IntraLATA Toll Rates:
Tests of A Positive Model of Regulation

by

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Abstract

This investigation finds that the economic theory of regulation provides an excellent basis for explaining differences among states in intrastate (intraLATA) long-distance telephone call prices. Several findings support the hypothesis that prices will be lower when consumers are more influential. This analysis also finds that present forms of facilities-based intraLATA toll competition have not driven toll rates lower in the 48 contiguous United States over years 1983-1992, even in the most "attractive" markets for entry. Toll rates are found, however, to be significantly lower in states where competitive access providers have the greatest presence.

It wasn't the regional Bell operating companies that killed [legislation] . . . it was the system and those who feed myths into the system . . . the rejectionist front--namely the long distance industry teamed up with the cable business. . . . In the recently deceased Senate legislation, [special interests] had the audacity to suggest that a reseller, without any facilities investment whatsoever, could get all the unbundled pieces from you and then get protected as a carrier of last resort. That's a transparent scheme to let sharpies, who never invested a dime in the national infrastructure, mine wealth out of the investments of others. Incredibly, some policy-makers bought off on it.

Phillip Quigley, Pacific Telesis CEO
Keynote speech, USTA convention
San Diego, CA. October 10, 1994

1. Introduction

There is considerable debate about the extent of competition in telecommunications markets.[1] The market for intrastate (intraLATA) long-distance service has emerged as an important consideration in both state level regulation and potential federal telecommunications reform.[2,3] Since 1983, most states have opened intraLATA toll markets to forms of competition, and the price of an average intraLATA call has fallen about 13% in real terms.[4] Despite some competition, the seven Bell Operating Companies (BOCs) still account for the vast majority of intraLATA toll calls.[5] This large market represents over $10 billion in 1993 BOC revenues.[6] Empirical evidence on the impact of intraLATA competition upon rates is mixed, however, and no study has carefully identified the underlying determinants of intraLATA toll rate differences among states. Through a careful application of the economic theory of regulation, this investigation provides strong evidence on the basic determinants of intraLATA toll rates.

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1 For different viewpoints, see Sievers (1994), Hall (1993), Taylor (1993), and Huber (1992).

2 The *Modification of Final Judgment* that ended the antitrust case against American Telephone and Telegraph (AT&T) in 1982 created 161 geographic regions called local access transport areas (LATAs) based largely on population density and calling patterns. The Bell Operating Companies are allowed to provide only intraLATA long-distance services.

3 No state currently allows intraLATA toll calls to be routed to carriers other than the local exchange carrier (LEC) on a 1+ dialing basis. The most common requirement is that consumers dial an access code, such as 10XXX, to route the call to another carrier. Dialing parity--1+ competition--was a precondition for BOC entry into interLATA markets in the failed bill S-1822, as approved by the Senate Commerce Committee (Bureau of National Affairs, August 18, 1994).

4 The percentage price change is computed using a five-minute, day-time call averaged over eight different mileage bands and 48 states in 1983 and 1992. Nominal prices are adjusted by the consumer price index.

5 The seven regional Bell operating companies accounted for 75% of long-distance message revenues (Class A) in 1991 (FCC, 1991). States that allowed facilities-based intraLATA toll competition in 1983 were FL, IA, MD, MT, NY, SC, TX, WA, and WY (NARUC 1983). The only states not to allow facilities-based intraLATA toll competition in 1993 were AZ, AR, CA, HI, NJ, NC, and OK (NARUC 1993c).

6 Revenue percentage calculated as toll network revenue divided by net revenue (subject to separations) for all BOCs and SNET (FCC ARMIS 43-01 reports for 1993, Table 1).

In the economic theory of regulation, policy-makers maximize political support, and outcomes of their decisions depend upon the relative strengths of opposing interest groups.[7] While previous research on intraLATA toll rates has not been based on the economic theory of regulation, the theory has been applied in related contexts.[8,9] A criticism of many tests of the economic theory of regulation has been the ad hoc nature of the reduced forms.[10] The present model revisits Peltzman's original "Stiglerian Model of Regulation" and includes explanatory variables, such as a measure lobbying activity, that are crucial to the theory yet absent in other studies. The approach here also departs from those in the literature on telecommunications prices by not including as explanatory variables either past rates or prices from related telecommunications services. While including prices in this manner may shed light on the impact of certain policies (e.g., cross-subsidization), all prices might be explained by the same underlying factors, and these factors are what drive the rate differences among states.[11]

This investigation finds that the economic theory of regulation provides an excellent basis for explaining differences among states in intraLATA toll rates. Several findings support the hypothesis that prices will be lower when consumers are more influential. Specifically, intraLATA toll rates are found to be lower in states with

1. Elected regulatory commissioners, who are more responsive to consumers than appointed commissioners;
2. Higher income residential consumers who due to high income elasticity are more likely to press for lower prices;

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[7] See Stigler (1971), Posner (1974), and Peltzman (1976).

[8] See Mathios and Rogers (1990), Kaserman et al. (1990), and Kaestner and Kahn (1992). The latter two studies maximize a utility function for the regulator like that discussed by Evans and Garber (1988); Evans and Garber (1988, p. 445) note that their objective function is "very different" than that used by Peltzman (1976).

[9] Beyond analyses of toll prices, Kaserman et al. (1993) conclude that the economic theory of regulation outperforms the public interest theory in a discrete choice model about deregulation of AT&T (intrastate, interLATA). In another discrete choice model (change in intraLATA rate structure), Teske (1991a and 1991b) tests an interest group theory. For empirical tests of the economic theory of regulation applied to other industries, see Caudill et al. (1993), Delorme et al. (1992), Im et al. (1989), Becker (1986), and Primeaux et al. (1984).

[10] Caudill et al. (1993) make this point and test specifications of seven models of regulatory behavior. They conclude that the economic theory of regulation consistently outperforms alternative theories and "rules of thumb" for explaining regulatory behavior.

[11] Mathios and Rogers (1990) include 1983 toll prices to explain those for 1986; Kaserman et al. (1990) include rates for access, local service, and intrastate toll subsidies per residential customer. Kaestner and Kahn (1992) include the prices of access, local, and toll.

3. Control by the Republican party, which represents the affluent;
4. More large industrial consumers, who have higher stakes in lowering prices; and,
5. Less rent seeking by special interests and producers.

The investigation also presents two findings on the impact of competition in intraLATA toll markets. First, present forms of facilities-based intraLATA toll competition have not driven toll rates lower in the 48 contiguous United States between 1983 and 1992, even in the most "attractive" markets for entry. This result is consistent with that of Kaestner and Kahn (1992) and reflects the unequal basis of present competition in intraLATA toll markets. The five-digit access code a customer must dial to reach a carrier other than the designated local exchange carrier imposes an inconvenience on residential users and a menu cost on corporations who use PBX systems. Even when regulatory commissions have approved intraLATA toll competition, potential facilities-based competitors have still had to file suit to force the local exchange carrier to open its network..[12]

A second finding is that toll rates are significantly lower in states where competitive access providers (CAPS) have the greatest presence. While CAPS remain on the periphery of intraLATA toll markets, customers lost to CAPS or to consortia of CAPS with interexchange carriers (e.g., AT&T, MCI, and Sprint) and cable carriers can result in total bypass of the local network, so the revenues for toll calls, basic local calls, and access services from those customers may be lost. As described by Seidenberg (1994), "competitive access providers are beginning to offer communications services that can be routed by various switches without ever touching the local exchange company."

Lastly, the analysis also finds that intraLATA toll rates are higher in states where climate-based measures of costs are higher. The paper is organized as follows. Section 2 presents the theoretical model. Section 3 contains the data motivation and description. Section 4 details the estimation procedure and results. Section 5 offers conclusions and directions for further research.

[12] For example, AT&T recently petitioned the Minnesota Court of Appeals to uphold a July 1994 Minnesota Public Utility Commission ruling designed to implement intraLATA toll competition (PR Newswire, 1995). AT&T also has a similar case in Wisconsin.

2. Elements of the Model

The model draws from Peltzman's (1976) work, which formalizes some of Stigler's (1971, 1962) work on the economic theory of regulation. Peltzman (1976) describes the economic theory of regulation as a theory of the optimum size of effective political coalitions set within the framework of the political process. At issue is a wealth transfer between two social groups, those who benefit from the wealth transfer and those who do not. By the theory, the regulator is nonpartisan and chooses the transfer so as to maximize net voting support. The theory ultimately explains the regularity of dominance in the regulatory process by small groups with high per capita stakes over large groups with more diffused interests.

