

Historical Perspectives on  
Interconnection Between  
Competing Local Exchange

by David Gabel  
and David Weiman

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Columbia Institute for Tele-Information  
Graduate School of Business  
Columbia University  
809 Uris Hall  
New York, NY 10027  
(212)854-4222

Historical Perspectives on Interconnection  
between Competing Local Exchange Companies\*

David Gabel  
Queens College

and

David F. Weiman  
Yale University and Institute  
for Advanced Study

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A widely accepted goal of telephone regulation has been the adoption of policies that promote competition with all of its perceived benefits. Where competitive forces are weak or absent, regulatory policies have tried to emulate them, most notably in the determination of rates. Restructuring rates to reflect competition conditions, regulatory commissions have argued, would discourage inefficient investment and purchasing decisions, such as entry induced by regulations and historical pricing practices. Consequently, commissions have advanced the policy of setting rates based on costs.

Indeed, cost based and competitive prices are often viewed as one and the same. Under certain conditions, economic theory suggests that prices in competitive markets will equal the marginal cost of production. If a firm departs from this pricing rule, rivals will sell their products for less and increase their market share. If it prices its product below the cost of production, the firm will sacrifice profits and eventually exit.

Yet, economic theory also identifies a host of conditions, under which marginal cost pricing is neither feasible nor optimal. For example, if there are fixed costs, then marginal cost pricing will result in losses. Similarly, in network industries characterized by interdependent demands, prices based on costs may not maximize social welfare. To address these problems, economists have formulated a plethora of "Ramsey"

pricing rules, which specify "optimal" departures from marginal cost pricing.<sup>1</sup>

Empirical studies of pricing under competition have lagged behind the theoretical analysis, especially in network industries such as telecommunications. This gap is both unfortunate and surprising in light of the recent trend in regulatory practice to adopt rates, which are intended to reflect competitive market outcomes. As our study shows, the prevailing assumption equating competitive and cost-based prices does not find support in the early history of the telephone industry. During the brief period of free entry into the local exchange market, we find instead that rival companies developed elaborate schemes of price discrimination to increase their market share.<sup>2</sup> We show that competition led to an increase in the price differential between business and residential services, a finding that contradicts the common assertion that value of service pricing is an artifact of regulated, monopoly markets.<sup>3</sup>

Our paper analyzes this historical episode and yields two valuable lessons. First, we document the pricing policies adopted by competitive telephone companies at the turn of the century.

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<sup>1</sup>Bridger M. Mitchell and Ingo Vogelsang, Telecommunications Pricing: Theory and Practice (New York, 1992).

<sup>2</sup>The airline industry's use of business, super saver, and a variety of other rates offers another vivid example of this point.

<sup>3</sup>For example, Phyllis Bernt and Martin Weiss mistakenly associate low residential rates with a monopoly market structure. International Telecommunications (Carmel, Indiana: Sams Publishing, 1993), pp. 27-28.

This history is instructive, for it suggests how entry into the local telecommunications market today would influence the evolution of rates. Absent such rivalry, this history may also serve as a guide to policy makers, indicating how commissions should price services if they truly sought to emulate the workings of a competitive market.

Second, we summarize how interconnection between rivals affected the evolution of the local exchange market. We contrast two alternatives, consolidation under the Bell System and state mandated interconnection. We focus on the latter policies, which were intended to promote universal service, and consider their implications for current policy.

#### 1. Competition and interconnection

Until 1894 the American Bell Telephone Company and its licensed operating companies enjoyed a complete monopoly over the markets for telephone equipment and service.<sup>4</sup> Protected by Bell's original patents, the company reaped substantial rents by charging high prices for service and in turn restricting supply mainly to business and affluent residential customers in larger

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<sup>4</sup>For a summary of this history, see Gerald W. Brock, The Telecommunications Industry: The Dynamics of Market Structure (Cambridge, MA, 1981), chs. 4 & 6; and Robert Bornholz and David S. Evans, "The Early History of Competition in the Telephone Industry," in David S. Evans, ed., Breaking Up Bell: Essays on Industrial Organization (New York, 1983), 7-39. On Bell's early marketing strategy, see Sidney H. Aronson, "Bell's Electrical Toy: What's the Use? The Sociology of Early Telephone Usage," in Ithiel de Sola Pool, ed., The Social Impact of the Telephone (Cambridge, MA, 1977), 16-19, 27-28.

urban centers. Bell's marketing strategy reflected the myopic vision, held by many of its executives and engineers. Conceiving the telephone as simply a substitute for the telegraph, they narrowly focused on the demands of businessmen, whether at the office or at home.

With the expiration of Bell's patents, independent companies quickly entered the industry and eroded the incumbent's dominant position in equipment and service markets. Independent manufacturers often matched Bell's own standards in station apparatus and deployed new technologies, such as the handset and the automatic switch, which greatly enhanced service quality and reduced operating costs. Independent operating companies developed new markets, even within large urban centers, by tapering service quality and prices to the varied demands of residential and business customers. They would even contest Bell's control over the lucrative business market in many metropolitan centers.

In response to actual and potential competition, Bell operating companies sharply cut their rates for local service and improved service quality. Between 1894 and 1910 the average price of Bell's local service fell by more than one-half, from over \$70 to only \$31.3 (see Figure 1).<sup>5</sup> Although average costs

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<sup>5</sup>The data come from the Annual Reports of the AT&T Company, 1909-1914; see also the Annual Report, 1909, 22-28. On the impact of royalty charges on the costs of Bell operating companies, see J. Warren Stehman, The Financial History of the American Telephone and Telegraph Company (New York, 1925), 26-27; and Bornholz and Evans, "The Early History," 121.

also fell sharply, almost one-half of these savings were due to the reduction in rental payments charged by the parent company.

Lower rates, higher service quality, and more aggressive marketing campaigns by Bell and independent companies spurred demand growth. The pace of market development, measured by the number of telephones per thousand people, accelerated after 1893 (see Figure 2).<sup>6</sup> The annual growth rate averaged 23.7 percent between 1894 and 1907, as compared to only 9.7 percent during the equivalent time span just prior to entry. During this period, the independents made sharp inroads into Bell's monopoly and by 1907 accounted for almost one-half of the market (see Figure 3).

After 1907, however, the benefits of competition abated rather abruptly. The downward trend in prices and costs gradually levelled off, and after 1910 both remained virtually unchanged. Telephone development, moreover, slowed to only 5.1 percent per year, less than the average growth rate under the Bell monopoly. The Bell System also began to reassert its dominance in markets throughout the country. As shown in Figure 3, Bell's market share reversed its previous decline and by 1914 reached 55 percent. Over the same period, the share of the Bell System, including sublicensed independent companies, jumped from 63 to 85 percent.

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<sup>6</sup>The data for Figures 2 and 3 are taken from U.S. Bureau of the Census, Historical Statistics of the United States, Part 2 (Washington, D.C., 197?), series R1-12. Claude Fischer and Glenn R. Carroll, "Telephone and Automobile Diffusion in the United States, 1902-1937," American Journal of Sociology, 93 (March 1988), 1153-78, identify the factors influencing the diffusion of the telephone over time and space.

The year 1907 is notable not only for a severe recession, which strained the finances of telephone companies. After this date, they shifted their marketing strategies by emphasizing the utility of an integrated telephone system, one capable of mediating a wider range of transactions. With the return of Theodore Vail, AT&T promoted "universal" service through a single, unified network.<sup>7</sup> Independent companies also offered their customers more extensive service through various forms of interconnection. Significantly, this shift responded to the demands of business customers and regulators, who became increasingly critical of competition between rival networks.

This transition can be interpreted in two ways. In terms of the industrial life-cycle, it represents the maturation of a relatively novel technology and a corresponding shift from extensive to intensive market development. The limited diffusion of telephone service under the Bell monopoly had created a large, pent-up demand for service. The formation of new exchanges filled in these gaps and so foreclosed the option of developing fresh territory. Moreover, rapid demand growth began to strain the limited capacity of manual switching facilities, and put mounting pressure on costs and prices.

With the greater penetration of telephone service, customers assimilated the new technology into their daily routines and

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<sup>7</sup>Robert W. Garnet, The Telephone Enterprise: The Evolution of Bell's Horizontal Structure (Baltimore, 1985), 128-54; and Louis Galambos, "Theodore N. Vail and the Role of Innovation in the Modern Bell System," Business History Review, 66 (Spring 1992), 95-126.



issued additional demands for service. Businesses, in particular, desired more extensive connections to coordinate their internal operations and mediate their external transactions with suppliers and customers. Eager to cultivate this potentially lucrative market, both Bell and independent companies sought to integrate their local networks into larger territorial systems.

Alternatively, the shift in strategy represents a new phase in the relationship between Bell and independent companies, one characterized by accommodation rather than competition. In its initial refusal to interconnect with adjacent independent companies, American Bell's managers challenged its rivals to build an entirely separate network. To expand their subscriber base and enhance the value of their network to business customers, Bell and independent companies pursued aggressive pricing and investment strategies aimed at more marginal users, what Milton Mueller calls access competition.<sup>8</sup>

After 1907, however, each side would admit the futility of this stance, albeit for different reasons, and seek some kind of interconnection agreement with the other. Under Vail AT&T embraced consolidation, and through acquisition and sublicensing would impose its private standard on the industry. This policy

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<sup>8</sup>Milton L. Mueller, "The Telephone War: Interconnection, Competition, and Monopoly in the Making of Universal Telephone Service, 1894-1920" (Ph.D. diss., University of Pennsylvania, 1989), 187, 195-97 and "Universal Service in the Telephone Industry: A reconstruction, Telecommunications Policy 17 (July 1993), pp. 352-69.

shift can be seen in the large increase in the share of connecting telephones after 1907 (see Figure 3). Independents, which did or could not join the Bell System, turned to the federal and state governments and sought regulations mandating interconnection. Their efforts are evident in number of states passing such laws especially after 1910 (see Figure 4).<sup>9</sup>

These alternative interpretations are not mutually exclusive. Access competition, our argument suggests, fueled the extensive development of the telephone industry between 1894 and 1907, as both independent and Bell companies sought a critical mass of subscribers to enhance the value of their networks. Rapid expansion, however, strained Bell's financial resources, while it reduced the independents' competitive advantage in providing local exchange and toll services. Through interconnection, both sides sought to preserve the value of their networks by satisfying the demands of business customers. From this perspective, the call for interconnection represented a retreat from, not the basis for, competition between telephone companies.

## 2. The Hierarchy of Demands and Demand Interdependence

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<sup>9</sup>United States Federal Communications Commission, Proposed Report: Telephone Investigation (Washington, D.C., 1938), 153. See also William P. Barnett and Glenn R. Carroll, "How Institutional Constraints Affected the Organization of Early U.S. Telephony," Journal of Law, Economics and Organization, 9 (April 1993), 108-09.

To comprehend the dynamics of the early competitive period, we first specify the complex demands for telephone service. Like the telecommunications industry today, entry occurred during a formative period, in which producers and consumers experimented with this novel technology and greatly enhanced its utility. Competition, accelerated the processes of innovation and learning in part by making corporate sponsors more responsive to the manifold, interrelated demands of subscribers.<sup>10</sup>

i) The hierarchy of demand

Writing in 1887, AT&T's Edward Hall identified the telephone's "field of usefulness, ... quick communication with instantaneous replies and prolonged personal interviews."<sup>11</sup> This demand for access varied along several dimensions: the frequency and timing of usage and the scope and quality of connections. Depending on the expected number of inward and outward calls during the day, customers purchased service, varying from a party-line to a private branch exchange with a direct trunk line to the central office. The complexity of their connections, such as the range of different parties and places called and the desired clarity of transmission, also influenced the demand for access.

In general, customers' valuation of these features were closely correlated and defined an hierarchy of demands, distinct

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<sup>10</sup>See, for example, Fischer, America Calling.

<sup>11</sup>AT&T Corporate Archives (AT&TCA), box 1259, E.J. Hall, Long Distance Telephone Work, 1887.

market segments ordered according to the utility derived from greater access. These distinct segments fell into two broad categories, business and residential customers.<sup>12</sup> Among the former, the demand for service paralleled the organization's internal structure and external market relations. Core business customers were drawn from larger enterprises engaged in long distance trade, such as hotels, wholesale merchants, department stores, financial intermediaries, transport companies, and national manufacturers. Typically located in the central business district, they demanded telephone connections to keep in touch with distant facilities (such as a branch plant or warehouse), as well as customers and suppliers within their trade area and beyond. Given the value of the information transmitted, they placed an obvious premium on the clarity and reliability of these connections.

Smaller businesses in more residential areas -- grocers, drug stores, or tailors -- used the telephone less frequently. Moreover, like their customers, they called within a narrower geographic range, although the telephone, in conjunction with improved delivery and transport services, enabled many retailers to widen their market area. They also demanded occasional distant connections to wholesalers in the central business district or a nearby city to place orders and arrange deliveries.

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<sup>12</sup>U.S. Bureau of the Census, Telephones: 1907, 74-75, 80; Aronson, "Bell's Electrical Toy," 29-31; Alan J. Moyer, "Urban Growth and the Development of the Telephone: Some Relationships at the Turn of the Century," in Pool, ed., Social Impact of the Telephone, 357-65; Fischer, America Calling, chs. 7-8.

The demands of households and smaller businesses differed by only a matter of degree. Economic elites such as managers and professionals often used their home telephones for business-related transactions and so valued more extensive connections.<sup>13</sup> By contrast, many lower income and working class households could not afford an individual line, and either purchased party-line service or frequented public telephones.

