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ABSTRACT

This paper examines how regulators set local prices in response to the changes brought on by the Telecommunications Act of 1996 ("Telecom Act"). We are particularly interested in the extent to which state regulators set prices that promoted efficiency or were influenced by private-interest groups who had secured rents under a regime of regulated monopoly. Using regional Bell operating company (RBOC) data, our empirical results indicate that private interests continue to influence the structure of retail and wholesale prices, although their influence appears to be waning. We find that changes to the regulatory structure, as measured by federal approval of RBOC Section 271 applications that open up markets to competition and universal service subsidies, resulted in a re-balancing of retail prices and lower overall price levels.

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"Today, with the stroke of a pen, our laws will catch up with our future. We will help to create an open marketplace where competition and innovation can move as quick as light. An industry that is already one-sixth of our entire economy will thrive. It will create opportunity, many more high-wage jobs and better lives for all Americans."[1]

I. INTRODUCTION

This paper examines how regulators set local retail and wholesale prices in response to the changes brought on by the Telecommunications Act of 1996 ("Telecom Act"). We are particularly interested in the extent to which state regulators set prices that promoted efficiency or were influenced by private-interest groups who had secured rents under a regime of regulated monopoly.[2] Understanding how markets and regulators respond to legislative mandates that expose regulated industries to competition informs policy makers in the U.S. and abroad as they move to restructure other regulated industries.

The Telecom Act is often criticized as a failure (for example, see Weissman, 2002 and Crandall, 2005). Detractors claim that its main legacies are additional layers of regulation and protracted litigation, providing little competition and few of the promised consumer benefits. The Federal Communications Commission (FCC), however, reports that by June, 2002 11.4 percent of all wire-line end users subscribed to service provided by entrants.[3] In addition, the number of end-user landlines decreased by about five hundred thousand lines between 1999 and 2002, while the number of wireless telephone

[1] Remarks by President William J. Clinton at the Signing Ceremony for the Telecommunications Act, February 8, 1996 (Clinton, 1996).
[2] Micro-level competition data would add to the analysis we undertake, but such data are commercially sensitive and not available to independent researchers at this point in time.
[3] About 72 percent of competitive lines were provided using incumbent facilities (FCC, 2005a). While competitors provided service to more residential and single-line business customers (11 million) than multi-line business customers (10.5 million), entrant's market share was higher in the multi-line business (22 percent) than residential and single-line business segment (8 percent).

subscriptions nearly doubled from 79.7 million to over 138.8 million.[4] Nascent competitors using new technologies, such as voice over Internet protocol, were also threatening to become important sources of competition as well.

Prior to the Telecom Act, most state and local governments treated local telephone service as a regulated monopoly and blocked competitive entry. State regulators also adopted systems of implicit and explicit subsidies whose stated goal was to increase subscribership.[5] The Telecom Act forced states to allow entry and mandated that incumbents share network effects with entrants by interconnecting and exchanging traffic with their competitors.[6] Regulators were required to revise universal service programs by replacing implicit subsidies with explicit subsidies, and allowing entrants, as well as incumbents, access to explicit universal service subsidies.

The Telecom Act attempted to jumpstart competition by permitting entrants to resell incumbent services and/or provide service over incumbent facilities. Entrants could lease incumbent network elements, such as the local loop to the household, at cost-based wholesale prices, which addressed concerns that telecom networks contain essential facilities that exhibit characteristics consistent with a natural monopoly, and fostered retail competition. While its stated goal was to develop a deregulated competitive communications marketplace, the Telecom Act required that federal and

[4] While many factors contributed to the growth of wireless, the Telecom Act's provisions requiring interconnection and symmetrical, cost-based rates for traffic exchange likely played an important role. (See 47 U.S.C. 252(d)(2)). The FCC (2005a) reports that by the end of 2004, competitor's market share grew to 18.5 percent, the number of end-user land lines experienced over a six-percent reduction compared to 1999, and the number wireless telephone subscriptions had grown to over 181 million.

[5] Riordan (2002) cautions that "cross subsidy" is often used loosely and ignores the potential impact network externalities and economies of scale have on efficient pricing of services. In addition, examples of urban-to-rural and business-to-residential cross subsidies often ignore profits from unregulated services.

[6] As discussed in footnote 4, in doing so, the Telecom Act required symmetrical, cost-based rates for charges competitors pay each other when a call is initiated on one carrier's network and terminated on another's.

state regulators develop and oversee an entirely new layer of rules regulating interconnection and the wholesale of network elements.

The new rules and regulations potentially undermine the structure of retail prices in place when the Telecom Act became law.[7] Because entrants target customers who generate subsidies, competitive entry may force regulators to rebalance prices to ensure the incumbent's solvency. Cost-based wholesale prices and the Telecom Act's other market-opening provisions accelerate the competitive process, giving regulators with the desire to maintain the status quo the incentive to set wholesale prices at levels that exceed costs.[8] Such incentives call into question whether the Telecom Act, as implemented, is truly deregulatory or simply a form of ostensible deregulation where regulators adopt new regulations that, on the surface, appear to promote competition, but in practice maintain the status quo.

Two theoretical literatures help explain state regulators' implementation of the Telecom Act. The public-interest theory of regulation is based on the normative premise that regulators intervene in markets to correct inefficiencies (Ramsey, 1927; Baumol and Bradford, 1970). According to Noll (1989), deregulation occurs when the costs of regulation exceed the transaction costs of deregulation and the costs of any market failure that remain. For our study, the theory suggests we should observe improved market performance as regulators implement the Telecom Act's provisions. By contrast, the private-interest theory argues that regulation is a forum where rents are created and

[7] Noll and Smart (1991) argue that residential and rural constituents use their persuasive powers to ensure urban-business customers pay retail prices that exceed cost so regulators can reduce the prices residential and rural customers pay for electricity, gas and local telephone service. Palmer (1992), Maher (1999) and Knittle (2004) test for the presence of implicit cross subsidy in local telephone prices and present evidence that is consistent with business and urban customers cross-subsidizing residential and rural customers.
[8] Alternatively, state regulators could adopt an aggressive universal service program that taxes retail prices and provides explicit subsidies to consumer groups who enjoyed below-cost prices before the Act.

influential constituencies compete for these rents by offering political support for favorable regulation (Stigler, 1971; Peltzman, 1976; Becker, 1983; Noll, 1989). Politically savvy consumer groups and regulated incumbents, who secured rents under the old regime, may actively oppose state regulators as they implement the Telecom Act's market-opening provisions. The implication is that political influence leads to sub-optimal regulated prices.

Our empirical analysis distinguishes between the different theoretical explanations by estimating the effects public-interest and private-interest proxies exert on regulated prices. Generally, our approach is similar to studies by Kroszner and Strahan (1999) and Heinemann and Schuller (2004), who use economic, political and institutional variables to explain regulatory and supervisory reform in the banking sector. Our paper also resembles studies by Smart (1994), Abel (2002) and De Figueiredo, Jr. and Edwards (2004), who provide political-economy explanations of entry and access prices, respectively, in local telephone markets. These latter studies, however, do not account for the structure of prices across consumer groups and different areas within a state, and as such, do not adequately capture the trade-offs facing regulators when setting prices that affect competition. Moreover, all the studies above typically proxy political effects with variables that measure the size of the interest group rather than the group's ability to effectively organize consumer surplus into political support (i.e., their "political influence"). In this paper, we estimate how political influence, measured by the price-cost margin for the specific consumer group, affects prices for other groups and regions while controlling for costs, demand and interest-group size.

We estimate retail and wholesale price equations for the regional Bell operating companies (RBOCs) using data on U.S. local telephone markets in 2002. Our results are consistent with the continued presence of both urban-to-rural and business-to-residential cross subsidy, although the inter-regional subsidy appears more pronounced. In regressions that estimate the relationship between inter-regional price-cost margins and retail prices, results show that regulators set retail prices within customer classes similarly, but use revenues from urban business customers to lower rural retail prices.

Wholesale (retail) prices are directly related to retail (wholesale) price-cost margins. These results indicate that regulators take into account the "opportunity cost" associated with lost profits when competitors serve customers using incumbent facilities when setting wholesale prices. The relatively small economic magnitude of the effects, however, is inconsistent with regulators overtly preserving historic pricing structures by increasing wholesale access prices. Private-interests also appear to influence wholesale access prices, as increases in entrants' political contributions lead to lower urban wholesale access prices, although the magnitude of the effect is small.

While the analysis provides evidence that private interests continue to influence regulatory pricing decisions, the changes to the regulatory and market structure, as measured by federal approval of RBOC Section 271 applications, resulted in a re-balancing of retail prices and lower overall price levels. In addition, the political influence of rural constituents appears limited, as regulators use new federal high-cost universal service subsidies to lower urban business prices, rather than increasing urban-rural cross-subsidies. These results suggest that the Telecom Act, and introduction of

competition, improved market performance and limited the ability of regulators to pursue private interest objectives.

The paper is organized as follows. Section II describes how U.S. local telephone markets are regulated. Section III provides a brief theoretical illustration of the opportunity costs and trade offs facing state regulators. Section IV outlines the empirical model and hypotheses about state regulator pricing behavior, and describes the data used to test our hypotheses. Estimation results are discussed in Section V and Section VI provides conclusions.

II. REGULATION OF LOCAL TELEPHONE MARKETS

U.S. regulation of local telephone markets requires coordination between federal and state commissions. State regulators set prices and regulations for local services, while federal regulators are responsible for services that cross state lines.[9] Recognizing the bi-jurisdictional nature of regulation, the Telecom Act required that the FCC (1996) set national guidelines state regulators were required to follow when implementing the Act.[10] States were obligated to set wholesale prices based on the forward-looking economic cost of providing leased facilities, plus a reasonable contribution to joint and common costs and the incumbent's profit. Because the cost of providing service differs substantially by population density, the FCC required that states define at least three different pricing zones for unbundled network elements (UNEs), and set different wholesale prices for

[9] The courts determined that facilities connecting consumers to the network carry both intrastate and interstate services, and determined that the FCC is responsible for regulating approximately 25 percent of the local network. For large carriers, the FCC uses price caps to regulate "interstate" charges, which include the fees long-distance companies pay local companies when a long-distance call originates or terminates on a local network (interstate access charges) and the flat-rated federal subscriber line charge (SLC).