In Peltzman's (1976) "Stiglerian Model of Regulation," the driving mechanism is a "majority generating function" that specifies factors affecting voting interests of the two groups. With a regulated price as the form of the wealth transfer, suppliers' votes increase in profit, and consumers' votes increase in consumer surplus. In addition, resource expenditures by both groups can affect the outcome of the regulator's price decision. Key elements of Peltzman's majority generating function include the per capita surplus levels, which depend critically on demand and production costs, the education level of consumers, the dollars spent by suppliers in campaign funds and lobbying, and the cost of group organization.

In the present model, the regulator is also concerned with the net votes (NV) from consumers and suppliers, where net votes are the difference between votes for and against either the regulatory body itself or those who appoint the regulators. Thus, $NV = NV^C + NV^S$ where superscripts refer to consumers and suppliers, respectively.[13] Consumer net voting support is assumed to be an increasing function of consumer surplus (CS). Letting Q(p) represent downward-sloping demand, consumer surplus is given

[13] For convenience, suppose as does Peltzman (1976) that ignorance does not lead to perverse voting.

formally by $CS(p) = \int_{p}^{\infty} Q(\tilde{p})\,d\tilde{p}$, with $CS_p = -Q(p)$. Subscripts denote partial derivatives. Thus,

$$NV^C = NV^C(CS) \text{ and } NV^C_p = \frac{dNV^C}{dCS}\frac{dCS}{dp} = -Q\underset{+}{NV^C_{CS}}.$$

Profit equals revenue less production costs. Production costs are the sum of fixed and variable costs, and variable costs, c(Q), where $\pi(p) = p \cdot Q(p) - c(Q(p)) - F$. Since $\frac{d\pi}{dQ} = MR - MC$,

$$\frac{d\pi}{dp} = \frac{d\pi}{dQ}\frac{dQ}{dp} = \underset{-}{\frac{dQ}{dp}}(MR - MC).$$

Voting by suppliers is assumed to increase in profit (π). Thus, $NV^S = NV^S(\pi)$, and

$$\begin{aligned} NV^S_p &= \frac{dNV^S}{d\pi}\frac{d\pi}{dp} \\ &= \frac{dNV^S}{d\pi}\left[\frac{dQ}{dp}(MR - MC)\right]. \end{aligned}$$

At the "monopoly" output, MR = MC, so $NV^S_p = 0$. At larger output levels, MR < MC, so $NV^S_p > 0$. Therefore, the curve NV^S_p is positively sloped and passes through 0 at the monopoly output as shown in Figure 1. For simplicity, Figure 1 also depicts both curves NV^C_p and NV^S_p as linear, and the curve $|NV^C_p|$ is shown as constant over the relevant range of output. These simplifications are easily dropped with no loss of generality by assuming nonlinear demand or that NV^C_{CS} and NV^S_π vary in output.

[Figure 1 here]

Formally, the regulator's problem [RP] is to select price so as to maximize net votes, NV:

$$\max_p \; NV, \quad \text{where } NV = NV^S + NV^C. \qquad \text{[RP]}$$

At a maximum of [RP], the following two conditions must hold:

$$\frac{dNV}{dp} = 0 \; = \; NV^S_p + NV^C_p$$

$$= \pi_p \cdot \underset{+}{NV^S_\pi} - Q \cdot \underset{+}{NV^C_{CS}}, \text{ and} \qquad (1)$$

$$\frac{d^2NV}{dp^2} = \pi_{pp} \cdot NV^S_\pi - Q_p \cdot NV^C_{CS} < 0.$$

At a maximum, equation (1) describes an equilibrium condition where the marginal political support gained from suppliers must equal the support lost from consumers as price increases, i.e., $\pi_p \cdot NV^S_\pi = Q \cdot NV^C_{CS}$. Thus, $\pi_p > 0$ and $Q > Q^{monopoly}$. Figure 1 depicts the equilibrium price and quantity, (p^*,q^*), at the intersection of the $|NV^C{}_p|$ and $NV^S{}_p$ curves.

The equilibrium levels will change with shifts in the $|NV^C{}_p|$ or $NV^S{}_p$ curves that result from changes in the underlying arguments. For example, demand and production costs affect the curves directly through π and CS. The impact of resource expenditures by parties in the political process, such as lobbying, may be captured through the functions $NV^S{}_\pi$ and $NV^C{}_{CS}$. Specific variables consistent with the theory are detailed in the following section.

3. The Dependent and Explanatory Variables

IntraLATA toll rates in the 48 contiguous states over the years 1983, 1986, 1988, 1990 and 1992 are employed to test the foregoing model of state price regulation.[14] The dependent variable equals the real price charged by the Bell operating company (BOC) in each state.[15] Unlike basic local service rates, intraLATA toll rates are the same for business and residential customers. Only one BOC operates in each state, and the BOCs account for the vast majority of intraLATA toll calls. In addition, by focusing on the rates of BOCs, network technology and quality of service are held relatively constant across

[14] Adding odd years gives little additional variation to the sample.

[15] The one exception is the inclusion of Southern New England Telephone, the primary local exchange carrier in Connecticut. Source of data on intraLATA toll rates: NARUC (1983-1992).

states. Call prices may vary by time of day, call duration (in minutes), or distance (in mileage).[16] For a standardized comparison across states, the dependent variable measures the price of a five minute, daytime intraLATA telephone call over the eight separate mileage bands used by most states: 0-10 miles, 11-16 miles, 17-22 miles, 23-30 miles, 31-40 miles, 41-55 miles, 56-70 miles, and 71-124 miles.[17,18,19] Calls that span longer distances generally bear higher prices. In practice, calls from different mileage bands are different products. For example, if two business units are located 55 miles apart, a call of 10 miles in length is not a substitute. Moreover, each mileage band has a different call volume associated with it. Since there are eight mileage bands, there are eight price observations per state for each year. Dummy variables are employed to capture the effect of distance on price. The econometric implications regarding the use of these dummy variables are discussed in detail with the estimation procedure in section 4.

In the preceding model, demand and production costs are primary components underlying the equilibrium condition that $Q \cdot NV^{C}_{CS} = \pi_{p} \cdot NV^{S}_{\pi}$. Corporate consumers generally have larger and more elastic demands for telecommunications services than do residential consumers. The large call volumes that corporate demanders generate also entail scale economies, a key consideration in production costs. The combination of scale economies with intraLATA toll rate schedules that historically have not involved price discrimination by customer class has led to competition among providers to serve the corporate segment of the market. States may allow resale competition, facilities-based competition, or

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16 Optional calling plans that involve volume discounts were not widely available in intraLATA toll markets by 1990. Accounting for those few states that offer discount plans introduces multicollinearity problems with company specific dummy variables.

17 This convention is also employed by Mathios and Rogers (1990).

18 Since many states are not large enough to yield meaningful comparisons for distances longer than 124 miles, call prices above 124 miles are not used in this study. Some states have mileage bands that exceed 124 miles, while others charge a fixed rate for calls beyond a certain distance. The truncation applies to relatively few observations.

19 For example, if a state charges one rate per minute for a call that spans up to eight miles and a different rate for a call that covers greater than eight miles, the standardized rate for the 0-10 mileage band is calculated simply as 0.8 times the short distance rate plus 0.2 times the rate for the longer distance.

both types. Virtually all states have allowed resale competition since 1983.[20] Under resale competition, an intermediary buys large volumes of minutes, often on lower quality lines, at a discount. The intermediary then sells these minutes directly to consumers at prices below that of the local exchange carrier. By comparison, facilities-based carriers can own their own switching equipment and lines. Most facilities-based intraLATA toll competition has come from interexchange carriers, such as AT&T, MCI, and Sprint. Over the years 1983 to 1992, no state allowed 1+ dialing competition, and today regulators still maintain substantial oversight in the rate structures for this market. Other forms of competition are, however, beginning to circumvent regulatory barriers. For example, competitive access providers (CAPS) already compete against BOCs and each other primarily in the markets for high-volume access, delivering traffic from large customers directly to interexchange carriers.[21] Competitive access providers have also begun to compete as alternative local exchange carriers that can offer intraLATA toll services.[22]

To summarize thus far, three variables have been motivated: proxies for the presence of large industrial consumers, facilities-based intraLATA toll competition, and competitive access providers. As a proxy for the presence of large industrial consumers, the variable FORTUNE500 contains the total number of "Service 500" and "Industrial 500" firms with headquarters located in the state (1983-1992) as published by *Fortune* magazine. (1985-1992). Since corporate demand is more elastic, it is also more price sensitive. This could be interpreted as an upward shift in $|NV^C{}_p|$ in Figure 1. Alternatively, more elastic demand could also be interpreted as increasing the sensitivity of supplier's profit and, thereby, voting to price changes: a rightward shift in $NV^S{}_p$ in Figure 1. Either interpretation results in a larger

[20] Only three of 48 states in the sample prohibit resale competition in 1992: AZ, IN, and RI (NARUC, 1992-1993, Table 170). Attention is restricted to facilities-based competition.

