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**Telecommunications Regulation in U.S. States:
Its Rise and Impacts in the Early Twentieth Century**

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* I thank Laura Goodman and Katrina Kosec for excellent research assistance. Kosec, especially, is to be commended for her careful and detailed reviews of AT&T's 1911 and 1913 regulatory surveys. I also thank Bob Hahn for useful comments. Any mistakes, however, are solely those of the author.

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Scott Wallsten

1. Introduction

The last two decades of the 20th century witnessed dramatic changes in telecom sectors around the world. Prior to 1980 only the United States, Canada, the Philippines, and a handful of Caribbean countries had privately owned telecommunications firms operating under government regulation. For the most part, in the rest of the world telecommunications services were provided by government-owned monopolies. But by the year 2000 more than 80 countries had at least partially privatized these companies, and more than 100 had established a telecommunications regulatory authority.¹ Research has consistently found robust evidence that competition is the most effective mechanism for improving telecommunications services, but building regulatory institutions that effectively promote competition has proven challenging. Countries trying to build new agencies face questions of how to balance independence, accountability, and transparency in addition to issues related to regulations themselves such as pricing, interconnection, and facilities sharing. Indeed, even the United States and other countries with more regulatory experience still grapple with these issues.

While the recent growth in the number of new regulatory agencies around the world is spectacular, it is not the first time that a large number of new regulators emerged on the scene. In particular, in the 19th century American states began building regulatory agencies with oversight over railroads. Telephone regulation *per se* did not exist at the time in the United States—or anywhere else in the world, for that matter. Indeed, the U.S. Federal Communications Commission was not established until 1934. But beginning in the early 1900s states began building on their experience regulating railroads and moved towards regulating utilities. States proceeded either to establish new telephone regulatory authorities or extended the railroad commissions' authority to telephone services. In 1902, only one state had an agency with the authority to regulate telephones, but by 1913, 39 states had such agencies.

The relatively quick rise of state telephone regulation had the potential to affect the industry's development, yet to my knowledge there is no empirical analysis of it. In 1911 and

¹ All statistics in this paragraph are derived from ITU (2001).

1913 AT&T, however, increasingly subject to state regulation, conducted extensive surveys of state regulators and compiled detailed information on regulatory structures and regulations. The U.S. Census, meanwhile, gathered detailed information on the telephone industry in 1902, 1907, and 1912. These two sources make it possible to test the effects of regulation on the early development of the telephone industry.

In addition to being an interesting historical study, this paper complements contemporary work in several ways. First, it may provide useful evidence for building regulatory institutions in developing countries. Even in 1900 the United States was relatively wealthy, with average annual nonfarm earnings—in 2005 dollars—of around \$10,000 and farm earnings of close to \$4,000, but the country bore many similarities to developing countries today.² The population was primarily rural, with less than 40 percent of residents living in urban areas. Life expectancy was short, averaging only about 47 years (Bureau of the Census 1975). In addition, in 1902 the U.S. had, on average, only about three telephones per hundred people, and the United States had little regulatory capacity or experience on which to draw. A study over US states also means that the cross-sectional institutional environments are more homogenous than in a typical cross-country analysis. This homogeneity makes it less difficult to identify the effects of differences in regulatory approaches.

Second, focusing on the industry at a time when fixed costs were higher than they are today potentially makes the results more generalizable to other sectors. That is, competition in telecommunications services succeeds today at least in part because fixed costs—especially in wireless services—have declined so dramatically. Research on telecommunications covering a time when fixed costs were high may make it possible to generalize the results to industries today where technological change has not been as dramatic as in telecoms and where fixed costs (in at least parts of the sector) remain high, such as electricity.

Finally, state (and local) governments still regulate many aspects of telecommunications and other utilities. Despite their near ubiquity, there is little empirical work on the effects of state and local regulations, especially with regards to telecommunications.³ This paper adds to the small empirical literature on the effects of subnational regulations.

² Note that these earnings are average for *employed* workers, meaning that *per capita* income was lower.

³ Wallsten (2005) studies state policies and broadband penetration; Kim and Buckley (2004) provide an overview of current state telecom regulations.

The remainder of the paper describes in detail these regulatory agencies based on the information in AT&T's surveys, examines empirically their impact on telephone development, discusses and concludes.

2. Regulation and Competition in Early 20th Century

The late 19th and early 20th centuries saw tremendous change in the industrial organization of the telephone industry. Bell's patent expired, leading to intense competition and then later to consolidation as Bell acquired the independent telephone companies and moved towards becoming a legally protected, regulated monopoly. Meanwhile, states became more assertive in controlling large players in the economy, starting with railroad regulation and moving steadily into other utilities.

While there is little empirical research on early telephone regulation in the U.S., several studies have used time-series data to examine the effects of competition on U.S. telephone development. In particular, growth in telephone penetration increased dramatically once Bell's telephone patent expired in 1894 and competition became legal (Gabel 1994; Gabel 1969; Jayakar 1999). Gabel (1969) notes that not only did the annual growth rate in the number of telephones increase from 6.3 percent between 1885-1894 to 20-30 percent between 1805-1905, prices fell by nearly half.

Research on early European telecommunications reaches similar results. At the turn of the 20th century, many European countries allowed private firms to provide telephone service, some—the Scandinavian countries in particular—allowing multiple private providers and intense competition between them. Other countries, including France, Germany, and Switzerland, had state-owned monopolies from the start. In a recent paper, I compiled data on telephone penetration, prices, and license provisions in the late 19th and early 20th century to test the effects of ownership and competition. I found that telephone penetration (even in rural areas) was higher, and prices lower, under private competition than under state-owned monopolies (Wallsten 2005).

State regulators

Ideally, economic regulation works in the public interest by efficiently correcting market failures (Pigou 1938). But achieving that goal in practice is never simple. The mechanics of regulation are complicated. For example, regulators possess less information than the firms they regulate, and regulations often have unintended consequences that can offset intended benefits from regulation. In addition, the very presence of a regulator that can affect investment, prices, and entry into a market means that various groups will lobby the regulator to make decisions in their favor.

Interactions with industry and other groups is not inherently bad—after all, the regulator requires information from the regulated industries as well as input from consumers, perhaps through their elected representatives. But this close and constant contact with interest groups can generate negative outcomes. On one hand, a regulator can be captured by a regulated firm (Stigler 1971), so that the regulations primarily protect the firm by blocking entry. On the other hand, regulators—in response to public or political pressure—may expropriate a firm’s assets by setting prices too low or making other unreasonable demands of the firm (de Soto 1989; Djankov, *et al.* 2002; Emery, *et al.* 2000; Friedman, *et al.* 2000).

U.S. States’ experience with building regulatory agencies exhibits aspects of all these theories of regulation. States first created regulatory agencies with authority over railroads. Kanazawa and Noll (1994) explored the state railroad regulators, which came into existence somewhat earlier. They found general support for the public interest theory of regulation—rural communities tended to favor regulation, while communities with no rail service tended to oppose it, thinking it would delay service. They also found that regulation did not seem to inhibit investment and that it lead to lower prices (Kanazawa and Noll 1994).