Evidence on traffic patterns from the beginning and end of the period delineate this hierarchy of demands, economically and spatially. At Bell's 1892 Switchboard Conference Hall presented detailed, quantitative data on calling patterns in Buffalo.<sup>14</sup> The graph in Figure 5 arrays "business classes" in ascending order according to the average number of local calls per subscriber station during the month. The evidence may understate the "social" demands of households, because it dates from the period of Bell's patent monopoly and so reflects the company's conscious marketing strategy to suppress what they deemed the frivolous use of the telephone. Still, it vividly demonstrates the wide variation in usage among businesses.

At the top, households including doctors' offices made the fewest calls, less than 50 per month or barely two a day. They were followed by a variety of local enterprises -- carriage

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<sup>13</sup>Ithiel de Sola Pool, "Foresight and Hindsight: The Case of the Telephone," in Pool, ed., The Social Impact of the Telephone, 142; and Fischer, America Calling, 40-42.

<sup>14</sup>AT&TCA, Book Collection, Telephone Switchboard Conference, March 15-18, 1892, 274-82.

builders, caterers, stables, stationers, and the like. At the opposite end were firms engaged in long distance communications and transport and manufacturing for the national market. They made more than 350 calls per month or at least 10 per business day. Newspapers, banks, hotels, and a variety of specialized wholesale merchants serving the metropolitan region also generated large demands for local service. Together, these sectors accounted for 15.4 percent of the subscriber stations in the Buffalo exchange, but 37.8 percent of all local calls.

Throughout the period toll service was virtually the exclusive province of business customers. Moreover, as the Buffalo data show, the demands for local and toll service were highly correlated.<sup>15</sup> Enterprises in long distance trade, not surprisingly, were more likely to demand toll connections, and on average made more toll calls per month than smaller, local businesses and households. In turn, the use of the toll service was even more concentrated than local service.

Another way of gauging the scope of demand is by the number of different subscriber stations called during the period. The calling circle of most households, even today, is rather narrow, a fact which some interexchange carriers exploit in their marketing plans.<sup>16</sup> Although the data for Buffalo do not

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<sup>15</sup>AT&TCA, Book Collection, Telephone Switchboard Conference, March 15-18, 1892, 281-82; AT&T Co., Proceedings of the Bell System Educational Conference, New York City, June 21-25, 1926 (New York, 1926), 59-60.

<sup>16</sup>Martin Mayer, "The Telephone and the Uses of Time," in Pool, ed., Social Impact of the Telephone, 226-29.

distinguish between types of customers, they clearly show that the vast majority of subscribers demanded a limited number of connections. The graph in Figure 6 displays the size distribution of subscribers by their demand for different connections. It peaks at 25-29 stations, or 1.5 percent of the subscriber base, and then declines sharply. Only 10 percent of subscribers called at least 100 different stations, and so had a community of interest that likely spanned the entire city.

A 1914 investigation into telephone rates in New York City offers a glimpse into the spatial pattern of calling within the metropolitan area.<sup>17</sup> Although less refined than the evidence from Buffalo, these data clearly distinguish the segments of the telephone market by their location relative to the central business districts of the city. For each zone, they indicate the distribution of businesses and residential customers by service demanded (type of access line and level of calling). Also, data on intra-urban toll traffic show the location of customers, who demanded more universal connections.

The graphs in Figure 7 depict the cumulative distributions of business customers by their demand for measured service. During this time period, customers selected an exchange pricing plan that was based on the number of calls that they anticipated on placing. Figure seven's data differentiate subscribers by their anticipated, not actual, usage, and so presumably reveal

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<sup>17</sup>New York State Legislature, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report (Albany, 1915).

trends in their annual calling. The largest users were concentrated in Manhattan (zone 1), whereas in the outskirts, especially the farther reaches of the Bronx and Queens (zones 3 and 7 to 9), the distributions are decidedly skewed towards smaller users. In Manhattan only 20 percent of business customers purchased the minimum service (6.0 thousand calls), and an equal share demanded over 20 thousand calls annually. As Edward Bemis who conducted the investigation for the Public Service Commission observed, Manhattan generated the densest traffic within the metropolitan area, and the financial district was the largest market in the borough.<sup>18</sup>

In the outlying zones, by contrast, business customers demanded more limited service. They typically made fewer calls, and a small fraction actually shared an access line. In the zones bordering on Manhattan -- Staten Island, the south Bronx, and the western portions of Queens and Brooklyn, the distributions fell in between these extremes. Yet, even in these areas, many firms opted for two-party service.

For residential customers, the spatial variation in demands is even greater. Additionally, households, at least those outside of Manhattan, had more options to purchase inexpensive, but lower quality access. In Brooklyn, for example, over one-half of residential customers purchased four-party service.

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<sup>18</sup>New York State Legislature, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 488-89; F.E. Richter, "The Telephone as an Economic Instrument," Bell System Quarterly, 4 (October 1925), 288-89.



Residential customers in Queens and Staten Island paid a very low flat rate for "neighborhood" service, but could call only within a narrow range without incurring an additional toll charge, hence the name.

In New York (and other large centers) local service did not cover the entire city.<sup>19</sup> The size of the local calling area depended on the district and type of service. Flat rate, neighborhood service provided connections only between adjacent central offices. In Manhattan local service embraced all central offices in the borough and the south Bronx (zone 2). For calls to other zones, subscribers paid 5 or 10 cents, depending on the distance. The higher rate generally applied to the more remote destinations, zones 7 to 9.

Table 1 displays the value of intra-urban toll traffic to and from Manhattan, northern Brooklyn, and the south Bronx. These zones, which constituted the core of the city's economy, generated 75 percent of all toll revenues. In fact, the traffic between the first two zones alone accounted for just over one-half. Additionally, these sections attracted the vast majority of toll calls originating in other parts of the city. In most zones or central offices, 75 percent of the toll calls were destined for stations in either Manhattan or Brooklyn. By

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<sup>19</sup>Merchants' Association of New York, Inquiry into Telephone Service and Rates in New York City (New York, 1905), 24-26; Chicago City Council, Committee on Gas, Oil and Electric Light, Telephone Service and Rates (Chicago, 1907), 22-23, 172-76.

contrast, the demand for connections between outlying sections, with the exception of those in the same local area, was scanty.

ii) Demand interdependence and network development

Viewed alternatively, the hierarchy of demands expresses the variation in subscribers' demand interdependence. Enlarging the subscriber base or building additional toll lines certainly enhanced the access afforded by telephone service, but the value of these potential connections depended on the size and scope of a household's or enterprise's community of interest. This formulation also delineates the complex interrelationships among the distinct market segments within the metropolitan area. Their calling circles, although sharply differentiated, nonetheless overlapped. These points of intersection concretely represent the mutual economic and social relations that constituted metropolitan communities.<sup>20</sup> They also imply the mutual determination of demand among all subscribers.

The challenge to telephone managers and engineers, then, was to design and operate exchange and local toll networks that satisfied these diverse, but interrelated demands. In the 1890s Thomas Doolittle of AT&T developed a simple, schematic "model" of the toll network, which addressed this very problem.<sup>21</sup> According

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<sup>20</sup>According to Bemis, the exchange area should encompass the "entire economic life" of a city residents. As an example, he mentioned commuting patterns in New York City, which often transcended the boundaries of a zone or borough. New York State Legislature, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 494.

<sup>21</sup>AT&TCA, box 1285, AT&T Co., Toll Line Service, 1892-1896, Doolittle-Davis, 6/4/1896. For an analysis of Doolittle's model

to his analysis, a well-designed network would trace out the interdependent demands for toll service within the metropolitan region and thereby reap the systemic benefits or externalities from connecting complementary market segments and users.

At the same time, he recognized that some investments might not yield returns when reckoned on a stand-alone basis, but would generate profits indirectly through their impact on demands for other services or at other locations. To "round out a system," Doolittle recommended "subsidizing" access to these more marginal areas with the profits earned elsewhere. His model, in fact, justified these transfers, because they would generate substantial externalities or rents. In other words, they were not truly subsidies, but represented an investment, necessary to realize the potential demand for toll services by core business customers.

Although Doolittle restricted his model to long distance services, its essential principles applied at local level as well.<sup>22</sup> Despite the narrow communities of interest of residential customers, businesses demanded extensive connections within city limits. The paradigmatic example, one targeted by Bell marketing programs, was the chain of transactions in the

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and its implications, see David F. Weiman, "Planning the Bell System: The Cumulative Dynamics of Urban and Regional Development," (unpublished mss., 1994), sects. 1-2.

<sup>22</sup>According to Doolittle, demand interdependence was weaker at the local level because of the limited scope of residential demands. Business customers, however, demanded extensive connections within as well as beyond city limits. See Weiman, "Planning the Bell System," 8-12.

mercantile sector.<sup>23</sup> Wholesale merchants, located in central business districts, increasingly relied on the telephone -- both local and toll services -- to contact retail merchants and other shops in their trade area. The latter, in turn, used the telephone to conduct transactions with their customers, other local businesses and households. With the diffusion of telephone service to each market segment, customers and merchants could place smaller orders with greater frequency and so utilized the telephone with increasing intensity. In similar fashion, large department stores depended on telephone service for marketing and even provided customers throughout the metropolitan area with the equivalent of "800" service to place their orders.

At the same time, expanding the range of connections within and beyond the local network resulted in higher costs and lower service quality, both which could stem demand growth. To furnish long distance connections, operating companies installed higher quality, more costly facilities.<sup>24</sup> They replaced grounded iron with two-wire copper circuits and installed additional poles,

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<sup>23</sup>See for example Richter, "The Telephone as an Economic Instrument," 291-94; Richard Whitcomb, "The Key Town Plan of Selling by Telephone," Bell System Quarterly, 8 (January 1929), 47-58; Moyer, "Urban Growth and the Development of the Telephone," 363; Kenneth Lipartito, "Marketing the Telephone: Bell's Response to the Consumer Society," (unpublished mss., 1992), 15; and Weiman, "Planning the Bell System," 15-16.

<sup>24</sup>Richard Gabel, Development of Separations Principles in the Telephone Industry (Lansing, 1967), 31-34; M.D. Fagen, ed., A History of Science and Engineering in the Bell System: The Early Years (1875-1925) (New York, 1976), 74-103, 233-34, 488-89; and Kenneth Lipartito, The Bell System and Regional Business: The Telephone in the South, 1877-1920 (Baltimore, 1989), 69-72.

more closely spaced, to bear the greater weight. They also upgraded their station and switching equipment to insure the technical compatibility of local and long distance networks.

Moreover, in the era of manual (and even simple electro-mechanical) switching technology, local service was an increasing cost segment of the industry. As a Bell engineer observed, "In a telephone system where one central exchange will forever accommodate, ... the cost of service varies in a rapidly increasing ratio, directly as the number of telephones and resulting number of calls increases."<sup>25</sup> Larger exchange boards multiplied the complexity of switching methods and so diminished the productivity of operators. To prevent the deterioration in service quality, companies had to expand the number of stations and to hire additional staff. In larger metropolitan centers served by multiple central offices, these factors were compounded by the additional capital and operating costs of relaying traffic through interoffice trunk lines and if necessary tandem switches.

### 3. The Competitive Dynamics of Network Development

Elaborating Doolittle's prescription, competing telephone companies employed various schemes of price discrimination to develop the urban market. Through these policies, they could reach marginal users, and still limit costs and congestion.

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<sup>25</sup>AT&TCA, box 1309, AT&T Co., Relation between Population and Rates, 1906, Smith-Abott, 12 May 1906. See also Milton Mueller, "The Switchboard Problem: Scale, Signalling, and Organization in Manual Switching, 1877-1897," Technology and Culture, 30 (July 1989), 534-60.

Moreover, by expanding the scope of their networks, they could induce core business customers to purchase higher quality, more profitable types of service. Like "penetration" pricing, these marketing strategies were designed to forge a critical mass of subscribers that would satisfy the demands of key customers for connections and so would enhance the long-term value of their networks.<sup>26</sup>

From the very outset, Bell operating companies charged business and residential customers differential rates for unlimited local service.<sup>27</sup> In 1894, just as entry was beginning, minimum business rates in Bell exchanges averaged \$68.1, as compared to \$56.0 for residential customers (see Table 2). The slight discount for the latter, only 18 percent, clearly reflects the parent company's top-down marketing strategy, which focused on core business and wealthy residential customers in larger urban centers.

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<sup>26</sup>Jeffrey Rohlfs, "A Theory of Interdependent Demand for a Communication Service," Bell Journal of Economics, 5 (Spring 1974), 33-36; Michael L. Katz and Carl Shapiro, "Technology Adoption in the Presence of Network Externalities," Journal of Political Economy, 91 (August 1986), 834; Joseph Farrell and Garth Saloner, "Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation," American Economic Review, 76 (December 1986), 950-51.

<sup>27</sup>Aronson, "Bell's Electrical Toy," 25; Pool, "Foresight and Hindsight, 130. According to Moyer, "Urban Growth and the Development of the Telephone," 350, "In some exchanges, there were almost as many rates as subscribers."

Independent companies pursued the alternative strategy, best characterized as building networks at the grass roots level.<sup>28</sup> Employing simpler less costly equipment, they could provide inexpensive, but effective local exchange and toll services. Moreover, they adopted pricing policies, which targeted more marginal users. To enlist urban and rural households, independents sharply discounted residential rates, relative to those charged to their business customers and by the incumbent. For unlimited local service, the norm was \$24 annually, as compared to \$36 for businesses.<sup>29</sup> In some centers, the independent company offered a residential discount of 50 percent.