[10] The FCC (1996) states that it "sets minimum uniform, national rules, but also relies heavily on state to apply these rules and to exercise their own discretion in implementing a pro-competitive regime in local telephone markets. On those issues where the need to create a factual record distinct to a state or to balance unique local considerations is material, we ask the states to develop their own rules that are consistent with the general guidance contained herein." (FCC 1996, para. 22).

each zone. While the FCC's rules limited the manner in which wholesale prices were set, state regulators had considerable discretion when setting wholesale prices. State regulators were obliged to determine, among other things, the appropriate cost of capital, depreciation rate, cost of labor, and fill factors when estimating the economic cost of providing UNEs. Each of these factors has a large impact on estimated costs.[11]

In return for opening their markets to competition, the Telecom Act allows RBOCs to enter interstate long-distance markets, which had been prohibited since the 1984 breakup of AT&T.[12] The Telecom Act's Section 271 provides a 14-point checklist incumbent RBOCs must satisfy before they are allowed into interstate markets. The checklist consists of specific market-opening actions, such as providing non-discriminatory access to UNEs. The approval process requires that RBOCs apply for 271 approval on a state-by-state basis, and begins by receiving state-regulator certification that section 271's checklist has been satisfied. As part of the federal approval process, the Department of Justice (DoJ) reviews the RBOC's application and consults the FCC. The DoJ, in an affidavit filed by Schwartz (1997), adopted an "Open Local Market" standard for authorizing RBOC entry into long-distance markets. The standard requires that the local market in applicant RBOC's state is "fully and irreversibly open to competition." The FCC approved the first 271 application, Verizon's New York application, in December 1999, nearly four years after the Act's passage.[13]

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[11] Gifford (2003) and Nuechterlein and Weiser (2005) discuss the leeway given to state regulators.

[12] The FCC found that "incumbent local exchange carriers have no economic incentive, independent of the incentives set forth in sections 271 and 274 of the 1996 Act, to provide potential competitors with opportunities to interconnect with and make use of the incumbent LEC's network and services." (FCC, 1996, para. 55).

[13] As July 1, 2002, the FCC had approved 271 applications in Arkansas, Connecticut, Georgia, Kansas, Louisiana, Massachusetts, Maine, Missouri, New Jersey, New York, Oklahoma, Pennsylvania, Rhode Island, Texas and Vermont. The FCC was in the process of reviewing applications from Alabama, Kentucky, Mississippi, North Carolina, South Carolina, New Hampshire and Delaware. Results where we

The Telecom Act requires that state and federal regulators reform universal service programs so they are compatible with a competitive environment. Universal service programs must be explicit, and prices in high-cost areas should be reasonably comparable with prices in urban areas. As part of its implementation of the Telecom Act, the FCC revised its high-cost subsidy program for large, non-rural carriers,[14] which includes the RBOCs, by targeting universal service subsidies to high-cost wire centers in states whose costs are well above the national average. Using a cost-proxy model, the FCC estimated the forward-looking economic cost of local telephone service to identify high-cost areas and determine subsidies.[15] Telecom companies contribute a percentage of their interstate revenues to the Universal Service Administration Company (USAC) to fund the revised federal program. USAC then distributes subsidies to companies, including entrants, providing service in targeted wire centers.[16]

Because state regulators have different preferences and constituencies, and costs differ across states, implementation of the Telecom Act may differ substantially across states and also within a state across different regions. Political and profit constraints

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include a variable for 271 applications under review yields largely similar results to those included in this study. RBOCs received 271 approval for all of their states by December 2003 (FCC, 2005b).

[14] A telephone company meets the FCC definition of a rural carrier if it meets any of the following criteria: serves only incorporated places with less than 10,000 inhabitants; has less than 50,000 access lines, has less than 100,000 access lines in any one state; or has less than 15 percent of its access lines in communities of more than 50,000 (FCC, 1996).

[15] Support is provided to "non-rural" carriers in states where cost-model estimated state-average cost is greater than 135 percent of the national average cost for large carriers. Federal non-rural USF support is distributed to Alabama, Kentucky, Maine, Mississippi, Vermont and West Virginia. Montana and Wyoming also receive support, but are not included in our data. For the second quarter 2005, telecom companies paid 11.1 percent of interstate revenues into the USF. Total USF collections were $1,806 million, of which $1,015 million went to high-cost support, $207 million went to low-income support, $577 million to schools and libraries, and $6 million to rural health care (Universal Service Administrative Company, 2002). Most companies charge a universal service fee to their customers to recover their contribution to the USF. There are also transaction costs incurred by the FCC to calculate fund contributions and identify high-cost areas.

[16] See United States Court of Appeals (2005). In this ruling the 10th Circuit upholds the mechanism the FCC adopted to induce states "to assist in implementing the goals of universal service. (pp. 31-2)" However, in this decision, the 10th Circuit required that the FCC revisit several issues related with its non-rural USF program, including the manner in which USF support is distributed to states.

ensure that one particular group's or region's influence affects how regulators set prices for other groups and regions in the state. The confluence of these factors means it is not clear whether state regulators behave in ways that promote local telephone competition and efficiency, or maintain the status quo. Section III provides a theoretical illustration of the opportunity costs and trade offs facing state regulators. The model gives insight into how prices for different groups are related and guides the empirical model and hypotheses in Section IV.

III. THEORETICAL DISCUSSION

We extend Armstrong et al.'s (1996) access pricing model to include multiple consumer groups who influence regulators' decisions. A regulated incumbent local telephone company with an essential facility competes with a fringe of new entrants for consumer groups $k = 1, \ldots, K$ in regions $m = 1, \ldots, M$. Fringe firms are identical and produce a homogenous service within class k using the essential facility of the incumbent and other inputs. All fringe firms are homogeneous and competition among them drives their retail price to cost. The incumbent's variable profit from serving group k in region m equals:

$$\Pi_{km}(P_{km}, p_{km}(w_m)) = \left(P_{km} - C_{km}\right) Q_{km}\left(P_{km}, p_{km}(w_m)\right) + \left(w_m - C^{w}_{km}\right) q^{w}_{km}\left(P_{km}, p_{km}(w_m)\right) \quad (1)$$

where P_{km} is the incumbent's retail price, p_{km} is the fringe's retail price, w_m is the wholesale price paid to access the essential facility, C_{km} and C^{w}_{km} are the incumbent's constant marginal cost's of supplying the retail service and essential facility, respectively, Q_{km} is the incumbent's retail output, $q^{w}_{km} = \frac{\partial c_{km}}{\partial w_m} q_{km}\left(P_{km}, p_{km}(w_m)\right)$ is fringe demand for access, $c_{km}(w_m)$ is fringe constant marginal cost of providing retail service and q_{km} is fringe retail output.

Interest groups influence the political environment so that regulators give preferential treatment to certain customers and regions through their pricing decisions. Consumer surplus for group *k* in *m* is represented by indirect utility $V_{km}\left(P_{km}, p_{km}(w_m)\right)$, and α_{km} are the weights regulators attach to consumer surplus.[17] As discussed by Ross (1984), α_{km} measures the political power group *k* in region *m* exerts on regulators, where a large α_k indicates that group *k* can more easily convert a dollar of surplus into political support. The regulator simultaneously chooses prices for each group and region to maximize:

$$V + \Pi \quad \text{subject to} \quad \Pi \geq F \tag{2}$$

where $V = \sum_{k=1}^{K}\sum_{m=1}^{M} \alpha_{km} V_{km}\left(P_{km}, p_{km}(w_m)\right)$, $\Pi = \sum_{k=1}^{K}\sum_{m=1}^{M} \Pi_{km}\left(P_{km}, p_{km}(w_m)\right)$ and F are fixed costs.

Consider the case of two customer groups k = R, B, representing residential and business customers, respectively, and one region, *m*. The first-order conditions (FOCs) for (2) with respect to P_{Rm}, P_{Bm} and w_m provide the price-cost markup equations:

$$P_{Rm} = \left(1 - \left(\frac{1+\lambda-\alpha_{Rm}}{(1+\lambda)\eta_{Rm}}\right)\right)^{-1}\left(C_{Rm} - \frac{\partial q^{w}_{Rm}/\partial P_{Rm}}{\partial Q_{Rm}/\partial P_{Rm}}\left(w_m - C^{w}_{Rm}\right)\right) \tag{3}$$

$$P_{Bm} = \left(1 - \left(\frac{1+\lambda-\alpha_{Bm}}{(1+\lambda)\eta_{Bm}}\right)\right)^{-1}\left(C_{Bm} - \frac{\partial q^{w}_{Bm}/\partial P_{Bm}}{\partial Q_{Bm}/\partial P_{Bm}}\left(w_m - C^{w}_{Bm}\right)\right) \tag{4}$$

$$w_m = \left(1 - \left(\frac{1+\lambda-(\alpha_{Rm}s_{Rm}+\alpha_{Bm}s_{Bm})}{(1+\lambda)\eta^{w}_{m}}\right)\right)^{-1} \times \left(\frac{\partial q^{w}_{Rm}/\partial w_m}{\partial q^{w}_{m}/\partial w_m} C^{w}_{Rm} - \frac{\partial Q_{Rm}/\partial w_m}{\partial q^{w}_{m}/\partial w_m}\left(P_{Rm} - C_{Rm}\right) + \frac{\partial q^{w}_{Bm}/\partial w_m}{\partial q^{w}_{m}/\partial w_m} C^{w}_{Bm} - \frac{\partial Q_{Bm}/\partial w_m}{\partial q^{w}_{m}/\partial w_m}\left(P_{Bm} - C_{Bm}\right)\right) \tag{5}$$

[17] Given small income effects, consumer surplus is $V_{km}(P_{km}, p_{km}(w_m))$, and $\frac{\partial V_{km}}{\partial P_{km}} = -Q_{km}$.

where $\lambda > 0$ is the Lagrange multiplier, η's are (absolute value) own-price elasticities of demand, s_{Rm} and s_{Bm} are shares of wholesale demand (i.e., $s_{Rm} = q^w_{Rm} / q^w_m$) and $q^w_m = q^w_{Rm} + q^w_{Bm}$. The second terms in parentheses on the right-hand side of each price equation are marginal opportunity costs of retail and wholesale service provision, respectively. This is the direct cost of providing service plus the opportunity cost of wholesale (retail) profit foregone when the incumbent sells one additional unit of its retail (wholesale) service (Willig, 1979; Baumol, 1983; Armstrong et al., 1996).