After 1900 states began extending the authority of their regulatory agencies beyond railroad regulation to utilities.⁴ The creation of state regulatory agencies was a response to a combination of factors. Corruption and the perceived indifference of large corporations to consumer welfare generated political pressure for government control and even ownership of large firms and utilities (e.g., Glaeser and Shleifer 2001). In response to the growing call for

⁴ Several reports detail the development of individual state public utility commissions. All show a similar chain of events, beginning with railroad regulation in the middle- to late-1800s, followed by electricity and gas in the early 1900s, and finally also including telephone and telegraph (e.g., Bailey 1964; Blackford 1994; Dearstyne 1994; Fisher 1933; Hellebrandt 1933; Lapp 1911; Moline 1984; Read 1998; South Dakota Public Utilities Commission 1994).

government intervention, utilities lobbied for state regulations, viewing state governments as more likely to be friendly than local governments (e.g., Troesken 2005). As Cohen (1994) noted, “State regulation was looked upon as the more appealing alternative because it was thought to be the most conservative form of regulation and would be least onerous, especially compared to municipal regulation, which was often seen as radical.”

While Troesken (2005) notes that “Although utilities supported state regulation because they believed it would undermine the onerous policies of local regulators, it is important to be clear that in a perfect world they would have preferred to have been subject to no rate regulation whatsoever.” Bell, however, seems to have had an even more favorable view of regulation, seeing it as a way to ensure a government-sanctioned monopoly. Cohen (1994) notes that telephone regulation in the U.S. resulted from complex interactions between government, firms, and different groups of consumers, but that AT&T ultimately preferred regulation to competition. Mueller (1997) explores AT&T’s drive to consolidate all telephone service into a single company and how some regulators were sympathetic to this view.

Describing state regulators and regulations

To be effective, regulatory agencies should generally meet several criteria.⁵ Noll (2000) argues that they should be independent of political pressure, transparent, accountable, and able to make informed decisions. These many criteria are necessary because regulatory agencies are in the unique position in democratic societies—and especially in the United States—of not only making laws (regulations), but also enforcing them and often being the first point of appeal for any party that disagrees with the agencies’ rulings. Moline (1984) notes in a history of the Kansas State Corporation Commission that “since agencies are often investigator, prosecutor, judge, jury and executioner, the hallowed notion of separation of powers seems consistently breached.” Indeed, the problem of inadequate checks and balances inherent in independent regulatory agencies remains inadequately resolved today. Furchtgott-Roth (2006), for example, argues that the lack of separation of powers inherent in the FCC inevitably leads to poor decision-making and inefficient outcomes.

⁵ Regulations can be divided into governance and content (Levy and Spiller 1994). *Governance* includes rules regarding regulatory decision-making and the organization (e.g., Levy and Spiller 1996; Williamson 1996). *Content* includes the specific laws and policies regarding pricing, competition, access, and investment.

Identifying how well regulatory agencies meet these criteria is difficult. For example, how, exactly, does one identify a regulator as being independent of political pressure? Despite the imprecision, it is possible to identify aspects of a regulatory agency that help it meet particular criteria. NERA (1997), for example, conducted surveys of selected infrastructure utility regulators in six countries.⁶ The 12 surveys elicited responses that NERA then interpreted and graded, providing a kind of “scorecard” of regulators. Wallsten, et al, (2004) surveyed telecommunications and electricity regulators in developing countries to create a database of regulations.

These were not the first efforts to survey regulators regarding their governance and regulatory content. In 1911 and 1913 American Telephone and Telegraph (AT&T) found itself increasingly subject to regulation and began to compile details of the various state regulatory authorities with which it had to contend (American Telephone and Telegraph 1911; American Telephone and Telegraph 1914).⁷ AT&T’s diligent work a century ago makes it possible to categorize then-new state regulatory boards according to the criteria that even today many believe are important in establishing effective regulators.

AT&T’s documents presents the data as written descriptions of regulations and regulatory agencies. I developed a list of questions regarding governance and content based in part on the surveys used in Wallsten, et al (2004), and we answered those questions from the information in the AT&T documents.⁸ Categorized in this way, it is possible to begin empirically exploring the data. Table 1 presents some information about regulatory governance in each state, while Table 2 highlights some of each state’s regulatory content.

Figure 1 shows, as Cohen (1994) notes, that southern states tended to be the first to establish agencies that regulated the telephone industry. Moreover, as Figure 2 shows, regulators were more likely to be elected in the South than in other parts of the country, where they tended to be appointed. Being elected is likely to make regulators more accountable to voters and more independent from other parts of the political process, since they are not beholden to a governor

⁶ NERA’s (1997) The survey covered electricity, gas, telecoms, transport, and water in Bangladesh, India, Indonesia, Malaysia, Pakistan, and the Philippines. They did not cover all industries in all countries, so the total number of surveys was 12.

⁷ Note that the 1911 volume covers regulations in force on November 1, 1911, and the 1914 document covers regulations in force on November 1, 1913.

⁸ I thank Katrina Kosec for her diligent and careful mapping of text into quantifiable data. To the list derived from AT&T’s reports we added some additional information from Cohen (1994), who compiled additional regulatory information from a 1910 report issued by the New York State legislature.

or legislature for their position. However, regulatory agencies in the South tended to be less transparent than elsewhere, as Figure 3 demonstrates. Less than one-quarter of southern regulatory agencies were required to hold public hearings and less than 10 percent made their reports public. Public reports were not common anywhere, but while no Western states mandated public reports from their regulators, every Western state mandated that hearings should be open to the public.

And while they were less transparent, southern regulators were not given as many tools with which to do their jobs. As Figure 4 shows, fewer than half of regulators in the South had the right to inspect a utility's property, and less than a quarter had free access to those facilities (though all states had the right to inspect firms' financial information).

Southern states, moreover, did not appear to be especially active regulators, at least judging by the types of regulations they promulgated. On one of today's most controversial issues—mandatory sharing of equipment by incumbents with entrants—southern states were relatively non-interventionist. Figure 5 shows that not a single state in the South required telecom firms to “jointly use and maintain telephone poles, conduits, or other equipment if they have lines on the same street.” However, Figure 6 demonstrates that while less than one-fifth of southern states required “that all entrants receive the same technical terms and conditions for access/interconnection,” according to Cohen's (1994) tabulation, only the northeastern states were more likely than southern states to mandate interconnection. Even so, mandatory interconnection was not the norm—only about a quarter of southern states and all states that had regulators required it.

Finally, southern regulators appeared less willing than others to influence industry concentration (Figure 7). Less than 10 percent of southern states required regulatory approval for telephone firms to merge, and only about 15 percent required regulatory approval for a telephone firm to buy stock in another company.

In at least one area, though, Southern states were active. 75 percent of states in the South regulated telephone rates, compared to less than 20 percent of states elsewhere (Figure 8). Without more information, though, it is not possible to determine how regulators used this power. It is possible that firms with market power could lobby them to set a high price, making it impossible for entrants to compete on price. It is also possible that regulators would want to set a low price. Given that regulators in the South tended to be elected and that one aspect of

telephone service consumers could easily monitor is the price, it is likely that regulators would have wanted to keep prices low.

Census of telephones

Today, the International Telecommunications Union (ITU) tracks country-level telecommunications data, which has been widely used by researchers studying telecom reforms.⁹ The United States Bureau of the Census collected state-level data on telecommunications through a special census of telephones and telegraphs in 1902, 1907, and 1912. Each Census report contains, among other information, by state and firm (Bell or Independent) data on telephone subscribers, telephone traffic, firm capitalization, operating expenses, number of rural lines, and employment and salaries. The Census did not collect all the data for all three years, complicating the analysis, as discussed below.