Armed with an appropriate technology and marketing strategy, independents initially entered smaller cities and towns, which Bell companies had bypassed. As important, they provided short-haul toll lines to nearby exchanges in the trade area of local businesses. In fact, local merchants often formed independent companies, because the incumbent refused to furnish these vital connections. Having developed these complementary market segments, independents successfully contested Bell's urban

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<sup>28</sup>On the strategy of the independents, see Mueller, "The Telephone War," 180-81; Lipartito, The Bell System and Regional Business, 90-91; David F. Weiman and Richard C. Levin, "Preying for Monopoly? The Case of Southern Bell Telephone, 1894-1912," Journal of Political Economy, 102 (February 1994), 106-08; and David Gabel, "Competition in a Network Industry: The Telephone Industry, 1894-1910," Journal of Economic History (forthcoming).

<sup>29</sup>See for example, S.D. Levings, "The Development Study," Telephony 17:10 (6 March 1909), 276; Stehman, Financial History of the American Telephone and Telegraph Company, 80-97.

strongholds, except where the incumbent enjoyed exclusive franchise rights (notably in Boston, Chicago, New Orleans, and New York) or densely covered hinterland markets (such as in its home base of New England).

To deter or at least contain their rivals, Bell operating companies responded in kind. They adopted equally aggressive pricing and investment strategies, which tapered their networks, service quality, and rates to the differentiated demands of customers, especially those at the lower end of the demand hierarchy. Explaining the pricing policies of local companies, a Bell official plainly admitted that local rates were set according to what the market would bear, and not simply costs. The "general method of conducting business," he elaborated, is to "[fix] rates in various exchanges to produce a high development, fixing them solely with reference to the value of service to the communities and without special regard to ... the cost of service in a particular case."<sup>30</sup> Even in the absence of direct competition, the policy would effectively "cover all parts of the field" and so preempt entry.

Striking evidence of this shift in policy is the widening differential between Bell's business and residential rates. To

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<sup>30</sup>AT&TCA, box 1309, Relationship between Population and Rates 1906, Ford-Fish, 5/24/1906, (emphasis added). AT&T did take into account the cost of production in setting rates. The firm grouped cities together by either population or the number of customers served. The company's engineers and accountants then estimated the cost of a typical city within each grouping. This cost data, along with demand data, was used to set rates. AT&T did not undertake cost and demand studies that were specific to each city within the groupings.



match actual or potential competitors, Bell companies slashed residential rates by an average of 60 percent (see Table 2).<sup>31</sup> They also cut business rates, but by only 40 or 47 percent depending on competitive conditions. During the initial phase of competition, then, the residential discount jumped to 34 percent in markets, where Bell retained its monopoly, and to 45 percent in competitive or dual markets.

Obviously concerned about the reaction of key business customers to the new rate structure, the parent company devoted several pages of its 1907 annual report to explain the mounting differential in prices.<sup>32</sup> Businesses, the report maintained, paid higher rates, because they derived greater benefits from telephone service and imposed greater costs on the network. Compared to residential customers, it continued, they placed and received more calls per day, and so reaped substantial, positive externalities from access and accounted for the congestion during peak periods.

Bell operating companies also introduced more refined systems of discrimination, further segmenting the subscriber base by furnishing business and residential customers with different qualities of service (or access) at varying prices. In 1894

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<sup>31</sup>Richard Sylla, "The Development of Telephony and Telephone Regulation in North Carolina -- An Analytical Historical Survey," (unpublished mss., 1975), 33, shows the evolution of business and residential rates in North Carolina between 1893 and 1898. Southern Bell Telephone lowered business rates by one-half and residential rates by 60 percent.

<sup>32</sup>Annual Report of the AT&T Company 1907, 19-21; and Moyer, "Urban Growth and the Development of the Telephone," 351.

Metropolitan Telephone introduced measured service within the core boroughs of New York City, which effectively reduced the cost of access to small businesses and residential customers. In suburban areas, such as Mt. Vernon and Yonkers, the company increased the density of pay or "Public" stations, which provided the minimum level of access.<sup>33</sup> Local companies also expanded the use of shared access lines, including an unsuccessful experiment with 10-party service.<sup>34</sup>

The case of measured service is illustrative. Key Bell officials, like Hall, advocated the change in pricing policy on the general principle that "the true unit of charge is the message."<sup>35</sup> Yet, even he acknowledged the strategic objective of furnishing "smaller users" with inexpensive forms of access. Moreover, from Bell's perspective, measured service had decided economic advantages over a straight discount on flat rates. By adjusting the incremental price of a call, local companies regulated usage and so insured that key business customers

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<sup>33</sup>AT&TCA box 1285, Toll Service, 1897-1898, Doolittle-Hudson, 5/25/1898; see also Annual Report of the American Bell Telephone Company, 1894, 11; 1896, 10; 1897, 8; and Annual Report of the AT&T Company, 1900, 9. As Doolittle candidly remarked, "the general adoption of this [measured service], it is claimed, will make the \$240 flat rate appear as a commuted rate and be looked upon as a concession instead of an extortion. This is an exceedingly optimistic view, but it may so work out."

<sup>34</sup>M. D. Atwater, "The History of the Central Union Telephone Company," August 26, 1913, AT&TCA.

<sup>35</sup>AT&TCA, box 1309, E.J. Hall, Industrial Commission Hearings, 1901; Garnet, The Telephone Enterprise, 76; and Joan Nix and David Gabel, "AT&T's Strategic Response to Competition: Why Not Preempt Entry?" Journal of Economic History, 53 (June 1993), 378-81.

enjoyed both access to a larger subscriber base and efficient service at a reasonable price.<sup>36</sup>

Also, measured service enabled operating companies to discriminate among customers along the dimension of quality and not simply price. In most large cities Bell and even independent companies offered customers the option of measured or flat rate service.<sup>37</sup> Regardless of the company, the schedule of measured rates sharply curtailed the residential discount. Still, minimum levels of measured service were priced well below flat rates, and so afforded marginal users, households and businesses, a less costly means to obtain access.

Where there was no competition, Bell could go even farther. In New York, Bell eliminated the residential discount altogether.<sup>38</sup> In Manhattan, the Bronx, and Brooklyn it charged all customers identical measured rates for an individual line. Outside of lower Manhattan, the company also offered less expensive, two- and four-party line service for marginal

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<sup>36</sup>The marginal price typically decreased with the volume of usage. In this way, the company could limit the "frivolous" calls of residential customers, while inducing additional demand by its core business customers. Where businesses balked at the potential costs of measured service, Bell operating companies even agreed to cap the maximum annual payment and so offered calls beyond the threshold for free.

<sup>37</sup>Chicago City Council, Committee on Gas, Oil, and Electric Light, Telephone Service and Rates, 171-98.

<sup>38</sup>Merchants' Association of New York, Inquiry into Telephone Service and Rates, 51-53; Chicago City Council, Committee on Gas, Oil, and Electric Light, Telephone Service and Rates, 172-73; New York State Assembly, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 44-48.

customers, who did not "desire the prompt, lively" access afforded by an individual line.<sup>39</sup>

As an alternative strategy to reach marginal users, Bell companies in New York, Chicago, and Philadelphia offered a limited version of inexpensive, flat rate service for as little as \$18 to \$24 annually. Through "neighborhood" exchanges or the zone system, households and in some cases businesses could purchase unlimited service within a narrow geographic area, ranging from the domain of a small central office to an entire district of the city. The service was feasible in large metropolitan centers because of their spatially segregated, close-knit residential neighborhoods. There, demand was "almost entirely of local character ... [consisting of] communication to the grocer, the butcher, the druggist, to all local business houses and to one's social associates."<sup>40</sup> Under these conditions, the company could employ lower cost exchange facilities and operating methods for local traffic, and provide less efficient, toll service for the trickle of calls to and from

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<sup>39</sup>AT&TCA, box 1390, Relation between Population and Rates 1906, Ford-Fish, 5/24/1906.

<sup>40</sup>Chicago City Council, Committee on Gas, Oil, and Electric Light, Telephone Service and Rates, 22. The New York State Assembly, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 36-37, offered a similar assessment: "These flat rates for residences outside of Manhattan have an important place. They encourage the development of the telephone who have little use for sending messages many miles from their residences, and who can only afford the low rates which a neighborhood residence service can give."

other parts of the city. In other words, neighborhood exchanges were operated like a branch exchange of the metropolitan network.

Finally, in cities with competing telephone companies, dual service itself represented a system of price discrimination, in which those demanding more extensive connections paid higher costs, either in cash or in kind. By serving largely distinct market segments, competing companies could provide more efficient, lower cost service to their customers. Customers demanding more extensive connections could purchase "dual" service, and through an access line to each network reach the entire urban market and the toll facilities of both companies.

Marginal customers could hardly utilize a single line, let alone justify the purchase of a second one. Still, for the occasional call to or from another service area, they could use public telephones, which were centrally placed at drug stores, hotels, and post offices. For this kind of access, users incurred a fixed charge per call, usually a nickel, plus assorted transactions costs, such as inconvenience, lack of privacy, and delays especially on incoming calls. Public telephones were often equipped for toll transmission and so provided the sole means of interconnection in territories with single service. In fact, independent and Bell operating companies often installed toll stations in advance of their entry into the local market, whether already occupied or not.<sup>41</sup>

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<sup>41</sup>AT&TCA, box 1285, AT&T Co., Toll Line Service, 1897-1898, Doolittle-Hudson, 5/19/1898; American Telephone Journal, 12 (December 30, 1905), 450.

Core business customers often criticized dual service mainly because of duplication in the subscriber base, which ranged from 15 to 20 percent in the largest urban markets.<sup>42</sup> Yet, according to contemporary estimates, dual service cost no more than Bell's monopoly rates prior to entry, and offered a much greater range of connections, despite the overlap. Moreover, the duplication of facilities provided a valuable source of easing line congestion and providing an alternative access line in case of prolonged service interruptions.

Business groups also voiced a more familiar complaint against this form value of service pricing. Subscribers with dual service, they insisted, were subsidizing access to other users, such as residential customers. They certainly contributed a larger share of operating companies' revenues. Moreover, because of dual service, marginal users could purchase cheaper local service from the independent and still be assured of reaching many businesses.<sup>43</sup>

Yet, then as today, it was not uncommon for businesses to provide free telephone services to their customers. Like advertising in several newspapers and multiple media or leasing a

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<sup>42</sup>Merchants' Association of New York, Telephone Competition from the Standpoint of the Public (New York, 1906), 11-12. The case for dual service is made by Gansey R. Johnston, "Comments on the 1907 Report of the A.T.&T. Co.," Telephony, 16 (October 10, 1908), 351-52; (October 17, 1908), 386-88; and (October 24, 1908), 409-11. See also "Before and After Competition," Telephony, 13 (March 1907), 251-52.

<sup>43</sup>Merchants' Association of New York, Telephone Competition, 15-16.

storefront on a main thoroughfare, businesses devised various forms of "800" service to attain more immediate, less costly access to a wider market area.<sup>44</sup> In another guise, these items would simply represent necessary sales costs. Paralleling the rent gradient between the central business district and a neighborhood shopping center, the price of dual and single service reflected the option value of greater accessibility. As a 1910 Bell survey of Louisville, Kentucky discovered, the analogy is very apt. The rate of dual service varied from almost unity for large-scale enterprises, operating at the wholesale level, to under 15 percent for neighborhood shops and residences.<sup>45</sup>

In fact, with one important exception, dual service resembled Bell's own neighborhood exchange service or zone system. Whether through a single or separate companies, the alternative plans segmented the metropolitan market according to the distinct communities of interest of more marginal users. In this way, local companies could satisfy their limited demands more efficiently. Core customers, in turn, could purchase "extended area" service, but paid a higher price in terms of out-of-pocket expenses and slower, more roundabout connections. The main difference, of course, was that the zone system furnished direct access to the metropolitan calling area through an

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<sup>44</sup>See, for example, U.S. Bureau of the Census, Telephones: 1907, 74; Lipartito, "Marketing the Telephone," 15; and Weiman, "Planning the Bell System," 15-16.

<sup>45</sup>Mueller, "The Telephone War," 255-61.

integrated network, whereas dual service required customers to negotiate between two separate networks. As we show below, in mandating interconnection between rival urban networks, regulatory authorities in Wisconsin essentially replicated Bell's zone system.

#### 4. Bridging the Gaps

After 1907 both Bell and the independents retreated from the competitive strategy of building parallel networks. First Bell and later the National Independent Telephone Association advocated physical interconnection to satisfy the mounting "public" demand for greater access. Not surprisingly, their proposals differed markedly.<sup>46</sup> Bell favored consolidation through acquisition and sublicensing. The independents, by contrast, sought mandated, universal interconnection under the watchful eye of neutral state regulators.