Let $(1 + \lambda) > \alpha_{Rm}, \alpha_{Bm} > 0$ so that variable profit (i.e., revenue less marginal *opportunity* cost) for each group ranges from zero to the monopoly level. The weights $\alpha_{Rm} = \alpha_{Bm} = 1$ correspond to standard Ramsey pricing rules whereby regulators choose $\lambda/(1+ \lambda)$ so the price level covers fixed costs, and elasticities determine the optimal departure of prices from costs. When residential consumer's influence increases relative to business consumers so that $\alpha_{Rm} > 1 > \alpha_{Bm}$, the residential retail price mark up declines and the business retail price must increase to finance the profit constraint. The relationship between regulatory preferences and the wholesale price is less clear. Ideally, two wholesale prices, w_{Rm} and w_{Bm}, should be available to the regulator. When residential consumers are preferred, the regulator decreases w_{Rm} to encourage entry in the residential market but increases w_{Bm} to protect the cross subsidy. In practice, regulators have a single compromised access price, w_m, that rises or falls with the relative strength of each group and the extent of cross subsidy.

The discussion has several positive implications contrary to the intentions of the Telecom Act. Given fixed costs and/or implicit cross subsidy, the regulator will set prices according to opportunity cost to support the historical pricing structure and prevent

inefficient entry in the subsidizing market. Empirically, a positive relationship between opportunity costs and retail and wholesale prices is consistent with this behavior. To the extent that retail prices reflect regulator's trade offs, the retail price-cost margin for a particular consumer group is a useful proxy for that group's relative political influence. All things equal, an inverse relationship between the retail price-cost margin for one group and the retail price for others suggests the use of implicit cross subsidies. The effect political power has on the wholesale price depends on the potential for entry in subsidizing and subsidized markets, respectively. When most wholesale sales are in the subsidizing market, an increase in the relative political influence of the subsidized group will increase the wholesale price.

IV. DATA AND EMPIRICAL MODEL

A. Data

To examine state regulator behavior, we gathered data on retail and wholesale access prices for the original RBOCs on July 1, 2002 for 7,661 wire centers in 43 states.[18] Price data are augmented with demographic and business-activity census data,[19] and the FCC's (2000) Hybrid Cost Proxy Model (HCPM),[20] which provides total cost data and line counts for each wire center in the sample. RBOCs account for about 80 percent of all U.S. local loops.[21]

[18] Alaska, Connecticut and Hawaii are excluded because they were not served by the original RBOCs. Wyoming and Montana are excluded because prices differ within wire centers. Idaho and Delaware are excluded because of insufficient cost data, and DC is excluded because it has only one UNE zone.
[19] United States Census Bureau (2002a, 2002b)
[20] The HCPM is based on engineering estimates of forward-looking economic costs assuming current wire center locations. These estimates are not the same as the historical or embedded costs that were incurred to build the network. Because we use cross-section data, the level of the cost is not as important as the relative costs across regions, and some of the criticisms of the HCPM should not affect our results. Marginal cost estimates were obtained from estimated total (loop and port) cost functions using HCPM data.
[21] This paper does not address pricing for small rural telephone companies, in part, because such companies were not generally subject to the same market opening and unbundling requirements as the RBOCs. In

Since most states have three UNE zones, generally representing urban, suburban and rural regions, we use that convention and define three regions in each state. Urban UNE regions consist of wire centers with the lowest UNE prices in a state and rural regions include wire centers with the highest UNE prices. Remaining wire centers are suburban.[22] Table 1 provides selected regional characteristics, prices and costs for 7,661 wire centers located in each of the three regions. 1,345 wire centers are urban, 2,104 are suburban and 4,212 are rural. Rural wire centers tend to include substantially more area than urban wire centers, but serve fewer customers. The average rural wire center covers over 137 square miles, providing service to over 6,000 lines, while the average urban wire center covers approximately 55 square miles and contains over 36,000 lines. The average urban wire center has over 4,800 lines per square mile, while rural wire centers average only 137 lines per square mile.

Table 2 and Table 3 compare business and residential retail prices with marginal-cost estimates for each of the three regions under consideration. These data suggest that, nearly six years after the Act's passage, state regulators continue the historical practice of using revenues from business customers to fund below-cost pricing for residential services. The average monthly business retail price exceeds marginal cost by approximately $20, and is fairly constant across regions. Nearly all business-line prices exceed estimated marginal cost. For residential services, the average retail price is more than $4 below estimated marginal cost, with the largest shortfall, over $6, occurring in rural zones. About 14 percent of all residential prices exceed estimated marginal cost. While this simple comparison is not a formal test of cross subsidy because we do include

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addition, small telephone companies generally only provide service within a single zone so would be inapplicable to the study we are conducting.

[22] Chow tests reject the null hypothesis that the data-generating processes are the same across regions.

data on revenues generated from additional services, such as caller ID, in-state long distance and other services, the data suggest that regulators favor residential customers.

Pair-wise analysis of retail prices suggests relationships contrary to the *a priori* expectations of a negative relationship due to cross subsidy. Figure 1 and Figure 2 plot business price-cost margins against residential price-cost margins for 1,345 urban and 4,212 rural regions, respectively. A simple linear regression shows that retail prices are positively related in both regions. Figure 3 plots the average business price-cost margin in urban regions against the average residential price-cost margin in rural regions for the 43 states in our data. Again, we observe a positive (albeit smaller) relationship.

Table 4 compares wholesale prices with marginal-cost estimates. Overall, the average wholesale price for access to unbundled loops, including the loop port, approximately equals marginal cost. In urban regions, the average wholesale price is nearly two dollars below marginal cost, while rural wholesale access prices exceed marginal cost by about three dollars.[23] While these data are inconsistent with regulators protecting historical pricing structures by setting wholesale prices above cost, no definitive conclusions are possible without considering other explanatory variables, unobservables, and the simultaneous setting of retail and wholesale prices.

B. Empirical Model

Our empirical model is a semi-reduced form representation of the FOCs contained in equations (3) through (5). The model sheds light on how state regulators balance economic and political forces when setting prices by including various proxies for public-

[23] The FCC allowed a mark-up for common costs. Because the average common cost is higher in rural areas, as shown by the difference between average and marginal costs in Table 2 through Table 4, the higher mark-ups in rural areas are consistent with FCC guidelines.

interest, private-interest, and institutional factors. The baseline regressions estimate price equations for market *i* located in urban and rural regions, respectively, of the form:

$$\ln P_{Ri} = \alpha_{Ri} + \beta_R cost_{Ri} + \delta_R x_{Ri} + \gamma_R z_{Ri} + \varepsilon_{Ri} \quad (6)$$

$$\ln P_{Bi} = \alpha_{Bi} + \beta_B cost_{Bi} + \delta_B x_{Bi} + \gamma_B z_{Bi} + \varepsilon_{Bi} \quad (7)$$

$$\ln w_i = \alpha_i^w + \beta^w cost_i^w + \delta^w x_i^w + \gamma^w z_i^w + \varepsilon_i^w \quad (8)$$

where P is the monthly price for retail service, cost is a vector of marginal cost variables, x is a vector of interest-group, institutional and political affiliation variables characterizing the regulatory environment, z is a vector of demand variables, w is the monthly wholesale price for access to the incumbent's network, α, β, δ and γ are parameters to be estimated and ε is an error. Because the rural and urban regions provide the starkest contrast with respect to population density, political influence, and potential cross-subsidy, our regression analysis concentrates on these two regions.[24]

C. Variables and Hypotheses

Dependent Variables: Retail prices were obtained from RBOC and state PUC websites.[25] Retail prices for business and residential service are the sum of state-determined monthly charges for local service, federal subscriber line charge, primary inter-exchange carrier charge, and state charges for non-optional extended areas of service.[26] Wholesale access prices were obtained from Gregg (2002) and were cross-checked and supplemented with data from the applicable RBOC state-tariff filings and PUC web sites. The wholesale

[24] Suburban region results are available on request.

[25] See http://cpr.bst.bellsouth.com/index2.html, http://tariffs.uswest.com:8000/, http://www.sbc.com/search/tariffs.jsp and https://retailgateway.bdi.gte.com:1490/.

[26] Prices are for flat-rated service, which allows unlimited calling within the customer's local calling area. In cases where states require measured service, where subscribers pay a monthly fee plus usage charges, estimates of monthly usage charges are included in the retail price. Retail price equations below include *RESMEAS (BUSMEAS)*, which equals one when residential (business) customers are required to purchase measured service, and zero otherwise, to control for the effect of measured service on demand and pricing.

access price equals sum of the UNE price for the loop and the rental price for the switch port (i.e., the interface between the switch and the loop). Telcordia (2000) data were used to match the retail and UNE prices with the appropriate wire center.

Cost: The marginal cost (*MC*) of providing service in each wire center is obtained by estimating total (loop and port) cost functions with HCPM data.[27] Public-interest theory predicts a positive association between retail and wholesale prices and their direct marginal costs (hereafter, marginal costs). Because the FCC's (1996) pricing guidelines provide state regulators great flexibility setting wholesale prices, regulators may use wholesale prices to pursue private-interest objectives such as restricting entry to maintain the historical retail pricing structure. A finding of no relationship between the wholesale price and marginal cost is consistent with private-interest arguments.