Figure 9 shows the number of telephones per capita for 1902, 1907, and 1912. For the first two years it also shows the number of Bell and Independent phones per capita. Figure 10 presents the same information, but separately for each region. The figures show the quick growth of telephone penetration, nearly tripling over the decade. They also show that penetration was not even across the country. Not surprisingly, the relatively poor South had the lowest telephone penetration rate, while the West and the Midwest had the highest. In the Midwest, moreover, the Independents had more telephone subscribers than did Bell.

3. Analysis and Results

These data, combined with historical state-level demographic data readily available from the U.S. Census Bureau, allow me to test the effects of competition and regulation on the development of the U.S. telephone industry. Most empirical work on telecommunications in developing countries attempts to identify correlations between industry structure (e.g., whether the incumbent telecom firm is private and the extent of competition) and the extent of telecommunications investment (typically proxied by the number of mainlines) at a country level. These studies also control for per capita income, population, and, when possible, fixed effects (e.g., Li and Xu 2001; Ros 1999; Wallsten 2001). This paper follows the same general approach.

⁹ See, for example (Garbacz and Thompson 2005; Li and Xu 2001; Ros 1999; Wallsten 2001; Wallsten 2005).

The data allow me to estimate regressions of the following form to explore the effects of regulation and competition:

$$(1) \quad y_{it} = \beta_0 + \beta_1*(competition_{it}) + \beta_2*(regulation_{it}) + \beta_3*Z_{it} + \gamma_i + \delta_t + \varepsilon$$

where i indicates a state, t indicates the year (1902, 1907, and 1912). In other words, I will exploit the panel nature of the data to allow for variation across states (i) and over time (t). Z includes state-level controls such as per capita income and urbanization, while γ_i and δ_t indicates state and year fixed effects, respectively. The richness of the data allow me to estimate several versions of equation (1) using different indicators of telephone development (y_{it}) and $regulation_{it}$. As discussed below, I test the effects of several aspects of state regulations.

Table 2 shows the results of estimating a version of equation 1, where y_{it} is first the number of telephones per capita, and then the number of “talks” per capita. In this case, $regulation_{it}$ is a vector of a number of regulatory variables, including whether the state regulates telephones, the age of the regulatory agency, whether “all entrants [must] receive the same technical terms and conditions for access / interconnection, or that the commission determines those terms / conditions / rates to ensure that they are not discriminatory,” whether interconnection is mandatory, rates are regulated, and whether the regulator must approve mergers. The data are from 1902, 1907, and 1912 and the analysis includes year and state fixed effects. Unfortunately, I have information on competition only for 1902 and 1907, making it impossible to include here. I estimate those effects separately below.

For robustness, I estimate the equation with each regulatory variable by itself, and then include them all simultaneously. The table shows that having a regulator is correlated with fewer telephones per capita and fewer talks per capita—the older the regulator, the bigger the effect. The interconnection and price regulation variables are not significant. The coefficient on the variable indicating that firms cannot merge without regulatory approval, however, is positive and significant on the number of telephones, though not statistically significant on the number of talks.

The magnitudes on these coefficients are not small. During this time period there were only about 0.06 telephones per capita in the U.S. (growing from 0.03 in 1902 to 0.09 in 1912). The coefficient on the presence of a regulator suggests that a state that had regulated telephones

for ten years, for example, would have 0.03 fewer telephones capita. States that required regulatory approval for firms to merge, however, had, on average, 0.03 more telephones per capita.

Tables 3 and 4 show the results of estimating a similar model that also includes a measure of competition. The measure is a Herfindahl-Hirschman Index (HHI) calculated from the share of Bell telephones and Independent telephones in a state. Because it counts all non-Bell phones as a single company it probably overstates industry concentration. Unfortunately, though, the Census tabulated data by company only in 1907 and 1912, meaning that the analysis can only use two years of data when including the HHI. With only two years of data there are fewer degrees of freedom and less variation over time, making fixed effects potentially problematic. As a result, I estimate each equation twice: once with state fixed effects and once without state fixed effects but including instead income per capita, the share of the state's population that is urbanized, and region fixed effects.¹⁰ As above, all the regressions include year fixed effects.

The results are similar, though not identical, to those discussed above. Competition, as measured by the HHI is correlated with industry improvements. In particular, the more concentrated the industry in a state-year, the fewer telephones per capita and fewer talks per capita. Notably, the competition variable tends to be statistically significant in the regressions with state fixed effects, but not quite significant at conventional levels without the state fixed effects. The presence of a regulator is, as above, negatively correlated with telephone growth, but is not consistently statistically significant. Similar to the results above, regulatory approval of mergers is positively correlated with the number of telephones and talks per capita, but is statistically significant only when including the state fixed effects. Mandatory interconnection is positive in these regressions, but only statistically significant when the state fixed effects are not included.

4. Discussion and Conclusion

This analysis suggests that the effects of regulation on development of the telephone industry were mixed. On the one hand, the presence of an official regulator seemed to slow

¹⁰ The income variable is unfortunately somewhat problematic. Personal income by state was available from the IRS only as early as 1916, meaning that income does not vary over time and is not even for the correct year in the analysis. Per capita income in a state in 1916 is surely correlated with income in 1907 and 1912, so it is an appropriate proxy for income at that time. Even so, these discrepancies may explain why the variable is not significant in the regressions, which are nonetheless robust to its inclusion or exclusion.

telephone penetration. On the other hand, some regulations regarding firm conduct appeared to encourage investment. In particular, requiring regulatory approval for mergers was generally correlated with faster growth, and some evidence suggests that interconnection mandates also encouraged growth. Combined with regression results showing the strong benefits of competition between the Independents and Bells on penetration rates, the apparent positive impacts of merger regulations may show how certain regulations helped promote competition, and therefore industry growth. In particular, during this time period AT&T began a strategy of buying competing firms in its quest to monopolize telephone provision. Regulatory barriers to this objective may have helped maintain competition, at least for some time.

But why does the presence of a regulator itself appear to have negative impacts on telephone growth? This result is confusing given that no particular regulation (that we observe) had strongly negative impacts on growth. One possible answer is that the result merely reflects endogeneity: states with lower telephone penetration were the ones more likely to establish regulatory agencies. Indeed, at least part of this observation is correct. As discussed earlier, southern states tended to be the first to regulate telephones and they had the lowest telephone penetration. The analysis, however, controls for state fixed effects, which should control for this particular form of endogeneity.

Another possible explanation for the negative impact of regulatory authorities is that the new presence of a regulator slowed growth by changing the rules of the game. This change could have come about in two ways. First, firms that had previously operated in a largely unregulated environment were confronted with new laws that differed across states and could change over time. The costs of dealing with these new laws may have slowed growth, as might the uncertainty of a new legal regime. Second, these new regulatory agencies presided over the consolidation of the industry into a monopoly under AT&T. To the extent that regulators aided the creation of a monopoly, they would have helped reduce growth by eliminating competition.

The descriptive statistics derived from AT&T's survey data show that regulatory regimes differed substantially across states. Southern states were more likely than others to elect their regulators, but once elected southern regulators were not required to operate as transparently as in other states. They did not generally have to hold public hearings or publish reports. They also required little of the telephone companies they regulated, except that they were more likely to regulate their rates than were other regulators.