[21] For example, 30% of Pacific Bell's business revenues come from 0.5% of their serving territory. Quigley (1994b) estimates that competitive access providers hold a 25-33% share of the high-capacity market in the Los Angeles and San Francisco areas they serve.

[22] For example, in New York state, Cablevision Lightpath Inc. offers "integrated cable, local telephone, and long-distance services to large users such as college campuses" through an arrangement with AT& T (Seidenberg, 1994).

equilibrium quantity and a lower equilibrium price with more large corporate consumers present in a state.

As a measure of facilities-based intraLATA toll competition, the dummy variable COMPETITION equals one if a state currently allows facilities-based intraLATA toll competition and equals negative one otherwise.[23] This variable tracks the growth of intraLATA competition over time. If present forms of competition from facilities-based carriers are effective, essentially increasing the demand elasticity for any given competitor's service, the market price should decrease by the previous reasoning. As an additional measure of where competition is both allowed and most likely to occur, one specification of the model also includes the interaction of COMPETITION with the number of Service 500 and Industrial 500 headquarters located in state, i.e., COMPETITION*FORTUNE500. With competition in these markets, intraLATA toll rates should decline.

To proxy the extent to which competitive access providers have gained footholds in access markets that might be used to enter intraLATA toll markets, the variable COMPACCESS measures the penetration rate of competitive access providers as the percentage of the state population living in urban areas actually served by competitive access providers in 1992.[24] This variable contains a single cross-section that is highly correlated with population density.[25] If the presence of a competitive fringe significantly increases the demand elasticity for the incumbent local exchange carrier's services, then toll rates should be lower as a result. The competitive access provider penetration rate is also interacted with the number of Fortune 500 headquarters in one specification of the model, i.e.,

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[23] Source of data on intraLATA toll competition by state: NARUC (1983-1992).

[24] Sources for data on CAPS and urbanized populations: Huber et al. (1992), U.S. Dept. of Commerce (1990a) and (1992), Slater et al. (1994). An alternative variable that measures directly the lines of competitive access providers (as a percentage of total or BOC lines in the state) would be problematic since a meaningful comparison requires data on lines of comparable capacity. Many CAPs' lines also have high-speed transfer rates not available from the BOCs.

[25] See the *State Telephone Regulation Report* (1994) for three recent articles on CAP location patterns.

COMPACCESS*FORTUNE500. This interaction measures the extent to which states with large corporate consumers attract competitive access providers.

Higher production costs shift the NV^S_p curve in Figure 1 leftward, resulting in a higher equilibrium price. Accounting data could be used to measure both labor and network maintenance expenses, but controls for human capital levels and the existing size and technology of the network would be necessary. An alternative measure draws from a substantial body of research on the influence of amenities on wages and land prices.[26] As a measure of the cost-of-living, amenities in labor markets, and of comparative network maintenance expenses across states, consider the relationship between wages and average temperatures (COST-1, COST-2).[27] Aggarwal and Kenny (1994) and Kenny and Denslow (1980) both find significant relationships between wage levels and average temperatures in January and July. In states with warmer January temperatures and more temperate climates, workers accept lower wages. In July, by contrast, extreme climates, hot or cold, require greater compensation. Beginning at a cold July temperature, warmer temperatures decrease the required wage. Beyond a certain point, the summer is too hot and hotter July temperatures require greater compensation at an increasing rate. Aggarwal and Kenny (1994) and Kenny and Denslow (1980) find wages are lowest with July temperatures of 74°-82°. Figure 2 depicts these relationships.

[Figure 2 here]

For telephone networks, network maintenance expenses are certainly higher in extreme climates. For example, costs are higher in states with cold January climates and winter storms (e.g., New York, Illinois, New England states) and in states with hot July temperatures and notable lightning storms or

[26] See, for example, Ridker and Henning (1967), Nordhaus and Tobin (1972), Hoch and Drake (1974), Izraeli (1977), Getz and Huang (1978), Rosen (1979), Kenny and Denslow (1980), Blomquist et al. (1988), and Aggarwal and Kenny (1994).

[27] Data on average temperatures were obtained from Kenny.

hurricane seasons (e.g., Florida, Mississippi, Texas, Louisiana).[28] Thus, lower rates are expected in more temperate climates where both network maintenance expenses and wages are lower.

Returning to the equilibrium condition that $Q \cdot NV^{C}_{CS} = \pi_{p} \cdot NV^{S}_{\pi}$, the remaining explanatory variables focus on consumer demand and the extent to which changes in surplus levels translate into votes. Peltzman's model suggests public educational expenditures help determine how much suppliers must expend in lobbying and campaign contributions to mitigate (consumer) opposition to higher prices. Educational attainment and income are highly correlated, and income also influences consumers' demand. As a proxy for consumer income, real personal income per capita (INCOME) is included (1983-1992).[29] Two conflicting effects accompany a rise in income. Individuals with a high value of time, other things equal, find it costlier to acquire political information but consume more, giving them a larger stake in bringing about lower prices. The following example illustrates these effects. Suppose that wage rates are linear in income. Suppose also that the marginal impact of an increase in consumer surplus upon net votes from consumers, NV^{C}_{CS}, is inversely proportional to wage rates, so $NV^{C}_{CS} = \beta\left(\frac{1}{\text{INCOME}}\right)$. The (absolute value) change in net consumer votes as price rises is then $\left|NV^{C}_{p}\right| = Q\left(\frac{\beta}{\text{INCOME}}\right)$. In fact, estimates for the Bell system suggest that the demand for intrastate long-distance calls is predominantly income elastic in the long-run.[30] If so, consumption of intraLATA toll services (Q) increases more rapidly than income, and the stakes effect dominates the cost effect. As

[28] NYNEX's 1993 operating expenses rose 1.6% mainly because of higher depreciation expenses and network repair costs associated with severe winter storms (FCC 1994).

[29] Real personal income per capita is calculated as current dollar personal income per capita adjusted by the consumer price index. All figures are from the U.S. Department of Commerce (1993).

[30] For intrastate toll, L. Taylor (1994, Table 1, p. 318-319) cites studies of states within the Bell System. The majority of long-run income elasticity estimates exceeds one, and the average is 1.33 (over the 27 states for which long-run elasticity estimates are reported).

a result, consumers in high income states are more sensitive to price changes, raising $|NV^C_p|$ in Figure 1 and resulting in lower prices.[31]

An interesting check on the estimate of the income variable relates to partisanship and voting behavior. The Republican party often espouses the interests of wealthier constituents. Wealthier citizens are expected to be more active politically or more represented in states where government is controlled by the Republican party. The variable REPUBLICAN equals one if the Republican party controls both the governor's seat and a majority in the state legislature, negative one for Democratic party control, and zero otherwise (1983-1992).[32] If wealthier consumers have income elastic demand, they will spend a greater portion of their income on intraLATA toll calls and thus have more to gain from lower prices. Thus, REPUBLICAN also should be negatively associated with price. If the income elasticity of demand is less than one, then the coefficients on INCOME and REPUBLICAN should be positive. Either way, the results must have the same sign to be consistent.

In the Stigler and Peltzman models, the regulator is nonpartisan and maximizes a voting majority. In practice, this suggests hypotheses to test. While REPUBLICAN accounts for partisanship of the state administration, the variable APPOINT indicates whether state regulatory commission members are appointed or elected; this variable remains constant over 1983-1992.[33] As prices increase, consumers are less likely to vote for an elected regulator. When consumers are voting for a governor or legislator that appoints regulatory commissioners, the vote is based upon a broader set of criteria, so the impact of price upon net votes, $|NV^C_p|$, is smaller. Thus, price is expected to be higher in states with appointed regulators.