The FCC (1996) explicitly rejected opportunity-cost based pricing (or, the efficient component pricing rule) because it would not force prices to competitive levels.[28] The theoretical discussion, however, permits the possibility that well-organized groups, such as the incumbent provider and residential customers, could influence regulators to include opportunity costs when setting wholesale prices to maintain the historical pricing structure or limit competition. To account for the incumbent's opportunity cost, we include both the residential (*RPCM*) and business (*BPCM*) retail price-cost margins in the wholesale price equation, and the wholesale price-cost margin (*WPCM)* in both retail price equations. These variables equal the difference between the price for the service and the estimated marginal cost in the wire center. An insignificant

[27] Cost function estimates are available from the authors on request.
[28] The FCC concludes that "the ECPR [efficient component pricing rule] does not provide any mechanism for moving prices toward competitive levels; it simply takes prices as given. … Congress specifically determined that input prices should be based on cost because this would foster competition in the retail market." (FCC 1996 para. 709 and 710).

relationship between opportunity costs and prices is consistent with regulatory behavior that follows closely the Telecom Act's intentions. Large positive coefficients on any of these price-cost margins indicate that private-interest groups may influence regulators' pricing decisions.

Political Influence (x): Theoretically, an increase in one group's political power lowers the favored group's price, at the expense of higher prices for less powerful groups (or lower incumbent profit). Traditionally, researchers use group size to measure the demand for favorable regulation. In price regressions, however, the effect an increase in an influential group's size exerts on prices is unclear. Consider the case where business customers subsidize residential customers. An increase in the number of residential customers may be correlated with an increase in residential customer's political influence and larger subsidies. Alternatively, holding the per-line subsidy constant, an increase in the number of residential customers requires more money be transferred from businesses to residential customers to provide the same per line subsidy. In this second case, where political influence is held constant, an increase in the number of residential customers may lead regulators to reduce per-line subsidies (but maintain or increase the total subsidy dollars), increasing both residential and business prices.[29] Both cases predict that business prices are positively related to the number of residential customers, but there is no clear prediction for residential prices.

We employ two proxies to capture the size of potentially powerful groups. To measure the number of residential customers relative to business customers, we include *POP-EMP*, which equals the ratio of residential population to number of service

[29] The latter effect is consistent with the private interest theory prediction that regulators "share the pain" when costs increase (Peltzman, 1976; Kaserman et al., 1990).

employees in all equations. We also include the percentage a state's population living in rural areas (*RUR POP*)[30] in all price equations for all regions.

Including regulators' preferences in the theoretical discussion shows that retail prices can be inversely related, a result that does not arise in the standard public-interest model. In the price equations, we use particular group's, or region's, retail price-cost margin as a proxy for that group's ability to organize its political support into favorable pricing outcomes regardless of group size.[31] Because we control for interest-group size explicitly, estimates of the effect particular group's price-cost margins exert on the prices of other groups and regions provides information on the particular group's political power. Importantly, such estimates capture only political-influence effects (i.e., the group's ability to organize and convert consumer surplus into political support) and are not confounded by the impact increased group size has on the ability of regulators to generate subsidy dollars. An inverse relationship between one group's retail price-cost margin and another group's retail price suggests regulators use implicit cross subsidies to favor private-interest groups.

To measure the extent of *intra-region* political influence, we include the business (residential) price-cost margin, *BPCM* (*RPCM*), in the residential (business) price equation for the same wire center. To examine the extent of *inter-region* implicit cross subsidy, we include the average residential price-cost margin in a state's rural regions

[30] *RUR POP* equals the percentage of households located in rural areas, as defined by the census, in the area served by the state's RBOC.

[31] Political influence is declining in the price-cost margin. A finding that regulators, holding demand and marginal cost constant, trade off higher mark-ups to one group to lower other retail prices suggests that regulators act in their private interest, responding to the influence of politically powerful groups. Under a standard Ramsey pricing scheme, holding demand and marginal cost constant, prices are set above cost to recover fixed costs. An increase in fixed costs results in an increase in all prices.

(*RUR RPCM*) in urban price equations and the urban business price-cost margin (*URB BPCM*) in rural price equations.

Incumbents and new entrants have vested interests in the outcomes of state regulatory proceedings that affect wholesale access prices and may attempt to influence outcomes by contributing to state politicians. To capture the effect relative political contributions exert on wholesale prices, we include *CONTRIB*, which equals the ratio of dollars contributed to state politicians by donors affiliated with competitors to contributions made by donors affiliated with a state's RBOC for the 2000 election cycle.[32] Private-interest theory predicts a negative relationship between relative contributions and wholesale access price, especially in lucrative urban markets.

Institutions and Political Affiliation (x): We examine the relationship between institutional factors, stemming both from the Telecom Act and a state's regulatory environment. To investigate how changes to the federal universal service program affected local prices, we construct *USF*, the monthly per-line federal subsidy targeted to a wire center in the second quarter 2002. Because only five urban wire centers attract high-cost support, and the support is small (averaging $0.86 per subsidized line), we include *USF* in only the rural retail price equations where 512 wire centers are subsidized.[33] To the extent that *USF* ensures rural retail prices are comparable with urban prices, we expect a negative coefficient for *USF* in rural retail price regressions. This conclusion,

[32] Data are obtained from The Institute on Money in State Politics at www.followthemoney.org. Non-incumbent RBOC wireless carriers are included as competitors. We divided the contributions between RBOC and competitors and were able to categorize more than 99 percent of contributions.

[33] Data on subsidies distributed by the high-cost program of the federal USF were obtained from the USAC. The federal USF provides support to 677 of the 7,661 wire centers in our data: five are urban; 160 are suburban; and 512 are rural.

however, requires that rural prices would reflect costs in the absence of an explicit subsidy.

The private-interest theory of regulation assumes that regulators view *USF* as a revenue source available for allocation across constituencies. Under this view, a negative coefficient on *USF* in rural retail price regressions may indicate that regulators use *USF* to increase rural cross-subsidies. In the presence of rural cross subsidies, public-interest theory implies that regulators may use *USF* dollars to relieve urban customers' subsidy burden by moving urban retail prices closer to cost. To test these distinctions, we construct *RUR USF,* which equals the average per-line subsidy in a state's rural areas, and include this variable in urban price regressions. The signs of the estimated coefficients on *USF* and *RUR USF* provide insight into the extent rural constituents influence regulatory behavior.

We also include *S271* (equals one if the RBOC received Section 271 approval by July 1, 2002 in a state and zero otherwise) in all equations to capture the effect lowered entry barriers and increased competition along with RBOC entry in interstate long-distance markets exert on retail and wholesale access prices. If regulators historically used business revenues to hold residential retail prices below competitive levels, increased entry and competition may lead to a rebalancing of retail prices. Such a finding is consistent with regulators adhering to public-interest standards, requiring that RBOCs open local markets to competition before approving 271 applications. A second possibility is that the removal of line-of-business restrictions loosens the incumbent's profit constraint, allowing regulators to decrease all prices, including wholesale access prices. Both of these findings are consistent with public-interest behavior.

Although not the main focus of this study, it is important to control for other aspects of the state's regulatory environment. Accordingly, we include *REP GOV* (which equals one when the state's governor is a Republican and zero otherwise), *REP PUC* (equals one when the majority of state's PUC commissioners are Republican and zero otherwise), *ELECT* (equals one when PUC commissioners are elected by the general population and zero otherwise) and *PRICECAP* (equals one if the PUC used price caps to regulate local prices in 2000 and zero otherwise) in all price equations.[34]

Demand (z): Measures of demand reflect the absolute size of markets and the size of particular customer groups within a market. In most cases, these variables are not helpful in distinguishing between different economic theories, and are best interpreted as controls. To control for demand in the residential price equation, we include the percentage of a wire-center's population over 60 years of age (*AGE*), the percentage of white households (*WHITE*), and the percentage of residents under the poverty level (*POVERTY*). We also include the number of households in the customer's free local calling area (*LCA)*. In the business equations we include, the number of employees in the wire center (*EMPLOY*), the percentage of service employees (*SERVICE)*, and the percentage of establishments with less than 20 employees (*SMALL FIRMS*).[35] *EMPLOY* and *LCA* are included in the access-price equation. Additionally, we include the percentage of a state's lines in the appropriate region (*PTLINES*) in the access-price equation, to capture the importance of access prices on the incumbent's budget constraint.

[34] Data were obtained from the National Association of Regulatory Utility Commissioners (2002), National Center for Appropriate Technology (2005), U.S. Census Bureau (2002c) and from David Sappington.
[35] *SMALL FIRMS* are the primary customers of business service we examine in this study. Demographic data for each wire center were obtained by matching census block group data from the 2000 decennial census to wire centers using Claritas (2003). The data also include information on business conditions, obtained from the Census's 2000 County Business Patterns, for the county in which the majority of a wire center is located.

As discussed above regulators may have the incentive to set higher wholesale access prices the larger the share of lines represented by a region.[36]

V. ESTIMATION RESULTS

A. Estimation Strategy

Theory suggests state regulators consider all retail and wholesale prices when setting prices, so any price-cost margin used as an explanatory variable is endogenous. *S271* is likely endogenous because state regulators, in consultation with the FCC and the DoJ, evaluate incumbents' 271 applications and also make pricing decisions. Both decisions may be correlated with unobserved factors. While Hausman (1978) statistics provide mixed results concerning the endogeneity of *S271* in price equations, we proceed cautiously and treat *S271* as endogenous. Since *PRICECAP* is constructed from 2000 data, we treat it exogenous.

Initial baseline regressions of price equations contain three endogenous variables: the two intra-region price-cost margins and *S271*. As indicated by price equations (6) through (8), the exogenous demand (z) variables differ across all equations, ensuring there are sufficient excluded instruments to identify the coefficients on price-cost margins. The coefficients on *S271* in all price equations are identified by a set of regional averages that reflect underlying cost and demand conditions in the urban and non-urban portions of the state.[37] These additional excluded exogenous variables are urban and non-urban averages for *DENSITY* (number of lines per square mile), *EMPLOY*,

[36] Table 5 and Table 6 report summary statistics for all variables in urban and rural price equations.
[37] The data confirm it is important to capture differences in cost and demand conditions between urban and non-urban areas of a state when choosing excluded exogenous variables for first-stage estimates. Hansen (1982) *J*-statistics rejected the null of zero correlation between instruments and errors in alternative specifications that used state averages on *DENSITY*, *EMPLOY*, *LCA*, and *POP-EMP* as excluded exogenous variables.

