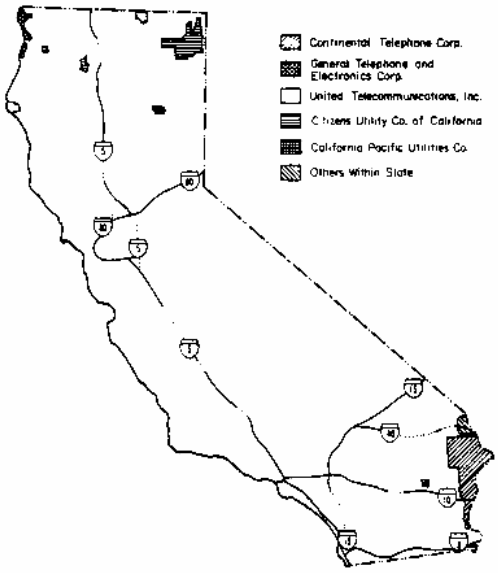


General Telephone and Electronics Corporation:
Operating Areas, 1972
(c)

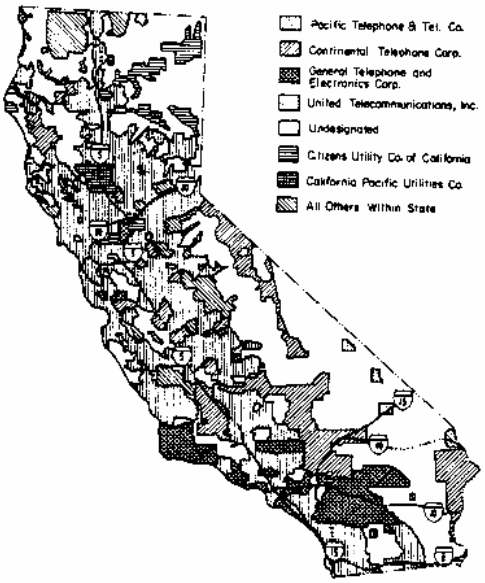


United Telecommunications, Inc.:
Operating Areas, 1972
(d)

Figure 2.29 (continued)



California Telephone Companies:
Operating Areas
(a)

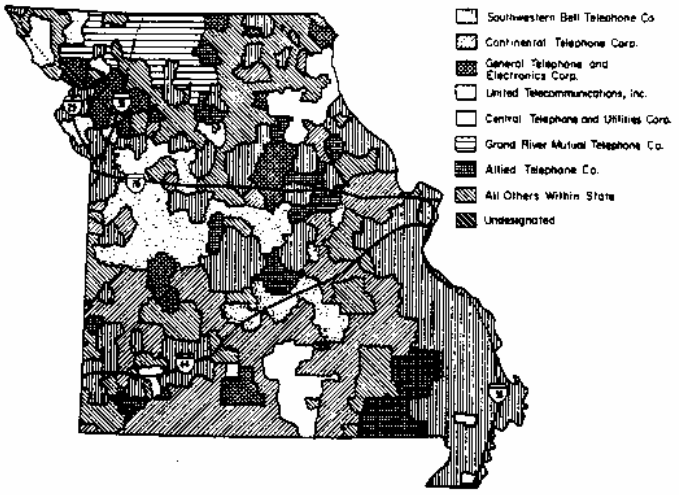


California Telephone Companies:
Independents Non-Contiguous to Bell
(b)

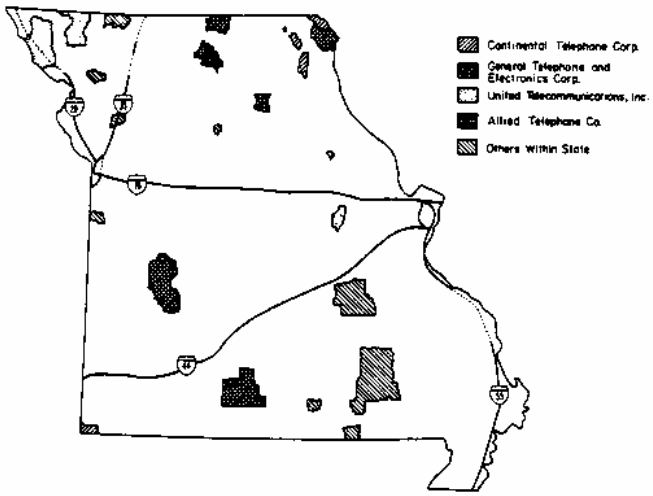
Figure 2.30

California and Missouri Telephone Companies:
Operating Areas

Source[S44]

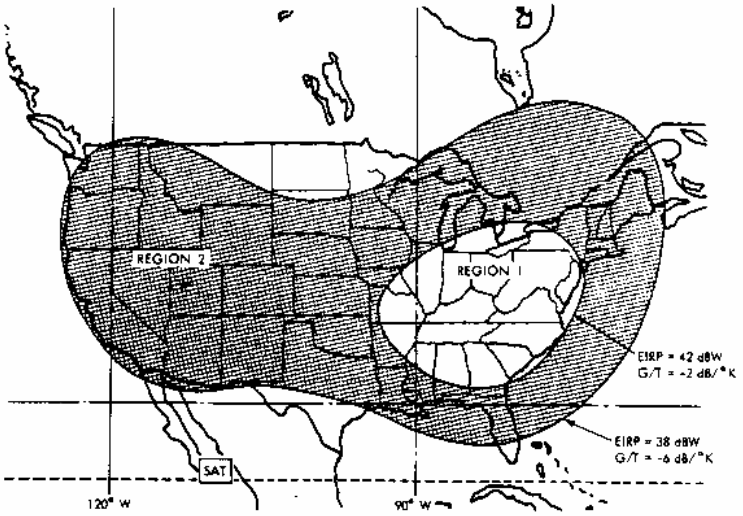


Missouri Telephone Companies: Operating Areas
(c)



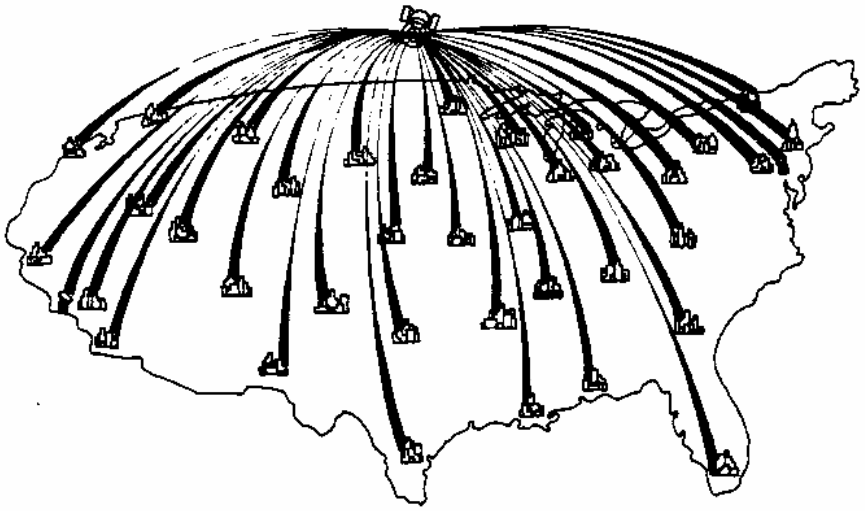
Missouri Telephone Companies: Independents Non-Contiguous to Bell
(d)

Figure 2.30 (continued)



Source: Satellite Business Systems, Inc.

Satellite Business Systems Geographic Coverage
(a)



Economically Attractive XTEN
Satellite Coverage

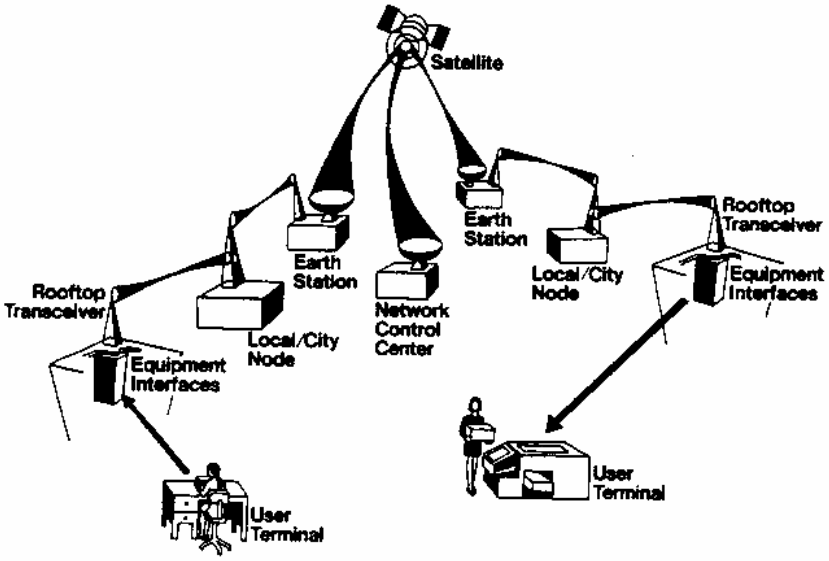
Source: Xerox Corporation.

Proposed Xerox XTEN System: Geographic Coverage
(b)

Figure 2.31

Domestic Satellite Geographic Coverage
and Information Flow

Source[S45]



End-to-End Information Flow
(c)

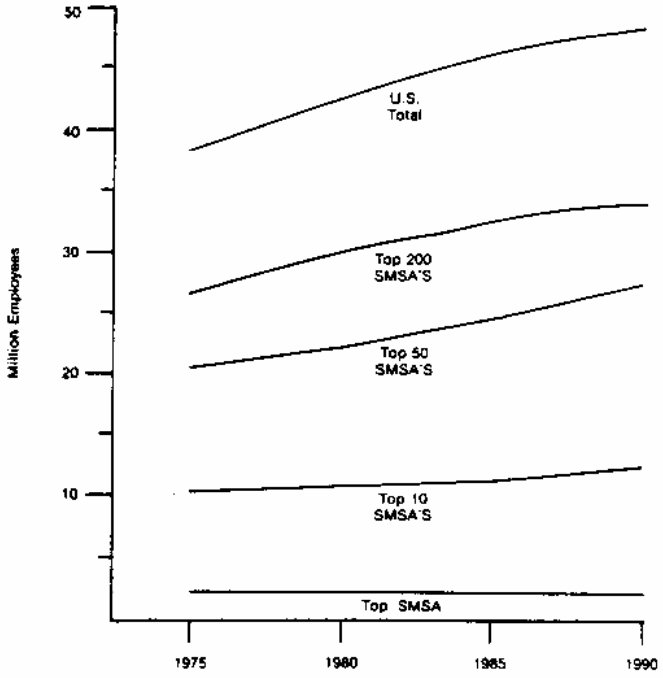
Figure 2.31 (continued)

separated locations, each a compact cluster, as in an industrial park,[14] "while smaller offices--each connected by terrestrial links to the nearest earth station--are also brought closer to the center of the organization."[15] A similar pattern of intercity coverage has been proposed for Xerox's XTEN service,[16] as illustrated in Figure 2.31(b). XTEN too has proposed to extend coverage through electrical or optical ground-based distribution around its earth stations, as sketched in Figure 2.31(c).

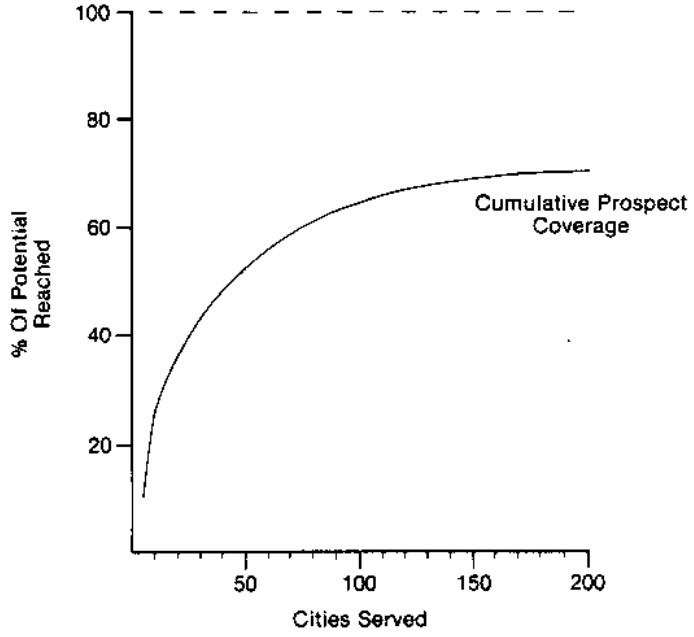
The XTEN business plan reflects both these geotechnical characteristics and the market concentrations described in Section 2-B1. The concentration of employees of prospective XTEN clients for intercommunicating office equipment is shown in Figure 2.32(a), and coverage of these prospects as a function of the number of cities served is shown in Figure 2.32(b).

E. Facilities

The classical model of a telecommunications channel, as described by Claude E. Shannon in 1948 (Figure 2.33), shows one transmitter and one receiver. As of 1978 , there were some 423 million telephones in the world, 169 million of them in the United States. Any customer could therefore talk to about 10^8 others. Figures 2.34 and 2.35 show something of what that scale entails, given that the number of possible pairwise links is over 10^{17}. The real telephone network does not give each customer a permanent link to every other; it relies instead on switching in a hierarchial design based on bundling or "trunking" calls among central offices and higher centers (Figure 2.35).



Qualified Prospect Employees in
Standard Metropolitan Statistical Area Groupings
(a)



Expansion of Prospective Market for Information Services
as a function of Cities Served
(1980 Projections)
(b)

Figure 2.32

Xerox XTEN Markets: Economic Attractiveness

Source[S46]

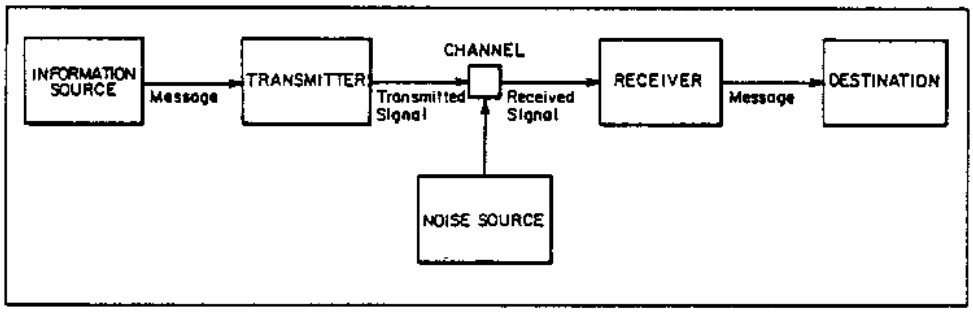


Figure 2.33

A Model Telecommunications Channel

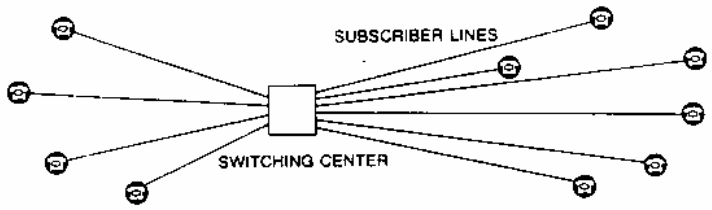
This block diagram was proposed by Claude E. Shannon in his influential 1948 paper "The Mathematical Theory of Communication", which laid the theoretical foundation for digital transmission of information. His work helped define the limits that noise puts on effective information transmission rates as well as practical methods for encoding messages coming from a source into suitable transmission codes.