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[31] In Bates and Rogerson (1980), the same prediction that prices and income shares are inversely related arises in their coalitional analysis of agriculture in development.

[32] Data on party control of governor's seat and state legislature were obtained from Husted and Kenny (1994).

[33] Source of data on whether utility commissioners are elected or appointed: NARUC (1992). Regulatory commissioners are elected in AL, AZ, GA, LA, MS, MT, NE, NM, ND, OK, SD, and TN. All other states appoint regulatory commissioners.

Peltzman's model explicitly includes lobbying as an instrument by which suppliers can exert influence and mitigate consumer opposition. As a proxy for rent-seeking, the variable LOBBYISTS measures the number of lobbyists per state legislator in 1992.[34] These data do not measure only those lobbyists representing the telecommunications industry but still reflect the degree of rent-seeking in the state. If a state allows more rent-seeking--access by special interests (suppliers)--campaign contributions may enable the regulator or legislator (if regulator is appointed) to provide more favorable information to constituents via advertising. Accentuating accomplishments through advertising may defray the loss of consumer votes as price rises. With a lower $|NV^C_p|$ in Figure 1, the equilibrium price will increase with rent-seeking. Effective lobbying should lead to higher prices than would prevail otherwise.

The last variable included is a measure of the authority that public utility commissions wield. The variable PUC_AUTHORITY is a dummy variable that equals one in states where the public utility commission holds a broader scope of authority. Specifically, the commissions to which this variable applies have responsibilities over both pole attachment policies and regulation of entry policies for cable television.[35] These authorities provide the regulator with more instruments that might be used in regulating or opening the markets of local exchange carriers. A priori, it is not clear from the regulatory capture or public interest theories why a more powerful regulator need favor one particular group. IntraLATA toll rates could be higher or lower in states with more powerful public utility commissions.

4. Estimation and Results

The sample is a panel that covers the 48 contiguous United States in years 1983, 1986, 1988, 1990, and 1992. The initial year, 1983, provides a pre-divestiture benchmark.. As mentioned in the description of the dependent variable, the intraLATA toll rates employed here may be interrelated in several ways. There may be price interrelation among the eight mileage bands, among the seven BOCs and Southern New England Telephone, among states served by the same company, and across years.

[34] Source of data on state lobbying: Morgan, et al. (1993).
[35] Source of data on state PUC authority over cable entry and pole attachment: NARUC (1993c).

Econometrically, there are several options for tending to these concerns. One option is to analyze the average price over multiple bands as the dependent variable. This approach introduces measurement error and denies that calls of different distance bands represent distinct services with unique call volumes in each area.[36] A second option is to analyze the mileage bands separately. This approach results in a loss of efficiency and may be inconsistent.[37] A third option that is consistent with the literature and employed here as well is to stack prices from all bands in a given year and to analyze them together as a single equation. The assumptions made in stacking the call prices are that (1) the error terms across different mileage bands are not correlated and (2) the variance across the different bands remains roughly constant. Dummy variables are used to capture the effects on prices of distance, company-specific variations, and time-specific variations. The dummy variable from each set that is omitted in the regressions is indicated in Table 1.

To explain intraLATA toll prices ($PRICE_{it}$), three reduced form equations are estimated. Subscripts denote the state (i) at a point in time (t). Since decisions to allow intraLATA toll competition and interconnection--competitor access to parts of the incumbent BOC's local network--are endogenous with the price level, Model 1 presents results without variables related to these decisions. Models 2 and 3 add to Model 1 variables that measure competition and interconnection in slightly different ways. Table 1 provides brief definitions and descriptive statistics for each of the variables. The reduced form models considered here are:

Model 1:

$$\begin{aligned} PRICE_{it} = \beta_0 &+ \beta_1 \text{ APPOINT} + \beta_2 \text{ COST-1} + \beta_3 \text{ COST-2} \\ &+ \beta_4 \text{ COST-2}^2 + \beta_5 \text{ FORTUNE500} + \beta_6 \text{ INCOME} \\ &+ \beta_7 \text{ LOBBYISTS} + \beta_8 \text{ PUC\_AUTHORITY} + \beta_9 \text{ REPUBLICAN} + u_{it} \end{aligned}$$

Model 2:

$$+ \beta_{10} \text{ COMPACCESS} + \beta_{11} \text{ COMPETITION} + \beta_{12} \text{ COMPETITION*FORTUNE500}$$

Model 3:

$$+ \beta_{10} \text{ COMPACCESS} + \beta_{11} \text{ COMPETITION} + \beta_{12} \text{ COMPACCESS*FORTUNE500}.$$

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36 The distribution of minutes across mileage bands is not available for all companies.

37 Mathios and Rogers (1990) note that estimating a separate reduced form equation for each mileage band may be inconsistent since omitted variables likely affect all mileage bands.

The coefficients to be estimated are β_0-β_{12}. The analysis finds a variance components error structure (random effects model) is appropriate.[38] There are a total of 384 cross-sections and 5 time series. The random error associated with $PRICE_{it}$, u_{it}, is assumed the sum of the random effects associated with the *i*th cross-section (v_i), the *t*th time series (e_t), and both cross-sections and time series (ε_{it}), so $u_{it} = v_i + e_t + \varepsilon_{it}$, $i = 1,..,384$; $t = 1,...,5$. The v_i are assumed constant over time, and the e_t are assumed constant across cross-sections. The errors v_i, e_t, and ε_{it} are independently distributed with zero means and variances $\sigma_v^2 \geq 0$, $\sigma_e^2 \geq 0$, and $\sigma_\varepsilon^2 \geq 0$, respectively. The variance components are estimated using the two-step Generalized Least Squares (GLS) procedure developed by Fuller and Battese (1974). Advantages of this procedure are its ability to incorporate variables that are constant over time or over cross-sections as well as its robustness to the underlying error structure.[39]

Tables 2 and 3 present the least squares and random effects estimates for all three models. Based on the random effects estimation, Table 4 presents estimates of the impact the explanatory variables have on the price of a five-minute intraLATA call. Overall, all three models perform well. The R-squares for OLS regressions are all approximately 0.78.[40] The OLS regressions provide highly significant t-statistics that almost always exceed those from the random effects procedure. The following discussion focuses on the results of the random effects procedures. Since the mean price is $1.00, the coefficients give the fractional response.

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[38] The F-statistics that the slopes and intercepts are the same have been checked, and a random effects procedure is appropriate. Since variance components estimates are inconsistent when the individual intercepts v_i are correlated with the independent variables (Greene 1993, p. 495), the Hausman test statistic for the difference between the fixed effects and random effects estimates has also been checked to verify noncorrelation.

[39] When the effects for individuals are assumed random, the best linear unbiased estimator (BLUE) is the generalized least squares estimator (Hsaio 1986, p. 34). When the sample size is large, the two-step GLS estimator has the same asymptotic efficiency as the GLS procedure with known variance components (Fuller and Battese 1974, Hsiao 1986).

[40] Orthoganality conditions prevent calculation of R-square statistics with two-step GLS.

In all three models, the number of Fortune Service 500 and Industrial 500 headquarters is significant at the 5% level. Large corporate consumers have strong incentives to bypass the network. Without interaction in model 1, prices are significantly lower in states with more large headquarters as expected. An increase of 29 additional headquarters (one standard deviation) corresponds to toll rates that are 5.4% lower.

This variable is interacted with the penetration rate of competitive access providers in model 3, and both variables are significant. The estimated effect of the number of headquarters is

$$\frac{dp}{d\ \mathrm{FORTUNE500}} = 0.003 - 0.007\ \mathrm{COMPACCESS}.$$

Interestingly, a small increase in the number of large corporate headquarters results in lower toll rates when competitive access providers serve urban areas that constitute more than 43% of the state population. Since competitive access providers are a significant vehicle for bypass, the spill-over into intraLATA toll rates occurs in the largest urban areas where CAPS have the strongest footholds and the greatest potential to serve intraLATA toll markets through consortia with interexchange carriers.

As expected, a small increase in the penetration rate of competitive access providers results in unambiguously lower toll rates, i.e.,

$$\frac{dp}{d\ \mathrm{COMPACCESS}} = -0.125 - 0.007\ \mathrm{FORTUNE500}.$$

Beginning near the mean of about 21 headquarters, in a state like Virginia, toll rates are an estimated 3.2% lower when competitive access providers serve urban areas that constitute an additional 23% of the state population. In a state like Texas where there are about 65 headquarters, the same 23% increase in CAP penetration corresponds to toll rates that are roughly 3.9% lower. Without interaction in model 2, higher CAP penetration rates also correspond to significantly lower toll rates.