LCA, and *POP-EMP*. We also include *DEREG* (equals one if the state deregulated its electric power industry before 2002, and zero otherwise) as an excluded exogenous variable, which measures a state's willingness to adopt market-oriented solutions for previously regulated industries without directly affecting telephone prices.

Subsequent price equations are augmented with an inter-region price-cost margin, which is also endogenous. Coefficients on inter-region price-cost margins are identified using the same instruments described above, as well as additional demand variables for urban or rural regions. When the inter-region price-cost margin is the average rural resident price-cost margin (*RUR RPCM*), the additional excluded instruments are average values for *AGE*, *POVERTY* and *WHITE* in rural regions. When the inter-region price-cost margin is the average urban business price-cost margin (*URB BPCM*), the additional excluded instruments are averages for *SERVICE* and *SMALL FIRMS* in urban regions.

Pagan-Hall test statistics from two-stage least squares results indicate that heteroskedasticity is present throughout all price equations. As such, Generalized Method of Moments (GMM) is used to obtain robust estimates with heteroskedasticity of unknown form. Because state regulators set prices throughout the state, observations on wire centers drawn from the same state are likely to be correlated, while observations on wire centers in different states are not. Following Baum (2003), we use weighting matrices that allow for intra-state clustering among wire centers.

B. Results

Table 7 and Table 8 provide residential, business and wholesale price equation estimates for rural and urban regions, respectively. The first column for each price equation includes intra-region price-cost margins only. The second column adds inter-region

variables as additional regressors. The data suggest that *RUR RPCM* and *RUR USF* are significant determinants of urban prices and *URB BPCM* is an important determinant of rural prices. Moreover, several of the estimated coefficients of interest in urban price equations are sensitive to the omission of these inter-region variables. The discussion below focuses primarily on our preferred specification with inter-region variables, found in columns two, four, and six of Table 7 and Table 8.[38]

The results suggest that prices correspond reasonably well with costs across consumer groups and regions. In both urban and rural regions, the estimated (*direct*) marginal cost (*MC*) of providing service has a significant positive effect on retail and wholesale prices. When considered with evidence from summary statistics in Table 4, where average UNE prices reflect estimated average costs, these results suggest that state regulators are complying with the spirit of the FCC (1996) order of cost-based wholesale pricing. Marginal cost effects have relatively small economic significance in urban regions. A one-dollar increase in *MC* increases urban residential, business, and wholesale prices by 6.8, 12.2, and 13 cents, respectively, when evaluated at the average price.[39] In contrast, a one-dollar increase in *MC* increases the corresponding rural prices by 21, 44.6, and 77.1 cents, respectively. Regulators appear to be more responsive to changes in the cost of providing rural service and pass on cost changes directly to rural consumers.

[38] Intercepts vary across regions served by different RBOCs. Partial R^2 statistics by Bound et al. (1995) and Shea (1997) suggest the excluded instruments have good explanatory power in first-stage regressions. In almost all cases, Hansen (1982) *J* statistics do not reject the null of zero correlation between instruments and errors.

[39] Unless stated otherwise, all economic effects are calculated using the arithmetic average for the variables of interest, as reported in Table 5 and Table 6, respectively.

In addition to *MC*, theory predicts that regulators may account for the opportunity cost of providing retail (wholesale) services when setting wholesale (retail) prices. Results show that opportunity costs exert a significant positive effect on urban wholesale prices, and that the magnitudes are reasonably comparable to the effects direct marginal cost have on wholesale prices. A one-dollar increase in the urban business (residential) price-cost margin increases urban wholesale prices by 8.9 (13.5) cents. Opportunity costs exert a positive, albeit marginally significant, effect on rural wholesale prices. Here, a one-dollar increase in the rural business price-cost margin increases rural UNE prices by 13.5 cents. In both urban retail price equations, estimated coefficients on the wholesale access price-cost margin (*WPCM*) are positive. The impact of opportunity cost is largest in the business price-equation. A one-dollar increase in *WPCM* increases residential and business prices by 12.6 and 57.6 cents, respectively.

In summary, estimated cost coefficients show that state regulators consider both direct and opportunity costs when setting prices. While the former result is encouraging, the relatively small size of the impact of direct cost on urban prices implies that prices are not set purely on public-interest criteria. It also appears that state regulators set wholesale prices that consider opportunity costs, albeit with a small effect. Moreover, the impact of opportunity cost on urban prices is comparable to the impact of direct marginal cost. This suggests that incumbents and residential customers may only be able to influence regulators to use opportunity-cost pricing to maintain a small part of the historical pricing structure.

We now consider how the sizes of consumer groups, i.e. urban and rural, and residential and business customers, affect regulator behavior. The estimated coefficients

on *RUR POP* are positive for retail price equations in both regions. Results indicate that a 10 percent increase in a state's rural population increases urban (rural) residential prices by 1.11 (0.85) percent, or approximately 16 (20.1) cents. The effects on business prices, while smaller in percentage terms; urban (rural) business prices increase by 0.87 (0.29) percent, have similar effects on prices. Urban (rural) business prices increase by about 31.1 (10.3) cents.

The relative size of residential to business consumers (*POP-EMP*) has no impact on residential prices but a positive effect on business prices. All things equal, this suggests that residential customers can use their group size in a way that results in business customers bearing a greater cost burden. A ten percent increase in population relative to employment results in a 2.8 percent, or $1.09, increase in the business price. The results on relative size are consistent with private-interests influencing state regulators; regulators increase non-member prices (urban and business) when favored groups (rural and residential) increase in size.

Both *RUR POP* and *POP-EMP* measure group size effects. Consumer groups with more members provide more potential votes. However, some groups, regardless of size, may be relatively more effective in converting surplus into political support. Controlling for group size, we use retail price-cost margins as proxies for the effectiveness of political influence. A negative coefficient on the retail price-cost margin measures the extent to which interest groups obtain favorable outcomes by using their persuasive powers and/or ability to organize political support.

For purpose of comparison, consider the initial baseline regressions that include intra-region price-cost margins only. In the urban residential price-equation, column one

of Table 7, the estimated coefficient on the intra-region business price-cost margin (*BPCM*) is -0.0042 and highly significant. A similar result is found in the retail business equation, located in column 3 of Table 7, where *RPCM* receives a coefficient of -0.0037 and is significant at the ten percent level. The signs of these estimated coefficients suggest regulators trade off residential and business customers within urban regions. No evidence of intra-regional trade-offs is found in the rural equations. In fact, results show that residential and business prices have a positive correspondence within rural regions. It appears that regulators tend to set both rural retail prices similarly rather than trade off residential and business customers.

When inter-region variables are considered in the preferred specification, evidence of a business-residential trade off within urban regions is weaker. Estimates of the urban-residential price equation, reported in the second column of Table 7, show the coefficient on *BPCM* has decreased to -0.0002 and is not significant. The coefficient on *RPCM* in the urban-business price equation, reported in the fourth column of Table 7, has also decreased to -0.0029 and is marginally significant. The results show, however, a significant inverse relationship between urban business prices and rural residential prices, which is consistent with urban-to-rural cross subsidization across customer services. Estimates in column 4 of table 7 show that a dollar increase in the *RUR RPCM* lowers urban business prices by 67.3 cents. Given there are about 0.95 rural residential lines for each urban business line, slightly more than half of any increase in rural residential net revenues is used to lower urban business prices. For rural residential prices (column 2 of Table 8), the results predict that a one-dollar increase in the average urban business price-

cost margin leads to a 19.1 cent decline in rural residential prices.[40] Inter-region trade-offs are not directly apparent in wholesale prices for either urban or rural regions.

Interestingly, columns 2 and 4 of Tables 7 and 8, respectively, show that rural residential price-cost margins (*RUR RPCM*) are positively related to urban residential prices, and urban business price-costs margin (*URB BPCM*) are positively related to rural business prices. Regulators tend to set all residential (or, business) prices similarly rather than trade off urban to rural regions within a specific class of customer service.

At this point, our estimation results suggest that aggregated studies that rely on state-average prices and/or ignore rural areas, do not properly capture the political process followed by regulators, and potentially misinterpret the trade offs they face. Nearly six years after the Telecom Act's passage, the data provide reasonable evidence that private-interest concerns, as measured by the price-cost margin facing rural (urban) residential (business) customers, continue to play a role in the explanation of regulator's retail pricing behavior.

We now explore how the political actions of incumbent and new entrants affect regulated wholesale prices. The interpretation of the negative coefficient on political contributions (*CONTRIB*) in the urban-wholesale price-equation is clear. Increased contributions by the incumbent relative to new and potential entrants increases the wholesale price in lucrative urban regions. However, the economic significance of this result is small. For instance, if the incumbent doubled its average contribution relative to

[40] Because part of the increase in net revenue from increasing urban business prices may also be used to lower suburban prices, this accounts for about one-half of the increase in net revenue.

its competitors, the urban wholesale price would increase by 8.6 cents.[41] Political contributions have no effect on rural wholesale prices.[42]

We find no evidence that state regulators further rural interests by using federal USF subsidies to exacerbate rural cross-subsidies. Wire-center-specific USF (*USF*) has no effect on rural retail prices.[43] By contrast, an increase in the federal universal service funding to rural regions (*RUR USF*) is associated with lower urban business prices. The estimated coefficient on *RUR USF* of -0.0126 is similar to the coefficient on *RUR RPCM* (-0.0172), indicating that a dollar per line in additional targeted federal universal service funding reduces urban business prices by about forty-seven cents. The similarity in magnitude of coefficients on *RUR USF* and *RUR RPCM* suggests that regulators view the contribution of an additional dollar from different sources similarly, using them to reduce urban business prices. This finding may also help explain the finding by Kaserman et. al. (1990) who find that explicit subsidy dollars do not lower residential prices.[44] Instead of providing rural price relief, regulators transfer the money to urban businesses, lowering the subsidy burden borne by urban businesses.[45]

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[41] Incumbent's contributions may have greater influence in states with relatively large rural populations. When the interests of the incumbent and subsidized rural customers coincide, regulators face more political pressure, and may raise wholesale prices by a greater amount to increase entry barriers and protect the historical pricing structure. We test this hypothesis in other regressions, not reported, and find the effect of incumbent contributions on wholesale prices increases with rural population. The coefficient on the interaction term *CONTRIB*×*RUR POP* is -0.091 and significant at the five percent level.