Source: Pierce, John R., "Communication", Scientific American, Vol. 227, No. 3, September 1972, p. 32.

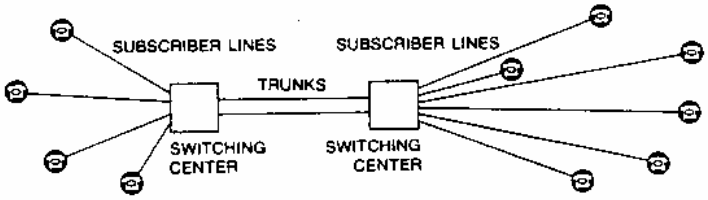
Source[S47]

(a)

(b)



(c)



(d)

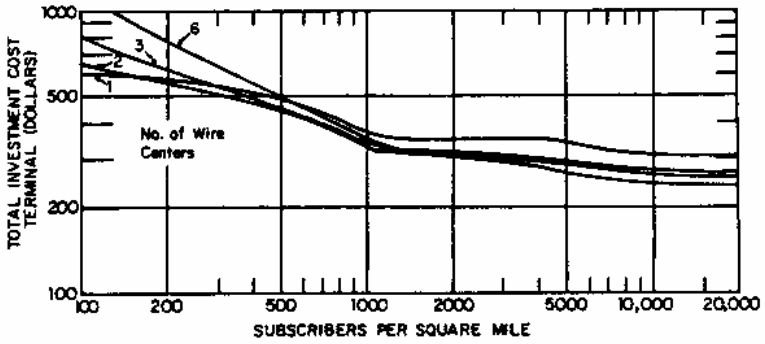


Figure 2.34

Switching and the Practical Interconnection of Terminals

Direct connection between all the terminals of a telecommunication network requires a large number of lines. For example, 10 telephones linked in this way would require 45 bi-directional lines (a). A switching center installed between them reduces the number of lines to 10 (b). If the telephones are separated by some distance, trunks connecting the local switching centers reduce the length of each of the individual subscriber lines and trunk capacity is further tailored to the assumption that only a fraction of all telephones are in use at any given time (c). While topologically accurate, (a) - (c) do not account for population densities. Under certain circumstances (d), one switching center is most economical for less than 150 subscribers per square mile, but two are better in the range of 150 to 2500 subscribers per square mile. Accurate estimates of such factors are important for economic viability.

Source[S48]

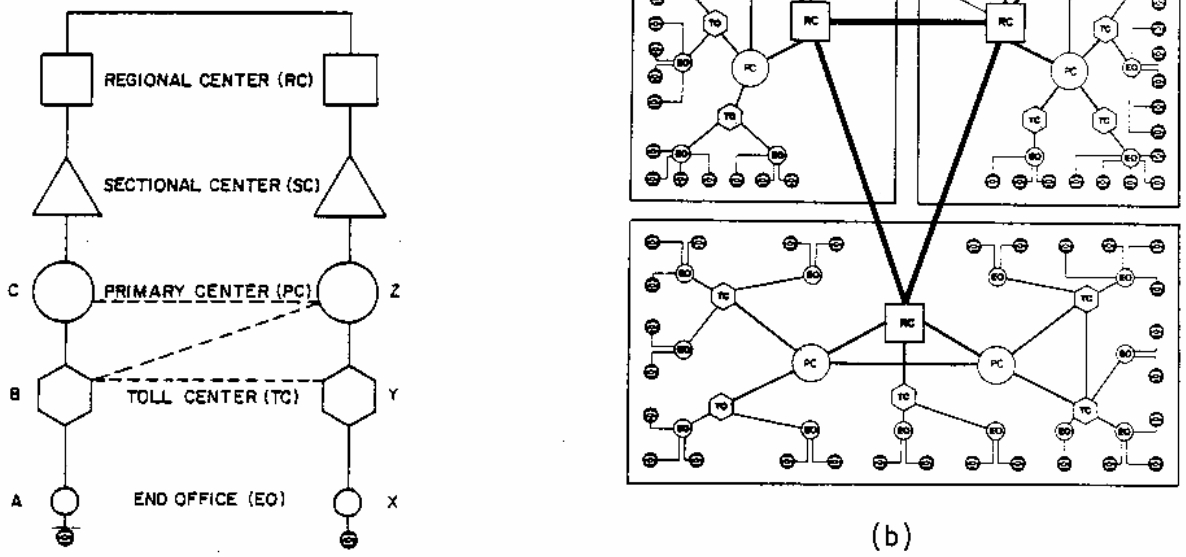
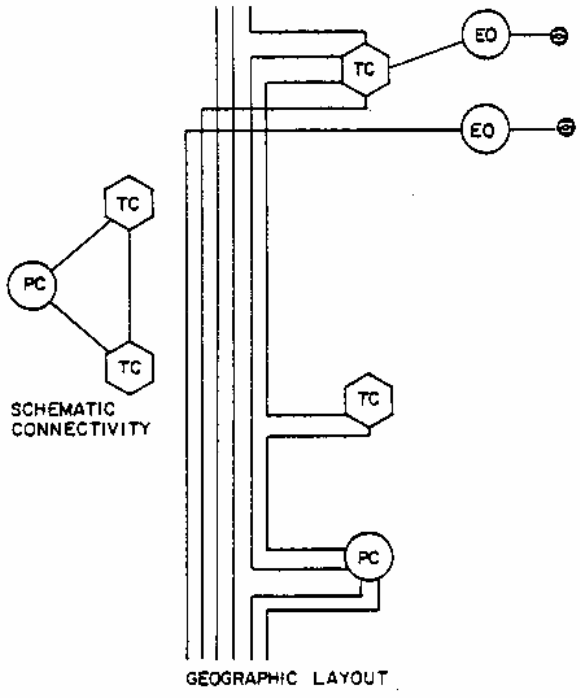


Figure 2.35

The Hierarchical Network

In actual practice, the principles sketched in Figure 2.34 are elaborated by the traditional telecommunications carriers into a network comprising a hierarchy of switches, not all of which are connected to every other, except for the twelve regional centers serving the United States and Canada, each of which has a trunk to every other. Any North American telephone may therefore be connected to any other through at most nine links (a). Where traffic is heavy, additional trunks (dashed lines) are provided and terminals, as well as switching systems, may be directly connected higher up in the hierarchy, omitting some of the intermediate levels shown. Normally, a call from to A to X would follow the three-link route A B Y X; however, if B Y should be blocked, the alternate route A B Z Y X will be tried. The ultimate resort is a nine-link route via regional centers. The overall pattern of connections is suggested by (b). The schematic lines in (b) do not necessarily reflect geographical routing, as illustrated in (c), although regions, sections, etc. generally correspond to contiguous geographic areas. Switches of different hierarchical rank may also happen to be located in the same building. In 1975, 700,000 intercity trunks and 2,000 long-distance switching systems served the United States and Canada.

Source[S49]



(c)

Figure 2.35 (continued)

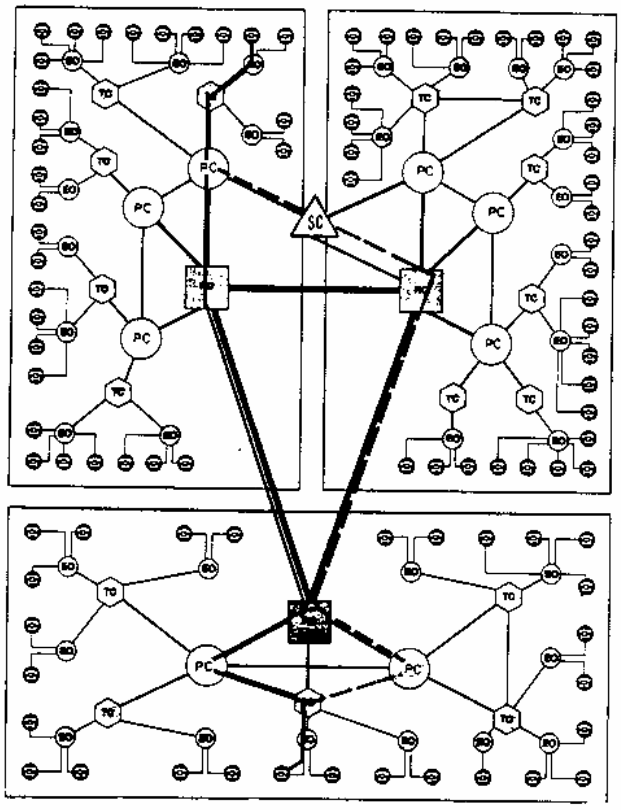
Since the effectiveness of switches and trunks depends on how many links might be active at any given time, the statistical distributions of calling times (Figure 2.17) and of call durations (holding times -- Figure 2.15) are important design parameters that depend on whether the links are used for conversations among people, for interactions among people and computers, or other purposes. Other important parameters include channel bandwidth (in hertz), a measure of the range of pure tones that the channel can faithfully transmit. A voice telephone channel typically has a bandwidth of 3000 hertz. Alternatively, some measure of digital or pulsed channel capacity is used. Pulse transmission capacity is described in bauds (signal elements--or pulses of various heights--per second). How much information (as measured in bits) can actually be transmitted over a channel also depends on how much noise--hum, error, crackle or snow--there is in the channel, as measured by the signal-to-noise ratio. For example, if the signal-to-noise ratio permits distinguishing 4 levels of pulse height, a channel may carry 2 bits per pulse, i.e., 2 bits per second per baud. On the other hand, if fighting noise requires sending redundant pulses, as through the use of error-detecting codes, the bit rate may be less than the number of baud. The technology of the seventies afforded roughly 3 bits per second per hertz of voicegrade bandwidth.

Especially significant for compunications is access-delay, or the time it takes to make a connection between transmitter and receiver. Network flexibility and growth potential, widespread availability of services and security that helps to protect confidentiality, are other performance traits of varying degrees of importance. Continuity of

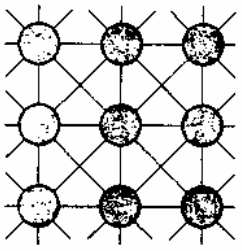
service is a trait increasingly in the public consciousness, since the Eastern power blackout of 1965, the Manhattan telephone fire of 1975, sabotage and airliner hijackings and the Three-Mile Island nuclear reactor failure of 1979 have exposed the vulnerability of many essential services (Figure 2.36).

The concrete facilities embodying abstract network functions are not evident in Figure 2.35. Figure 2.37 gives a snapshot of these facilities in terms of the capital invested in them; and it illustrates the dynamics of recent changes in the switching and transmission components.

Figure 2.35 oversimplifies in other critical ways. Ordinary telephones, although predominant, are not the only instruments at the ends of telephone lines. As early as 1878, a prospectus for the District Telephone and Automatic Signal Company offered to connect burglar alarms to that company's central office via telephone wire, but the service apparently was unsuccessful.[17] Figure 2.38 samples devices currently linked by the telecommunications network. Telemetry and telecontrol devices are of obvious importance in the production of most goods as well as the science and technology. By linking remote pickups to radio or TV stations, and the stations with one another and with their transmitters, the telecommunications system provides the backbone of radio and TV networks. Teletypewriters link up the telecommunications network with the Postal Service as in the delivery of Mailgrams; along with telephoto terminals, teletypewriters have long been the workhorses of news services such as the Association Press (AP) and United Press International (UPI) and of most newspapers and radio/TV news services as well. During the seventies, computers, computer terminals and telecommunications facilities have recently been



(a)



(b)

Figure 2.36

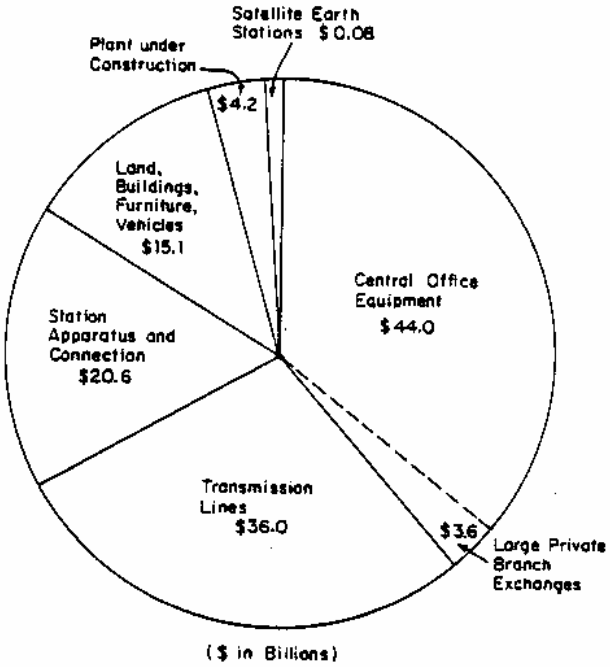
Alternate Routing and Network Reliability

(a) Alternate routing in a hierarchical network is more economical than full connectivity, yet also helps ward off blockage due to ordinary peaks of demand or limited outage due to failure of a cable that might be plowed up by a bulldozer. Extraordinary demand peaks, as during a hurricane, may keep the network so busy hunting for alternate routes that it would block altogether without the manual override function of network management. Major physical damage from accidents or sabotage requires automatic or manual changes in actual physical routes and eventual restoral of damaged facilities.

(b) The military AUTOVON network puts greater emphasis on the "polygrid" configuration which uses more physical links with diversified physical routing and less on the attractive economies of the "star" configurations in the hierarchical network.

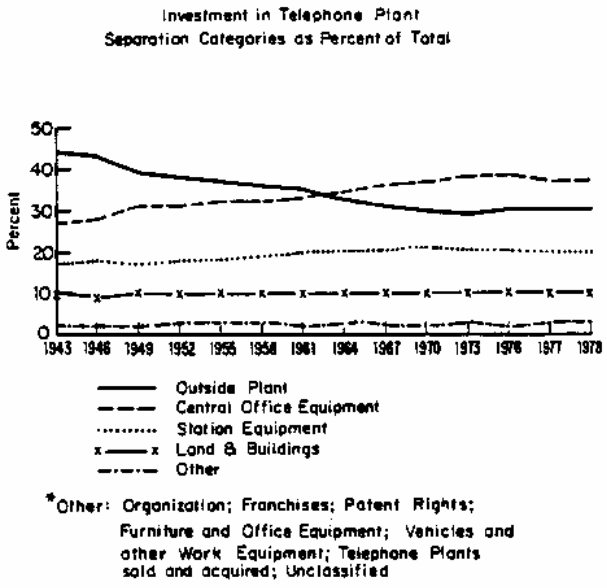
Because of alternate routing, paths and transmission quality will vary from call to call. How much alternate routing or how many alternate physical facilities are to be provided by whom and who might bear the costs are among the questions that arise when choosing between monopoly and competition or between regulated and free markets in compunications.

Source[S50]



Telephone Plant Value, 1978

(a)



Investment in Telephone Plant:
Separation Categories as Percent of Total

(b)

Figure 2.37

Telephone Plant Proportions of Switching and Transmission

(a) By 1978, switching accounted for $47.6 billion or 38.5%, and transmission for $36.0 billion or 29.1% of plant value.