In calling for interconnection, rival companies were largely responding to the demands of business customers for local and long distance connections. Having adapted their practices and even organizations to exploit the telephone, businesses sought less costly, more convenient access, whether to another borough of the city or region of the country. In turn, they harshly

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<sup>46</sup>On the relationship between market structure, market share, and the standards-setting process, see Shane M. Greenstein, "Invisible Hands Versus Invisible Advisors: Coordination Mechanisms in Economic Networks," Bureau of Economic and Business Research, University of Illinois at Urban-Champaign, Faculty Working Papers Series 93-0111, 5-21.



criticized the fragmentation of the telephone network, especially dual service. Telephone officials acknowledged that only a small fraction of their total traffic and an even smaller share of their subscriber base required interconnection. Yet, eager or desperate to capture this lucrative market, companies readily acceded to the demand.

i) Consolidation under the Bell standard

In 1907 Vail announced AT&T's more conciliatory stance by expressing an increased interest in sublicensing.<sup>47</sup> Sublicense agreements specified the terms for the interchange of toll traffic between Bell and independent companies. By insisting on a strict division of territory and exclusive access, they also orchestrated a cartel under Bell control. Sublicensed independents companies were limited to a "small and compact" area, which did not "infringe" on the territory of any Bell division.<sup>48</sup> Moreover, they were explicitly prohibited from connecting with other long distance companies or forming their own toll networks. Hall, who drafted AT&T's sublicensing policy, even recommended separate, staggered contracts for contiguous or otherwise affiliated exchanges to prevent the formation of rival networks.<sup>49</sup>

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<sup>47</sup>Annual Report of the AT&T Company, 1908, 19.

<sup>48</sup>AT&TCA, box 66, Sub-Licensing Policy, 1907-1908, Hall-French, 5/16/1908. See also Kenneth Lipartito, "System Building on the Margin: The Problem of Public Choice in the Telephone Industry," Journal of Economic History, 49 (1989), 330-31.

<sup>49</sup>In a 1909 report on Southern Bell, Doolittle would take this logic one step further. "As a general proposition," he

Through sublicensing, the parent company also sought to regulate or more accurately to raise the rates of independent companies. Hall perceived a potential conflict, if operating companies allowed independents to retain "unsuitable" rates, meaning those far below the prices for comparable Bell service. These disparities, he observed, would incorrectly "educate the public in the belief that such low rates must be paying rates," and so ultimately "prove as much of an embarrassment to the licensee as if actual competition existed."<sup>50</sup>

Although AT&T did not have the power to stipulate rates, it exerted influence indirectly by regulating the other terms of the contract. As earlier experience demonstrated, a combination of higher technical standards, inflated rental fees on equipment, and "fair" commissions on toll services would increase the independent's costs and so force the necessary adjustment in prices. Bell operating companies even assisted independents in negotiating higher rates, usually by furnishing desired toll connections or guaranteeing their local monopoly against potential entrants.<sup>51</sup>

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remarked, "each sublicensed or independent system should be kept separate from every other such system by one or more intervening Southern Bell exchanges." AT&TCA, box 2026, Toll Traffic Matters, 1909, Doolittle-Carty, 7/14/1909.

<sup>50</sup>AT&T Archives, box 66, Sub-Licensing Policy, 1907-1908, Hall-French, 5/16/1908. Emphasis added.

<sup>51</sup>Under Hall's leadership, Southern Bell successfully used sublicensing to consolidate the company's network and to close the gap between its rates and those of the independents. See, for example, AT&TCA, box 1263, SBT&T Co., Sub-License Contracts, Southern Bell Telephone and Telegraph, Company, 1898-1899,

In larger urban centers, strategic considerations overruled the potential benefits of sublicensing. AT&T permitted no concessions over these pivotal locations, which would anchor any rival toll network. Consequently, Hall sanctioned Bell's aggressive, if not predatory, tactics to eliminate actual or potential competition in these markets.<sup>52</sup> Bell companies would eventually achieve this goal, but often through the political process. By lobbying municipal governments or state regulators, they forced independents to sell their properties or procured exclusive franchises.

Core business users figured significantly in these campaigns. To achieve more efficient universal service, they sided with the Bell operating company and provided the necessary political support for its "natural" monopoly over local service.<sup>53</sup> In return, business customers insisted on some form of rate regulation. These administrative contracts would check Bell's market power and so institutionalize some of the gains from competition. As important, regulated, as opposed to

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Easterlin-Wilson, 9/26/1898; Wilson-Hall, 2/9/1899; box 1340, SBT&T Co., Acquisitions and Sale of Exchanges in North Carolina, 1903, Gentry-French, 7/16/1903; SBT&T Co., Sub-Licenses, 1900, Wilson-French, 9/21/1900.

<sup>52</sup>AT&TCA, box 66, Sub-Licensing Policy, 1907-1908, Hall-French, 5/16/1908; box 1340, SBT&T Co., Acquisition of Independent Companies, 1897-1901, Hall-Cochrane, 3/6/1901; Acquisition of Independent Companies, 1902-1911, Gentry-Hall, 10/13/1909; and box 2026, Toll Traffic Matters, 1909, Doolittle-Carty, 7/14/1909.

<sup>53</sup>Weiman and Levin, "Preying for Monopoly?", sect. 5.

competitive, rates would compress rate structures and thereby shift the fixed costs of the network onto more marginal users.

ii) The Independent movement for interconnection

The Independents reversed their earlier opposition to mandatory interconnection, as their prospects of constructing a nationwide network dwindled.<sup>54</sup> In 1907 they experienced a series of setbacks, when city officials and courts in Boston, New York, Chicago, and Milwaukee imposed conditions delaying entry into these markets. The outcome in New York City was especially damaging, because this market was universally regarded as the "keystone" of the Bell System and of any national toll network.<sup>55</sup>

The Independents were dealt a second, equally severe blow in 1909, when AT&T acquired the United State Telephone Company. United States operated the largest system of Independent exchanges in Ohio and Indiana. Equally important, it had taken the lead in forming a nationwide Independent toll network, providing trunk line service. United's successful inroad into the toll market had cut into Bell's profits. In response, AT&T conducted a war of attrition by slashing its toll rates until United relented and sold its properties.<sup>56</sup>

The case of United States Telephone illustrates the problems faced by Independents in forming an integrated national network.

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<sup>54</sup>Bornholz and Evans, "The Early History of Competition," 27-28; Langdale, "The Growth of Long-Distance Telephony," 154-55.

<sup>55</sup>Paul Latzke, A Fight With an Octopus (Chicago, 1906), p.12.

<sup>56</sup>Gabel, "Competition in a Network Industry."

Independents cemented their toll networks through exclusive, long-term contracts, which prohibited defections even if a party joined the Bell network. When an independent like United States sold out to Bell or signed a sublicense agreement, it often terminated the connection. These arrangements, however, proved to be less effective than common ownership. The contracts were costly to enforce, and in some venues judges considered the arrangements to be an illegal restraint of trade.<sup>57</sup>

Thwarted in their efforts to build a rival toll network, the leaders of the Independent movement sought relief through the political arena. In late 1908 their national organization lobbied the U.S. Justice Department and state Attorney Generals to sue Bell for violating anti-trust statutes.<sup>58</sup> A little more than two years later, the Independents began to focus on obtaining toll interconnection through either negotiations with Bell or legislation (see Figure 4).<sup>59</sup>

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<sup>57</sup>Union Trust v. Kinloch Long Distance Telephone, 258 Illinois 202 (1913); and U.S. Telephone v. Central Union Telephone, et. al. 202 Fed 66 (1913). Other courts concluded that exclusive toll contracts promoted competition and therefore did not violate state anti-trust laws. See, for example, U.S. Telephone v. Middlepoint Home Telephone 86 Ohio 319 (1912); Home Telephone Co. v. Sarxocie Light and Telephone Co. 236 Mo. 114; Cumberland Telephone and Teleg co v. State, 100 Miss. 102.

<sup>58</sup>Telephony, January 9, 1909, 34; J.B. Ware to W.F. Goodrich, November 14, 1908, Wisconsin State Telephone Association records.

<sup>59</sup>See the extensive debate in the pages of Telephony, vol. 60 (1911), esp. 60:9 (March 4, 1911), 271, 304-05; and MacMeal, p.186.

## 5. Mandatory Interconnection in Wisconsin

Kellog, Thorne, and Huber have recently argued that prior to the 1970s, no state or federal agencies mandated interconnection between competing telephone networks, with the exception of the Kingsbury Agreement.<sup>60</sup> State and federal courts, they argue, held that while suppliers had to provide service without discrimination to end-users, rival companies were not granted similar network access. Kellog, Thorne, and Huber overlooked some important regulatory actions during the first quarter of the twentieth century. While the Courts held that the common carrier obligations did not extend to rivals, equal access could be mandated by law. In *Evansville & H. Traction Co. v. Henderson Bridge Co.*, the Federal Circuit Court held that State's could enact legislation that mandated interconnection of rival networks.<sup>61</sup>

In this section we review the history of mandated interconnection in Wisconsin. Although Wisconsin was not the first state to mandate physical interconnection, its Railroad Commission was the first regulatory body to exercise this authority. Consequently, as in other areas of regulation, Wisconsin served as a laboratory for the rest of the country, showing how regulators implemented interconnection and its impact

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<sup>60</sup>Michael K. Kellog, John Thorne, and Peter W. Huber, Federal Telecommunications Law (Boston, 1992), 13-14, 156-57. The Kingsbury agreement provided for interconnection on toll calls that were more than 50 miles in length.

<sup>61</sup>134 F 973, 978 (1904); *affirmed* 141 F 51 (1905).

on the evolution of rival networks. We give special attention to the impact interconnection had on the pricing strategies of the rivals.<sup>62</sup>

In Wisconsin, Bell and the Independents had successfully argued against the passage of interconnection during each legislative session between 1901 and 1909 inclusive. In 1911, however, the Independents supported the passage of a bill that mandated toll interconnection. During the 1911 legislative debate the Independents expressed their concern that interconnection would eliminate the goodwill that they had built up in their local systems. They asked that the state protect

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<sup>62</sup>Frank Winter, "The Fight for Physical Connection of Telephone Systems," La Crosse County Historical Sketches, Series 4, p.70; National Civic Federation, "Compilation and Analysis of Laws of Forty-Three States for the Regulation of Central Commissions of Railroad and other Public Utilities," (1913), pp. 318-325; 593-95.

While most states granted broad regulatory authority to the Commissions, there were some exceptions. In Arizona and California the Commissions did not have the authority to compel interconnection "where the purpose of such connection is primarily to secure the transmission of local messages or conversations between points within the same city, or town..." *Ariz.--Sess. Laws 1912, ch. 90, sec. 40; Cal.--Stats. 1911, ch.14, sec. 40.* The Michigan statute was unusual in that the law set the price for interconnection: "Any telephone corporation which is required to perform switching service for another telephone corporation under the terms of such an [interconnection] order may demand and receive as compensation for such service the sum of five cents per message in addition to the regular service charge, if any." *Pub. Acts 911, no. 138, sec. 6.*

Wisconsin also served as a model for the Bell System. The impact of interconnection on Bell's operations in Wisconsin were observed, and used by the Company's leaders for formulating policy in other jurisdictions. Sunny/Kingsbury, July 16, 1915, AT&TCA.

this intangible property by either prohibiting local interconnection or placing a surcharge on calls.<sup>63</sup>

Wisconsin Telephone opposed mandatory local or toll interconnection. The legislature rejected the firm's appeal and passed a bill that authorized the Railroad Commission to order interconnection when "public and convenience require." It did, however, respond to Bell's and the Independents' concern that if access were not properly priced, interconnection could potentially harm their networks. The legislature required the Commission to find that no "irreparable injury" would result from interconnection.<sup>64</sup>

The first two major tests of the Wisconsin physical connection law occurred in 1912 through 1914 when citizens in La Crosse and Janesville requested that the Regulatory Commission order interconnection between the Independents' and Wisconsin Telephone's networks. In both cities the customers claimed that public convenience and necessity required a connection. In La Crosse the petitioners only requested toll interconnection, while in Janesville both local and toll connections were requested.<sup>65</sup>

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<sup>63</sup>Milwaukee Daily News, April 7, 1911; Milwaukee Sentinel, April 26, 1911; and Rock County Telephone and Badger Telegraph and Telephone Company, "The Merits of Substitute No. 886A, and Demerits of Substitute Amendment No. 1A, to Bill No. 393A," 1911, Wisconsin Legislative Reference Bureau.

<sup>64</sup>Chapter 546, 1911 Laws of Wisconsin (quote); and Milwaukee Journal, June 9, 1911.

<sup>65</sup>Frank Winter v. La Crosse Telephone Company and Wisconsin Telephone Company (hereafter "Winter"), U-317, 11 Wisconsin Railroad Commission Reports 748 (1913); and E.D. McGowan v. Rock County Telephone Company and Wisconsin Telephone Company



The customers, especially businesses, felt that it would be more convenient if the systems were connected. In La Crosse, for example, if an Independent customer received a toll call on the Bell network, it took about thirty minutes to contact the party and complete the connection. Customers could overcome this obstacle by renting two phones, and eight percent of the subscribers in La Crosse purchased dual service. Still, physical connection would eliminate the expense of the second telephone.<sup>66</sup>

In the La Crosse case the Independent company raised no objection to the petition. Rock County Telephone Company, by contrast, supported the petition by the citizens of Janesville. In both cases the Independent firms took a minor interest in the case relative to effort made by Wisconsin Telephone.<sup>67</sup>

Bell claimed that the Railroad Commission had no "right or authority" to order interconnection, and "that any order made, directing such physical connection to be made [would] deny the...Company the equal protection of the law and of trial by

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(hereafter "McGowan"), U-500, 14 Wisconsin Railroad Commission Reports 529 (1914).

The issues resolved in these two cases, especially the Winter case, established legal and pricing precedents that were subsequently followed in other cases. See, for example, Wisconsin Telephone to Commercial Club of Ashland, April 11, 1917, in case file Commercial Club of Ashland v. Ashland Telephone Company and Wisconsin Telephone Company (U-1066), 19 Wisconsin Railroad Commission Reports 281 (1917).