[42] In other regressions, not reported, we include *CONTRIB* in both urban and rural retail equations. *CONTRIB* had no relationship with retail prices.

[43] In other specifications, not reported, *USF* and average urban USF were included in the urban and rural price equations, respectively, were insignificant and had no appreciable impact on the other coefficients.

[44] Eriksson et al. (1998) and Ackerberg et al. (2005) discuss targeted subsidy schemes in the context of low-income support and find that those also have a positive effect on telephone subscriptions. Goolsbee and Guryan (2005) show that the E-rate subsidy, initiated from the Telecom Act and financed by the federal USF, significantly increased Internet access in California public schools.

[45] Our analysis focuses on RBOCs, which have substantial urban and rural service territories. State regulators may not be able to effectuate such transfers within smaller rural telephone companies that do not serve urban business customers. It is possible that USF subsidies may affect local telephone penetration through non-price channels, such as quality improvements.

Urban residential prices are higher and urban business prices lower in states where the incumbent has had its Section 271 application approved. The change in relative prices is substantial. Urban business prices are 18.2 percent lower in states with 271 approval and urban-residential prices are 4.5 percent higher.[46] This corresponds to a $7.22 decrease in the business price and an $0.86 increase in the residential price. Some of the change may be due to rebalancing of prices in the face of competition as in Knittel (2004). In addition, it appears the regulators take advantage of the additional revenue stream to reduce prices overall. There are about 1.4 urban residential lines for each urban business line, and the revenues lost from the 18.2 percent reduction in business prices outweigh the 4.5 percent increase in residential prices. Somewhat surprisingly, results also indicate that 271 approval leads to substantially lower business and wholesale prices in rural areas. This result runs contrary to the widely held belief that competition is concentrated in urban areas. Rural business and wholesale prices are $4.44 and $11.69 lower, respectively, in states with 271 approval.

Although not the main focus of this study, some discussion of the relationship between regulatory environment variables and prices is warranted. Republican governors and Republican PUCs have different effects – Republican governors tend to reduce the urban retail prices and Republican PUCs increase all retail (urban and rural) prices. In contrast, Republican governors have no impact on UNE prices and Republican PUCs lead to lower urban UNE prices. The Republican PUC effect may come from more cost-based retail prices and less pressure to set above-cost UNE prices simply to protect sources of implicit subsidy. The election of PUC Commissioners leads to higher prices.

[46] Knittle (2004) shows that increased local competition in seventy cities from 1988 to 1995 resulted in a 2.5 percent decrease in business prices and a 3.6 percent increase in residential prices.

This may be due to the political influence of the incumbents in the election process. States with price caps in place in 2000 tend to have higher retail prices in 2002.

VI. CONCLUSIONS

State regulators responded to the Telecom Act by setting new wholesale prices and adjusting local retail prices. We examine the extent to which these prices were in the public interest or were influenced by private-interest groups. Using data on RBOC retail and wholesale access prices empirical results indicate that private interests continue to influence the structure of retail and wholesale prices, although their influence appears to be waning. We find that changes to the regulatory structure, as measured by federal approval of RBOC Section 271 applications and universal service subsidies, resulted in a re-balancing of retail prices and lower overall price levels.

While both retail and wholesale prices are positively related to estimated marginal costs, the magnitude of the relationship is small. As suggested by theory, results also show that wholesale prices are positively related to opportunity costs, measured by business and residential retail price-cost margins. However, the relatively small economic magnitude of the effects is inconsistent with regulators overtly preserving historic pricing structures by increasing wholesale access prices.

In contrast to other studies that rely solely on the size of potentially powerful groups to measure political influence, we also include group and region price-cost margins as direct measures of a group's ability to secure favorable outcomes. While results indicate that increases in the relative size of residential and rural customers lead to higher business and urban prices, neither measure indicates that these groups use their size to secure lower prices. Results on price-cost margins, however, are consistent with

the presence of business-to-residential and urban-to-rural cross subsidies. While the results are consistent with a small amount of intra-region cross subsidy, inter-regional cross subsidies, as demonstrated by the negative correlation between rural residential (urban-business) price-cost margins and urban business (rural-residential) retail prices, are more prominent.

Because of the political process, regulators set retail prices within customer classes similarly, but use revenues from urban business customers to lower retail prices in rural regions. The political influence of rural constituents, however, appears limited, as regulators use new federal high-cost universal service subsidies to lower urban business prices, rather than increasing urban-rural cross-subsidies. The analysis finds that private-interests influence wholesale access prices as well, as increases in entrants' political contributions, relative to incumbents, lead to lower urban wholesale access prices, although the magnitude of the effect is small.

Our results provide evidence that private-interest concerns continue to play a role in the explanation of regulator's retail pricing behavior, but we also find that increased competition reduced the impact private-interests exert on regulatory behavior. In exchange for opening their markets to competition, the Telecom Act allows RBOCs to enter interstate long-distance markets, provided regulators are satisfied that their markets are open to competition. Retail business prices are lower, and residential prices higher in states where the RBOC's Section 271 application was approved. Moreover, overall price levels are lower in such states. While Section 271 approval is an indirect measure of the Telecom Act's impact on market structure, results concerning Section 271 suggest that increased competition has improved economic efficiency and has conferred benefits to

consumers in the form of lower prices. Despite claims that it is a failure, evidence presented in this paper indicates that the Telecom Act's market-opening provisions mitigate the influence private interests exert on the structure of regulated prices.

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TABLE 1
SELECTED REGIONAL CHARACTERISTICS, PRICES AND COSTS 2002

Regional characteristics	All Zones	Urban Zones	Suburban Zones	Rural Zones
Geographical area (mile^2)	107.27	55.57	80.64	137.08
	(166.63)	(89.29)	(103.06)	(201.40)
Telephone Lines per mile^2	1,310	4,804	1,426	137.5
	(9,628)	(22,290)	(3,038)	(397.2)
Households in local calling area (100,000's)	1.75	4.39	2.22	0.67
	(2.81)	(3.83)	(2.87)	(1.45)
Percentage of households in poverty	0.12	0.13	0.11	0.12
	(0.08)	(0.08)	(0.08)	(0.07)
Total employment (100,000's)	2.22	5.45	2.80	0.90
	(4.95)	(7.99)	(4.52)	(2.96)
% of establishments with < 20 employees	0.87	0.85	0.86	0.88
	(0.03)	(0.02)	(0.03)	(0.03)
Total lines at 2000	16,677	36,665	24,487	6,393
	(22,904)	(29,240)	(24,644)	(10,687)
USF contribution ($) per line (2nd Quarter 2002)	0.81	0.003	0.46	1.24
	(4.46)	(0.10)	(2.56)	(5.70)
Number of observations	7,661	1,345	2,104	4,212

Note. Standard deviations in parentheses. Summary statistics weighted by appropriate number of lines.

TABLE 2
SUMMARY OF BUSINESS PRICE, COSTS AND LINES 2002

Business Lines	All Zones	Urban Zones	Suburban Zones	Rural Zones
Retail Price (P_B)	35.65	35.83	35.70	35.06
	(8.88)	(10.04)	(8.11)	(6.96)
Estimated Marginal Cost (MC_B)	15.23	15.10	15.29	15.46
	(2.02)	(1.81)	(1.89)	(2.71)
$P_B - MC_B$	20.42	20.73	20.41	19.59
	(9.03)	(10.25)	(8.06)	(7.38)
Wholesale UNE (Loop & Port) Price (w)	14.89	12.77	15.31	19.66
	(4.77)	(3.03)	(3.69)	(6.65)
$P_B - w$	20.76	23.06	20.39	15.40
	(8.46)	(8.48)	(7.40)	(8.07)
Estimated Average Cost	19.90	18.09	19.85	24.86
	(5.53)	(3.27)	(4.17)	(8.95)
% Lines $P_B > MC_B$	99.94%	100%	100%	99.65%
% Lines $P_B > w$	99.79%	100%	99.92%	98.93%
Percentage of Lines	100%	46.44%	37.25%	16.3%

Note. Standard deviations in parentheses. Summary statistics weighted by appropriate number of lines.

TABLE 3
SUMMARY OF RESIDENTIAL PRICE, COSTS AND LINES 2002

Residential Lines	All Zones	Urban Zones	Suburban Zones	Rural Zones
Retail Price (P_R)	18.77	18.51	19.01	18.70
	(3.39)	(3.00)	(3.61)	(3.48)
Estimated Marginal Cost (MC_R)	23.10	22.45	22.61	24.93
	(2.75)	(2.07)	(2.49)	(3.22)
$P_R - MC_R$	-4.33	-3.94	-3.59	-6.23
	(4.40)	(3.24)	(4.60)	(4.95)
Wholesale UNE (Loop & Port) Price (w)	16.25	13.37	15.81	21.33
	(6.12)	(3.18)	(4.31)	(8.57)
$P_R - w$	2.51	5.14	3.20	-2.63
	(6.49)	(3.03)	(5.25)	(8.93)
Estimated Average Cost	23.00	19.75	21.10	31.23
	(11.33)	(4.19)	(6.07)	(19.15)
% Lines $P_R > MC_R$	13.58%	10.09%	18.95%	7.73%
% Lines $P_R > w$	75.79%	93.92%	74.06%	51.78%
Percentage of Lines	100%	35.99%	39.97%	24.04%

Note. Standard deviations in parentheses. Summary statistics weighted by appropriate number of lines.

TABLE 4
SUMMARY OF UNE PRICE, COSTS AND LINES 2002

UNE Loop & Port	All Zones	Urban Zones	Suburban Zones	Rural Zones
Wholesale UNE (Loop & Port) Price (w)	15.77	13.12	15.65	20.86
	(5.72)	(3.13)	(4.13)	(8.11)
Estimated Marginal Cost (MC^w)	15.92	15.06	15.90	17.53
	(2.14)	(2.12)	(1.76)	(1.88)
Estimated Average Cost	20.18	17.51	19.12	27.08
	(8.62)	(3.66)	(5.05)	(14.71)
$w - MC^w$	-0.15	-1.94	-0.25	3.33
	(4.93)	(2.98)	(3.68)	(7.43)
% Lines $w > MC^w$	40.29%	21.81%	43.32%	68.32%
Percentage of Lines (total)	100%	39.54%	38.99%	21.46%

Note. Standard deviations in parentheses. Summary statistics weighted by appropriate number of lines.