(b) The reversal in 1960 of the proportions of investment in switching (central office equipment) and in transmission (outside plant) is foreshadowed by an earlier - and continuing - change in the relative rates of investment.

Given the dramatic decreases in cost of transmission (Figure 8), it is plain why establishing transmission facilities without switching would appear increasingly attractive, thus accounting in part for the emergence of Specialized Common Carriers (SCC's) in 1970's.

The Uniform System of Accounts from which the data are drawn includes such items as multiplex apparatus and covers for transmission power apparatus among central office equipment. Engineers might consider such apparatus as part of the transmission lines. The difference between switching and transmission plant may therefore be somewhat overstated. In practice, these differing perceptions of accountants and engineers complicate the economists' theoretical ideas of costs.

Source[S51]

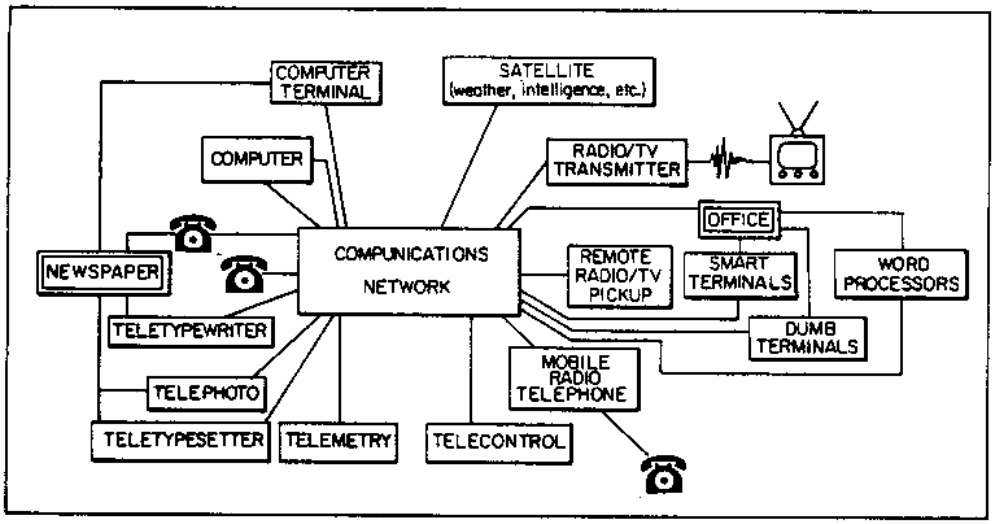


Figure 2.38

Social Infrastructure: The Changing Telecommunications Network

As of 1978, telephones still predominated -- 169 million in the U.S., 29% of them extensions -- but many other devices are now attached to a network that has become an infrastructure basic to most social functions including many that reach directly into the home. As computers and computer terminals have become increasingly pervasive over the last two decades, the network has taken on technical characteristics of an integrated computer/communications or compunications network.

Source[S52]

integrated into a compunications system that automates many of UPI's news collecting, editing and distributing functions. In an increasing number of organizations such systems are the backbone of intracompany information handling and links in chains of interorganizational functions. Their emergence has led to increasing competition between traditional postal and telecommunications services.[18]

This sharing of elaborate facilities by the most diverse services is both an important source of friction among them (Figure 2.39) and a key to understanding their past and future evolution. This is as true of private line services (PLS) as it is of MTS and WATS. In private line services, traditional carriers and their competitors supply clients with communications paths all their own and--in the simplest versions--each of them conceptually similar to the first telephone installation wherein a pair of wires connected Alexander Graham Bell in one room with one instrument with Mr. Watson in another room with another instrument. Today many different types of private line services are provided to transmit conversations, data or television programs. These private service systems rely in part on dedicated paths through transmission and associated facilities common also to other services or to other clients.

The range of technologies used in transmission is illustrated in Figure 2.40. Switching and, increasingly, various facets of transmission are based on technologies common also to the computer industry and to the electronics industries generally. As indicated by Figure 2.40(c),(d) the estimate of telecommunications costs depends, as most cost estimates do, on estimated production levels, as measured, in this instance, by the portion of transmission capacity in actual use.

Figure 2.41(a) shows the actual geographic layout of AT&T's major

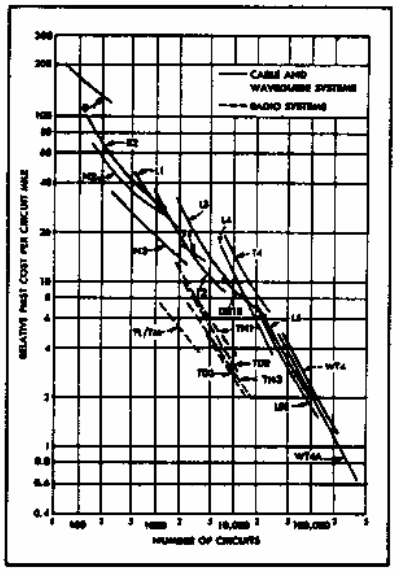
Aeronautical Radio, Inc.	National Association of Manufacturers
Aerospace Industries Assoc. of America, Inc.	National Association of Motor Bus Owners
Air Transportation Association of America	National Retail Merchants Association
Altair Airlines	National Data Corp.
American Facsimile Services Corp.	North American Telephone Assoc.
American Newspaper Publishers Association	Orlando Communications Club, Inc.
American Satellite Corp.	Packet Communications Inc.
American Telephone and Telegraph Co.	RCA Global Communications, Inc.
American Trucking Associations, Inc.	Remote Data Processing Services Section of Adapso, Inc.
Associated Press	Satellite Business Systems, Inc. (formerly CML Satellite Corp.)
Association of American Railroads	Securities Industry Automation Corp.
Bank Wire	Southern Pacific Communications Company
Boeing Computer Services, Inc.	Telenet Communications Corp.
Bunker Ramo Corp.	Tymshare, Inc.
Central Committee on Telecommunications of the American Petroleum Institute	United Press International, Inc.
Citicorp	United System Service, Inc.
Commodity News Services, Inc.	Utilities Telecommunications Council
Computer and Business Equipment Manufacturers Association	Wells National Services Corp.
Data Transmission Company	Western Union International, Inc.
Dow Jones & Company, Inc.	Western Union Telegraph Company
Graphnet Systems, Inc.	Xero-Fax, Inc.
GTE Service Corp.	
International Business Machines	Department of Health, Education and Welfare
ITT World Communications Inc.	Department of Justice
MCI Telecommunications Corp.	Office of Telecommunications Policy

Figure 2.39

Interdependence of Information Systems

Illustrative of the multiple stakes in the structure and pricing of basic information services is the diversity of the organizations commenting on an inquiry into resale and shared use of telecommunications services and facilities that the Federal Communications Commission originated in mid 1974 (Docket No. 20097) and which concluded in 1978 when the Supreme Court refused certiorari. Some service companies or trade and other associations have found a niche in purchasing wholesale and in retailing, sometimes with other services added, on terms more favorable than those available directly from the common carriers. Hitherto, such brokerage has not been common in telecommunications; its effect on the structure of the telecommunications industry, questions about the boundary between telecommunications and data processing and allegations of illegal preferential treatment are among the issues raised. In part, the inquiry arose when truckers (American Trucking Associations, Inc.) alleged preferential treatment of airlines (Aeronautical Radio, Inc.). Also at stake are interests of newspapers and news wire services, banks, manufacturers and retail merchants; of various suppliers of telecommunications and data processing goods and services; and of the general "public interest, convenience and necessity".

Source[S53]



LEGEND		
Bell System Code	Transmission Vehicle	Range
DR	Digital Microwave Radio	Short
K	Cabled Wires	Long
L	Coaxial Cables	Long
N	Cabled Wires	Short
O	Open Wires	Short
T1	Digital Cabled Wires	Short
T2	Digital Cabled Wires	Long
T4	Digital Coaxial Cables	Long
TD,TH	Microwave Radio	Long
WT	Waveguide	Long

Cost trends for short- and long-haul transmission are down while carrying capacity is up, both by several orders of magnitude. Each of the vehicles illustrated here is capable of carrying simultaneously many conversations or other types of information. This includes the "O" system that improves on the classical open wires. The increase in the handling capacity of the several vehicles represents development over time as well as technical improvements. Line termination, switching and personnel costs are among the additional elements that enter into the cost of complete telecommunication systems. Present cost proportions and price patterns are such that a pair of wires carrying but one conversation is still generally the vehicle for local conveyance from an individual telephone toward the nearest exchange, where many conversations heading the same way are bundled for further short or long haul. Optical technologies are becoming an important contender with the terrestrial technologies illustrated here along with the satellite facilities described in Section 2-D.

Cost Related to Capacity

(a)

Short- and Long-Haul Transmission

	Million Circuit Miles (Telephone Grade Carrier Facilities)	% of Total Circuit Miles
Open Wire	1.2	0.2
Paired Cable	100.0	15.1
Coaxial Cable	148.6	22.5
Microwave Radio	410.9	62.2
Total	660.7	100.0

Interexchange and intraexchange trunks. Local loops generally are "baseband" not "carrier" facilities; the paired cable category, however, includes 0.7 million circuit miles of carrier-type subscriber facilities.

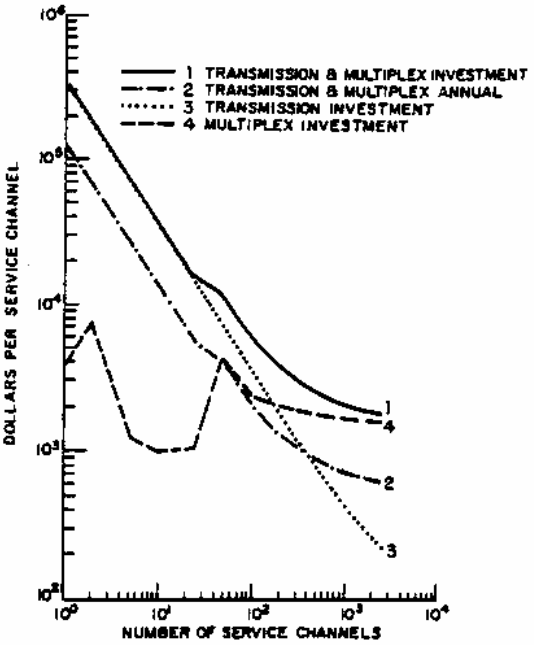
Bell System Plant, 1976

(b)

Figure 2.40

Transmission Cost Trends

Source[S54]



So-called economies of scale are reflected by the downward trend in Figure 2.40(a), where transmission costs per circuit decrease as the capacity of the system increases. At full load, for example, the WT4A system is both larger and more economical than its predecessors. The precise nature of economies of scale is hotly disputed, since their absence favors the effectiveness of competition, while their strong presence defines a "natural" monopoly. While the cost of transmission alone decreases smoothly with scale, as shown in Figure 2.40 (a) and by curve 3 of (c), multiplexing costs introduce lumps, as shown by curves 1 and 2 of (c). For zero transmission costs, the lumpiness would dominate (c/4). Multiplexing is the technique used to carve multiple channels out of a single facility.

The picture is further complicated by distinctions between comparing technologies over the long-term, assuming a fixed loading, and the short-term effects on unit costs of the transition between no-load and full load of a fixed facility. What one party sees as prudent spare capacity may be seen as wanton overcapacity by another.

Economies of Scale

(c)

Figure 2.40 (continued)

Origin of Telephone Call	Destination	Ratio of Average Costs 1980(projected): 1972
Bangor	Miami	1.05
Bangor	Portland	0.89
Portland	New York	0.88
New York	Washington	0.85
New York	Richmond	0.80
New York	Miami	1.12

The inventory costs of carrying unused "lumpy" plant while it fills up affect average costs over the period of averaging. Depending on the size of the lumps and assumptions about demand (rate of fill), "better" technology may or may not realize economies of scale. Under a fixed set of assumptions about startup demand, rate of demand growth, traffic density (cross-section) along each route, length of route, subscriber density in local service area, etc. new equipment may or may not reduce costs. For six private line voice routes studied by Systems Applications, Inc., for the White House Office of Telecommunications Policy, the projected ratios of average costs in 1980 to average costs in 1972 were less than 1 (economies of scale realized) in four cases, greater than 1 in two cases.

Projected Ratios of Average Costs, 1980: 1972

(d)

Figure 2.40 (continued)

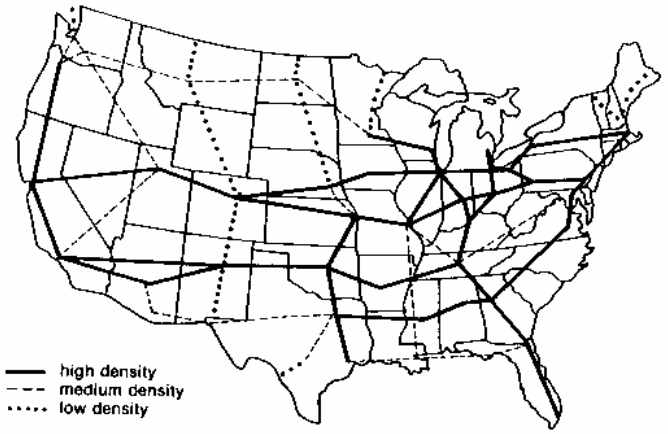
routes and Figure 2.41(b) the routes of the major terrestrial competitors (see Figures 2.31 and 2.32 for illustrative satellite coverage). The two sets of routes are overlaid for comparison in Figure 2.41(c). Investment in such routes accounts for the principal part of competitors' capital outlays. As Table 2.16 indicates, it amounts to 6%-30% of Bell System capital book costs. Note that the breakdown in Figure 2.37 is based on the FCC-mandated Uniform System of Accounts, while that of Table 2.16 is more consonant with the competitive categories as defined in Section 2-D2d. Figure 2.41(d) shows the cities where, as of early 1980, terrestrial competitors offered services comparable to the MTS of the traditional carriers.

F. Labor

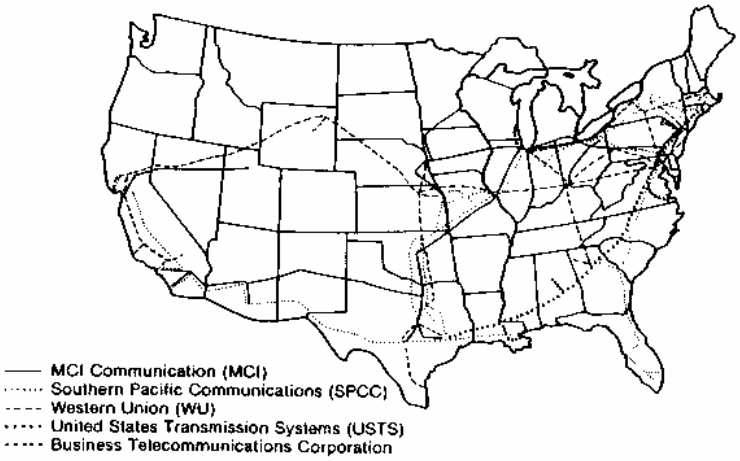
In 1976 the Bell System employed 778,000 people, Independents reporting to USITA employed 154,493 people, and the remaining independents employed 5,507 people for a total of 938,000 people, compared to 539,000 postal employees. Historical employment data are shown in Figure 2.42. Payroll expenses as a percent of operating expenses are displayed in Figure 2.43. Table 2.17 gives a breakdown according to occupational categories. Two indices of "productivity," the average number of telephones per employee and average dollars of investment per employee, are shown in Table 2.18.