By contrast to the results on large corporate consumers and competitive access providers, the measure of present intraLATA toll competition (COMPETITION) is not significant, even when interacted with the number of Fortune 500 headquarters. This result is consistent with that of Kaestner and Kahn (1992) and reflects the unequal basis of present competition in intraLATA toll markets. The five-digit access code a customer must dial to reach a carrier other than the designated local exchange carrier imposes an inconvenience on residential users and a menu cost on corporations who use PBX systems. Even when regulatory commissions have approved intraLATA toll competition, potential facilities-based competitors have still had to file suit to force the local exchange carrier to open its network..

The measures of amenities, relative wages, and network maintenance expenses (COST-1 and COST-2) are significant and perform as expected. IntraLATA toll rates are 2%-3% lower in states like Nevada than in states like Delaware, where average January temperatures are about 13° colder. By comparison, the lowest toll rates occur in states where July temperatures are about 80°. This is consistent with the range of 74°-82° found in Aggarwal and Kenny (1994) and Kenny and Denslow (1980). Extreme temperatures in either direction away from 80° correspond to progressively higher rates. Beginning at 80° in a state like Georgia, states where average July temperatures are about five degrees warmer or cooler, such as in Texas and South Dakota, respectively, have toll rates that are roughly 1%-1.5% higher. The finding here that extreme January temperatures have a larger impact upon toll rates than July temperatures is also consistent with the finding of Kenny and Denslow (1980) that January temperatures correspond to larger wage differentials than do July temperatures.

Moving to the consumer demand and voting measures, the variables on income and partisanship are also significant and consistent with one another and with demand being income elastic. In all models, real personal income per capita (INCOME) is significant at the 0.01% level. Toll rates are 11% to 12% lower in states where personal income per capita is $2134 higher. By comparison, a change from Democratic to Republican party control of the state administration (REPUBLICAN) corresponds to toll rates that are 3% to 4% lower. The consistency in signs provides additional support for the assumption that Republicans represent the relatively affluent. These finding are furthermore consistent with evidence of income elastic demand for intraLATA toll services. Wealthier consumers, who are represented by the Republican party, spend a greater portion of their income on intraLATA toll calls and thus have more to gain from lower prices. Since wealthier citizens are also expected to be more active politically or more represented in states where government is controlled by the Republican party, lower rates under Republican leadership are consistent with income elastic demand in the long-run.

The hypothesis that appointed regulators (APPOINT) are less sensitive to consumers' concern for lower prices than their elected counterparts is supported. States with appointed regulators are found to have intraLATA toll rates that are 4%-5% higher.

Rent seeking is expected to give suppliers more influence in determining price. Indeed, as measured by LOBBY, rent seeking does play a significant role in determining rate differences among states. IntraLATA toll rates are about 2% higher in states with six additional lobbyists per legislator. As a rough gauge, dividing the total BOC revenues of about $10 billion among 48 states provides an average revenue per state of about $21 million. Two percent of this is about $416,000, so six more lobbyists are worth approximately $70,000 each per year!

The final variable, PUC_AUTHORITY, tests the impact of broader state commission authority as measured by oversight of cable television entry and pole attachment policies. The variable is highly significant. States with broader regulatory commission authority have toll rates that are 10% to 18% lower. If the variable PUC_AUTHORITY is viewed as a measure of regulators' bent towards either regulatory capture or public interest, the public interest appears to dominate. Alternatively, the variable suggests that regulatory commissions hold a broader scope of authority in states where consumer interests are stronger on the margin.

Brief comments regarding the dummy variable sets are in order. The regressions include dummy variables to capture the effects of the distance sensitivity of prices, company specific variations, and time-specific variations. The estimated coefficients for the dummy variables on the different mileage bands are all highly significant at the 0.01% level. Since prices increase with distance, the negative mileage band coefficients represent the percentages by which the mean price for the band is lower than that for the 71-124 miles band. For example, the price for a five-minute day-time call in the 56-70 miles band is approximately 9.4% lower than a call in the 71-124 miles band. Similarly, dummy variables for each year indicate that prices between 1983 and 1988 were significantly (at the .01% level) higher in real terms than those in 1992. Between 1983 and 1988, the price of a five-minute call declined approximately 5% annually. Prices in 1990 and 1992 were not significantly different. Finally, the dummy variables for each company (AMERITECH,...,USWEST) are all significant. The estimated coefficients on the company-specific dummy variables are all relative to the excluded company, Southern New England Telephone. Relative to Connecticut, US West states have by far the lowest toll rates: roughly 37%-58% lower.[41] After US West, Ameritech and Southwestern Bell states have the next lowest toll rates, roughly 23%-40% lower than those in Connecticut. BellSouth and Pacific Bell follow with rates that are about 20% lower than those in Connecticut.

5. Conclusions

This investigation has found that some types of competition are effective in lowering prices. States with the greatest presence by competitive access providers have the lowest intraLATA toll rates. This presence may be effective because, in the largest urban areas, competitive access providers and their consortia with interexchange carriers and cable carriers can help large corporate consumers to bypass the local network entirely. When this occurs, the revenues derived from those customers may be lost in markets for intraLATA toll calls, basic local calls, and access services.

41 These findings are suggestive of those in Teske (1991b), who finds that U.S. West states differ politically, have been more open to deregulation, and have experienced greater change in intraLATA toll rate structures. It is not obvious, however, that deregulation encouraged by US West need result in lower toll rates.

Consistent with the results of Kaestner and Kahn (1992), this research has found that present forms of facilities-based intraLATA toll competition have not led to significantly lower rates, even in markets with the most large corporate consumers. Short of bypassing the local exchange network and many of its regulatory obstacles, the broadest forms of facilities-based intraLATA toll competition adopted by 1992 required that consumers dial additional digits to reach alternative carriers. This inconvenience, combined with the limited spread of discounted calling plans, can help explain the lack of price responsiveness to present competition.

This study provides strong evidence that prices are lower when consumer votes are more sensitive to prices. First, lower toll rates are found in states with more large business consumers, which more readily switch to alternative providers. Second, wealthier states and states in which richer citizens are better represented have lower toll rates; this is consistent with the hypothesis that consumers are more involved politically on issues dealing with goods that represent a larger share of their budget. Third, toll rates are lower in states with elected public utility commissioners, who are more responsive to consumer interests. Fifth, toll rates are lower in states with less rent-seeking and thus less special interest and producer influence. Finally, prices appear to be lower in states where production is cheaper.

This investigation opens the door to numerous directions of future research. In particular, more detailed studies of elected and appointed commissioners, the scope of authority of public utility commissions, and the impact of optional calling plans are all promising directions for analysis. This investigation found states with elected public utility commissioners have 4% to 5% lower toll rates. An interesting question is whether these same states have experienced lower regulated prices in other markets and industries, lower quality levels, or slower adoption of new technologies. Among state commissions of comparable size and budgetary resources, it also would be insightful to know what factors most contribute to lower rates, e.g., scope of authority, stringency in monitoring (auditing), choice of regulatory techniques and policies.

REFERENCES

Aggarwal, A. and Kenny, L. (1994). On the interaction between land and labor markets. Unpublished manuscript.

Atkinson, S.E. and Nowell, C. (1994). Explaining regulatory commission behavior in the electric utility industry. *Southern Economic Journal* 60(3): 634-643.

Bates, R.H. and Rogerson, W.F. (1980). Agriculture in development: a coalitional analysis. *Public Choice* 35 (5): 513-527.

Becker, G. (1986). The public interest hypothesis revisited: A new test of Peltzman's theory of regulation. *Public Choice* 49(3): 223-234.

BellSouth Telecommunications (1993). *Regulatory reform: A nationwide summary.* Atlanta, GA: BellSouth Telecommunications Regulatory Policy & Planning 14, October.

Blomquist, G.C. Berger, M.C. and Hoehn, J.P. (1988). New estimates of quality of life in urban areas." *American Economic Review* : 89-107.

Brockway, N. (1994). Universal service and local competition: The competitive shell game and its impact on the captive consumer. National Consumer Law Center, Boston, MA. Paper presented at the NARUC Ninth Biennial Regulatory Information Conference in Columbus, OH. September.

Bureau of National Affairs, Inc. (1994). Staff's summary of S-1822 approved by Senate commerce committee. *Antitrust and Trade Regulation Report* 67(1677): August 18.