<sup>66</sup>"Winter," hearings January 3, 1912, p. 3, and 20 and May 27, 1912, p. 13, WSHS; "McGowan," p. 537, and hearing July 2, 1913, p. 22-23, WSHS.

<sup>67</sup>Ibid., and "Winter," brief of Wisconsin Telephone Company, p. 3 and 7 (n.d.).

jury, and [would] be taking of its properties without due process of law and without due compensation..."<sup>68</sup> In support of its position Bell repeated many of the same claims, which it had made at the legislature -- that harm would be caused by connecting a technically inferior telephone network; a state agency could not order interconnection because it might interfere with interstate commerce and thereby violate article eight of the United States constitution; and that through interconnection the Independent would be able to identify the most frequently requested toll routes, and then selectively construct lines on these most profitable paths.<sup>69</sup>

Wisconsin Telephone also presented a more novel argument in these cases, one which the Supreme Court of the State found "logic[al]," but not compelling. Bell argued that with interconnection, its customers might disconnect service and only subscribe to the "home company" because of their desire to support small, locally owned companies. Furthermore, in the case of La Crosse, where only toll interconnection was requested, customers would migrate to the company with the larger customer base. If physical connection was required, toll calls could be made to customers on either network, but it would still be impossible to reach all local customers, who did not purchase dual service. Therefore, it would be sensible for customers to

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<sup>68</sup>Railroad Commission decision in "Winter," U-317, p. 2, WSHS.

<sup>69</sup>Wisconsin Telephone Company brief in "Winter," p. 4; "Winter," hearing May 27, 1912, tr. 57, 125, and 130.

switch to one company in order to obtain universal service. Since La Crosse Telephone was larger and since the primary reason for subscribing to Bell was its toll connections, Bell expected to lose most of its customers if interconnection was ordered. Wisconsin Telephone's vice-president testified that if interconnection was ordered, the subsequent loss of customers would make the firms plant "useless."<sup>70</sup>

In support of this last argument the Company provided data that showed the impact of interconnection on the Bell Telephone Company of Canada. After interconnection was ordered in eight cities, customers of Bell's competitor were required to pay a fifteen cent surcharge on all calls that went out on Bell's network. Despite the surcharge, Bell saw its positive growth in stations reversed, while its competitor continued to grow. Since the local companies continued to use Bell's toll facilities, Bell's toll business continued to expand after interconnection was mandated.<sup>71</sup>

The Wisconsin statute required that the Commission make three findings before it ordered physical connection:

- (1) that the connection is required by public convenience and necessity;
- (2) that it will not result in irreparable injury to the owner or other users of

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<sup>70</sup>162 Wisconsin Reports 383, 398, 156 N.W. 614, L.R.A. 1916E 748; "Winter," hearing May 27, 1912, p. 33 and May 28, 1912, pp. 135 (quote), and 163; Brief of Wisconsin Telephone Company in "Winter," p. 27; and "McGowan," hearing July 13, 1914, p. 7.

<sup>71</sup>"Winter," exhibit 106, and hearing May 27, 1912, p. 108.

the facilities of such public utilities; and (3) that no substantial detriment to the service will result therefrom...<sup>72</sup>

The Commission found the "term 'public convenience and necessity' [to be] indeterminate." Without offering its own definition of the term, the Commission found that interconnection was allowable under this clause because it would solve the problem of connecting together customers on the two systems.<sup>73</sup> The Commission also concluded that the equipment of the Independents and Bell were not incompatible and therefore that no technical harm would result from interconnection.<sup>74</sup>

The Commission believed that the property of Wisconsin Telephone could be protected if an appropriate charge for interconnection was established. Such a charge would "preserve

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<sup>72</sup>"Winter," decision May 14, 1913, p. 9.

<sup>73</sup>"Winter," decision May 14, 1913, pp. 4-5, 10. When the Supreme Court reviewed this case, it pointed out that no doubt physical connection would be convenient to the customers, but that convenience does not imply necessity. The court defined a necessity as something that was "indispensable," and physical connection did not meet this criteria. But in approving the Commission's decision, the court conceded that if this rigid construction of the word necessity was used, it would be unlikely that interconnection of any utilities would ever be order. The court therefore "constru[ed] necessity "to mean not absolute but reasonable necessity." Wisconsin Telephone Company v. Railroad Commission of Wisconsin and others, 162 Wisconsin Reports 383, 396, (1916).

<sup>74</sup>"Winter," decision May 14, 1913, p. 5. Also see testimony of Wisconsin Telephone's engineer L. Killam, hearing January 3, 1912, pp. 36-37; "McGowan," P.B. Turner to Commissioner Roemer, May 22, 1914; and Robert Conner et. al. v. J.C. March and Wisconsin Telephone Company, 6 Wisconsin Railroad Commission Reports, 589, 598-99 (1911).

the *status quo*," that is, help keep customers with their existing telephone company, including those who had a need for two telephones.<sup>75</sup> In turn, it asked La Crosse Telephone and Wisconsin Telephone to negotiate the appropriate toll charges. The parties were unable to reach an agreement, and the Commission was compelled to establish the rate.<sup>76</sup> It specifically rejected Wisconsin Telephone's proposal, which had been made under protest, of a fifty cents monthly customer charge for any customer who desired interconnection plus fifteen cents per originating or terminating toll message.

Instead, the Commission approved an originating call surcharge that was based on the distance of the toll call: five cents for calls of less than fifty miles, ten cents for calls of between fifty and hundred miles, and fifteen cents for any calls of greater distance. With respect to the petition from the citizens of Janesville, the Commission also had to establish a rate for local calls. They concluded that a charge of five cents per message would be sufficient to deter anyone who had service from both companies from discontinuing the service of either company.<sup>77</sup> The revenue collected from the surcharge was

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<sup>75</sup>"McGowan," p. 538.

<sup>76</sup>More recently, incumbent and entrants have been unable to reach private agreements and have found it necessary for the government to set the price of interconnection. Dawson Walker and Jonathan Solomon, "The Interconnection Imperative: 'E Pluribus Unum,'" Telecommunications Policy May/June 1993, pp. 257-80.

<sup>77</sup>The charge for local interconnection in Janesville was apparently based on the price of call from a pay station, five

transferred to the terminating customer's company.<sup>78</sup> Through this arrangement the Independents obtained some revenue for calls interconnected between the two networks -- a concern of the Independents since interconnection was first considered.<sup>79</sup>

The Commission realized that there might be some imperfections in the charges so it encouraged the companies to bring any problems to its attention if the charges did not provide adequate protection. Wisconsin Telephone was not satisfied with this arrangement or the other conclusions reached by the Commission in the La Crosse case, and therefore appealed the decision to the State Supreme Court. The court upheld the Commission. On the issue of protection of property the court held that "[t]he correctness of this [toll surcharge] should be

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cents. This rate had been recommended by Rock County Telephone. "McGowan," hearing July 23, 1914, p. 19.; "Winter," hearing October 13, 1913, p. 46; and Winter v. La Crosse Telephone Company and Wisconsin Telephone Company, 15 Wisconsin Railroad Commission Reports 36, 39-40, (1913).

The pricing structure adopted in these cases, one in which the customer paid more for a call that crossed networks than originated and terminated on the same network, was subsequently adopted in the Kingsbury agreement. The Kingsbury agreement, which only covered toll calls that were more than 50 miles in length, required the customer to pay a ten cents surcharge in addition to the regular Bell toll rate. Floyd Robert Simpson, "Monopoly Building Techniques, Costs, Prices and Market Structure in the Telephone Industry." Ph.D. dissertation, University of Minnesota, 1944, citing, Federal Communications Commission, Investigation of the Telephone Industry--Control of Independent Telephone Companies, Exhibit 2096D, pp.37-41.

<sup>78</sup>McGowan v. Rock County Telephone Company and Wisconsin Telephone Company, 15 Wisconsin Railroad Commission Reports 378, 383 (1914).

<sup>79</sup>C.W. Twining to J.C. Harper, August 22, 1899 and Harper to Twining, October 22, 1899, Dane County Telephone Company Papers.

subjected to the acid test of experience before it is condemned." If sufficient protection was not provided, either the courts or the Commission could be asked to revise the rates.<sup>80</sup>

The impact of physical connection on the business of Wisconsin Telephone and its competitors are shown on Tables 3 and 4. The initial decision in the La Crosse case was issued on May 14, 1913. The Commission's decision regarding the rate for calls between systems was issued August 20, 1914. Interconnection apparently began in November 1914, well before the State Supreme Court's 1916 ruling on the constitutionality of interconnection.

Wisconsin Telephone claimed that its subscription fell at La Crosse between 1910 and 1912 because it discontinued its unprofitable annual rate of a twelve dollars per telephone. Wisconsin Telephone's market share did fall after 1915, and partly in anticipation of greater losses, the firm proposed to sell its properties to La Crosse Telephone during the same year. Interconnection appears to have weakened Bell's market position and encouraged it to leave the city. The petitioner for interconnection, Frank Winter, attributed the sale to Bell's setback by the Supreme Court. The sale was not completed until late 1918.<sup>81</sup>

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<sup>80</sup>Ibid., p. 40; and Wisconsin Telephone Company v. Railroad Commission of Wisconsin and others, 162 Wisconsin Reports 383, 401-02, (1916).

<sup>81</sup>La Crosse Telephone Company to Railroad Commission of Wisconsin, June 24, 1915, La Crosse Telephone Company archives, La Crosse, Wisconsin; and Frank Winter, "The Fight for Physical Connection of Telephone Systems," La Crosse County Historical Sketches, series 4 (n.d), p. 71.

In Janesville the provision of physical connection does not appear to have had any adverse effect on the subscription level of either firm. The initial decision in the Janesville case was issued on June 3, 1914, and went into effect on November 1, 1914.<sup>82</sup> The data reported in Table 4 indicates that there was no major switch to the "home company," as Bell had feared. The flow of traffic between the two exchanges was relatively balanced; as shown on Table 5, there was slightly more traffic originating on Bell's and terminating on the Independent's exchange. When the data were collected, Bell had 2,363 lines-in-service, only 38 more than the Independent. In November 1921 the citizens of Janesville supported Wisconsin Bell's acquisition of Rock County, because they were dissatisfied with the charge for calls between the two systems.<sup>83</sup>

The different impact that physical connection had in the two cities may be attributed to two factors. First, in La Crosse only toll interconnection was ordered. Once customers of La

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As early as July 1913, prior to the physical connection of the two plants, but after the Commission had issued its decision in the Winter case, Wisconsin Telephone made plans to sell its La Crosse properties. Kingsbury to B.E. Sunny, President of Wisconsin Telephone, July 9, 1913, box 31, AT&TCHA.

<sup>82</sup>Sunny/Kingsbury, July 16, 1915, AT&TCA.

<sup>83</sup>Fred Howe to Wisconsin Railroad Commission, January 21, 1921, U-2311, series 1265, WSHS; and Roger Cunningham, City Attorney of Janesville to Wisconsin Railroad Commission, February 21, 1921 and Interstate Commerce Commission Finance Docket No. 162, November 15, 1921, Joint Application of Rock County Telephone Company and Wisconsin Telephone Company for Certificate that Acquisition Will be in the Public Interest, pp. 2-3 [70 Interstate Commerce Commission 636-638]; and Janesville Gazette, May 13, 1921.



Crosse Telephone gained access to Bell's toll network, they had less incentive to stay with Bell.<sup>84</sup> Unless their volume of toll calls were large, it was sensible to obtain service only from the Independent since that firm served the vast majority of the city.

At Janesville local interconnection was ordered by the Commission and therefore customers had less incentive to migrate to one company. Customers could have avoided the nickel surcharge on the interchange of local calls, if they all switched to the same system. Yet, at the time, it was not apparent which company would be chosen by most customers. Bell's larger market share favored a movement toward the incumbent, but there was also strong support for the locally owned firm. Second, unlike in La Crosse neither company had a clear advantage in terms of market share. It was the larger number of customers on the Independent's system in La Crosse and its short-haul toll network that perhaps best explains why its customer base grew after interconnection was ordered.

#### 6. Interconnection through Clearinghouses

Even without pressure by core business customers, Bell and independent companies would eventually have yielded to the demands for interconnection. Although our analysis casts doubts on whether universal service implied a natural monopoly, it does suggest that the alternative regimes brought an end to competition. The Bell System's unified governance structure

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<sup>84</sup>Sunny/Kingsbury, July 16, 1915, AT&TCA.

certainly solved the complex coordination problems of interconnection by enforcing standards and internalizing the systemic benefits of innovation.<sup>85</sup> Yet, without the threat of competition, Bell would again slight its more marginal customers by raising their relative rates and even "retreated" from rural markets.<sup>86</sup>

Mandatory interconnection assigned the task of coordination to regulatory authorities. In principle, this alternative would yield the mutual benefits of competition and greater access. In practice, however, it fell short of the mark. As the Wisconsin cases illustrate, authorities proceeded tentatively to avoid infringing on firms' prerogatives. They insisted on interconnection only where currently feasible, and set access fees to protect the investments of both parties.<sup>87</sup> Consequently, state intervention also produced a bureaucratic division of the market, although it did not endorse one standard over another.