Overall, the analysis demonstrates that the new state regulatory agencies established at the beginning of the twentieth century differed substantially from state to state, both in terms of their governance and content. Their impacts on telephone development were mixed. The presence of a regulator slowed growth, and this effect appeared to be more pronounced the longer the regulator had existed. Some particular regulations, such as those that required regulatory approval for telephone companies to merge, however, appeared to have positive impacts on telephone growth, perhaps by helping to extend the period of competition between Bells and Independents.

Figures

Figure 1

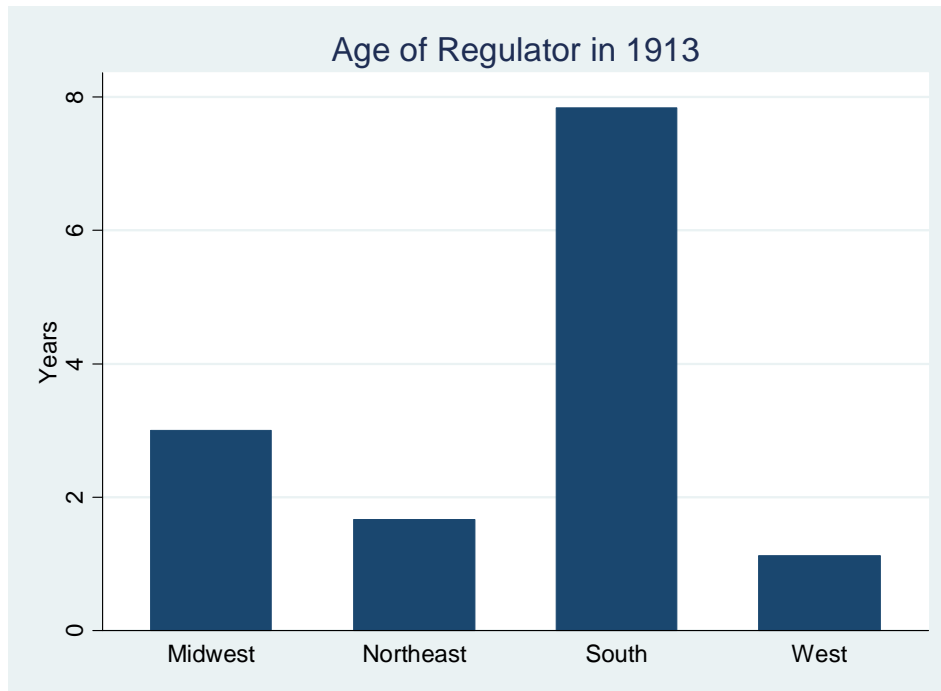


Figure 2

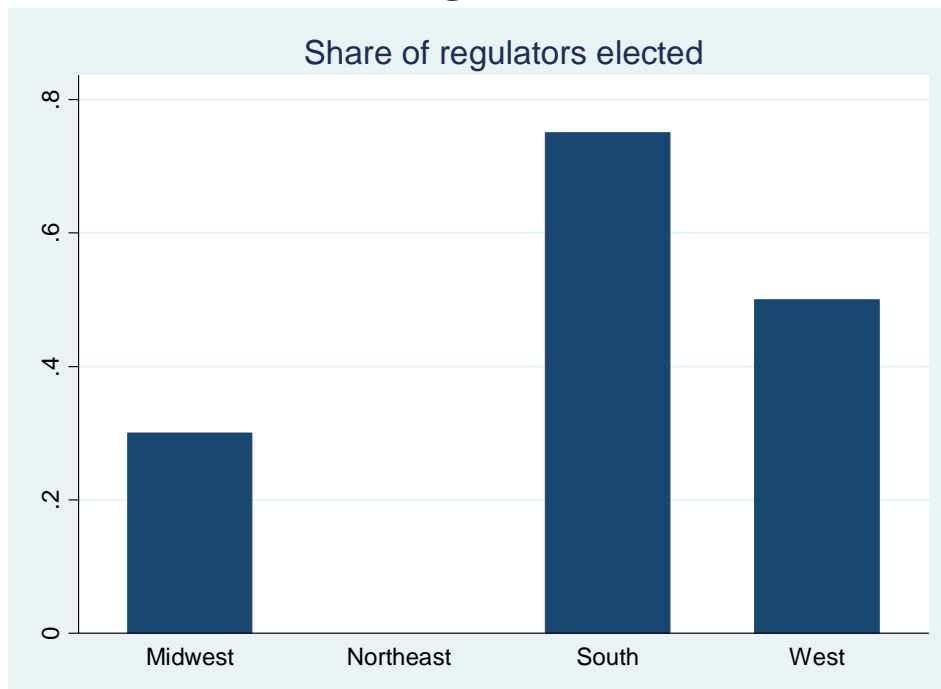


Figure 3

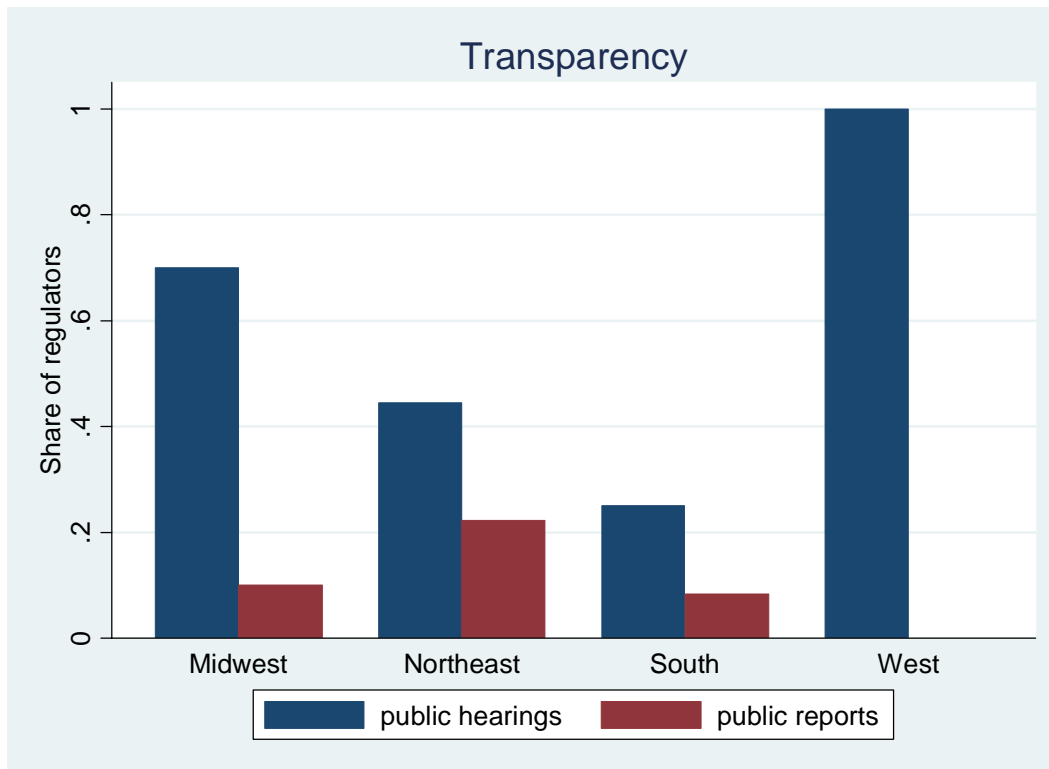


Figure 4

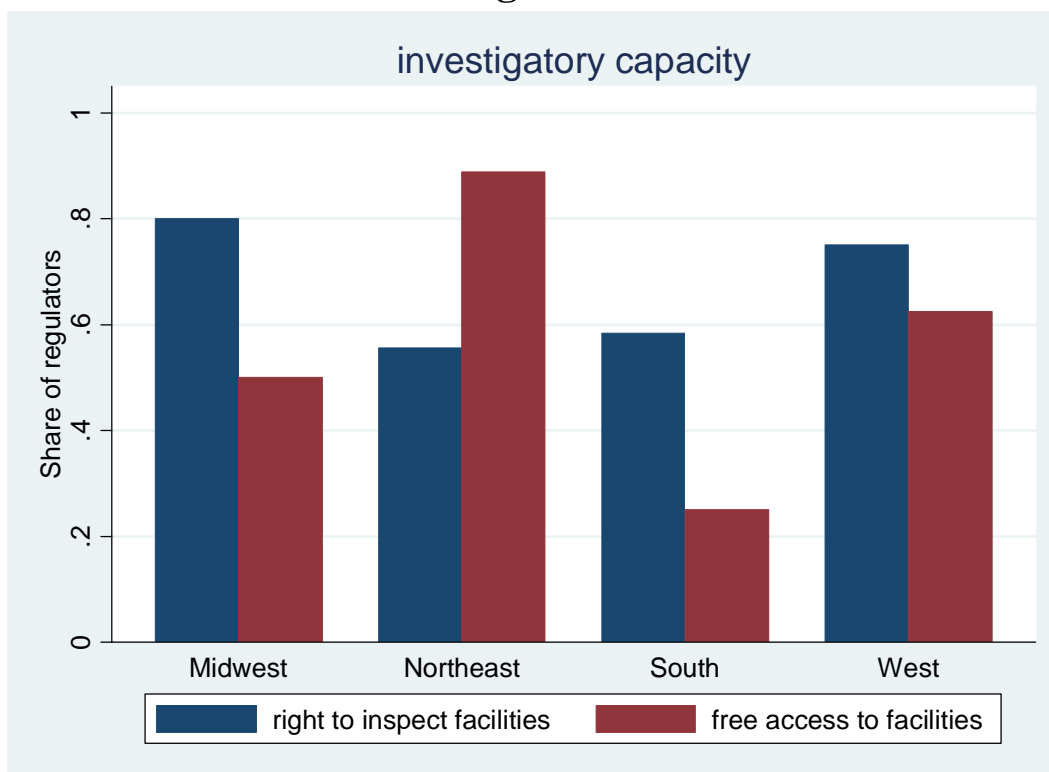
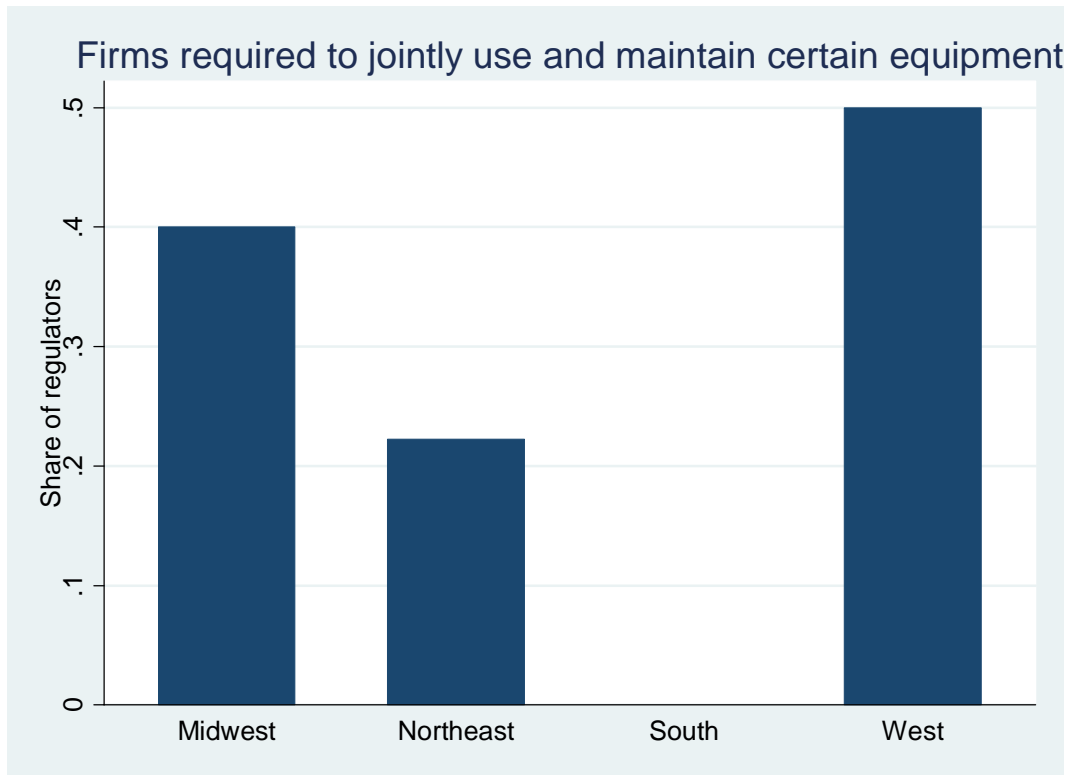