The Communications Workers of America (CWA) is a union with about 625,000 members. Most of these work within the telephone industry, the lion's share in the Bell System (520,000). CWA also represents workers at General Telephone & Electronics (41,000), other telephone companies (20,000), some telegraph companies, and some interconnect companies. In addition, CWA represents public employees (30,000).

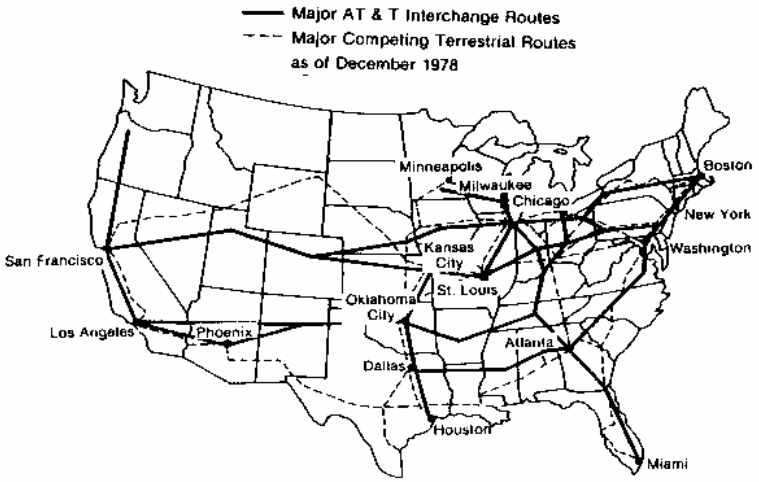
Other unions which include telephone workers are the International Brotherhood of Electrical Workers, the Telecommunications International Union,



Major AT&T Terrestrial Interexchange Routes
(a)



Major Competing Terrestrial Interexchange Routes
(December 1978)
(b)

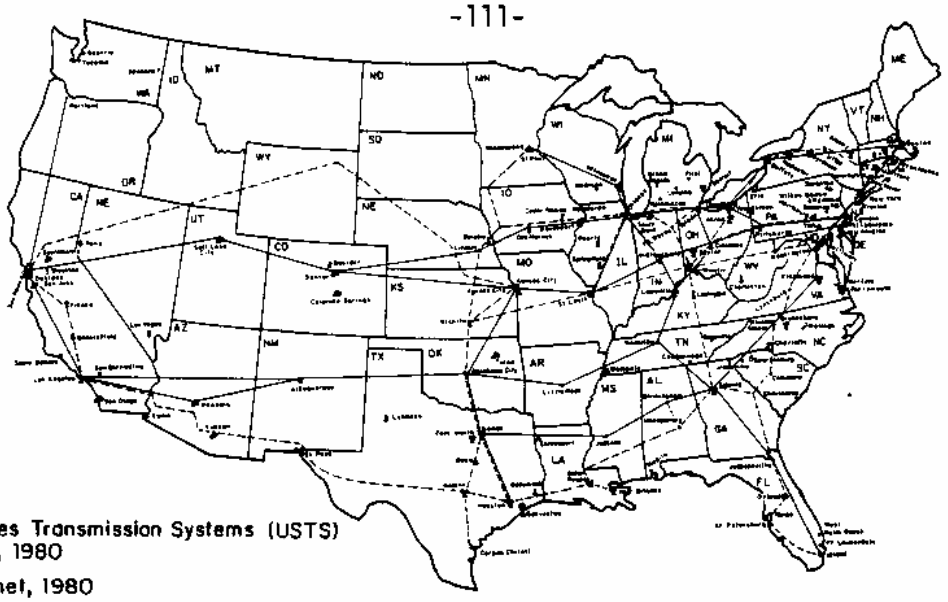


Major Terrestrial Interexchange Group
(c)

Figure 2.41

Major Interexchange Routes and Cities Served

Source[S55]

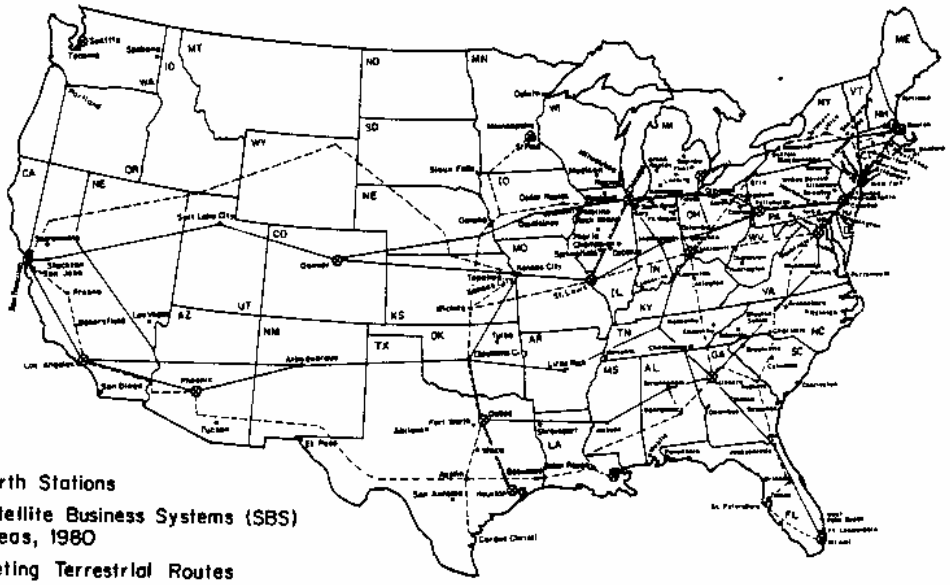


Legend

- • United States Transmission Systems (USTS) City-Call, 1980
- △ MCI Execunet, 1980
- ○ Southern Pacific Communications (SPCC) Sprint Y, 1980
- ----- Major Competing Terrestrial Routes, December 1978
- ——— Major AT&T Interexchange Routes

Cities with Dial-up Services by AT&T's Competitors (1980)

(d)



Legend

- ◉ Satellite Earth Stations
- • Proposed Satellite Business Systems (SBS) Service Areas, 1980
- ---- Major Competing Terrestrial Routes
- ——— Major AT&T Interexchange Routes

Proposed Satellite Business Systems Earth Stations and Service Areas (1980)

(e)

Figure 2.41 (continued)

Residence Terminals	4%
Business Terminals	11%
Inside Wiring	3%
Drops	3%
Loop	26%
Local Central Office Switch	22%
Non Traffic Sensitive 6%	
Traffic Sensitive 16%	
Tandem & Regional Switches	5%
Intra/InterExchange Trunks	18%
Long Lines Switches	2%
Long Lines Trunks	6%
Total	100%

Table 2.16

Bell System Plant Investment, 1976

Source[S56]

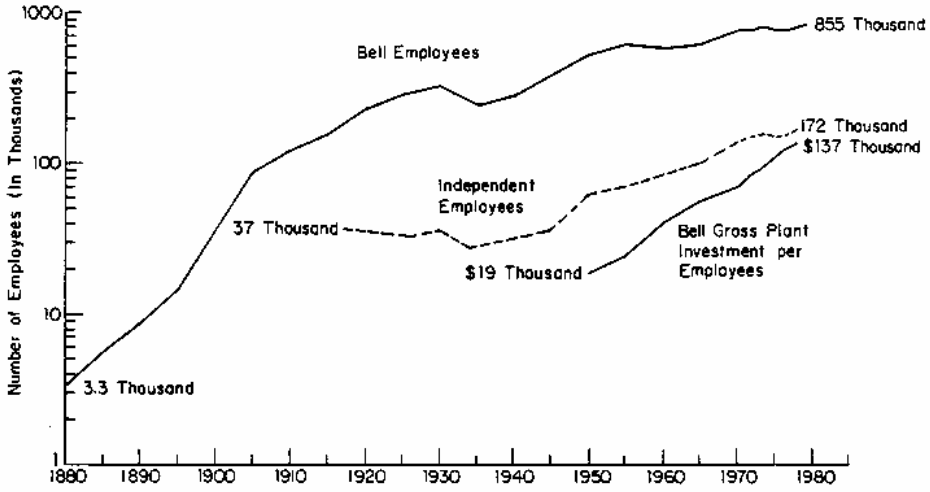


Figure 2.42

Bell System and Independent Companies:
Number of Employees (thousand) and
Plant Investment per Employee ($ thousand),
1880-1974

Source[S57]

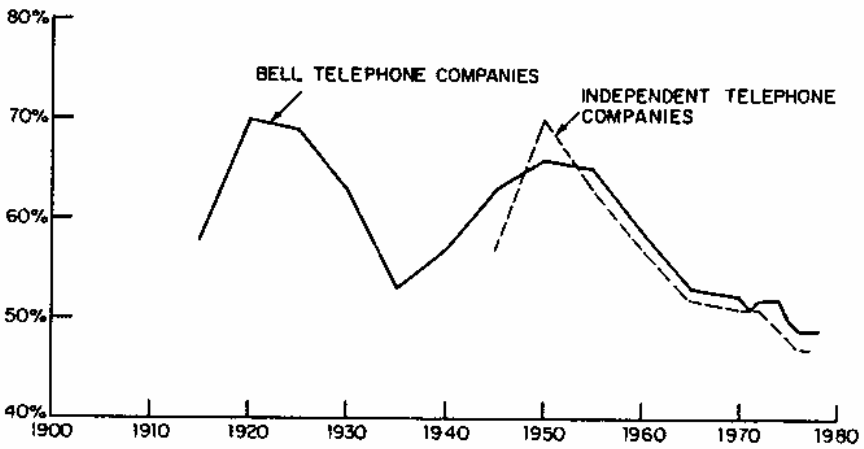


Figure 2.43

Payroll Versus Percent of Operating Expenses for Bell System and Independent Telephone Companies

Source[S58]

Classification According to Occupation	Employees as of December 31, 1976 Number	%
Officials and Managerial Assistants	6872	4.4
Professional and Semi-professional Employees	13284	8.6
Business Office and Sales Employees	10901	7.1
Clerical Employees	27617	17.9
Chief Operators, Supervisors, and Instructors	2886	1.9
Switchboard Operators and Other Switchboard Employees	22637	14.7
Foremen of Telephone Craftsmen	7507	4.9
Central Office Craftsmen	19047	12.3
Installation and Exchange Repair Craftsmen	23789	15.4
Line, Cable, and Conduit Craftsmen	11420	7.4
Laborers	516	0.3
Building, Supply, and Motor Vehicle Employees	6727	4.4
Other Employees - Not Elsewhere Classified	1290	0.8
Total	154493	100.1*

* error due to rounding

Independent Telephone Companies

(a)

Classification According to Occupation	Employees as of December 31, 1976 Number	%
Officials and Managerial Assistants	19561	2.6
Professional and Semi-professional Employees	77590	10.2
Business Office and Sales Employees	67170	8.8
Clerical Employees	167712	22.1
Chief Operators, Supervisors, and Instructors	15665	2.1
Switchboard Operators and Other Switchboard Employees	114353	15.0
Foremen of Telephone Craftsmen	35374	4.7
Central Office Craftsmen	113996	15.0
Installation and Exchange Repair Craftsmen	84320	11.1
Line, Cable, and Conduit Craftsmen	41790	5.5
Laborers		
Building, Supply, and Motor Vehicle Employees	21733	2.9
Other Employees - Not Elsewhere Classified	597	.1
Total	759861	100.1*

Bell System**

* error due to rounding

** excludes SNET, Cinn. Bell, Bell labs and Western Electric

(b)

Table 2.17

Number of Independent and Bell System Employees, 1976

Source S59

	Number of Employees (Thousands)	Total Payroll (Thousands)	Average Annual Payroll per Employee	Average No. Telephones per Employee	Average Dollars of Investment per Employee
1976	154	$1 949 111	$12 616	174	$138 019
1975	152	1 736 809	11 448	168	128 669
1974	157	1 607 874	10 273	155	112 931
1973	157	1 438 165	9 133	147	101 047
1972	152	1 293 966	8 533	143	94 137
1971	148	1 137 155	7 703	137	85 929
1970	142	1 001 008	7 042	135	78 623
1969	133	871 301	6 531	135	74 344
1968	123	781 627	6 362	136	70 932
1967	114	$ 670 777	$ 5 871	135	$ 70 603

Independent Telephone Companies

(a)

	Number of Employees (Thousands)	Total Payroll (Thousands)	Average Annual Payroll per Employee	Average No. Telephones per Employee	Average Dollars of Investment per Employee
1976	760	11, 878, 796	15, 630	162	123, 186
1975	770	10, 858, 462	14, 102	154	113, 128
1974	793	9, 961, 635	12, 562	144	101, 815
1973	799	9, 055, 623	11, 334	138	92, 269
1972	778	8, 137, 543	10, 460	135	85, 915
1971	777	7, 144, 910	9, 196	129	77, 974
1970	773	6, 468, 962	8, 369	125	70, 912
1969	736	5, 758, 241	7, 824	126	66, 921
1968	679	5, 001, 623	7, 366	130	66, 226
1967	656	4, 668, 700	7, 117	128	63, 195

Bell System

(b)

Table 2.18

Bell System and Independent
Payroll, Telephones and Investment per Employee, 1967-1976

Source[S60]

and the American Communications Association, a division of the Teamsters Union.

G. Capital

The differences between personal and business uses of the 170 million telephones in the U.S. as of 1978 and the few at the start of the century are evident from the contrast between the 1909 rules in Figure 2.44 and our own present practices. The contrast is further sharpened in Figure 2.38, which shows how many information services, other than conversations over ordinary telephones, increasingly depend on the infrastructure provided by the telecommunications network.

The pervasive character of telecommunications as an infrastructure is reflected, as shown in Figure 2.45, in continuing rapid growth of telephone usage since its inception a century ago. Continuing high levels of capital expenditures therefore characterize the telecommunications industry (Table 2.19). About $14 billion (81%) of $17 billion 1978 telecommunications industry capital spending was by the Bell System, and the remainder, about $3 billion (19%) by the largest Independents. Altogether, this amounts to roughly 11% of all capital expenditures in the U.S. in 1978.[19]

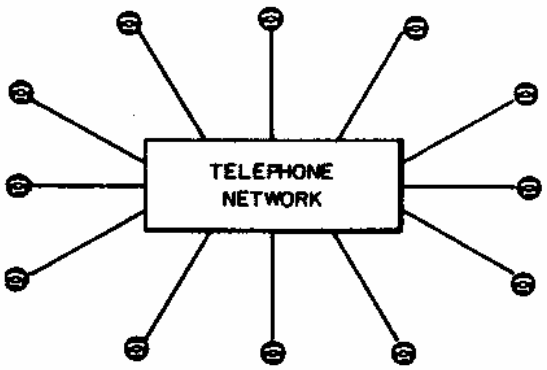
Table 2.19 shows that between 1975 and 1979 annual increases in capital spending by the Independents have been uniformly higher than those of the Bell System, consonant with the generally more rapid growth of Independent business (Table 2.20). This reflects the predominance of Independents in areas sparsely settled a century ago, but nowadays partaking of suburban and Sun Belt growth rates higher than those in the urban concentrations where the Bell System predominates.