FIGURE 1
URBAN RETAIL PRICE-COST MARGINS

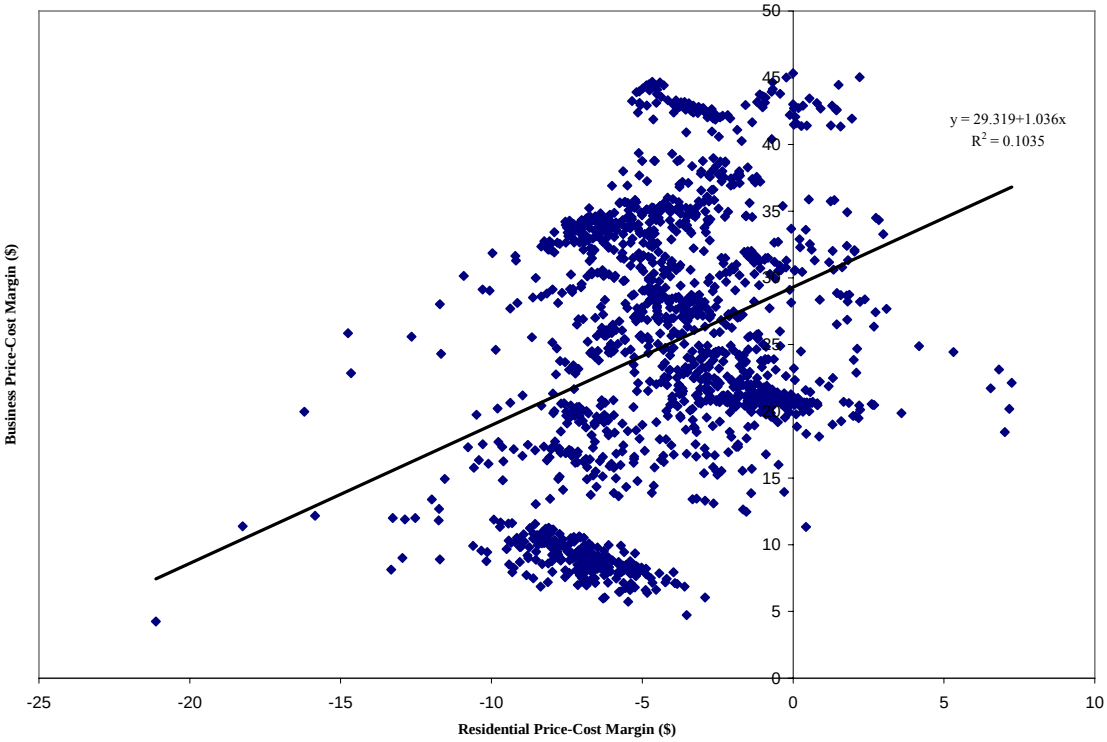


FIGURE 2
RURAL RETAIL PRICE-COST MARGINS

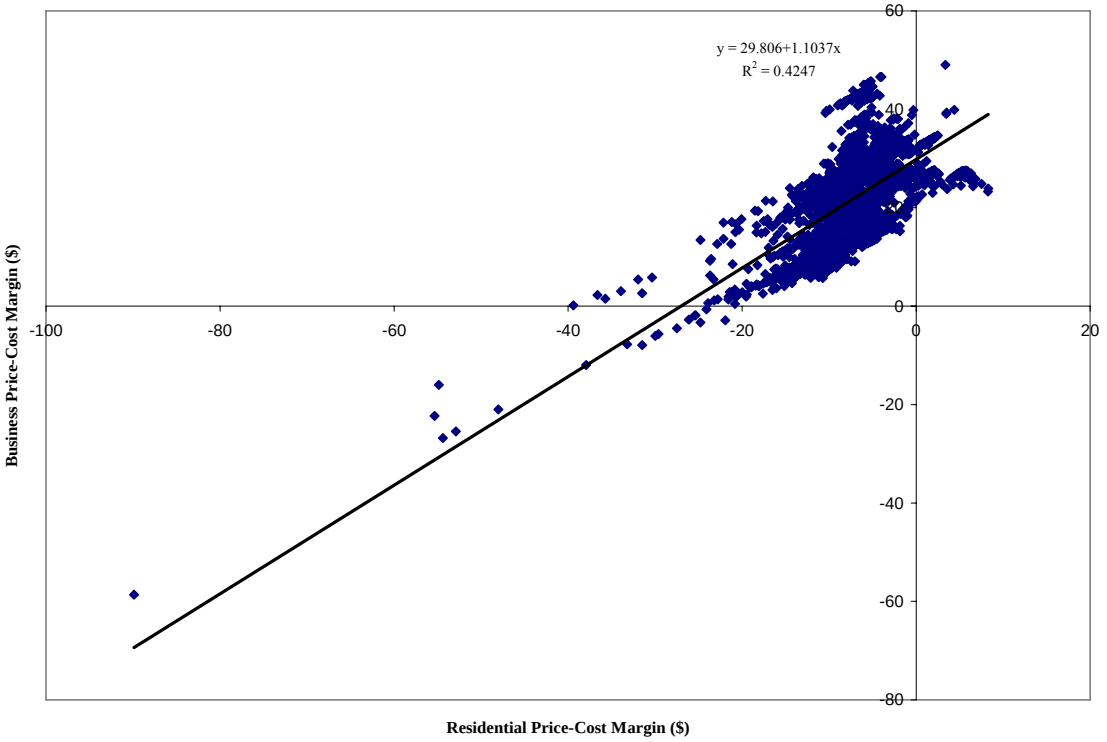
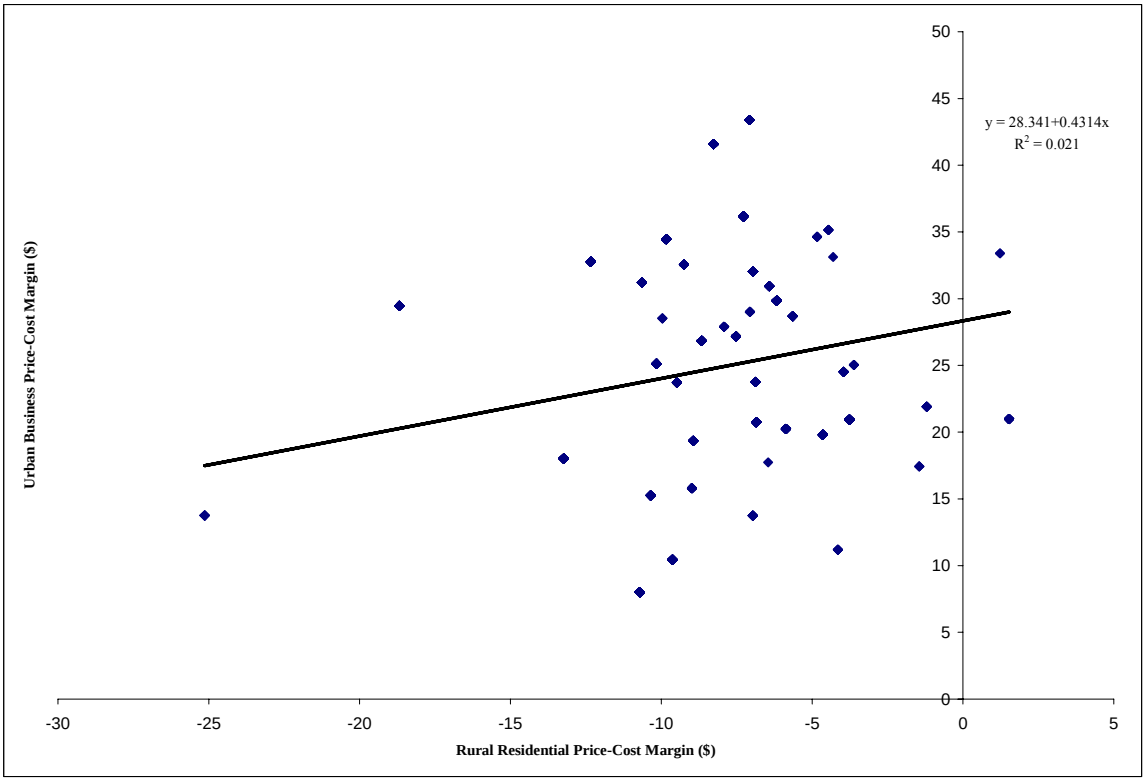


FIGURE 3
URBAN BUSINESS AND RURAL RESIDENTIAL RETAIL PRICE-COST MARGINS



Note: Because we use state averages, there are 43 observations.

TABLE 5

SUMMARY STATISTICS FOR URBAN PRICE EQUATIONS

Variable	Mean	Std. Dev.	Min	Max
P_R	18.9999	2.8522	12.1830	26.8000
MC_R	23.4298	2.0185	17.1233	41.2015
WPCM	-2.4010	2.6584	-9.4898	7.8809
BPCM	24.9648	10.1166	4.2504	45.3384
RUR RPCM	-8.7795	3.2328	-25.1415	1.5273
RUR POP	0.1818	0.1054	0.0382	0.5994
POP-EMP	2.8272	0.4068	0.7832	3.4378
S271	0.3197	0.4665	0.0000	1.0000
RUR USF	0.6384	2.8566	0.0000	22.4286
REP GOV	0.4498	0.4977	0.0000	1.0000
REP PUC	0.5123	0.5000	0.0000	1.0000
ELECT	0.2342	0.4237	0.0000	1.0000
PRICECAP	0.8989	0.3016	0.0000	1.0000
LCA	4.3962	3.8310	0.0129	18.1023
AGE	0.1530	0.0504	0.0000	0.5468
WHITE	0.7296	0.2325	0.0000	1.0000
POVERTY	0.1264	0.0833	0.0000	0.6225
RESMEAS	0.0245	0.1548	0.0000	1.0000
P_B	39.5888	9.8641	23.4829	58.6400
MC_B	14.6240	1.6513	11.8535	32.1696
RPCM	-4.4299	3.0828	-21.1215	7.2419
EMPLOY	5.4512	7.9884	0.0066	38.6387
SERVICE	0.7815	0.0870	0.3904	0.9663
SMALL FIRMS	0.8468	0.0254	0.7823	0.9596
BUSMEAS	0.2810	0.4497	0.0000	1.0000
w	13.9383	2.8228	7.6000	20.5700
MC^W	16.3393	1.7956	3.4239	24.6998
CONTRIB	0.9185	2.5385	0.0000	61.0000
PTLINES	0.5856	0.2006	0.0343	0.9210

Note. Number of observations is 1,345.