The history of other network industries, notably surface transportation and banking, does offer an alternative model of

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<sup>85</sup>Alfred D. Chandler, Jr., The Visible Hand: The Managerial Revolution in American Business (Cambridge, MA: 1977), esp. pt II. See also Garnet, The Telephone Enterprise, ch. 9; and Lipartito, The Bell System, ch. 7

<sup>86</sup>Claude S. Fischer, "Technology's Retreat: The Decline of Rural Telephony, 1920-1940," Social Science History, 11 (1987), 295-327.

<sup>87</sup>Lipartito, The Bell System, 187-94, finds evidence of more aggressive action by state regulators in the south, but in most cases, regulators did not impose standards; Sylla, "Telephone and Telephone Regulation in North Carolina," 40-59; New York State Legislature, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 19-20.

interconnection. Fast-freight and railroad companies formed independent associations, which coordinated freight shipments across geographic and institutional boundaries.<sup>88</sup> In the case of the railroads, these agreements also promoted standardization (of gauges) and innovations (such as air brakes and signalling devices) that accelerated the through shipments of freight and rolling stock. These associations also displayed a singular tendency to collude, affirming Adam Smith's admonition about the mingling of capitalists.

Despite differences in technology (which in the modern information era, have diminished), the banking industry may provide a more instructive example. In many respects, telephone companies and banks faced the same economic problem, coordinating flows over space and through a dual industrial structure. The solution in both cases involved the formation of hierarchical networks, an ascending succession of hub-and-spoke systems centered around local, regional, and national metropolises. In banking, however, state and federal regulations prohibited branching and so precluded the first model of corporate organization.

As an alternative, large, money center banks orchestrated a national system of clearing and financial intermediation by forming independent clearinghouse associations and establishing non-exclusive correspondent relationships with smaller, "country"

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<sup>88</sup>See, for example, Chandler, The Visible Hand, 124-43.

banks.<sup>89</sup> Urban clearinghouses, in effect, corresponded to a tandem switch, mediating transactions between member banks (i.e., central offices) within the metropolitan area and region.<sup>90</sup> Correspondent relations, the functional equivalent of Bell's sublicense agreements, handled longer distance transactions. Clearinghouses mediated these relationships, only when they involved banks in other large urban centers.

Through the clearinghouse, competing banks effectively delegated the ownership and control of a critical bottleneck facility, the clearinghouse, to a joint venture. In this way, they cooperated to realize the external economies of a more integrated financial network. Moreover, by joining forces, they also minimized the cumulative impact of systemic disruptions, such as bank runs. In a rare display of openness, they even granted the association access to their books, which contained confidential information about customer relationships.

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<sup>89</sup>On urban clearinghouses, see James G. Cannon, Clearing Houses, 61st Congress, 2nd Session, Senate Document 491 (Washington, D.C., 1910); Gary Gorton, "Clearinghouses and the Origins of Central Banking in the United States," Journal of Economic History, 45 (1985), 277-84; Charles Goodhart, The Evolution of Central Banks (Cambridge, MA, 1988), 71-73. On the correspondent system, see John James, Money and Capital Markets in Postbellum America (Princeton, 1978), 89-148; and Michael Conzen, "The Maturing Urban System in the United States, 1840-1910," Annals of the Association of American Geographers 67 (1977), 92-104.

<sup>90</sup>Extending the analogy, like densely travelled routes in the network, large banks serving complementary markets might bypass the clearinghouse and clear their balances directly. This structure of ATM networks clearly displays this parallel; Steven C. Salop, "Deregulating Self-Regulated ATM Networks," Economics of Innovation and New Technology, 1 (1990), 85-96.

Equally important, instead of exclusive correspondent relationships, money center banks vigorously competed to expand their customer base among country banks. Needless to say, they frequently complained about "ruinous" competition, precisely because it widely diffused the benefits of an integrated financial. These more flexible relationships fostered the expansion banking services in peripheral regions and enabled country banks to respond elastically to the seasonal demands of their clientele.

At the same time, we do not mean to idealize the clearinghouse arrangement. To many contemporaries and students of the industry, these associations regulated competition in large urban centers and their financial hinterlands.<sup>91</sup> Wielding their members' vast resources and access to bottleneck facilities, they could set prices and compel compliance. These associations were also vulnerable to forms of "bypass" or competition through financial innovations, which escaped their purview. These gaps could impair the integrity of the network, as evidenced by the impact of trust companies during the Panic of 1907.<sup>92</sup> Thus, clearinghouse associations did not dispense with

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<sup>91</sup>See for example U.S. Congress, House Subcommittee on the Committee on Banking and Currency (Pujo Committee), Investigation of Financial and Monetary Conditions in the United States (Washington, D.C., 1913).

<sup>92</sup>Jon Moen and Ellis W. Tallman, "The Bank Panic of 1907: The Role of the Trust Companies," Journal of Economic History, 52 (1992), 611-30.

the need for state regulation to curb their market power and to manage innovation and structural change.

Despite the potential drawbacks, the clearinghouse model represented an intriguing and, we believe, tractable alternative organization of the telephone network. Clearinghouse arrangements could have supplanted AT&T and coordinated the flow of traffic between independent companies, within and between city boundaries. Moreover, instead of a private or public bureaucracy setting standards, the association could have performed this task as well. Yet, to insure efficiency and open access, this system would have required both self- and state regulation of companies' joint ventures and private, correspondent relationships.

As further support of our counterfactual, we find a precedent in the early competitive period itself. Independent companies formed toll associations, joining their local systems into larger regional and even national networks. To insure the seamless flow of traffic through the network, the association established efficient procedures for "checking" and routing traffic and rationalized the rate structure.<sup>93</sup> Lacking the power to mandate these changes, it diffused technical information to members through trade journals and annual conventions. Additionally, by developing the market for toll traffic, the

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<sup>93</sup>J.W. Thill, "Iowa's Telephone Clearing House," Telephony, 16 (November 28, 1908), 537-40; and Franklin H. Reed, "The Nebraska System--A Guaranteed Business," Telephony, 19:25 (November 18, 1910), 763-70.

clearinghouse may have induced companies to invest in a network of copper wire circuits.

The independent associations also developed a system for the division of toll revenue. Although not as arcane as today's separations procedures, their method compensated local companies for their contribution to providing long-distance service. Typically, the originating exchange received 25 percent of revenue, and the rest was divided among interexchange carriers on the basis of relative mileage.<sup>94</sup> The terminating company received no additional revenues.

Local and toll Independent carriers determined these rates to provide financial incentives for companies to join the network coalition. The 25 percent revenue allocation to the originating exchange was not based on any cost analysis, despite the clear exchange related costs associated with providing toll service.<sup>95</sup> The mechanism for sharing revenues was instead the result of a bargaining process, based on the mutual advantage of

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<sup>94</sup>Contract between Knapp Telephone Company and Wisconsin Telephone Company, November 19, 1914, and contract between Knapp Telephone Company and Tri-State Telephone Company, December 11, 1914. General Telephone Company Papers, Wausau, Wisconsin. Also, see testimony of L.F. Silverthorn before the Wisconsin Railroad Commission, July 15, 1915. Docket U-811, p. 13. Footville Historical Society, Footville, Wisconsin.

Bell only paid the exchange carrier fifteen percent of the originating revenue. Where an exchange carrier had a choice of routing toll traffic to a destination either over the Independents or Bells network, they chose the former because of the higher compensation. "Winter," hearings, January 3, 1912, pp. 109, 117, and 125.

<sup>95</sup>These included billing and some operator functions, and also upgrading the network to insure technical compatibility with the more demanding standards of the toll network.

interconnection. The interexchange carriers depended on independent exchanges for originating and terminating calls. Exchange carriers, in turn, gained valuable access to more distant points, and so could charge higher rates to their core customers as well as earn dividends from the toll traffic.

A hybrid institution, telephone clearinghouse ultimately foundered, in part because of ambivalent state policies. As noted above, the associations' exclusive access clauses were vulnerable to anti-trust challenges. Their dubious legal standing made it difficult to attract financing and to prevent defections. Ironically, state and federal authorities displayed greater tolerance of Bell's exclusive contracts, at least until 1912, and in this way contributed indirectly to the restoration of its monopoly. Thus, either due to inclination or expediency, state authorities opted for the first model of corporate organization. In this way, state policies precluded the third alternative, which we believe would have yielded the benefits of both interconnection and competition.

#### 7. The Efficient Pricing of Interconnection

The experience in Wisconsin illustrates some of the pitfalls of legislation mandating interconnection. Mandatory interconnection had the potential to end competition. It essentially eliminated Wisconsin Telephone's main strategic advantage in toll service. Vertical integration had allowed Bell to extract the rents associated with technological innovation.



As the firm extended and improved its toll network, it was able to raise its monthly subscriber fee. After mandated interconnection, customers could choose the firm which provided the best value in terms of the fixed monthly fee, and still have access to customers on the other network.

Thus, interconnection promoted an outcome, in which the most efficient local exchange company served the market, rather than the local exchange which was part of the vertically and horizontally integrated Bell System.<sup>96</sup> In turn, the profits from improving and extending toll service could only be recovered through long distance rates. To the extent that Bell was unable to extract all the profits through its toll rate schedule, the gains were shared by the Independents and consumers. Although beneficial to some, the dissipating of rents may have reduced Bell's incentive to innovate.

The Regulatory Commission also faced difficulties in setting access charges. On the one hand, the Commission felt that it was obligated to set a price that would not encourage customers to

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<sup>96</sup>The sharing of rents may impede innovation in an industry. In setting the rates for interconnection, regulators must trade-off the potential dynamic gains of innovation that result from rent seeking behavior of innovators, with the dynamic gains from rivalry. To date, the federal government has concluded that the gains from rivalry overwhelm whatever reduced incentives to innovate an incumbent faces when the market is transferred from a monopoly to oligopolistic market structure. This issue was litigated in the 1974 anti-trust case. More recently, the Federal Communications Commission endorsed the gains from rivalry in its decision to approve local interconnection. Federal Communications Commission, In the Matter of Expanded Interconnection with Local Telephone Company Facilities, CC Docket No. 91-141, Released October 19, 1992, paragraph 2.

disconnect service with either firm.<sup>97</sup> On the other hand, it did not want to set a price that would discourage customers from using the physical connection. If the price were too high, the intended public convenience of physical connection would not be realized. If a price existed which would have achieved this balance in La Crosse, it was difficult to locate. The regulators apparently did not discover it when they first set the price. Because of its concern that no such price could be set, Wisconsin Telephone felt a need to sell off its exchange property.

Wisconsin Telephone's exit from La Crosse is most startling in a light of the Commission's and the State Supreme Court's concerted effort to maintain the "*status quo*."<sup>98</sup> Today, maintenance of the status quo remains on the regulatory agenda. Commissions still face the statutory obligation that rates must be fair, reasonable, and afford investors an opportunity to earn a reasonable return.<sup>99</sup> Now however, the debate on how to maintain the *status quo* is focusing more on ways to maintain the flow of funds from high-volume business-users to network customers who generate less revenue, as well as to cover fixed and uneconomic costs, and high-cost areas. The low volume users not only require fewer lines and make fewer calls, but they have

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<sup>97</sup>"Winter," decision May 14, 1913, p. 9; McGowan, p.538.

<sup>98</sup>"McGowan," p.538.

<sup>99</sup>Federal Power Commission v. Hope Natural Gas 320 U.S. 591 (1944).

less need for the wideband and broadband services which the local exchange companies are introducing.

As at the turn of the century, the development of the network was most easily financed, if local exchange carriers were able to practice price discrimination -- charging a premium price to business-customers in order to promote development in the residential community. But this type of pricing is difficult to sustain, if interconnection is based on the cost of an end-user or competitive access provider connecting to the local exchange carrier's network. If the price of interconnection to a local exchange company's network is based just on the cost-of-service, its competitor will not be making a contribution to the extension of service to the less intensive users of the network.<sup>100</sup>

Baumol and Willig, as well as Kahn, have proposed that this problem be remedied by pricing interconnection on a residual basis. An interconnecting firm would have to pay the local exchange company the retail price for service, less the costs avoided because competitive access providers' facilities are used for a portion of the call.<sup>101</sup> The interconnection fee proposal

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<sup>100</sup>Gerald Brock, "Interconnection Conditions, Access Charges, and Universal Service," Paper Presented at the Telecommunications Policy Research Conference, October 4, 1993.

<sup>101</sup>William J. Baumol and Robert D. Willig, "Economic Principles for Evaluation of the Issues Raised by Clear Communications Ltd. on Interconnection with Telecom Corporation of New Zealand, Ltd." (August 1992); and Affidavit of Alfred Kahn, cited in Federal Communications Commission, In the Matter of Expanded Interconnection with Local Telephone Company Facilities, CC Docket No. 91-141, Released October 19, 1992, paragraph 123.

is designed to recover the opportunity cost associated with tying together networks. This pricing scheme, which Baumol and Willig refer to as efficient component pricing, is viewed by the proponents as encouraging optimal use of society's scarce resources because

...the supplier of such a product component...[is] *indifferent* [original emphasis] as to whether the other components of the final product are provided by itself (that is, the traffic is carried entirely over its own lines, from origin to destination), or whether, instead, those remaining components are supplied by others (the traffic is carried over a joint route operated in part by competitors). This criterion follows the well-known economic principle that efficiency requires the price of a product to cover its full incremental cost, *including its opportunity cost* [original emphasis]--that is, the cost in terms of the component's net contribution to revenues forgone because the component has been made available to a competitor.<sup>102</sup>

This method, which has been the basis for interexchange access rates in Maine, has been much criticized.<sup>103</sup> MCI has

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<sup>102</sup>William J. Baumol and Robert D. Willig, "Brief of Evidence: Economic Principle for Evaluation of the Issues Raised by Clear Communications Ltd. on Interconnection with Telecom Corporation of New Zealand Ltd.", paragraph 47 (August 1992).