Caudill, S.B. Im, B.G. and Kaserman, D.L. (1993). Modeling regulatory behavior: The economic theory of regulation versus alternative theories and simple rules of thumb. *Journal of Regulatory Economics* 5(3): 251-262.

Delorme, C.D. Kamerschen, D.R. and Thompson, H.G. (1992). Pricing in the nuclear power industry: Public or private interest? *Public Choice* 73(4): 385-396.

Donald, S. and Sappington, D.E.M. (1995) Explaining the choice among regulatory plans in the U.S. telecommunications industry. Unpubliched manuscript.

Evans, L. and Garber, S. (1988). Public-utility regulators are only human: A positive theory of rational constraints. *American Economic Review* 78(3): 444-462.

Fortune. Fortune yearly memoranda of "Industrial 500" and "Service 500" by state 1985-90: (unpublished); 127(11), May 13, 1993, 245; April 20, 1992, 290.

Fuller, W.A. and Battese, G.E. (1974). Estimation of linear models with crossed-error structure. *Journal of Econometrics* 2(1): 67-78.

Getz, M. and Haung, Y.C. (1978). Consumer revealed preference for environmental goods. *Review of Economics and Statistics* 60: 449-458.

Greene, W. (1993). *Econometric analysis* (2nd ed.). New York: Macmillan Publishing Company.

Hall, R.E. (1993). *Long distance: Public benefits from increased competition.* Unpublished manuscript.

Hoch, I.J. and Drake, J. (1974). Wages, climate, and the quality of life. *Journal of Environmental Economics and Management* 1: 268-295.

Hsiao, C. (1986). *Analysis of Panel Data.* New York: Cambridge University Press.

Huber, P.W. Kellogg, M.K. and Thorne, J. (1993). *The Geodesic Network II: 1993 Report on Competition in the Telephone Industry.* Washington, DC: The Geodesic Company.

Husted, T.A. and Kenny, L.W. (1994). The effect of the expansion of the voting franchise on the size of state government. Unpublished manuscript.

Im, B.G. Kaserman, D.L. and Melese, F. (1989). Endogenous regulation and the firm's regulatory expenditures. *Applied Economics* 21(3): 375-385.

Izraeli, O. (1977). Differentials in nominal wages and prices between cities. *Urban Studies* 14: 275-290.

Kaestner, R. and Kahn, B. (1992). The impact of intraLATA competition on local exchange company prices." In M.A. Crew (Ed.), *Economic Innovations in Public Utility Regulation,* 37-55. Boston: Kluwer.

Kaserman, D.L. Mayo, J.W. and Pacey, P.L. (1993). The political economy of deregulation: The case of intrastate long distance." *Journal of Regulatory Economics* 5(1): 49-63.

Kaserman, D.L. Mayo, J.W. and Flynn, J.E. (1990). Cross-subsidization in telecommunications: Beyond the universal service fairy tale. *Journal of Regulatory Economics* 2(3): 231-249.

Kenny, L.W. and Denslow, D.A. (1980). Compensating differentials in teachers' salaries. *Journal of Urban Economics* 7(2): 198-207.

Mathios, A.D. and Rogers, R.P. (1990). The impact and politics of entry regulation on intrastate telephone rates. *Journal of Regulatory Economics* 2(2): 53-68.

Mathios, A.D. and Rogers, R.P. (1989). The impact of alternative forms of state regulation of AT&T on direct-dial, long-distance telephone rates. *Rand Journal of Economics* 20(3): 437-453.

Mitchell, B.M. and Vogelsang, I. (1991). *Telecommunications pricing: Theory and practice.* New York: Cambridge Univeristy Press.

Morgan, K.O. Morgan, S. and Quinto, N. (1993). *State rankings 1993.* Lawrence, KS: Morgan Quinto Corporation.

National Association of Regulatory Utility Commissioners. (1983-1992). *Annual report on utility and carrier regulation*. Washington, DC: NARUC.

National Association of Regulatory Utility Commissioners. (1983b-1992b). *Bell operating company long-distance message telephone rates.* Washington, DC: NARUC.

National Association of Regulatory Utility Commissioners. (1991-1993a). *Profiles of regulatory agencies of the United States and Canada: Yearbook.* Washington, DC: NARUC.

National Association of Regulatory Utility Commissioners. (1993b). *NARUC report on the status of competition in intrastate telecommunications.* Washington, D.C.: NARUC.

National Association of Regulatory Utility Commissioners. (1991-1993c). *Utility regulatory policy in the United States and Canada: Compilation.* Washington, DC: NARUC.

Nordhaus, W.D. and Tobin, J. (1972). Is growth obsolete? *Economic research: retrospect and prospect, vol. 5, economic growth.* New York: Columbia Univeristy Press.

Peltzman, S. (1976). Toward a more general theory of regulation. *The Journal of Law and Economics* 19(2): 211-240.

Peltzman, S. (1985). An economic interpretation of the history of congressional voting in the twentieth century. *The American Economic Review* 75(4): 656-675.

Posner, R.A. (1974). Theories of economic regulation. *Bell Journal of Economics and Management Science* 5(2): 335-358.

Primeaux, W.J. Filer, J.E. Herren, R.S. and Hollas, R.R. (1984). Determinants of regulatory policies toward competition in the electric utility industry. *Public Choice* 43(2): 173-186.

Quigley, P.J. (1994). Pacific Telesis CEO Quigley defends RHC role in demise of S-1822. Keynote speech at USTA conference in San Diego, CA. October, 10.

Quigley, P.J. (1994). Testimony of Phillip J. Quigley, President Pacific Bell, House Energy/ Telecommunications and Finance Antitrust Reform Act 1993. U.S. House of Representatives. Washington, DC: Federal Document Clearing House Congressional Testimony. February 10.

Ridker, RG., and Henning, J.A. (1967). The determinants of residential property values with special reference to air pollution. *Review of Economics and Statistics* 49: 246-257.

Rosen, Sherwin. (1979). Wages-based indexes of urban quality of life. In P. Mieszkowski and M. Straszheim (Eds.), *Current issues in urban economics*. Baltimore: Johns Hopkins Univeristy Press.

Seidenberg, I.J. (1994). Prepared testimony of Ivan J. Seidenberg, Vice-Chairman, NYNEX Corporation, on behalf of the United States Telephone Association H.R. 3636, the 'National Communications Competition and Infrastructure Act.'" Subcommittee on Telecommunications and Finance Committee on Energy and Commerce. Federal News Service. February 9.

Sievers, M. (1994). Should the interLATA restriction be lifted? Unpublished manuscript.

Slater, C.M. and Hall, G.E. (Eds.). (1994). *1994 County and city extra: Annual metro, city, and county data book.* Lanham, MD: Bernan Press.

State Telephone Regulation Report. (1994). Alexandria, VA: Telecom Publishing Group, 12(12-14), June 16, June 30, July 14.

Stigler, G. The theory of economic regulation. (1971). *Bell Journal of Economics and Management Science* 2(1): 1-21.

Stigler, G. and Friedland, C. (1962). What can regulators regulate? The case of electricity. *Journal of Law and Economics* 5(1): 1962.

Taylor, L. *Telecommunications demand in theory and practice.* Boston: Kluwer, 1994.

Taylor, W. and Taylor, L. (1993). Postdivestiture long-distance competition in the United States. *AEA Papers and Proceedings* 83(2): 185-190.

Teske, P. (1991a). Interests and institutions in state regulation. *American Journal of Political Science* 35(1): 139-54.

Teske, P. (1991b). Rent-seeking in the deregulatory environment: State telecommunications. *Public Choice* 68(1-3): 235-243.

Tollison, R.D. (1989). Chicago political economy. *Public Choice* 63(3): 293-297.

United States Department of Commerce. (1990a). Land area and population density. *Summary population and housing characteristics: United States summary.* Washington, DC: Bureau of the Census.

United States Department of Commerce. (1991). *State and metropolitan area data book 1991.* Washington, DC: Bureau of the Census.

United States Department of Commerce. (1984, 1988, 1990b, 1991, 1992, 1993). *Statistical abstract of the United States.* Washington, DC: Bureau of the Census.

United States Federal Communications Commission. (1994). *Communications Daily* 13(73), Washington, DC: FCC. April 28.

United States Federal Communications Commission. (1993). Table 1, 1993 ARMIS 43-01 reports. Obtained from FCC State-Link, Washington, DC: FCC.