TABLE 6
SUMMARY STATISTICS FOR RURAL PRICE EQUATIONS

Variable	Mean	Std. Dev.	Min	Max
P_R	18.8493	3.3167	12.6900	29.3900
MC_R	25.7041	3.4685	20.4924	105.9991
WPCM	6.6772	10.8727	-22.7517	62.3738
BPCM	22.2403	8.3533	-58.6328	49.0423
URB BPCM	23.2493	8.3634	8.0065	43.3947
POP-EMP	4.8808	1.3157	3.0010	8.4414
USF	1.2419	5.7026	0.0000	78.3800
LCA	0.6744	1.4538	0.0008	14.6626
AGE	0.1857	0.0566	0.0011	0.7851
WHITE	0.8997	0.1398	0.0198	1.0000
POVERTY	0.1206	0.0710	0.0000	0.5438
RESMEAS	0.0802	0.2717	0.0000	1.0000
P_B	37.1564	7.5930	21.8300	63.0000
MC_B	14.9161	3.1003	12.5799	86.5228
RPCM	-6.8548	4.9323	-89.8791	8.2785
EMPLOY	0.8975	2.9611	0.0003	38.6387
SERVICE	0.7100	0.1162	0.0691	0.9789
SMALL FIRMS	0.8824	0.0311	0.7349	1.0000
BUSMEAS	0.4190	0.4935	0.0000	1.0000
w	25.0806	11.3665	11.6500	80.3900
MC^W	18.4034	1.7167	12.5450	56.8243
PTLINES	0.3484	0.2512	0.0343	0.9210

Note. Number of observations is 4,212.

TABLE 7
GMM ESTIMATES OF URBAN PRICE EQUATIONS

	Residential Retail Price		Business Retail Price		Wholesale Access Price	
MC	0.0004	0.0036**	0.0001	0.0031**	0.0065	0.0093*
	(0.37)	(2.01)	(0.06)	(2.02)	(1.44)	(1.75)
WPCM	0.0030**	0.0067**	0.0128***	0.0146***		
	(2.03)	(2.42)	(2.88)	(3.56)		
BCPM	-0.0042***	-0.0002			0.0050**	0.0064**
	(4.08)	(0.12)			(2.52)	(2.30)
RPCM			-0.0037*	-0.0029	0.0064***	0.0096***
			(1.78)	(1.64)	(2.64)	(2.99)
RUR POP	0.7242***	0.6161***	0.1843	0.4870***	0.0948	0.0127
	(6.57)	(6.62)	(1.32)	(2.77)	(0.82)	(0.08)
POP-EMP	0.0017	-0.0150	0.1079***	0.0977***	0.0452*	0.0432
	(0.06)	(0.58)	(3.16)	(2.73)	(1.78)	(1.50)
RUR RPCM		0.0187***		-0.0172***		-0.0004
		(4.40)		(2.87)		(0.08)
CONTRIB					-0.0074***	-0.0078***
					(3.77)	(3.79)
RUR USF		-0.0007		-0.0126***		0.0077
		(0.23)		(3.70)		(1.49)
S271	-0.0247	0.0452*	-0.1358**	-0.1824***	-0.0713	-0.0152
	(0.53)	(1.80)	(2.21)	(3.06)	(1.34)	(0.27)
REP GOV	-0.0679**	-0.0205	-0.0739	-0.1450***	0.0041	0.0182
	(2.04)	(0.68)	(1.50)	(2.61)	(0.15)	(0.53)
REP PUC	0.0647*	0.0917***	0.0884***	0.0936***	-0.0647***	-0.0614***
	(1.77)	(3.84)	(2.62)	(2.78)	(2.80)	(2.74)
ELECT	0.1282***	0.0545**	0.1322***	0.1822***	0.1053**	0.0607
	(3.42)	(2.29)	(2.91)	(4.25)	(2.25)	(1.23)
PRICECAP	0.1882***	0.1204***	0.0891*	0.1475***	-0.1197**	-0.0873*
	(5.63)	(3.11)	(1.91)	(2.71)	(2.29)	(1.65)
LCA	0.0016***	0.0006			0.0035**	0.0038**
	(2.85)	(0.96)			(2.11)	(1.96)
EMPLOY			-0.0006	-0.0006*	-0.0000	-0.0002
			(0.63)	(1.80)	(0.05)	(0.31)
SERVICE			-0.0492	-0.0204		
			(1.46)	(0.45)		
SMALL FIRMS			0.4123*	0.4359*		
			(1.69)	(1.73)		
AGE	0.0083	-0.0488**				
	(0.31)	(2.20)				
WHTE	0.0096	-0.0276***				
	(0.84)	(2.93)				
POVERTY	0.0151	-0.1337***				
	(0.43)	(3.41)				
PTLINES					0.1279**	0.1461**
					(2.24)	(2.33)
CONSTANT	2.6982***	2.8289***	3.1733***	2.8554***	2.2437***	2.1400***
	(27.12)	(26.69)	(15.41)	(12.93)	(16.59)	(15.80)
Measured Service Control	Yes	Yes	Yes	Yes	No	No
Hansen *J* Statistic	19.946*	20.460	17.619	14.164	20.554	20.862

Note. * significant at 0.1 level; ** significant at 0.05 level; *** significant at 0.01 level. Absolute value of *t*-statistics in parenthesis. Standard errors used to calculate *t*-statistics are heteroskedasticity consistent and permit intra-state clustering among wire centers. Number of observations is 1,345.

TABLE 8
GMM ESTIMATES OF RURAL PRICE EQUATIONS

	Residential Retail Price		Business Retail Price		Wholesale Access Price	
MC	0.0053***	0.0111***	0.0073*	0.0113***	0.0121	0.0298**
	(3.19)	(7.25)	(1.85)	(3.26)	(0.85)	(2.32)
WPCM	0.0028	0.0015	0.0048**	0.0033***		
	(1.50)	(0.88)	(2.00)	(2.88)		
BCPM	0.0054***	0.0125***			0.0093*	0.0056
	(3.36)	(8.37)			(1.79)	(0.74)
RPCM			0.0072*	0.0112***	-0.0064	0.0054*
			(1.93)	(3.47)	(0.61)	(1.64)
RUR POP	0.1811**	0.4760***	0.3426***	0.1610*	0.4107*	0.5537**
	(2.07)	(4.93)	(3.58)	(1.83)	(1.66)	(2.46)
POP-EMP	-0.0003	-0.0152	0.0450***	0.0388***	0.0202	0.0283
	(0.02)	(0.95)	(5.11)	(6.09)	(0.75)	(1.35)
URB BPCM		-0.0101***		0.0064***		-0.0035
		(5.01)		(4.15)		(0.80)
CONTRIB					0.0031	0.0023
					(1.53)	(1.38)
USF	0.0009	-0.0004	-0.0011	0.0001	-0.0052**	-0.0050***
	(0.71)	(0.36)	(0.88)	(0.04)	(2.08)	(2.89)
S271	0.0227	0.0427	-0.0743*	-0.1195***	-0.4096***	-0.4521***
	(0.42)	(0.84)	(1.71)	(2.96)	(3.69)	(4.04)
REP GOV	-0.0346	-0.0849**	-0.0278	0.0228	0.2509**	0.2165**
	(1.00)	(2.55)	(0.68)	(0.93)	(2.75)	(2.36)
REP PUC	0.0629**	0.1141***	0.0770	0.030	-0.0550	-0.0221
	(2.25)	(4.15)	(2.37)	(1.36)	(0.56)	(0.25)
ELECT	0.0321	0.0929***	-0.0327	-0.0590***	0.3300***	0.3083***
	(0.64)	(2.62)	(0.84)	(2.73)	(3.14)	(3.29)
PRICECAP	0.1007**	0.0586	0.1174***	0.0980***	0.0342	0.0171
	(2.04)	(1.44)	(3.26)	(3.95)	(0.38)	(0.18)
LCA	-0.0022	-0.0009			-0.0009	-0.0001
	(0.76)	(0.28)			(0.29)	(0.05)
EMPLOY			-0.0037***	-0.0023***	0.0061**	0.0051*
			(3.03)	(3.42)	(2.50)	(2.73)
SERVICE			0.0312*	0.0315**		
			(1.92)	(2.30)		
SMALL FIRMS			-0.3394***	-0.2963***		
			(2.74)	(4.26)		
AGE	-0.0790*	-0.0013				
	(1.88)	(0.03)				
WHTE	-0.0069	-0.0109				
	(0.19)	(0.35)				
POVERTY	-0.0857	-0.0231				
	(1.52)	(0.44)				
PTLINES					-0.8705***	-0.9272***
					(5.18)	(6.33)
CONSTANT	2.5381***	2.4834***	3.4891***	3.3067***	2.1987***	2.1495***
	(26.66)	(29.62)	(27.27)	(36.03)	(11.16)	(8.67)
Measured Service Control	Yes	Yes	Yes	Yes	No	No
Hansen *J* Statistic	22.157*	17.798	20.665	21.247	15.571	19.087

Note. * significant at 0.1 level; ** significant at 0.05 level; *** significant at 0.01 level. Absolute value of *t*-statistics in parenthesis. Standard errors used to calculate *t*-statistics are heteroskedasticity consistent and permit intra-state clustering among wire centers. Number of observations is 4,212.