<sup>103</sup>Interconnection charges are set "in an amount approximately equal to the amount recovered through retail rates

argued that the efficient component pricing rule "inhibits competition because it virtually forces every interexchange carrier to mirror" the rates of the local exchange company.<sup>104</sup> Furthermore, to the extent that the current contribution from a toll call results in the incumbent earning monopoly profits, or helps cover the expense of inefficient operations or poor investment decisions, nothing in the efficient component pricing plan will correct this inefficiency. In part because of the threat that "the inclusion in any access levy of a monopoly profit component..." may harm an entrant, the New Zealand Court of Appeal recently rejected efficient component pricing.<sup>105</sup>

Some advocates of efficient component pricing agree with the Court's concern and have argued that a local exchange company should not be allowed to collect revenues that exceed the stand-alone cost of production.<sup>106</sup> If stand-alone cost is used as a price ceiling, the regulated utility would be limited to earning

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minus the local exchange carriers's marginal costs." Maine Public Service Commission, Chapter 280, "Provision of Competitive Telecommunications Services," November 14, 1991, p.3.

<sup>104</sup>MCI adds that by setting the interconnection price at the local exchange carrier's price less the costs that the local exchange carrier avoids "is unworkable in practice because of the bewildering variety of prices and discounts" for toll service offered by a local exchange company." Exceptions of MCI to Hearing Examiner's Decision, Maine Public Service Commission, Investigation into New England Telephone Company's Cost of Service and Rate Design, Docket No. 92-130, p.4.

<sup>105</sup>Clear Communications, Ltd. v. Telecom Corp. of New Zealand, C.A. 25-93, slip op. at 33 (December 17, 1993).

<sup>106</sup>Baumol and Sidak, Toward Competition in Local Telephony, p. 108; 140-41.

a competitive return on its investment. We agree with Baumol and Sidak that the opportunity cost of interconnection, as well as the stand-alone cost of production, should be taken into account in the setting of the price of interconnection.<sup>107</sup>

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<sup>107</sup>In this era of declining costs, limiting revenue to the stand-alone cost of production may result in an economic revenue requirement that is less than the firm's revenue requirement. Since regulated utilities are given the opportunity to earn a fair return on their historical investment, the difference between current revenues for voice services, and the stand-alone cost of production, may have to be collected from auxiliary services. There may also be a need to adjust local exchange carriers' book assets to reflect the economic cost of production.

TABLE 1  
Intra-Metropolitan Toll Traffic: New York City, 1914

Value of Toll Traffic Between Zones (in dollars)

Source of Call

Destination	Manhattan	NE Brkln	S Bronx	Zone 3	Zone 4	Zone 6	Zone 9	Zone 8	Zone 7	Zone 10	Zone 11
Manhattan	0.0	683079.9	0.0	20212.7	50663.3	55210.8	68625.7	24171.5	34943.9	58850.3	4820.0
NE Brooklyn	752016.9	0.0	67424.9	2665.2	0.0	0.0	13772.0	37321.4	11691.1	7941.5	868.7
South Bronx	0.0	57265.3	0.0	0.0	5528.3	7800.1	14222.8	2467.0	4758.3	5043.9	557.8
Other Zones	323059.9	81246.2	54279.1	2182.6	8914.6	5319.3	5197.8	12002.0	9510.0	2958.9	192.8
Total	1075076.8	821591.4	121704.0	25060.5	65106.2	68330.2	101818.3	75961.9	60903.3	74794.6	6439.3

Share of Traffic Destined to Manhattan and Brooklyn

Source of Call

Destination	Zone 1	Zone 5	Zone 2	Zone 3	Zone 4	Zone 6	Zone 9	Zone 8	Zone 7	Zone 10	Zone 11
Manhattan	0.0%	83.1%	0.0%	80.7%	77.8%	80.8%	67.4%	31.8%	57.4%	78.7%	74.9%
NE Brooklyn	70.0%	0.0%	55.4%	10.6%	0.0%	0.0%	13.5%	49.1%	19.2%	10.6%	13.5%
Subtotal	70.0%	83.1%	55.4%	91.3%	77.8%	80.8%	80.9%	81.0%	76.6%	89.3%	88.3%
Next Largest	7.6%	7.0%	18.1%	1.9%	8.5%	11.4%	14.0%	6.7%	7.8%	6.7%	8.7%
Total	77.6%	90.1%	73.5%	93.2%	86.3%	92.2%	94.9%	87.7%	84.4%	96.0%	97.0%

Note: The area of each zone is given under the destination column

Source: New York State Legislature, Joint Committee to Investigate Telegraph and Telephone Companies, Final Report, 148-49.

TABLE 2				
Business and Residential Rates: Before and After Entry				
		Mean Minimum Rates		
Company	Competitive Conditions	Business	Residential	Ratio
Before entry, 1894				
Bell	Monopoly	\$68.10	\$56.00	0.82
After Entry, 1909				
Bell	Monopoly	\$36.00	\$23.75	0.66
	Competitive	\$41.25	\$22.80	0.55
Independents	Competitive	\$37.15	\$23.25	0.63
Notes: Ratio equals residential/business rates. Sources: Annual Report of the AT&T Company, 1909, 25-28.				

TABLE 3					
Market Shares in La Crosse: Before and After Mandated Interconnection					
Year	Number of Subscribers			Market Share	
	Wisconsin Bell	La Crosse Telephone	Total	Wisconsin Bell	La Crosse Telephone
1910	1855	2996	4851	38.2%	61.8%
1911	1780	3355	5135	34.7%	65.3%
1912	1480	3817	5297	27.9%	72.1%
1913	1384	4201	5585	24.8%	75.2%
1914	1089	4911	6000	18.2%	81.9%
1915	828	5137	5965	13.9%	86.1%
1916	779	5687	6466	12.0%	88.0%
1917	835	6078	6913	12.1%	87.9%
1918	583	6126	6709	8.7%	91.3%
1919	0	6574	6574	0.0%	100.0%
Sources: Annual Reports of Telephone Companies, series 1337, box 76, 77, 171, and series 1345, WSHS.					



TABLE 4

Market Shares in Janesville: Before and  
After Mandated Interconnection

Year	Number of Subscribers			Market Share	
	Wisconsin Bell	Rock County	Total	Wisconsin Bell	Rock County
1910	1320	1864	3184	41.5%	58.5%
1911	1390	1905	3295	42.2%	57.8%
1912	1769	1938	3707	47.7%	52.3%
1913	1985	1942	3927	50.5%	49.5%
1914	2189	2043	4232	51.7%	48.3%
1915	2281	2108	4389	52.0%	48.0%
1916	2410	2081	4491	53.7%	46.3%
1917	2398	2026	4424	54.2%	45.8%
1918	2409	1976	4385	54.9%	45.1%
1919	2761	2057	4818	57.3%	42.7%
1920	3133	2147	5280	59.3%	40.7%
1921	5019	2126	7145	70.2%	29.8%
1922	4209	0	4209	100.0%	0.0%

Notes: Wisconsin Bell acquired Rock County Telephone on November 30, 1921. The former's 5,019 customers in 1921 includes the 2,126 subscribers of the latter.

Sources: Annual Reports of Telephone Companies, series 1337, box 170, and series 1345, WSHS.

TABLE 5

Interchange of Traffic in Janesville under  
Mandatory Interconnection

Originating Network	Terminating Network	Number of Calls
Toll Calls		
Independent	Bell	156
Bell	Independent	204
Local Calls		
Independent	Bell	839
Bell	Independent	900
<u>Sources:</u> AT&T Archives, box ??, Sunny- Kingsbury (16 July 1915).		