United States Federal Communications Commission. (1991). *Statistics of Communications Common Carriers.* Washington, DC: FCC.

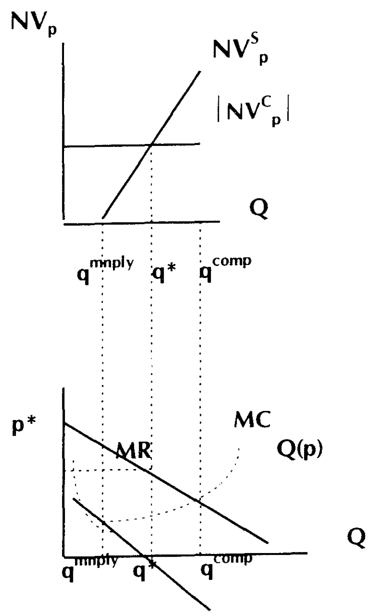

FIGURE 1. Model and Equilibrium

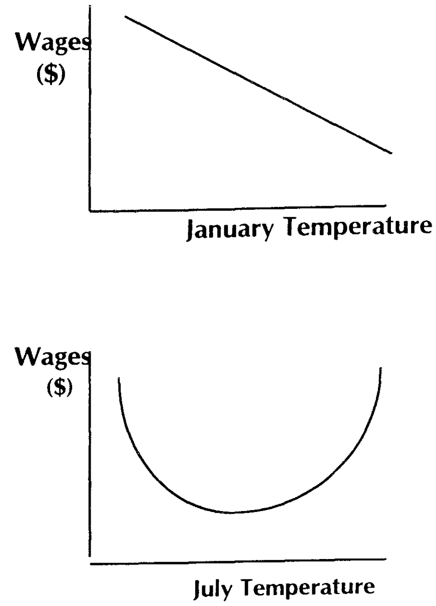

FIGURE 2. Amenities, Wages, and Seasonal Temperatures

TABLE 1. Variables Used To Explain IntraLATA Toll Rates

Variable	Definition	Mean	Std. Dev.
APPOINT	=1 if regulators appointed. =-1 otherwise	0.50	0.87
COMPACCESS	Competitive access provider penetration rate (1992)	0.20	0.23
COMPETITION	= 1 if state permits facilities-based intraLATA toll competiton. = -1 otherwise	0.00	1.00
COST-1	Average January temperature for state	27.17	13.00
COST-2	Average July temperature for state	75.48	5.15
FORTUNE500	Number of Fortune 500 headquarters in state	20.53	28.67
INCOME	Real personal income per capita ($)	12937	2134
LOBBYISTS	Number of lobbyists per legislator (1991)	6.04	5.47
PRICE	Real price of intraLATA long-distance call ($)	1.00	0.44
PUC_AUTHORITY	=1 if PUC has authority over CATV entry and pole attachment policies. =-1 otherwise	-0.75	0.66
REPUBLICAN	= 1 if Republican governor and majority state legislature = 0 if parties (D/R) split governor and majority state legislature. =-1 if Democratic governor and majority state legislature	-0.23	0.61
AMERITECH	=1 if state is part of Ameritech. = 0 otherwise	0.10	0.31
BELLAT	=1 if state is part of Bell Atlantic. = 0 otherwise	0.13	0.33
BELLSTH	=1 if state is part of BellSouth. = 0 otherwise	0.19	0.39
NYNEX	=1 if state is part of NYNEX. = 0 otherwise	0.13	0.33
PACTEL	=1 if state is part of Pacific-Telesis. = 0 otherwise	0.04	0.20
SWBELL	=1 if state is part of Southwestern Bell. = 0 otherwise	0.10	0.31
USWEST	=1 if state is part of U.S. West. = 0 otherwise	0.29	0.45
SNET-DROP*	=1 if state is CT, = 0 otherwise	0.02	0.14
0 -10 MI	=1 if call is between 0 and 10 miles. = 0 otherwise	0.13	0.33
11-16 MI	=1 if call is between 11 and 16 miles. = 0 otherwise	0.13	0.33
17-22 MI	=1 if call is between 17 and 22 miles. = 0 otherwise	0.13	0.33
23-30 MI	=1 if call is between 23 and 30 miles. = 0 otherwise	0.13	0.33
31-40 MI	=1 if call is between 31 and 40 miles. = 0 otherwise	0.13	0.33
41-55 MI	=1 if call is between 41 and 55 miles. = 0 otherwise	0.13	0.33
56-70 MI	=1 if call is between 56 and 70 miles. = 0 otherwise	0.13	0.33
71-124 MI-DROP*	=1 if call is between 71 and 124 miles. = 0 otherwise	0.13	0.33
1983	=1 if year is 1983. = 0 otherwise	0.20	0.40
1986	=1 if year is 1986. = 0 otherwise	0.20	0.40
1988	=1 if year is 1988. = 0 otherwise	0.20	0.40
1990	=1 if year is 1990. = 0 otherwise	0.20	0.40
1992-DROP*	=1 if year is 1992. = 0 otherwise	0.20	0.40

* Variable dropped in all regressions.

TABLE 2. OLS Regression Results for IntraLATA Toll Rate Regression Models 1-3

Estimation Method: OLS Dep Mean =1.00 F Value 251.45 Root MSE 0.20797 R-square 0.78

Estimation Method: OLS N = 1920 Prob>F 0.0001 Adj R-sq 0.78

	MODEL 1		MODEL 2		MODEL 3	
Variable	Estimate		Estimate		Estimate	
APPOINT	0.025	***	0.288	***	0.022	***
	(-3.35)		(3.81)		(2.98)	
COMPACCESS	---		-0.107	**	-0.006	**
	---		(-2.17)		(-0.94)	
COMPACCESS*FORTUNE500	---		---		-0.008	***
	---		---		(-5.927)	
COMPETITION	---		-0.006		-0.001	
	---		(-0.75)		(-0.939)	
COMPETITION*FORTUNE500	---		-0.0004	**	---	
	---		(-1.87)		---	
COSTS-1	-0.023	***	0.002	***	0.002	***
	(3.78)		(2.91)		(2.71)	
COSTS-2	-0.094	***	-0.085	***	0.072	***
	(-3.70)		(-3.289)		(-2.80)	
COSTS-2^2	0.001	***	0.001	***	0.005	***
	(3.56)		(3.226)		(2.72)	
FORTUNE500	-0.002	***	-0.001	***	-0.003	***
	(-6.93)		(3.395)		(-3.99)	
INCOME	-0.0001	***	-0.0001	***	-0.0001	***
	(16.18)		(-13.51)		(-13.279)	
LOBBYISTS	0.003	***	0.003	***	0.003	***
	(2.42)		(2.77)		(2.56)	
PUC-AUTHORITY	-0.049	***	-0.063	***	-0.084	***
	(-5.202)		(-5.11)		(-6.57)	
REPUBLICAN	-0.026	***	-0.027	***	-0.020	***
	(-2.932)		(-2.97)		(-2.27)	

The asterisks indicate significance at 10% (*), 5% (**), and 1% (***) for a single-tailed test.

	MODEL 1		MODEL 2		MODEL 3	
Variable	Estimate		Estimate		Estimate	
AMERITECH	-0.422	***	-0.376	***	-0.257	***
	(-9.81)		(-8.06)		(-5.04)	
BELLAT	-0.304	***	-0.258	***	-0.119	**
	(-7.37)		(-5.71)		(-2.33)	
BELLSTH	-0.038	***	-0.359	***	-0.228	**
	(-7.71)		(-7.10)		(-4.14)	
NYNEX	-0.252	***	-0.196	**	-0.016	
	(-6.24)		(-4.30)		(-0.28)	
PACTEL	-0.339	***	-0.349	***	-0.192	**
	(-6.89)		(-7.07)		(-3.49)	
SWBELL	-0.419	***	-0.394	***	-0.288	***
	(-8.72)		(-8.05)		(-5.54)	
USWEST	-0.595	***	-0.544	***	-0.388	***
	(-13.27)		(-11.03)		(-5.89)	
0 -10 MI	-0.972	***	-0.972	***	-0.972	***
	(-51.17)		(-51.23)		(-51.66)	
11-16 MI	-0.802	***	-0.802	***	-0.802	***
	(-42.22)		(-42.28)		(-42.63)	
17-22 MI	-0.677	***	-0.677	***	-0.677	***
	(-35.63)		(-35.67)		(-35.97)	
23-30 MI	-0.497	***	-0.497	***	-0.497	***
	(-26.16)		(-26.20)		(-26.41)	
31-40 MI	-0.360	***	-0.360	***	-0.360	***
	(-18.94)		(-18.97)		(-19.12)	
41-55 MI	-0.226	***	-0.226	***	-0.226	***
	(-11.89)		(-11.90)		(-12.00)	
56-70 MI	-0.101	***	-0.101	***	-0.101	***
	(-5.30)		(-5.30)		(-5.35)	
1983	0.336	***	0.342	***	0.343	***
	(19.39)		(18.32)		(18.56)	
1986	0.339	***	0.341	***	0.340	***
	(22.31)		(21.77)		(21.91)	
1988	0.246	***	0.251	***	0.249	***
	(16.62)		(16.49)		(16.52)	
1990	0.104	***	0.105	***	0.103	***
	(6.91)		(6.93)		(6.90)	
INTERCEPT	6.309	***	5.790	***	5.065	***
	(6.38)		(5.715)		(5.05)	