Growth in telecommunications geographic incidence and total usage is reflected in continuing growth in revenues of the traditional telecommunications carriers (Figure 2.46) and of their new competitors (Table 2.12). Like all other factors we have considered so far, neither investment nor revenues are

RULES FOR USING THE TELEPHONE—CIRCA 1909

AN AMUSING look at some of the by-laws of the early days of the Walker County Telephone Company is provided in these 1909 by-laws of the telephone company as passed by the Board of Directors:

(1) Each person renting a phone shall accept the same subject to the by-laws of the company and such regulations as may be fixed by the company from time to time.
(2) Social conversations are not permitted when the line is required for the transmission of business messages.
(3) No one shall use the line for more than five minutes if another is waiting for it. Anyone failing to surrender the line in five minutes after being requested to do so shall be charged the sum of 25¢ for each three minutes and at the same rate for any extra time over.
(4) Any and all persons using party lines shall, upon notice that there is a long distance message to be transmitted, immediately surrender the line, and in case of failure to so surrender, each of said parties using the party line shall pay 25¢ for each three minutes and at the same rate for any time over three minutes.
(5) No one shall be allowed to use improper language over the line and any person so offending shall be charged $1.00 for such conversation over the phone and will also be liable for prosecution for violation of the law.



(6) No one shall be allowed to take down the receiver for the purpose of listening to a message not intended for him. Each person so offending shall be charged 25¢.
(7) No one shall allow anyone but members of his family, invited guests or other subscribers to use his telephone free of charge. All subscribers allowing messages from their phone by parties not authorized to talk free will be charged with the conversation (10 cents) and shall be required to collect the same and turn it over to the telephone company at the end of each month.

Figure 2.44

Changing Perceptions of the Telephone

Source[S61]

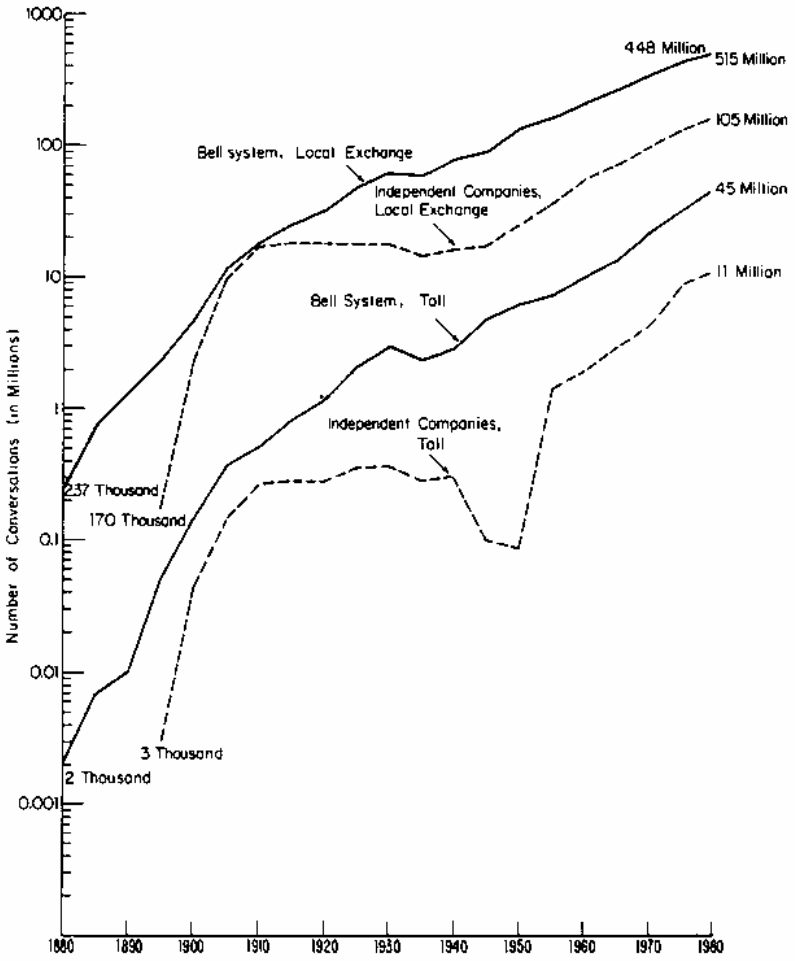


Figure 2.45

Bell System and Independent Companies;
Average Number of Daily Telephone Calls,
1880-1970

Source[S62]

Company	1975	1976	Percent Increase	1977	Percent Increase	1978	Percent Increase	1979E	Percent Increase
American Telephone & Telegraph	$ 9,354	$10,000	6.9%	$11,600	16.0%	$13,700	18.1%	$15,000	9.5%
Allied Telephone	$ 17	$ 20	17.6	$ 18	(10.0)	$ 27	50.0	$ 22	(18.5)
Central Telephone & Utilities	131	146	11.5	186	27.4	204	9.7	204	-
Continental Telephone	232	210	(9.5)	263	25.2	336	27.8	400	19.0
General Telephone & Electronics	1,291	1,476	14.3	1,677	13.6	2,081	24.1	2,300	10.5
Lincoln Telephone & Telegraph	28	27	(3.6)	29	7.4	30	3.4	35	16.7
Mid-Continent Telephone	56	66	17.9	76	15.2	87	14.5	94	8.0
Rochester Telephone	35	32	(8.6)	34	6.3	30	(11.8)	34	13.3
United Telecommunications	299	326	9.0	421	29.1	470	11.6	525	11.7
Winter Park Telephone	10	15	50.0	12	(20.0)	14	16.7	19	35.7
Total Nine Independents	$ 2,099	$ 2,318	10.4%	$ 2,716	17.2%	$ 3,279	20.7%	$ 3,633	10.7%
Total Ten Companies	$11,453	$12,318	7.6%	$14,316	16.2%	$16,979	18.6%	$18,633	9.7%

Table 2.19

Telecommunications Industry Capital Spending ($ million)

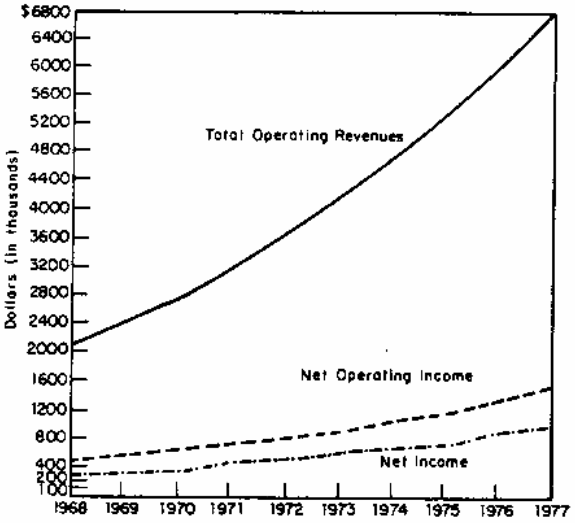
Source[S63]

	Average Growth Rates 1968-1977	
	Bell	Independent Companies
Telephones (Main & Equivalent)	3.6%	4.6%
Originated Toll Revenue	13.2%	14.6%
Local Services Revenues	10.1%	11.3%

Table 2.20

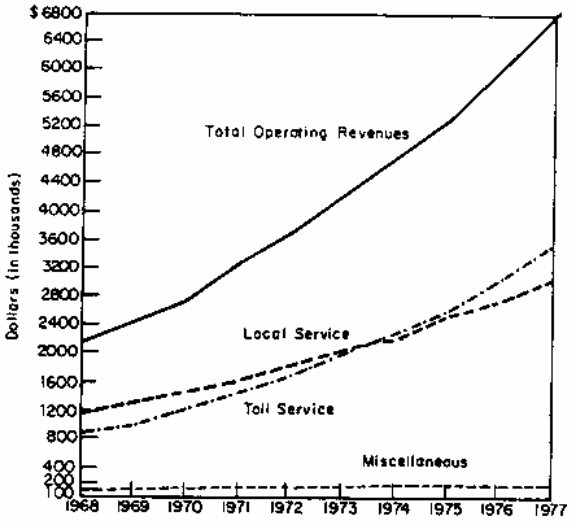
Independent Growth Rates Outstrip Bell, 1968-1977

Source[S64]



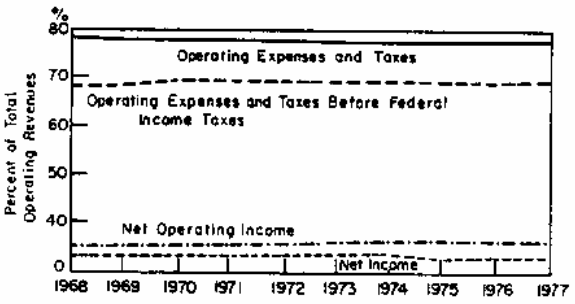
Independent Companies
Revenues and Income

(a)



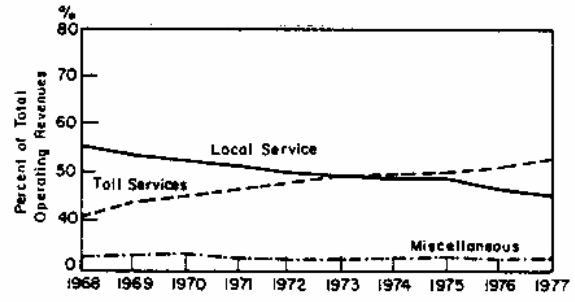
Independent Companies
Total Operating Revenues

(b)



Independent Companies
Percent of Total Operating Revenues

(c)



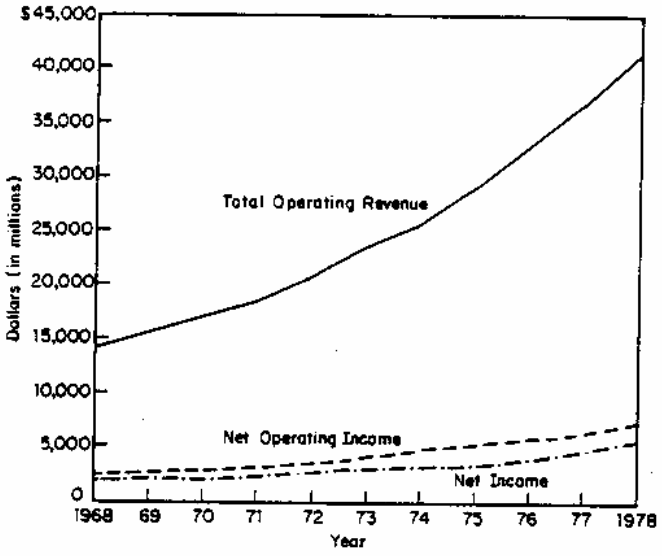
Independent Companies
Percent of Total Operating Revenues

(d)

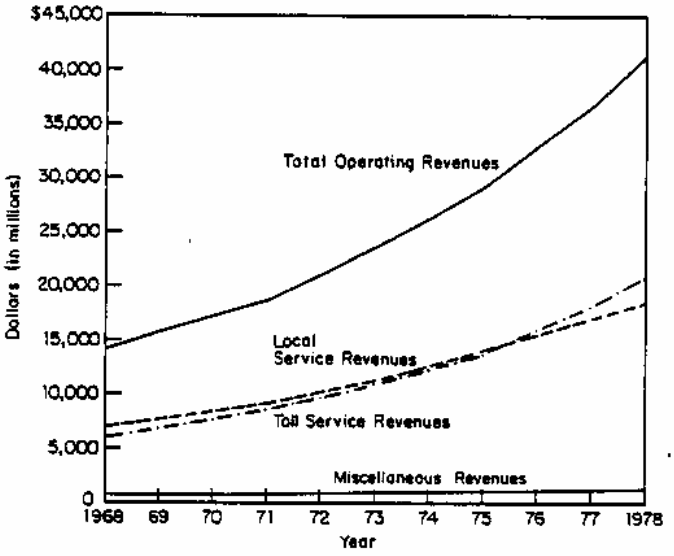
Figure 2.46

Bell System and Independent Companies Reporting
to USITA Operating Revenues and Income, 1968-1978

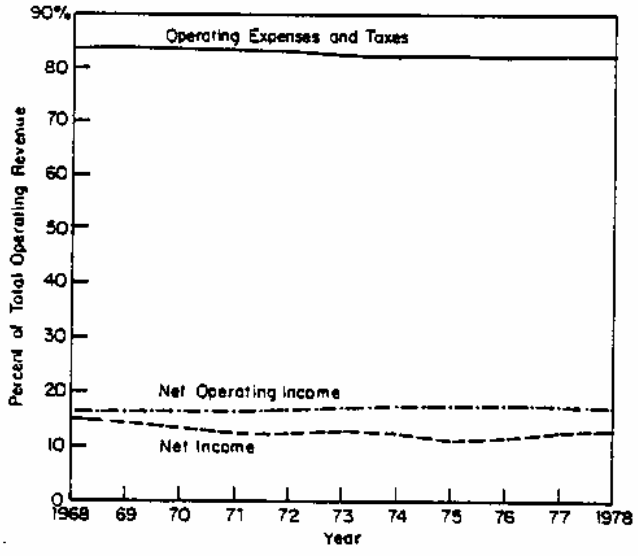
Source[S65]



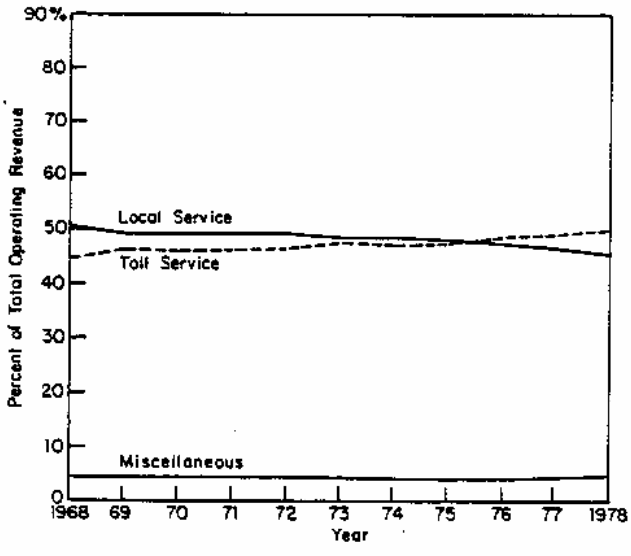
Bell System
Revenues and Income
(e)



Bell System
Total Operating Revenues
(f)

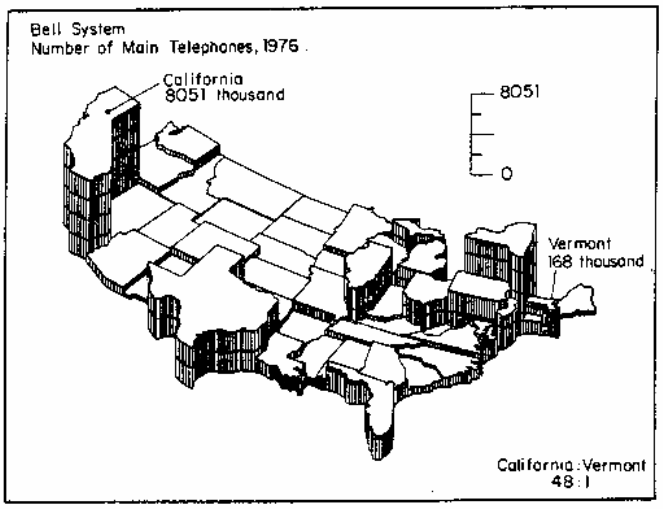


Bell System
Percent of Total Operating Revenues
(g)