Figure 1: Average Exchange Revenues and Costs in the Bell System

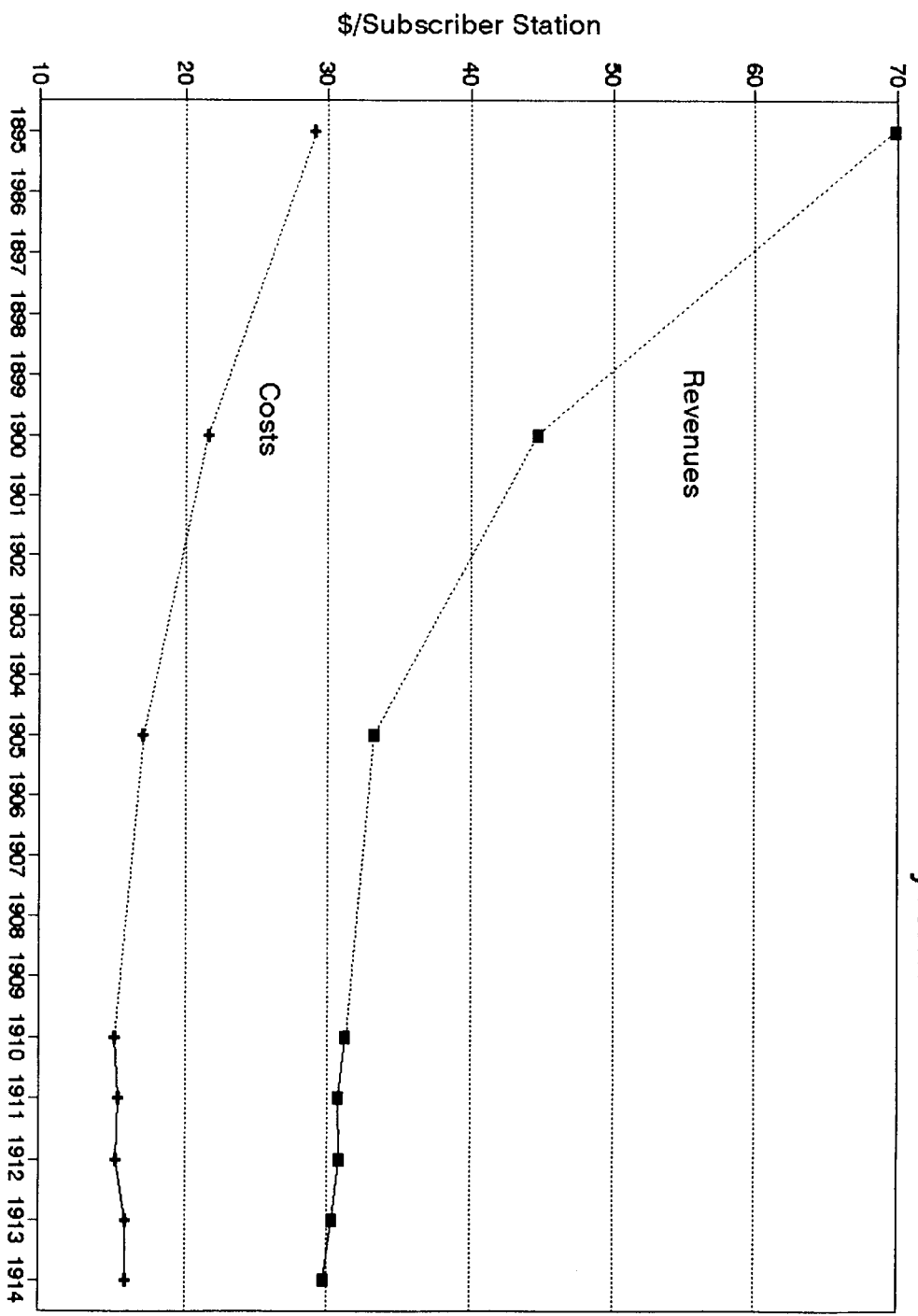


Figure 2: Telephone Development,  
1880 - 1930

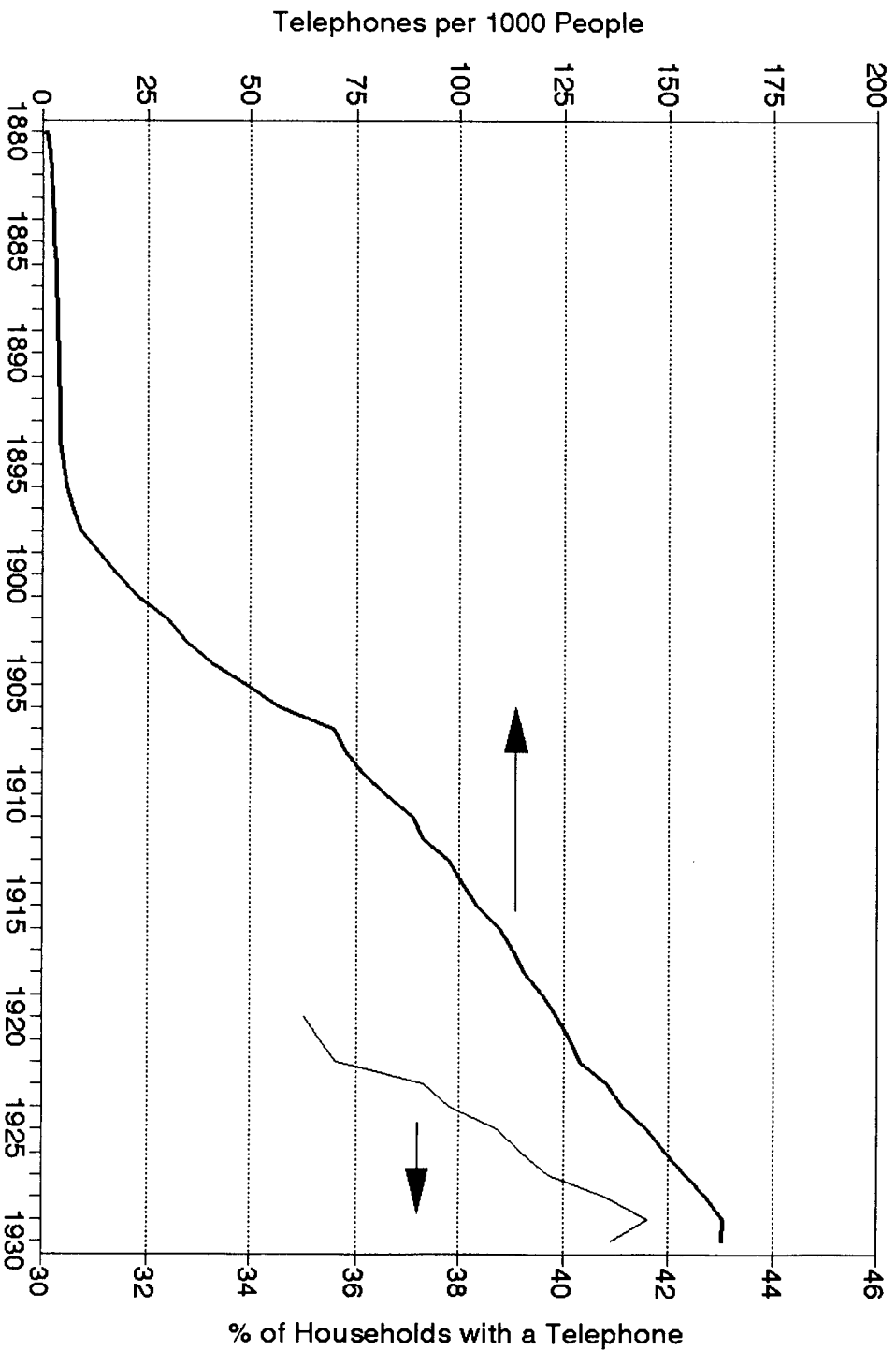


Figure 3: Bell's Market Share,  
1880 - 1930

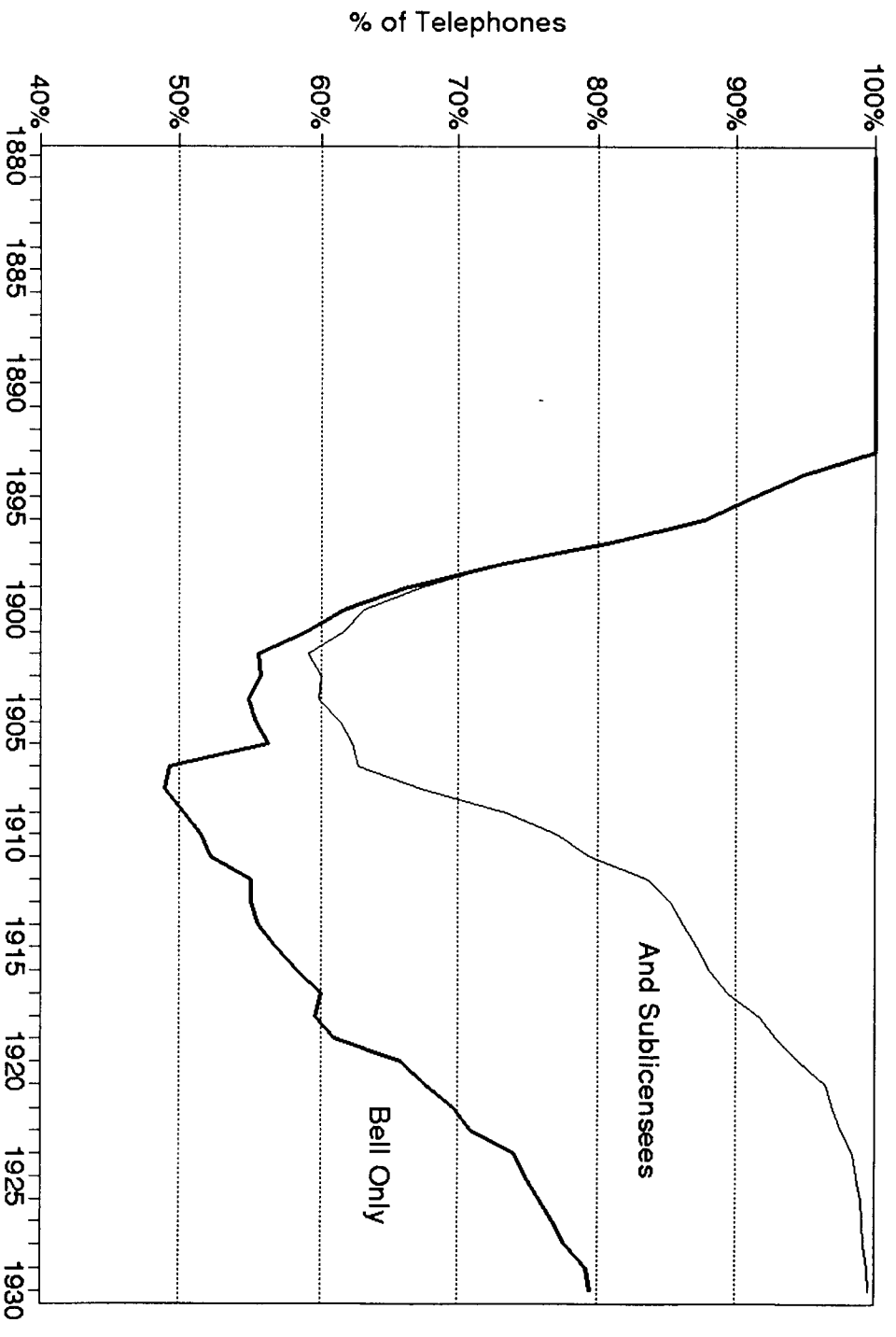


Figure 4: States Mandating Interconnection

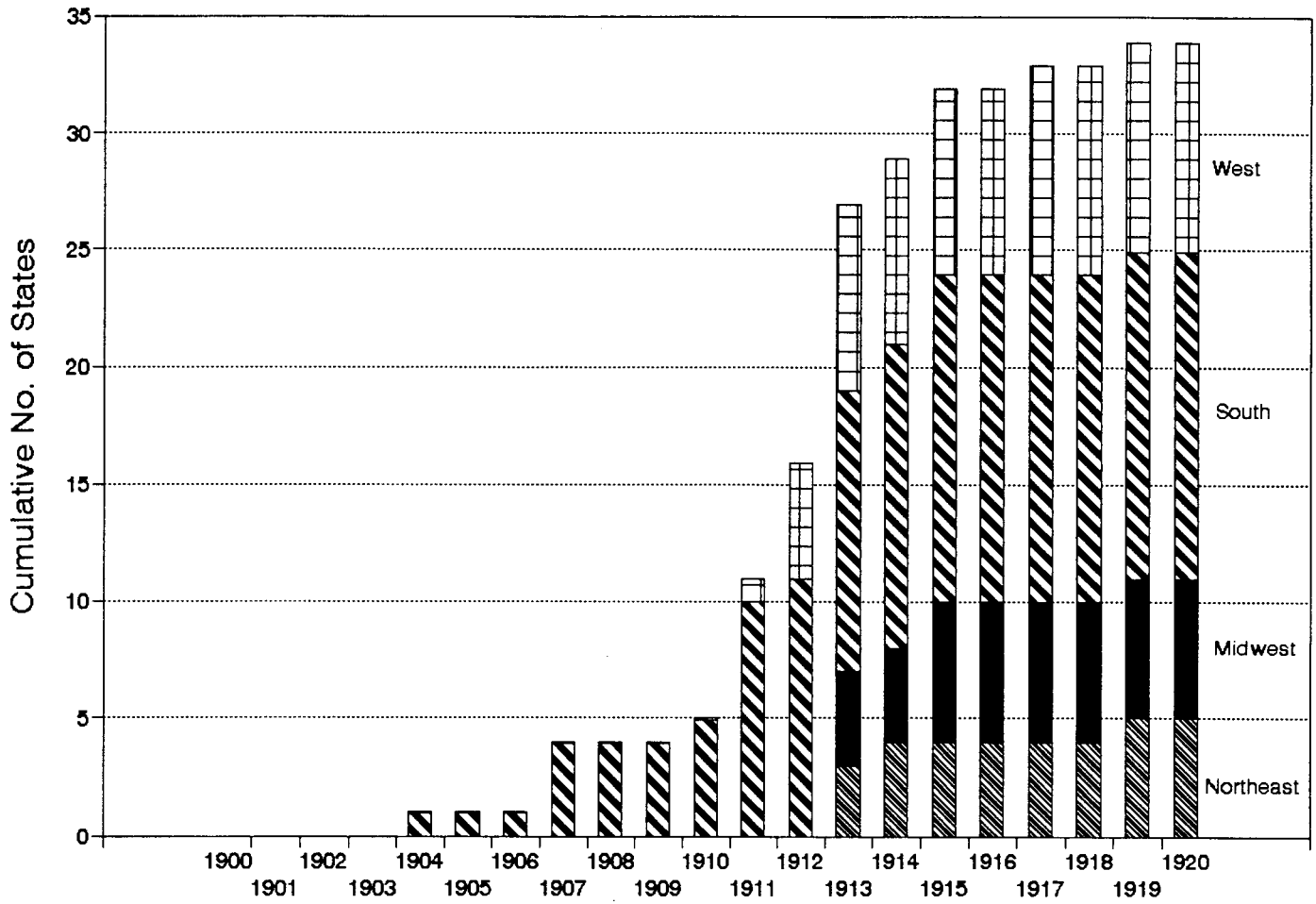


Figure 5: Frequency of Local Calling by Business Class

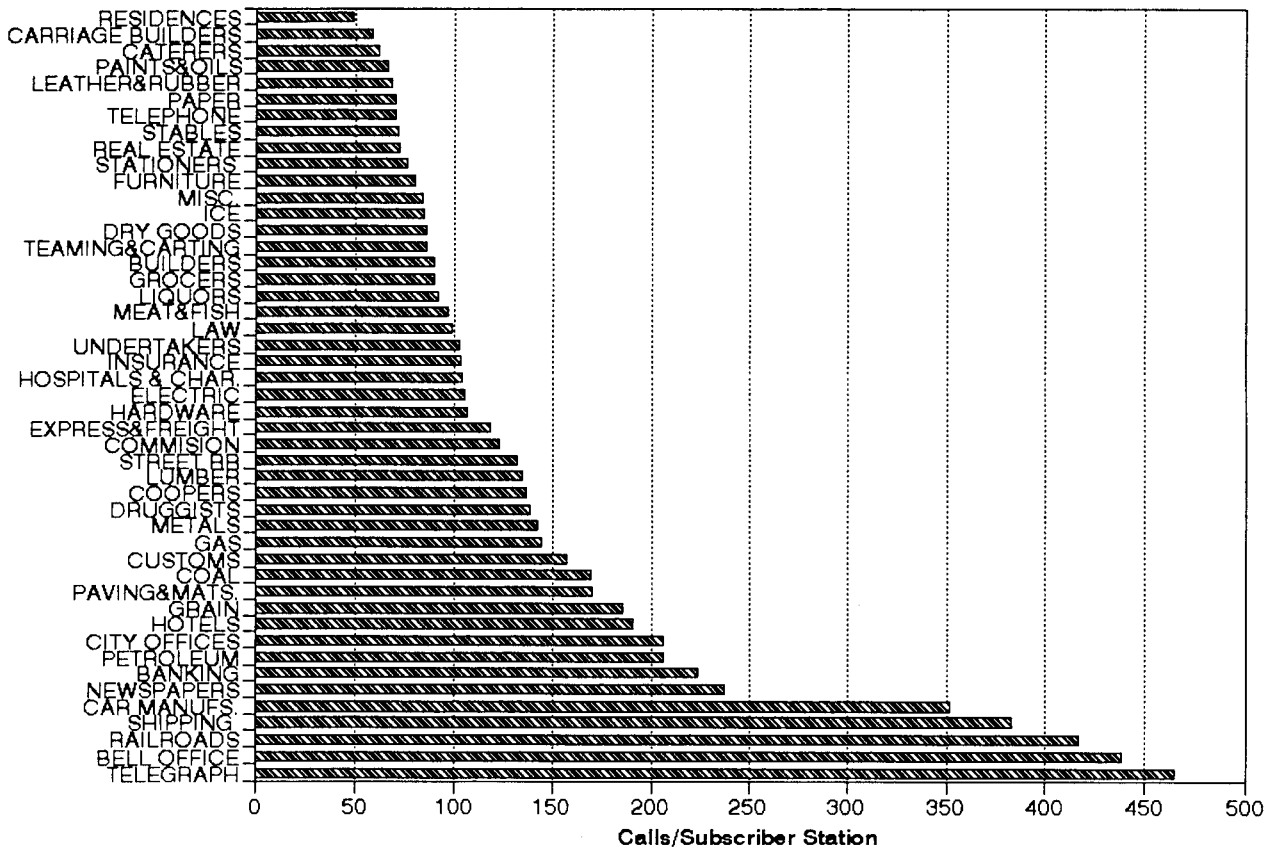


Figure 6: Percentage of Subscribers by Number of Stations Called