Figure 5**Figure 6**

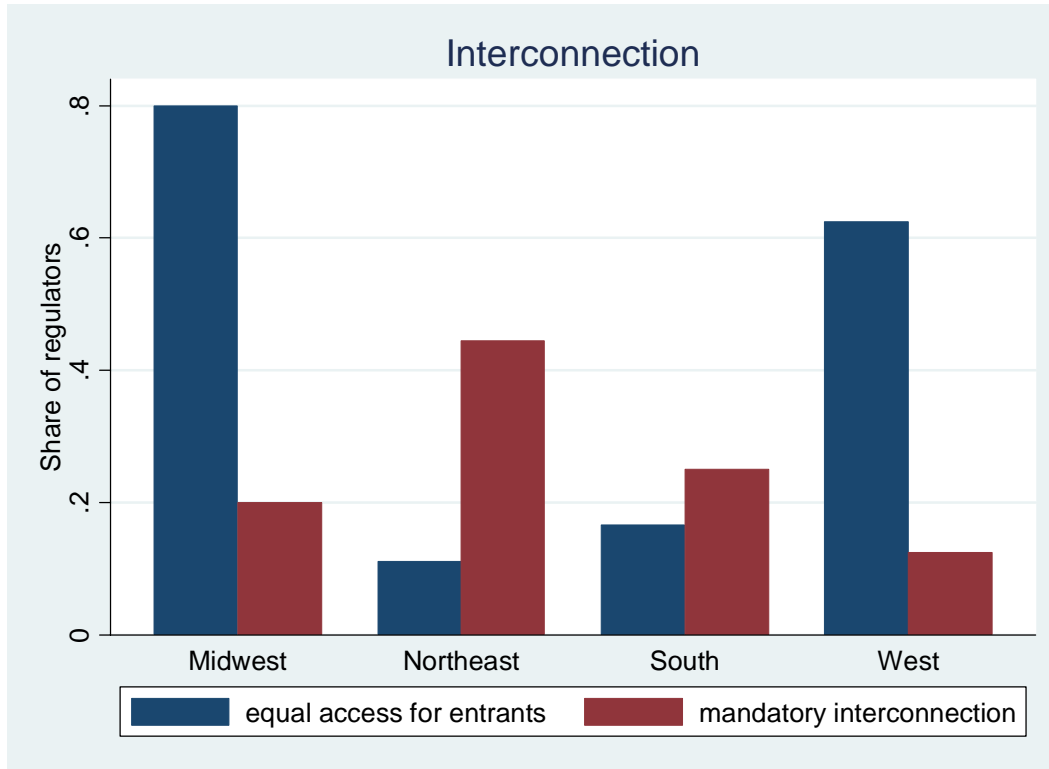


Figure 7

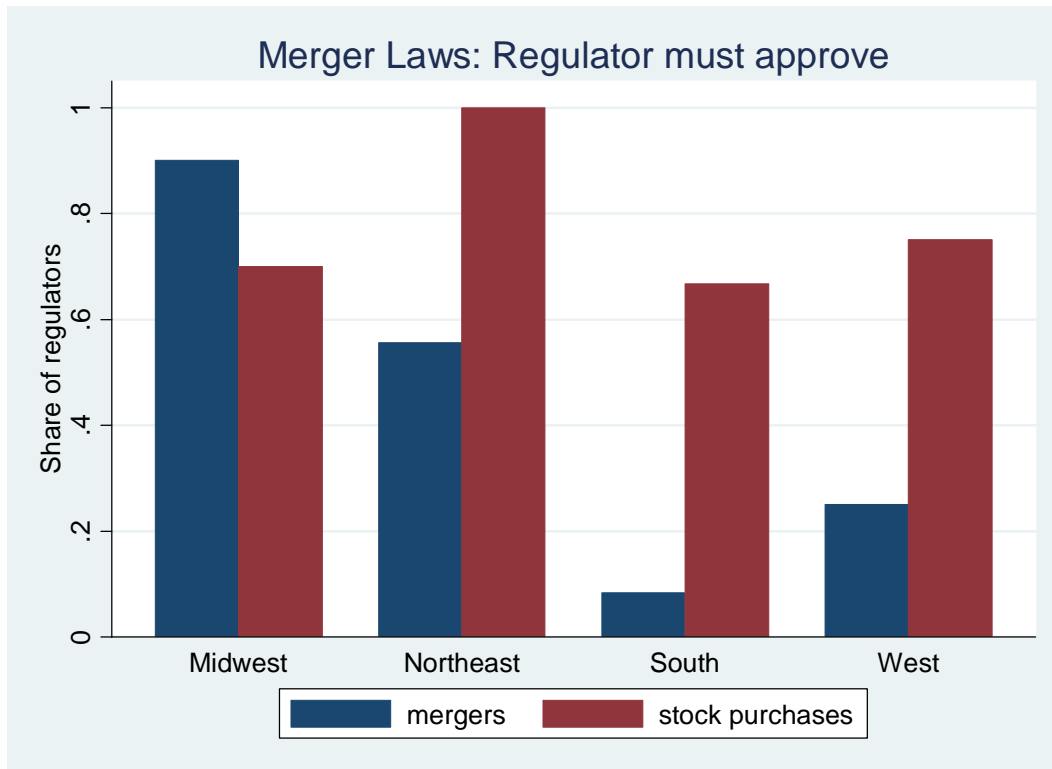


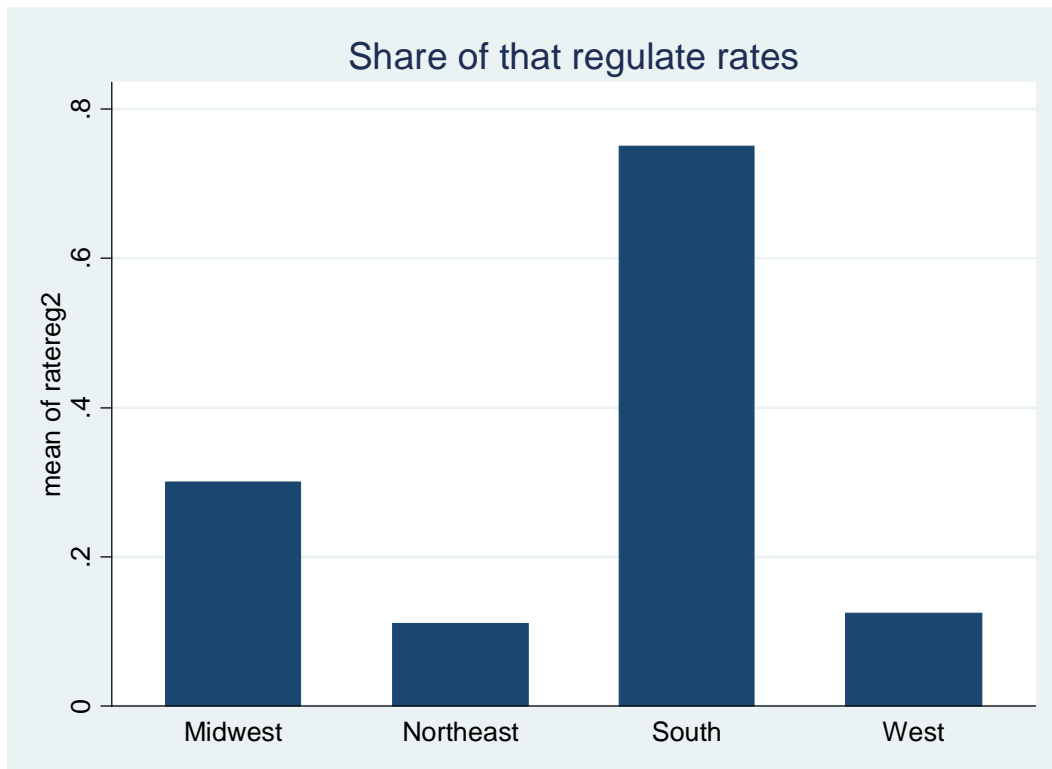
Figure 8

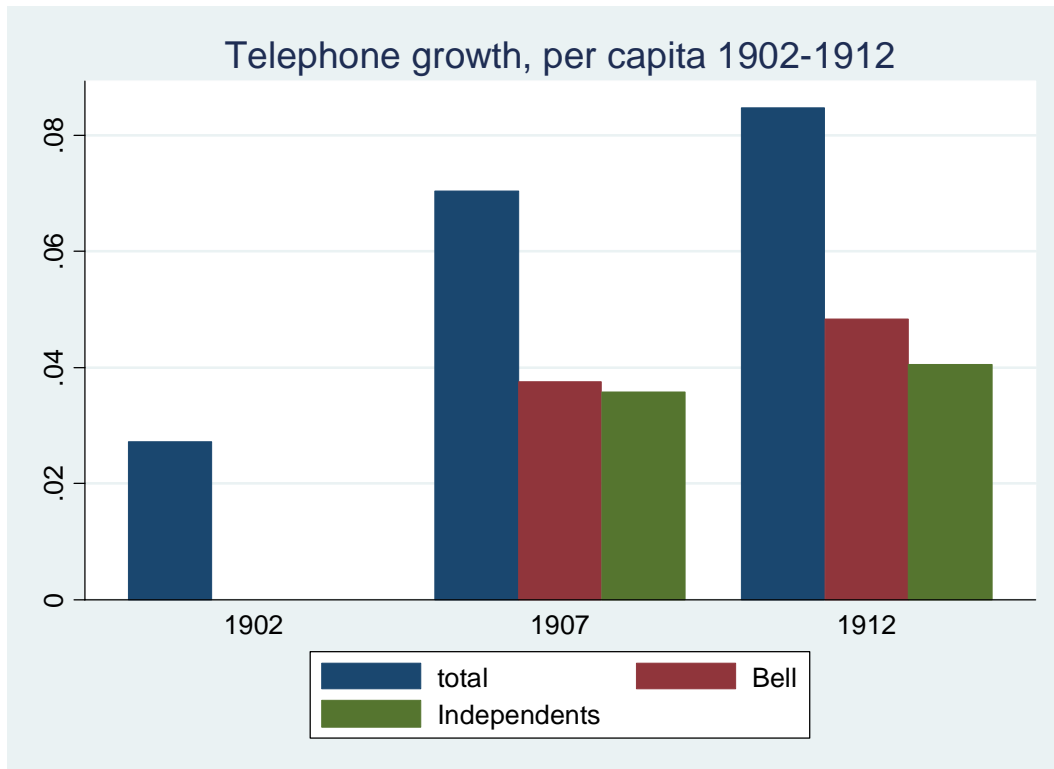
Figure 9

Figure 10

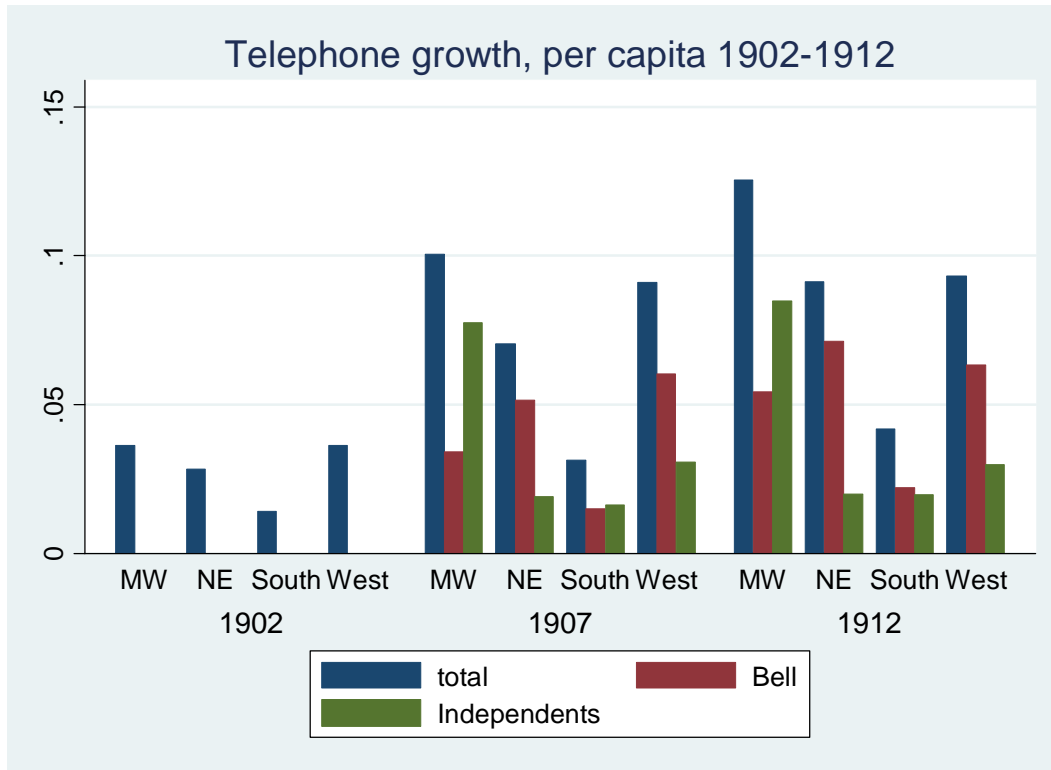


Table 2
Regulation and Telephone Development, 1902-1912

	phones per capita							number of talks per capita						
State regulates telephones	-0.005 (0.87)	-0.006 (0.90)	-0.016 (2.36)*	-0.008 (1.26)	-0.002 (0.34)	-0.006 (0.88)	-0.02 (2.21)*	-11.39 (1.14)	-12.347 (1.04)	-20.693 (1.71)+	-14.445 (1.39)	-6.71 (0.56)	-14.92 (1.39)	-21.964 (1.33)
Age of regulator (in years)	-0.003 (2.61)*	-0.003 (2.60)*	-0.003 (2.38)*	-0.003 (2.74)**	-0.003 (2.30)*	-0.003 (2.60)*	-0.003 (2.48)*	-6.134 (3.20)**	-6.143 (3.19)**	-5.845 (3.05)**	-6.287 (3.28)**	-5.739 (2.87)**	-6.344 (3.29)**	-5.987 (2.97)**
All entrants must receive same technical terms and conditions		0.003 (0.31)					-0.008 (0.87)		2.216 (0.16)					-8.402 (0.49)
Regulator must approve mergers			0.023 (2.86)**				0.029 (2.84)**			19.223 (1.36)				19.981 (1.11)
Local authorities, not regulator, make rights-of-way decisions				0.018 (1.59)			0.015 (1.36)				21.818 (1.13)			19.244 (0.97)
Rate regulation					-0.006 (0.70)		0.006 (0.61)					-10.486 (0.71)		-5.080 (0.30)
Mandatory interconnection						0.002 (0.21)	0.002 (0.20)						15.315 (0.92)	17.807 (1.01)
Constant	0.028 (11.21)**	0.028 (11.15)**	0.028 (11.71)**	0.028 (11.34)**	0.028 (11.20)**	0.028 (11.15)**	0.028 (11.59)**	57.693 (13.29)**	57.717 (13.22)**	57.797 (13.38)**	57.815 (13.34)**	57.914 (13.27)**	57.846 (13.31)**	58.101 (13.25)**
Observations	135	135	135	135	135	135	135	135	135	135	135	135	135	135
R-squared	0.78	0.78	0.79	0.78	0.78	0.78	0.80	0.70	0.70	0.71	0.71	0.71	0.71	0.72

Absolute value of t statistics in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