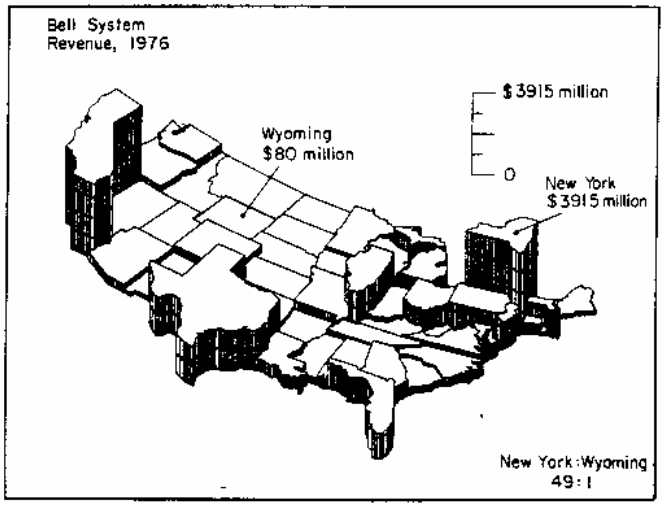


Bell System
Percent of Total Operating Revenues
(h)

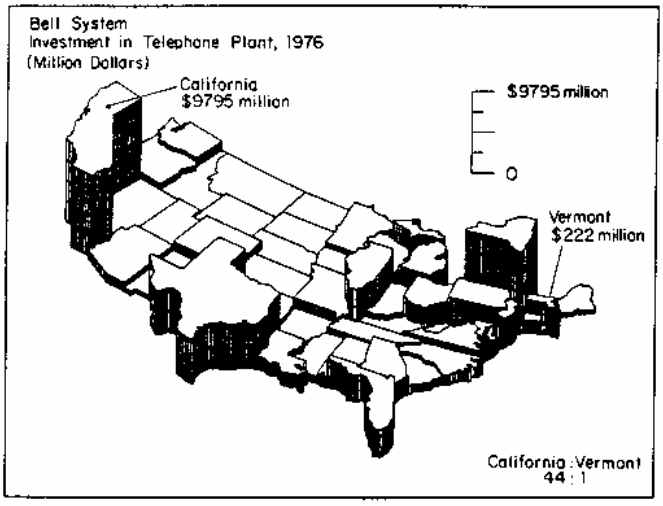
Figure 2.46 (continued)



(a)



(b)



(c)

Figure 2.47

Bell System State-by-State Number of Main Telephones, Revenues ($ million), and Investment in Telephone Plant ($ million), 1976

Source[S66]

	No. of Main Telephones	Revenue	Investment in Telephone Plant
AL	1018438	455.4	1262.8
AZ	859238	395.2	1040.6
AR	521787	218.3	626.0
CA	8051216	3624.9	9794.9
CO	1081770	506.0	1498.2
CT	1308915	533.5	1522.0
DE	240499	100.7	291.5
FL	2293210	1192.3	3213.9
GA	1555362	720.7	2195.6
ID	251589	103.2	285.4
IL	4056675	1750.7	4563.8
IN	1226385	523.3	1494.9
IA	775599	331.4	946.9
KS	752136	292.6	827.4
KY	837536	323.1	920.1
LA	1309458	565.9	1552.8
ME	361104	150.4	429.2
MD	1743075	667.4	1888.5
MA	2462253	1193.9	3158.6
MI	3254330	1175.5	3583.6
MN	1285862	500.4	1484.7
MS	700966	316.5	850.1
MO	1504851	637.5	1788.0
MT	244310	104.3	306.2
NE	348411	160.4	482.5
NV	102557	91.1	224.2
NH	327806	144.5	410.0
NJ	3209138	1315.5	3532.1
NM	358113	157.1	465.8
NY	7563330	3915.3	9701.1
NC	971353	427.8	1241.7
ND	192247	87.3	262.3
OH	3158943	1197.4	3165.4
OK	974384	379.8	1072.5
OR	732434	347.3	904.6
PA	4016757	1357.5	3859.7
RI	390668	143.2	400.4
SC	686597	305.6	878.8
SD	199026	89.2	273.2
TN	1299296	542.9	1488.3
TX	3983552	1865.5	5302.1
UT	446872	169.7	514.3
VT	167526	84.1	221.5
VA	1465530	639.9	1900.8
WA	1197249	494.6	1347.8
WV	558674	204.0	629.9
WI	1293530	436.1	1358.5
WY	147848	79.5	256.5

Ranked

No. of Main Telephones		Revenue		Investment in Telephone Plant	
CA	8051216	NY	3915.3	CA	9794.9
NY	7563330	CA	3624.9	NY	9701.1
IL	4056675	TX	1865.5	TX	5302.1
PA	4016757	IL	1750.7	IL	4563.8
TX	3983552	PA	1357.5	PA	3859.7
MI	3254330	NJ	1315.5	MI	3583.6
NJ	3209138	OH	1197.4	NJ	3532.1
OH	3158943	MA	1193.9	FL	3213.9
MA	2462253	FL	1192.3	OH	3165.4
FL	2293210	MI	1175.5	MA	3158.6
MD	1743075	GA	720.7	GA	2195.6
GA	1555362	MD	667.4	VA	1900.8
MO	1504851	VA	639.9	MD	1888.5
VA	1465530	MO	637.5	MO	1788.0
LA	1309458	LA	565.9	LA	1552.8
CT	1308915	TN	542.9	CT	1522.0
TN	1299296	CT	533.5	CO	1498.2
WI	1293530	IN	523.3	IN	1494.9
MN	1285862	CO	506.0	TN	1488.3
IN	1226385	MN	500.4	MN	1484.7
WA	1197249	WA	494.6	WI	1358.5
CO	1081770	AL	455.4	WA	1347.8
AL	1018438	WI	436.1	AL	1262.8
OK	974384	NC	427.8	NC	1241.7
NC	971353	AZ	395.2	OK	1072.5
AZ	859238	OK	379.8	AZ	1040.6
KY	837536	OR	347.3	IA	946.9
IA	775599	IA	331.4	KY	920.1
KS	752136	KY	323.1	OR	904.6
OR	732434	MS	316.5	SC	878.8
MS	700966	SC	305.6	MS	850.1
SC	686597	KS	292.6	KS	827.4
WV	558674	AR	218.3	WV	629.9
AR	521787	WV	204.0	AR	626.0
UT	446872	UT	169.7	UT	514.3
RI	390668	NE	160.4	NE	482.5
ME	361104	NM	157.1	NM	465.8
NM	358113	ME	150.4	ME	429.2
NE	348411	NH	144.5	NH	410.0
NH	327806	RI	143.2	RI	400.4
ID	251589	MT	104.3	MT	306.2
MT	244310	ID	103.2	DE	291.5
DE	240499	DE	100.7	ID	285.4
SD	199026	NV	91.1	SD	273.2
ND	192247	SD	89.2	ND	262.3
VT	167526	ND	87.3	WY	256.5
WY	147848	VT	84.1	NV	224.2
NV	102557	WY	79.5	VT	221.5

Table 2.21

Bell System State-by-State Number of Main Telephones, Revenues ($ million), and Investment in Telephone Plant ($ million), 1976

Source[S67]

homogeneously distributed across the nation, but vary in state by state concentration as illustrated in Figure 2.47 and Table 2.21 and as detailed in Part 4.

The capital structures of telecommunications carriers likewise are not uniform, either historically or across categories (Figure 2.48, Table 2.22). Comparative rates of return on investment (after tax) are shown in Figure 2.49. Bell System returns to equity capital and returns to total capital are compared to braoder indicators of returns to debt and to equity in Figure 2.50 and AT&T stock earnings to the Consumer Price Index in Figure 2.51.

The traditional telecommunications carriers, their transmission competitors and, to some extent, their resale competitors but not their terminal and broad computer and electronics industry competitors have their rates of return and, to varying degrees, their prices regulated by federal and state governments. While the courts draw a line between legitimate government intervention in corporate affairs and a management sphere beyond the reach of government, the boundary is a fuzzy one in practice.

The Communications Act of 1934 mandates that "All charges...shall be just and reasonable".[20] As the courts had interpreted this standard by 1943 "it is the result reached not the method employed which is controlling...It is not theory but the impact...which counts."[21] Furthermore, "The fixing of 'just and reasonable' rates involves a balancing of the investor and the consumer interests. Thus, we stated in the Natural Gas Pipeline Co. case that 'regulation does not insure that the business shall produce net revenues.' 315 U.S. p. 590. But such considerations aside, the investor interest has a legitimate concern with the financial integrity of the company whose rates are being regulated...By that standard, the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return,

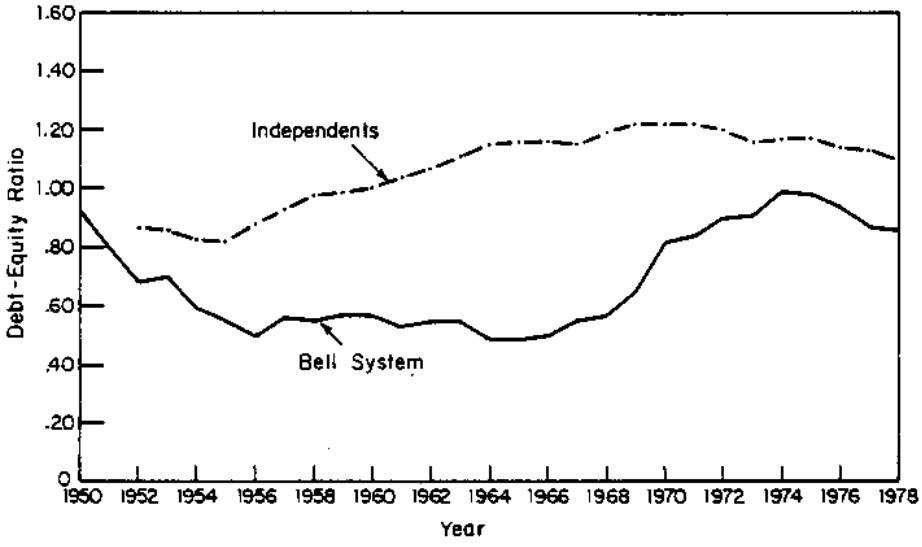


Figure 2.48

Debt/Equity Ratios for Bell System
and Independent Telephone Companies, 1950-1978

Source S68

Year	% Bonds	% Debentures and Notes	% Total Debt	% Preferred Stock	% Common Stock	% Surplus (Retained Earnings)	% Total Equity	Debt/Equity Ratio
1952	38.7	7.8	46.5	15.4	28.8	9.3	53.5	.87
1953	39.1	7.0	46.1	15.0	29.7	9.2	53.9	.86
1954	38.5	6.8	45.3	15.5	29.3	9.9	54.7	.83
1955	37.5	7.7	45.2	14.7	29.7	10.4	54.8	.82
1956	36.9	9.9	46.8	12.4	30.0	10.8	53.2	.88
1957	35.4	12.8	48.2	12.3	29.2	10.3	51.8	.93
1958	36.1	13.3	49.4	11.3	29.3	10.0	50.6	.98
1959	35.5	14.2	49.7	11.4	28.8	10.1	50.3	.99
1960	35.0	15.1	50.1	10.8	28.4	10.7	49.9	1.00
1961	35.4	15.7	51.1	10.6	27.2	11.1	48.9	1.04
1962	34.7	17.1	51.8	9.7	26.6	11.9	48.2	1.07
1963	34.3	18.4	52.7	9.4	25.6	12.3	47.3	1.11
1964	34.4	19.1	53.5	7.8	25.4	13.3	46.5	1.15
1965	35.4	18.2	53.6	6.9	26.0	13.5	46.4	1.16
1966	34.5	19.1	53.6	6.1	26.1	14.2	46.4	1.16
1967	34.1	19.4	53.5	5.1	26.7	14.7	46.5	1.15
1968	34.1	20.3	54.4	4.2	26.5	14.9	45.6	1.19
1969	33.1	21.8	54.9	3.8	25.7	15.6	45.1	1.22
1970	33.5	21.4	54.9	3.3	25.2	16.6	45.1	1.22
1971	33.5	21.5	55.0	3.2	26.1	15.7	45.0	1.22
1972	34.0	20.5	54.5	3.0	25.9	16.6	45.5	1.20
1973	33.6	20.1	53.7	4.0	24.8	17.5	46.3	1.16
1974	34.3	19.7	54.0	4.0	24.2	17.8	46.0	1.17
1975	34.9	19.0	53.9	4.4	23.2	18.5	46.1	1.17
1976	34.9	18.4	53.3	4.3	22.6	19.8	46.7	1.14
1977	35.5	17.5	53.0	4.1	22.0	20.9	47.0	1.13
1978	34.1	18.3	52.4	3.8	22.0	20.9	47.7	1.10

Bell System
(a)

Year	% Total Debt	% Preferred Stock	% Common Stock	% Premium on AT&T Co. Stock	% Reinvested Earning	% Total Equity	Debt/Equity
1950	48.25	.23	37.62	7.90	5.97	51.75	.93
1951	44.50	.20	39.76	9.17	6.37	55.50	.80
1952	40.32	.19	42.27	10.59	6.63	59.68	.68
1953	41.25	.17	40.95	10.64	6.99	58.75	.70
1954	37.22	.16	43.21	11.73	7.68	62.78	.59
1955	35.48	.14	43.36	12.57	8.45	64.52	.55
1956	33.50	.12	44.98	12.23	9.17	66.50	.50
1957	36.05	.11	42.16	11.64	10.04	63.95	.56
1958	35.29	.10	41.65	11.89	11.07	64.71	.55
1959	36.26	.09	39.60	11.38	12.67	63.74	.57
1960	36.40	.09	38.15	11.23	14.13	63.60	.57
1961	34.64	.08	37.13	13.12	15.03	65.36	.53
1962	35.35	.07	35.09	13.28	16.21	64.65	.55
1963	35.33	.07	33.78	13.06	17.76	64.67	.55
1964	32.73	.06	32.81	15.87	18.53	67.27	.49
1965	32.72	.06	31.46	15.90	19.86	67.28	.49
1966	33.35	.06	29.93	15.70	20.96	66.65	.50
1967	35.36	.05	27.89	14.74	21.96	64.64	.55
1968	36.44	.05	26.46	14.35	22.70	63.56	.57
1969	39.49	.05	24.35	13.16	22.95	60.51	.65
1970	44.91	.04	21.49	11.61	21.95	55.09	.82
1971	45.54	.09	19.60	13.25	21.52	54.46	.84
1972	47.36	.08	17.87	13.51	21.18	52.64	.90
1973	47.58	.11	16.61	14.14	21.56	52.42	.91
1974	49.75	.10	15.37	13.22	21.56	50.25	.99
1975	49.54	.10	15.09	13.44	21.83	50.46	.98
1976	48.45	.09	14.93	13.88	22.65	51.55	.94
1977	46.62	.46	14.97	14.30	23.64	53.38	.87
1978	46.26	.66	14.32	14.21	24.55	53.74	.86

Independent Telephone Companies
(b)

Table 2.22

Debt/Equity Ratios for Bell System
and Independent Telephone Companies

Source[S69]