TABLE 3. Random Effects Regression Results for IntraLATA Toll Rate Regression Models 1-3

Estimation Method: Fuller-Battese Dep Mean 1.00361 N = 1920

	MODEL 1		MODEL 2		MODEL 3	
Variable	Estimate		Estimate		Estimate	
APPOINT	0.021	*	0.026	**	0.021	*
	(1.54)		(1.79)		(1.46)	
COMPACCESS	---		-0.141	*	-0.125	*
	---		(-1.54)		(-1.38)	
COMPACCESS*FORTUNE500	---		---		-0.007	***
	---		---		(-2.94)	
COMPETITION	---		-0.003		-0.009	
	---		(-0.27)		(-1.01)	
COMPETITION*FORTUNE500	---		-0.0002		---	
	---		(-0.67)		---	
COSTS-1	-0.002	**	-0.002		-0.002	
	(-1.83)		(-1.22)		(-1.18)	
COSTS-2	-0.093	**	-0.085	**	-0.070	*
	(-1.91)		(-1.72)		(-1.44)	
COSTS-2^2	0.001	**	0.001	**	0.001	*
	(1.83)		(1.67)		(1.40)	
FORTUNE500	-0.002	***	-0.001	**	0.003	**
	(-4.18)		(-2.14)		(1.86)	
INCOME	-0.0001	***	-0.0001	***	-0.0001	***
	(-7.78)		(-6.33)		(-6.32)	
LOBBYISTS	0.003		0.003	*	0.003	*
	(1.15)		(1.47)		(1.35)	
PUC-AUTHORITY	-0.053	***	-0.074	***	-0.091	***
	(-2.93)		(-3.29)		(-3.95)	
REPUBLICAN	-0.020	*	-0.021	*	-0.018	*
	(-1.52)		(-1.57)		(-1.31)	

Variance Components

	Cross Sections	**Time Series**	**Erro**	SSE	MSE	DFE
MODEL 1	0.03	8.00E-06	0.02	36.15	0.02	1892
MODEL 2	0.03	8.00E-06	0.02	36.09	0.02	1889
MODEL 3	0.03	8.00E-06	0.02	36.12	0.02	1889

	MODEL 1		MODEL 2		MODEL 3	
Variable	Estimate		Estimate		Estimate	
AMERITECH	-0.397	***	-0.344	***	-0.232	***
	(-4.88)		(-3.93)		(-2.43)	
BELLAT	-0.290	***	-0.236	***	-0.106	
	(-3.70)		(-2.78)		(-1.11)	
BELLSTH	-0.357	***	-0.330	***	-0.208	**
	(-3.78)		(-3.44)		(-2.01)	
NYNEX	-0.237	***	-0.178	**	-0.005	
	(-3.10)		(-2.12)		(-0.044)	
PACTEL	-0.329	***	-0.342	***	-0.196	**
	(-3.53)		(-3.65)		(-1.87)	
SWBELL	-0.392	***	-0.368	***	-0.268	***
	(-4.31)		(-3.98)		(-2.73)	
USWEST	-0.576	***	-0.517	***	-0.370	***
	(-6.78)		(-5.65)		(-3.54)	
0 -10 MI	-0.971	***	-0.971	***	-0.971	***
	(-70.84)		(-70.84)		(-70.93)	
11-16 MI	-0.794	***	-0.794	***	-0.794	***
	(-56.39)		(-56.39)		(-56.46)	
17-22 MI	-0.672	***	-0.672	***	-0.672	***
	(-47.51)		(-47.51)		(-47.55)	
23-30 MI	-0.464	***	-0.464	***	-0.465	***
	(-33.33)		(-33.33)		(-33.37)	
31-40 MI	-0.329	***	-0.329	***	-0.339	***
	(-23.76)		(-23.76)		(-23.78)	
41-55 MI	-0.226	***	-0.226	***	-0.226	***
	(-16.70)		(-16.70)		(-16.70)	
56-70 MI	-0.094	***	-0.094	***	-0.094	***
	(-7.19)		(-7.19)		(-7.20)	
1983	0.351	***	0.355	***	0.356	***
	(11.96)		(11.34)		(11.50)	
1986	0.227	***	0.226	***	0.228	***
	(10.20)		(9.85)		(10.01)	
1988	0.098	***	0.097	***	0.098	***
	(4.74)		(4.60)		(4.71)	
1990	-0.013		-0.014		-0.013	
	(-0.76)		(-0.81)		(-0.77)	
INTERCEPT	6.200	***	5.720	***	4.966	***
	(3.29)		(2.98)		(2.606)	

The asterisks indicate significance at 10% (*), 5% (**), and 1% (***) for a single-tailed test.

Table 4. **Impact of Explanatory Variables on IntraLATA Call Prices: Elasticity Estimates Around Means Values**

Model 1*

Continuous (elasticities).

Variable	Elasticity
COST-1	-0.06
COST-2	-6.99
FORT500	-0.04
INCOME	-0.75
LOBBYISTS	0.02

Discrete (coefficients).

APPOINT	0.04
PUC_AUTHORITY	-0.10
REPUBLICAN	-0.04
AMERITECH	-0.40
BELLAT	-0.29
BELLSTH	-0.36
NYNEX	-0.24
PACTEL	-0.33
SWBELL	-0.39
USWEST	-0.58
0 -10 MI	-0.97
11-16 MI	-0.79
17-22 MI	-0.67
23-30 MI	-0.46
31-40 MI	-0.33
41-55 MI	-0.23
56-70 MI	-0.09
1983	0.35
1986	0.23
1988	0.10
1990	-0.01

Model 2*

Continuous (elasticities).

Variable	Elasticity
COMPACCESS	-0.03
COST-1	-0.04
COST-2	-6.40
FORTUNE500**	0.001
INCOME	-0.68
LOBBYISTS	0.02

Discrete (coefficients).

APPOINT	0.05
COMPETITION**	-0.01
PUC_AUTHORITY	-0.15
REPUBLICAN	-0.04
AMERITECH	-0.34
BELLAT	-0.24
BELLSTH	-0.33
NYNEX	-0.18
PACTEL	-0.34
SWBELL	-0.37
USWEST	-0.52
0 -10 MI	-0.97
11-16 MI	-0.79
17-22 MI	-0.67
23-30 MI	-0.46
31-40 MI	-0.33
41-55 MI	-0.23
56-70 MI	-0.09
1983	0.35
1986	0.23
1988	0.10
1990	-0.01

Model 3*

Continuous (elasticities).

Variable	Elasticity
COMPACCESS**	-0.27
COST-1	-0.04
COST-2	-5.30
FORTUNE500**	0.002
INCOME	-0.67
LOBBYISTS	0.02

Discrete (coefficients).

APPOINT	0.04
COMPETITION	-0.02
PUC_AUTHORITY	-0.18
REPUBLICAN	-0.04
AMERITECH	-0.23
BELLAT	-0.11
BELLSTH	-0.21
NYNEX	-0.001
PACTEL	-0.20
SWBELL	-0.27
USWEST	-0.37
0 -10 MI	-0.97
11-16 MI	-0.79
17-22 MI	-0.67
23-30 MI	-0.46
31-40 MI	-0.33
41-55 MI	-0.23
56-70 MI	-0.09
1983	0.36
1986	0.23
1988	0.10
1990	-0.01

*All estimates based on variance components estimation.

**includes interaction