State and year fixed effects included

Table 3
Regulation and Competition on Telephones per Capita

	phones per capita													
State regulates telephones	-0.006 (0.84)	-0.002 (0.43)	-0.004 (0.46)	-0.002 (0.27)	-0.009 (1.07)	-0.012 (1.85)+	-0.007 (0.99)	-0.005 (0.81)	-0.007 (0.90)	-0.001 (0.08)	-0.009 (1.24)	-0.002 (0.36)	-0.013 (1.29)	-0.018 (1.92)+
Age of regulator (in years)	-0.001 (1.01)	-0.001 (0.49)	-0.001 (0.90)	-0.001 (0.49)	-0.001 (0.90)	-0.001 (0.48)	-0.001 (1.05)	-0.001 (0.70)	-0.001 (1.04)	-0.000 (0.35)	-0.001 (1.26)	-0.001 (0.47)	-0.001 (0.83)	-0.001 (0.90)
All entrants must receive same technical terms and Regulator must approve mergers			-0.006 (0.62)	-0.001 (0.18)		0.007 (2.43)*							-0.023 (1.88)+	-0.010 (1.21)
Local authorities, not regulator, make rights-of-way					0.007 (0.67)	0.017 (2.43)*	0.010 (0.75)	0.011 (1.14)					0.018 (1.48)	0.026 (2.80)**
Rate regulation									0.003 (0.34)	-0.004 (0.55)			0.004 (0.44)	0.008 (0.90)
Mandatory interconnection											0.014 (1.37)	-0.001 (0.14)	0.022 (1.91)+	-0.001 (0.08)
HHI (divided by 10000)	-0.0140183 (1.73)+	-0.0352646 (1.48)	-0.0144542 (1.77)+	-0.0348628 (1.44)	-0.0128892 (1.55)	-0.0337036 (1.50)	-0.0144103 (1.77)+	-0.0307551 (1.28)	-0.014039 (1.72)+	-0.0371483 (1.53)	-0.035053 (1.54)	-0.0125054 (1.45)	-0.010474 (1.26)	-0.0224613 (0.96)
Personal income per capita (in 1916)	-0.000 (0.26)		-0.000 (0.21)		-0.000 (0.42)		-0.000 (0.15)		-0.000 (0.24)		-0.000 (0.48)		-0.000 (0.80)	
Share of state population that is urban	0.090 (3.22)**		0.090 (3.19)**		0.092 (3.26)**		0.090 (3.18)**		0.090 (3.20)**		0.091 (3.27)**		0.095 (3.40)**	
South	-0.038 (4.36)**		-0.039 (4.38)**		-0.038 (4.32)**		-0.037 (4.11)**		-0.039 (4.23)**		-0.038 (4.43)**		-0.043 (4.42)**	
Midwest	0.024 (3.00)**		0.024 (3.00)**		0.022 (2.68)**		0.024 (3.03)**		0.024 (2.95)**		0.024 (2.98)**		0.019 (2.25)*	
Northeast	-0.033 (3.19)**		-0.034 (3.23)**		-0.034 (3.23)**		-0.034 (3.25)**		-0.033 (3.18)**		-0.033 (3.26)**		-0.042 (3.80)**	
Constant	0.078 (6.63)**	0.095 (6.03)**	0.079 (6.63)**	0.111 (7.05)**	0.078 (6.56)**	0.111 (7.63)**	0.078 (6.56)**	0.109 (7.07)**	0.078 (6.59)**	0.112 (7.13)**	0.079 (6.72)**	0.111 (7.07)**	0.081 (6.85)**	0.105 (7.05)**
Observations	84	87	84	87	84	87	84	87	84	87	84	87	84	87
R-squared	0.69	0.47	0.70	0.47	0.70	0.55	0.70	0.49	0.69	0.48	0.70	0.47	0.72	0.59
Fixed effects included	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state

Absolute value of t statistics in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4
Regulation and Competition on Talks per Capita

	number of talks per capita													
State regulates telephones	-15.116 (1.33)	-11.311 (0.95)	-13.164 (1.02)	-7.664 (0.54)	-14.555 (1.06)	-22.713 (1.51)	-16.332 (1.38)	-16.766 (1.32)	-14.789 (1.12)	-3.396 (0.24)	-22.269 (1.88)+	-13.567 (1.07)	-15.817 (0.97)	-20.745 (0.96)
Age of regulator (in years)	-1.622 (1.10)	-3.922 (1.38)	-1.549 (1.03)	-3.954 (1.38)	-1.638 (1.09)	-3.873 (1.37)	-1.661 (1.12)	-4.565 (1.59)	-1.612 (1.08)	-3.188 (1.09)	-2.158 (1.46)	-4.072 (1.41)	-1.879 (1.21)	-4.292 (1.42)
All entrants must receive same technical terms and conditions			-5.090 (0.33)	-8.390 (0.49)									-25.282 (1.22)	-16.724 (0.87)
Regulator must approve mergers					-1.228 (0.07)	20.505 (1.23)							5.485 (0.26)	24.013 (1.11)
Local authorities, not regulator, make rights-of-way decisions							10.090 (0.44)	25.428 (1.19)					5.369 (0.23)	22.720 (1.03)
Rate regulation									-0.757 (0.05)	-19.251 (1.09)			-6.824 (0.43)	-10.211 (0.49)
Mandatory interconnection											31.982 (1.89)+	12.106 (0.57)	45.576 (2.31)*	14.356 (0.67)
HHI (divided by 10000)	-0.002 (1.30)	-0.010 (1.96)+	-0.002 (1.32)	-0.010 (1.89)+	-0.002 (1.28)	-0.010 (1.94)+	-0.002 (1.32)	-0.009 (1.75)+	-0.002 (1.29)	-0.011 (2.10)*	-0.001 (1.05)	-0.010 (1.97)+	-0.001 (0.99)	-0.009 (1.70)+
Personal income per capita (in 1916)	-0.094 (0.48)		-0.089 (0.45)		-0.090 (0.44)		-0.082 (0.41)		-0.094 (0.48)		-0.154 (0.79)		-0.170 (0.81)	
Share of state population that is urban	273.514 (5.84)**		273.053 (5.79)**		273.105 (5.75)**		272.863 (5.79)**		273.511 (5.80)**		275.513 (5.99)**		275.525 (5.85)**	
South	-35.929 (2.48)*		-36.932 (2.48)*		-35.959 (2.46)*		-34.641 (2.33)*		-35.688 (2.33)*		-36.917 (2.59)*		-39.324 (2.39)*	
Midwest	14.902 (1.11)		14.974 (1.11)		15.195 (1.08)		15.230 (1.13)		14.953 (1.11)		14.228 (1.08)		13.628 (0.95)	
Northeast	-122.565 (7.11)**		-123.667 (7.00)**		-122.431 (7.02)**		-123.752 (7.06)**		-122.526 (7.06)**		-123.930 (7.31)**		-130.864 (7.12)**	
Constant	86.325 (4.38)**	218.928 (6.43)**	86.960 (4.36)**	217.385 (6.30)**	86.401 (4.35)**	218.749 (6.47)**	85.884 (4.33)**	214.862 (6.32)**	86.258 (4.34)**	223.759 (6.54)**	88.031 (4.54)**	220.273 (6.40)**	90.737 (4.55)**	216.168 (6.15)**
Observations	84	87	84	87	84	87	84	87	84	87	84	87	84	87
R-squared	0.68	0.28	0.68	0.29	0.68	0.31	0.68	0.31	0.68	0.31	0.69	0.29	0.70	0.37
Fixed effects included	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state	year	year, state

Absolute value of t statistics in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

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Executive Summary

In the second half of the 19th century U.S. states began regulating railroads, and in the early 20th century they began regulating utilities, including telephone service. In 1902, only Louisiana had a regulatory agency with authority over telephone companies, but by 1913, 39 states did. These agencies survive today, usually as public utility commissions. This paper explores their impacts on the early development of the U.S. telephone industry. I construct a unique dataset from the 1902, 1907, and 1912 U.S. Census of telephones and from detailed surveys of regulators compiled by American Telephone and Telegraph (AT&T) in 1911 and 1913. These data sources provide an opportunity to test the effects of competition and regulation on development of the telephone industry in an environment where regulations were new and the telephone network relatively undeveloped. Consistent with other research, competition between telephone providers is correlated with growth in telephone penetration. The results also suggest that the presence of state regulators slowed telephone penetration, but that certain specific regulations, such as requiring regulatory approval for mergers, may have stimulated growth.