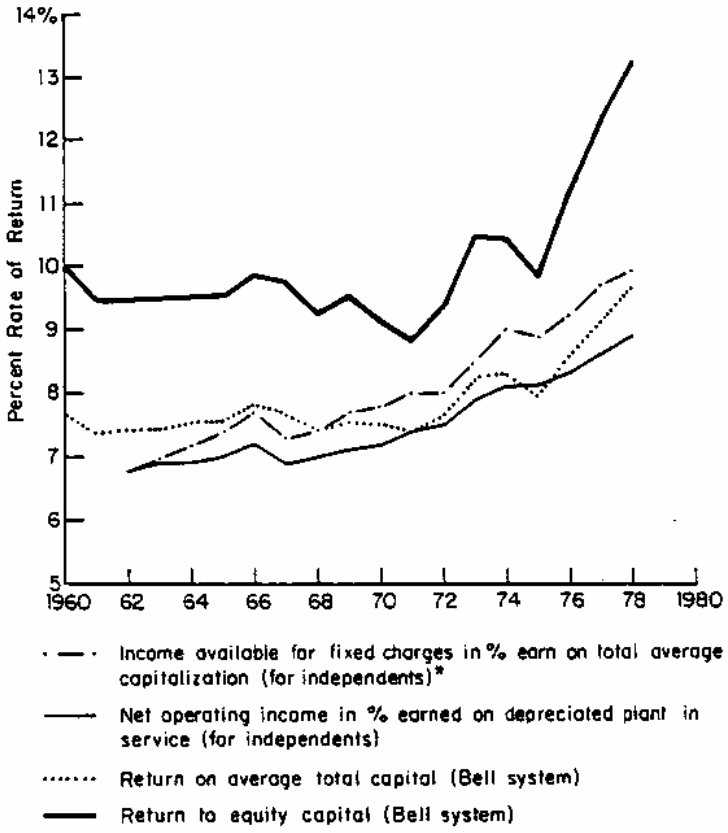


Figure 2.49

Rate of Return: Bell System and Independents, 1960-1978

Source[S70]

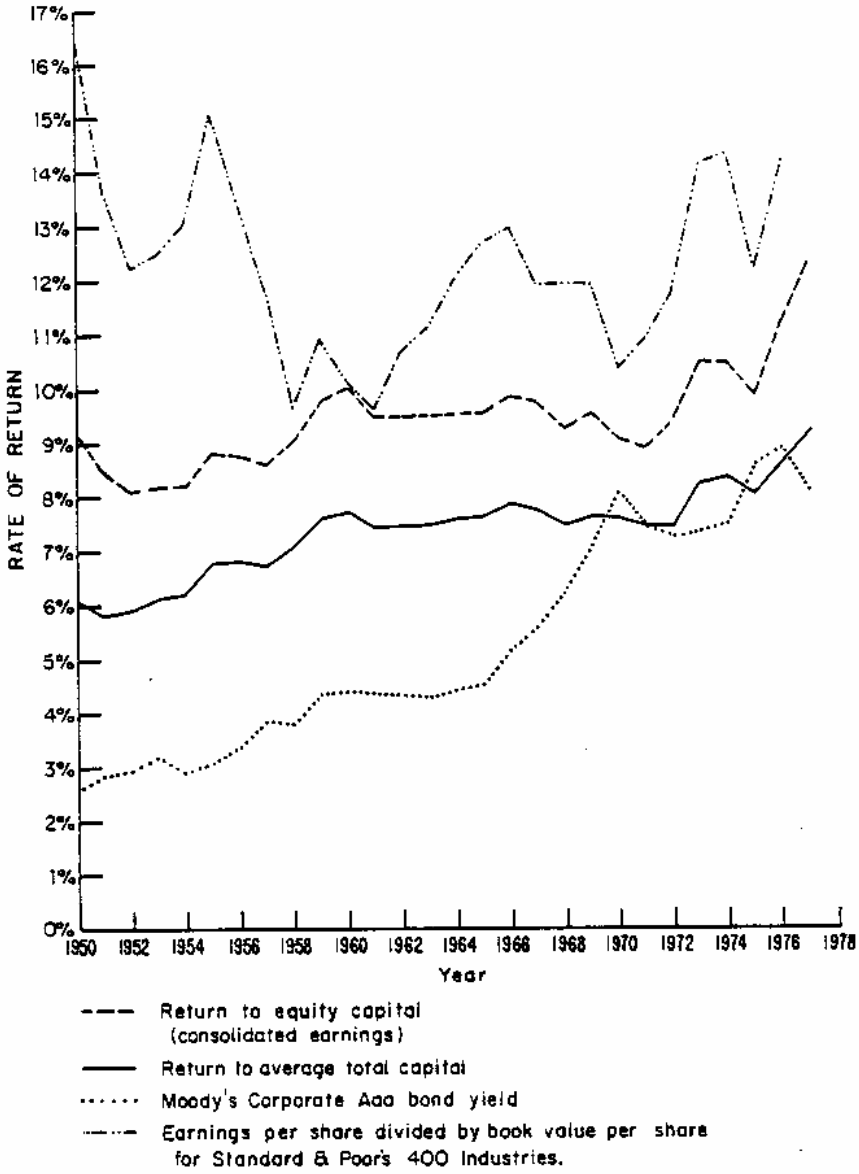


Figure 2.50

Bell System Return to Equity Capital and Return to Average Total Capital, 1950-1977

Source[S71]

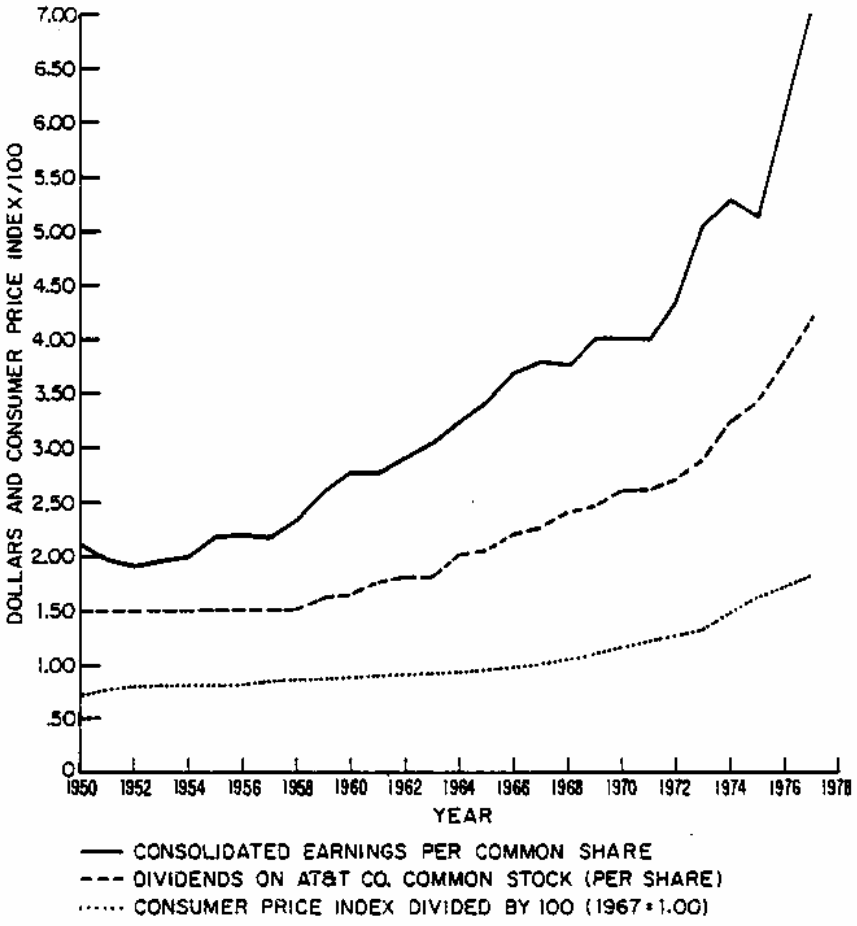


Figure 2.51

AT&T Earnings Indices, 1950-1977

Source[S72]

moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital."[22]

Regulatory and judicial intervention do not, however, represent the whole of government presence, since regulated industries are, like all others, subject to tax, antitrust, environmental and other laws of general applicability. To provide some perspective on respective government and management roles, Table 2.23 and Figure 2.52 portray the relative shares of control over key aspects of Bell System performance.

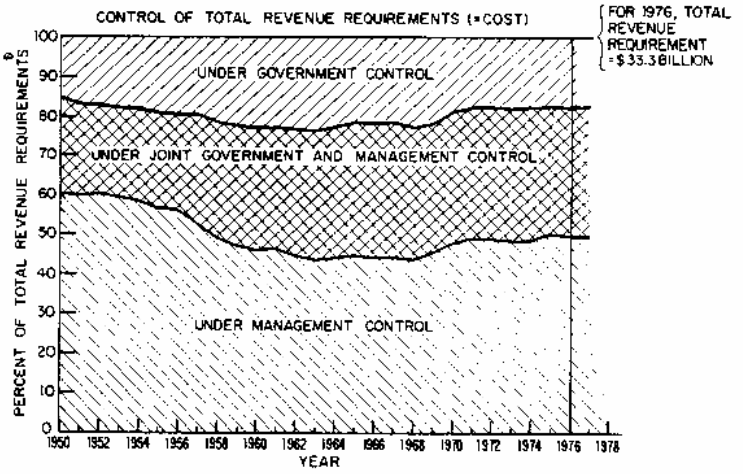
Elements of total regulated revenue requirements (expenses plus return on investment) as defined under the Federal Communications Commission's Uniform System of Accounts are allocated to three broad control categories in Table 2.23. Total Bell System revenue requirements for 1976 (Figure 3.1, Box 18) were about $33 billion. The proportions of these revenue requirements in each control category are shown in Figure 2.52(a). Net of taxes, which are under exclusive government control, the proportions of revenue requirements under some management control are shown in Figure 2.52(b). Net of after-tax return on investment, the proportions of operating expenses are shown in Figure 2.52(c). Figure 2.52(d) gives the breakdown of the plant-related operating expenses that are examined in detail in Parts 3 and 4. Although Figure 2.52(e),(f) shows depreciation expenses as a modest portion of all expenses, these jointly controlled expenses are an appreciable part of plant-related expenses. Table 2.24 shows how expenses differ among various categories of traditional telecommunications companies with consequences detailed in Section 4-H.

Principally Management Controlled	Shared Management and Government Controlled	Principally Government Controlled
Maintenance Expenses	Depreciation and Amortization Expenses	Taxes
Traffic Expenses	Income Before Interest Deductions (ROI)	
Commercial Expenses		
Marketing Expenses		
General Office Salaries and Expenses		
Other Operating Expenses		

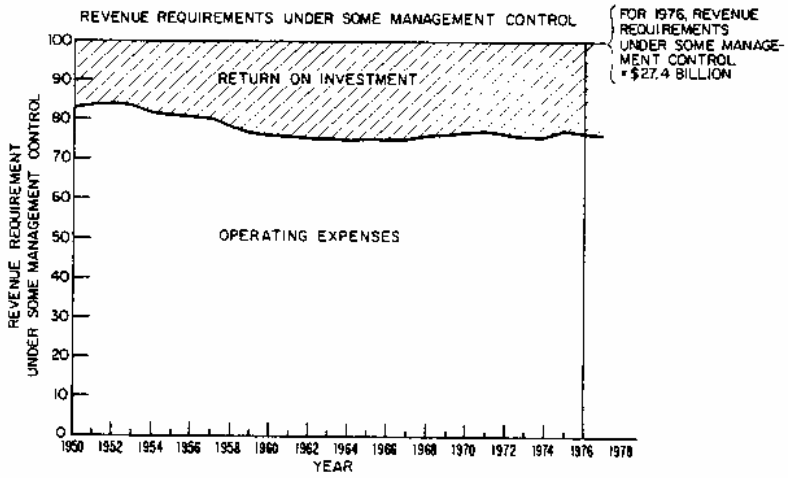
Table 2.23

Control of Total Revenue Requirements

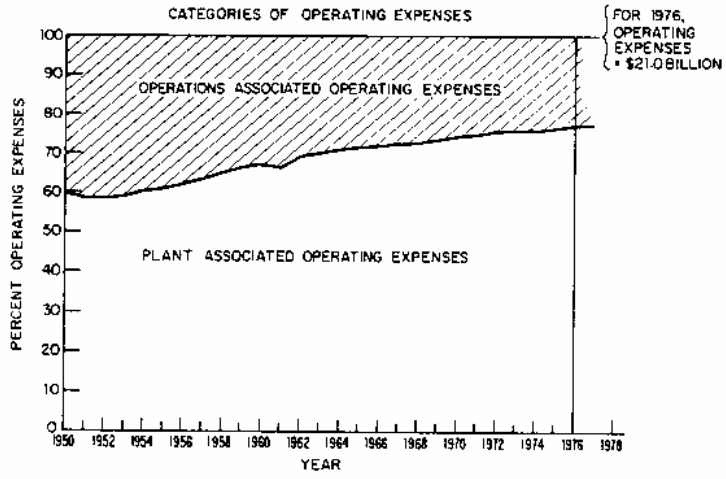
Source[S73]



Control of Total Revenue Requirements (=Cost)
(a)



Revenue Requirements Under Some Management Control
(b)

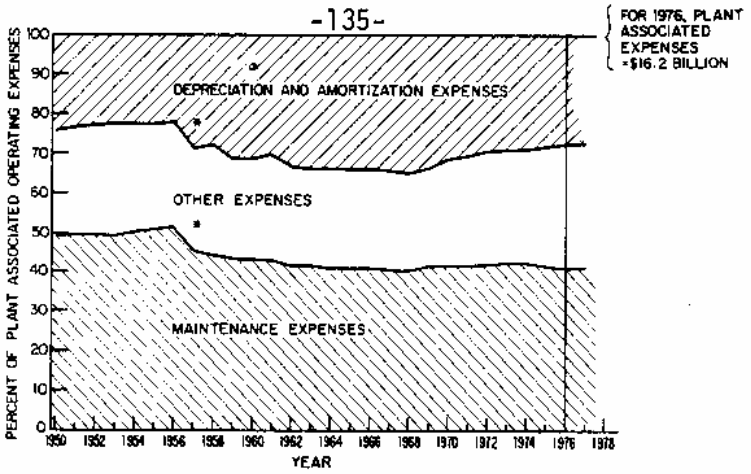


Categories of Operating Expenses
(c)

Figure 2.52

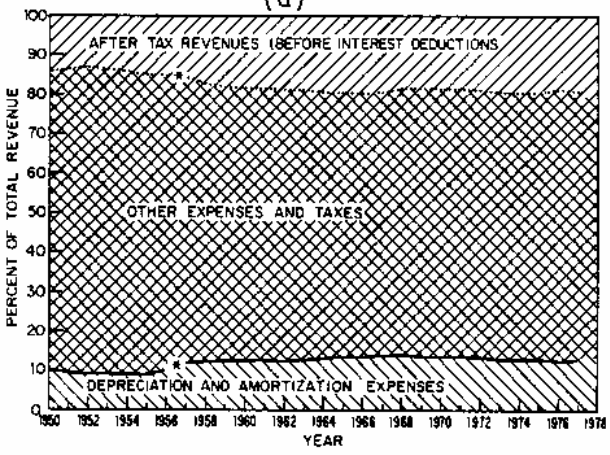
Bell System Revenues, Revenue Requirements, and Operating Expenses, 1950-1977

Source[S74]



*CHANGE IN ACCOUNTING FOR STATION EQUIPMENT EFFECTIVE JANUARY 1, 1957.

Plant Associated Operating Expenses
(d)

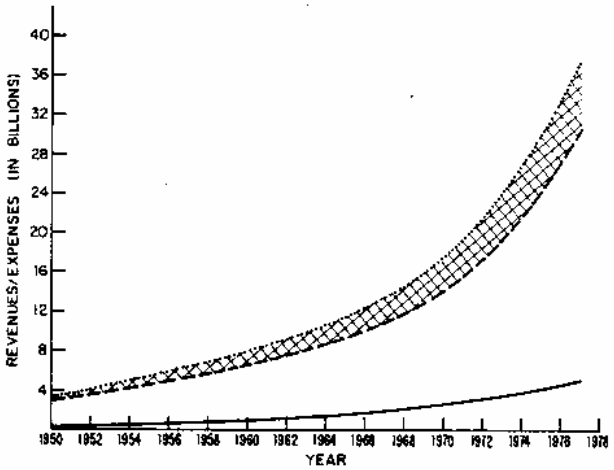


—— DEPRECIATION AND AMORTIZATION EXPENSES AS PERCENTAGE OF REVENUES

····· TOTAL OPERATING EXPENSES AND TAXES AS PERCENTAGE OF REVENUES

*CHANGE IN ACCOUNTING FOR STATION EQUIPMENT EFFECTIVE JANUARY 1, 1957

Expenses and Taxes as Percent of Total Revenues
(e)



—— DEPRECIATION AND AMORTIZATION EXPENSES

--- TOTAL OPERATING EXPENSES AND TAXES

····· TOTAL OPERATING REVENUES AND TOTAL OTHER INCOME

▨ EQUIVALENT APPROXIMATELY TO INCOME BEFORE INTEREST DEDUCTIONS

Total Operating Revenues and Expenses
(f)

Figure 2.52 (continued)

Expense Category	Bell Companies	Selected Large Independents*	Medium Independents*	REA Borrowers
Maintenance	31.5%	31.1%	28.8%	28.3%
Dept. & Amort.	21.5%	30.0%	30.2%	33.5%
Traffic	11.0%	9.4%	12.3%	4.8%
Commercial	12.5%	10.1%	9.3%	8.6%
General Office	8.0%	10.1%	10.3%	14.4%
Other Operating Expenses	15.5%	9.3%	9.1%	10.5%
Total Operating Expenses	100.0%	100.0%	100.0%	100.0%
Number of Companies	24	19	22	876
Phones per Company	5,300,000	822,000	98,000	5,500

* "Selected Large" independent telephone companies have from 300,000 to 3.1 million phones each. "Medium" independents fall in the range from 8,000 to 300,000 phones each.

Table 2.24

Distribution of Total Operating Expenses for Bell Companies as Compared to Independents, 1976

Source[S75]

It is clear that extreme rhetoric about either free enterprise or state intervention cannot shed much light on the realities of control over telecommunications costs and prices. At issue are choices of extent and of modalities.

H. Jurisdictions

The Communications Act of 1934 provisions for common carrier regulation "apply to all interstate and foreign communication by wire or radio."[23] Explicitly excluded from federal regulation, however, are "charges, classifications, practices, services, facilities, or regulations for or in connection with intrastate communication service by wire or radio."[24] This jurisdictional division, although at first blush merely decreed by Congress and therefore alterable by Congress--as has, indeed, been proposed in legislation before the 96th Congress[25]--was deeply embedded in the structure and the practices of the traditional telecommunications industry as of early 1980.

In particular, the telecommunications facilities described in Section 2-E are, in large part, used jointly for state and interstate services. That this is nearly inherently so is illustrated by the practical merits of using the same telephone instrument rather than two distinct ones for placing in-state and out-of-state long distance calls even though this is not logically necessary. This jurisdictional cut across such otherwise undifferentiated facilities has had profound consequences on cost allocations and price determination. These are examined in detail in Parts 3 and 4.

Local power, albeit not explicitly addressed within either the Communications Act of 1934 or the legislative proposals of early 1980,

remains a major determinant of telecommunications policy and practice. Although derivative of the powers of each state, explicit local legal powers over rights-of-way, property taxes, franchises and the like are widespread and widely exercised for purposes ranging from private gain of local entrepreneurs to deeply rooted community-wide interests. In addition, local consumer interests in such matters as the size of a local exchange area or the structure and level of local service prices are consequential at the level of both state politics and consumer activism in various forums. These matters are detailed in Part 4.

In practice, therefore, telecommunications regulation is exercised at all three major levels of government: local, state and federal.

I. Prices, Revenues and Costs--The Loose Linkages

1. Economics Review.

Expository, empirical and theoretical accounts of various aspects of the economics of telecommunications according to diverse ideological and methodological standpoints are summarized in Table 2.25.

2. Relation of Regulated Telco Prices to Costs.

The total revenues of the traditional telephone industry were $40.1 billion in 1976 (Figure 3.1, Box 18). Only $35.9 billion of this total is regularly reported to the Federal Communications Commission (FCC). However, regular reports to the FCC and the United States Independent Telephone Association (USITA) combined account for $39.9 billion, or 99.4% of the total. The remaining companies mostly report regularly to the Rural Electrification Administration of the Department of Agriculture (REA), but REA reports overlap with USITA's, so are hard to

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Table 2.25 (continued)

disentangle. The 247 million estimated residue (.6%) is therefore not tracked in any macroscopic analysis based on Figure 3.1.

Total revenues (Box 18) are related to total costs (Box 1) by the relationships:

$$\text{Costs} = ((\text{Plant Investment}) \times \text{Rate of Return}) + \text{Expenses}$$
$$= \text{Revenue Requirement}$$
$$= \text{Revenue}$$
$$= \sum_{\text{Services}} P_s \cdot Q_s$$

where P_s and Q_s are prices and quantities, respectively, of various services.

In the process of price regulation as applied to most utilities, the telephone companies among them, this set of equations is used to project revenue requirements, defined as equal to costs that include projected operating expenses, and a rate of return on plant investment that the regulator has determined to be fair and reasonable according to standards such as sketched in Section 2-G. Actual revenues different from the revenue requirement or actual costs different from the estimates may then imbalance the equation at the prescribed rate of return. The realized rate of return calculated after the fact to bring the equation into balance may therefore turn out to be higher or lower than any prescribed rate, hence regulators and the courts generally prescribe a "zone of reasonableness" rather than a single specific rate of return.

At this point we need not explore the consequences of differences between projected rates of return and those actually realized. For much of the subsequent analysis we rely on historical data like the 1976

data of Figure 3.1. In such a retrospective analysis, actual costs are known and actual revenues are equivalent to revenue requirements at whatever realized rate of return balances the equations.

What is important to appreciate is that under federal and state statutes utility prices are not generally set by the regulator. Within the limits set by the balancing of the equations for total costs and revenues, it is generally a management perogative to set prices for diverse services and to promulgate them in tariffs. Regulators may challenge these tariffs on various grounds prescribed by statute, but this process also is not explored in this paper. It is, in the first instance, management judgment that relates prices to demand so as to yield a sum of price times quantity over all the offered services likely to provide a satisfactory rate of return. Neither legislatures nor the courts guarantee that this rate of return will be achieved, although they tend to look askance if it is exceeded. Except at the total aggregate level, there is therefore no legally necessary relation between the price of any particular service and the cost of that service, however measured.

The description of cost measurement that follows in Part 3 therefore relates to prices or rates in a fashion so indirect that we shall be able to consider rates only in Part 4.

One of the consequences of introducing competition into a hitherto regulated monopoly market is to push toward a more direct relationship between the costs of competitive services and their prices. Since diverse economic approaches to reckoning costs do not necessarily agree with one another nor necessarily accord with costs as defined for purposes of jurisdictional cost separations and intercompany division of revenues (see Parts 3 and 4), the resulting "errors of closure" are becoming a focus of attention. Sections 4-B and 4-C detail telecommunication price changes that took place between the late sixties, when competition arose in the transmission market, and the late seventies. The results are illustrated in Figure 2.53.

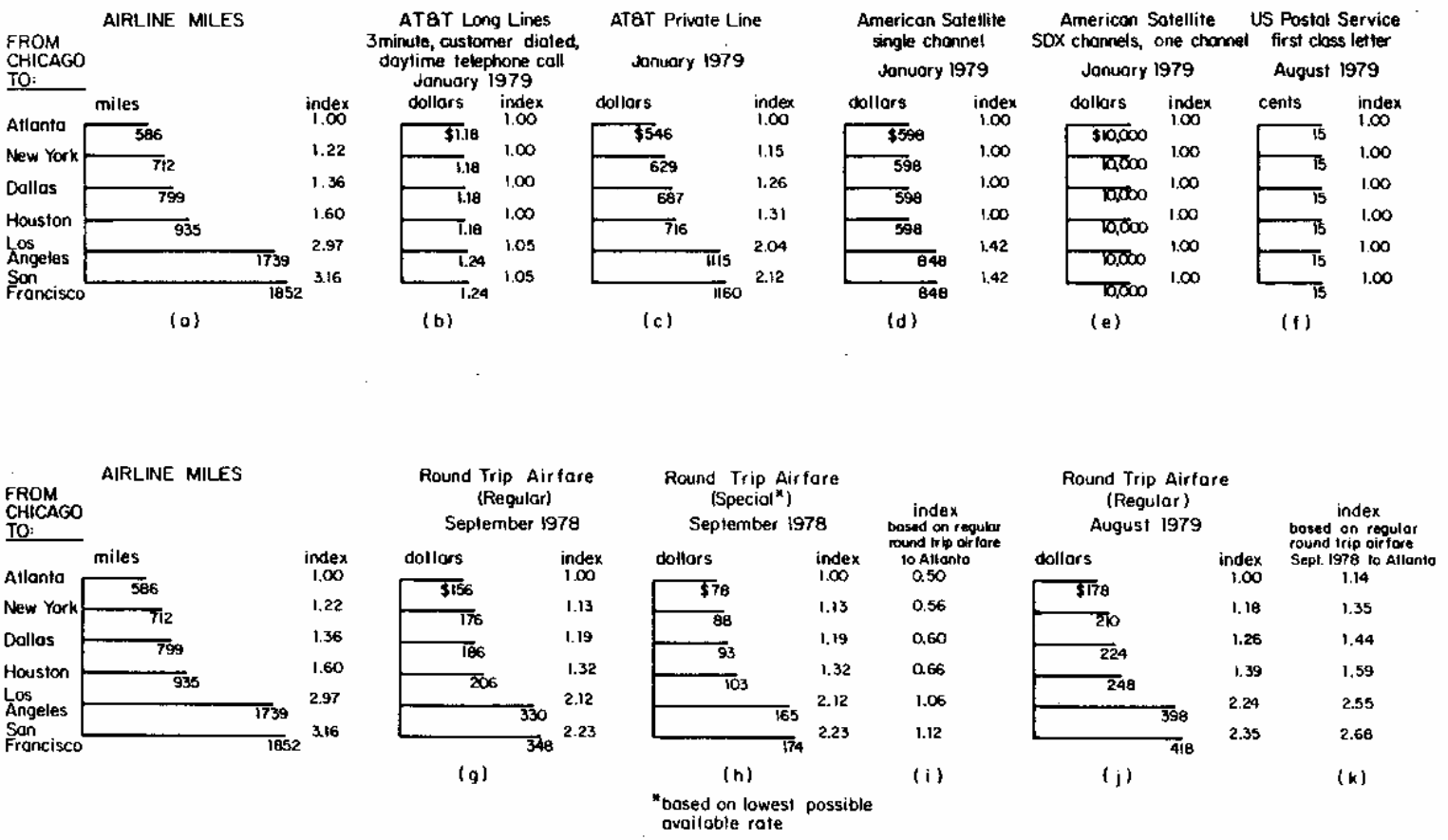

Figure 2.53

Comparison of Telecommunication, Postal and Airline Rates Versus Distance, Late 1970's

Source[S76]

Figure 2.53(a) shows airline miles between Chicago and six other major U.S. cities. As a basis for comparison, these distances are indexed relative to the shortest of them, Chicago to Atlanta, indexed as 1.00. Prices for an ordinary interstate call in 1977 are indexed in Figure 2.52(b). Although the distances in Figure 2.52(a) range over 300%, the price increment in Figure 2.53(b) is only 5%. For an AT&T private leased line (Figure 2.53(c)), the price increment is 112%. A comparable private satellite channel (Figure 2.53(d)) differs from AT&T both in absolute prices and in the index, with a 42% increase between the top of the range and the bottom, compared to AT&T's 112%. A bulk offering by American Satellite Corporation shows distance-insensitive prices, without any change in the index (Figure 2.53(e)); absolute prices are not directly comparable to those of Figures 2.53(c),(d).

That competition is not a necessary condition for distance-insensitive rates is illustrated by Figure 2.53(e). This "postalization" of rates was hotly fought in the 19th century,[26] but has long been accepted as the norm, at least for the first-class U.S. mail which, by the Private Express Statutes, is a monopoly of the U.S. Postal Service.

Neither is competition a sufficient condition for distance-insensitive rates. As Figures 2.53(g)-(j) show, airline rates, albeit flatter than distance, show ranges as high as 200% even after the Civil Aeronautics Board and the Congress decreased their regulation of prices on competitive routes.

In any event, the flattening of telecommunications rates is only partly explained by the cost characteristics of competing satellite and terrestrial technologies. A fuller explanation must address the peculiarities of the telecommunications industry and of its regulatory structure and the range of adjustments to competition possible under existing or alterna-

tive structures.

These adjustments might include cost adjustments, price revisions, external subsidies or taxes. Who might actually want or need to invoke what cannot be addressed, however, without first estimating the magnitude and incidence of likely effects of competition and forming judgments as to whether these represent matters of low or high politics. We begin this task in Part 3.

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23. 47 U.S.C.A. §152 (a).

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S75. Meyer, John R. et al., The Economics of Competition in the Telecommunications Industry, Charles River Associates, Inc., Boston, Mass., August 1979, Table 5-4, p. 274.

S76. American Satellite Corporation.

AT&T. Federal-State Joint Board, Request No. JB-50, April 1, 1977.

Civil Aeronautics Board.

Rueben H. Donnelly Corporation. Official Airline Guide, January 1, 1979, p. 302, 308, 214, 218, 323, 330.

APPENDIX

Abbreviations of State Names used in Tables

AL	Alabama	NE	Nebraska
AZ	Arizona	NV	Nevada
AR	Arkansas	NH	New Hampshire
CA	California	NJ	New Jersey
CO	Colorado	NM	New Mexico
CT	Connecticut	NY	New York
DE	Delaware	NC	North Carolina
FL	Florida	ND	North Dakota
GA	Georgia	OH	Ohio
ID	Idaho	OK	Oklahoma
IL	Illinois	OR	Oregon
IN	Indiana	PA	Pennsylvania
IA	Iowa	RI	Rhode Island
KS	Kansas	SC	South Carolina
KY	Kentucky	SD	South Dakota
LA	Louisiana	TN	Tennessee
ME	Maine	TX	Texas
MD	Maryland	UT	Utah
MA	Massachusetts	VT	Vermont
MI	Michigan	VA	Virginia
MN	Minnesota	WA	Washington
MS	Mississippi	WV	West Virginia
MO	Missouri	WI	Wisconsin
MT	Montana	WY	Wyoming