THE TELECOMMUNICATIONS ACT OF 1996 AND MEDICAID HEALTH MAINTENANCE ORGANIZATIONS

By

TROY CLARENCE QUAST

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2006

To my parents, Clarence and Elaine Quast; and to my son, Andres Quast.

ACKNOWLEDGMENTS

I thank my advisor, David Sappington, and committee members Chunrong Ai, David Figlio, and Justin Brown. I also thank Betsy Shenkman, David Gabel, Donald Stockdale, Richard Romano, Mark Jamison, Sanford Berg, Jonathan Hamilton, Laura Braden, Damon Clark, Roger Clemmons, Mircea Marcu, Burcin Unel, Richard Gentry, and Vanessa Cruz for their helpful advice and words of encouragement. I am grateful for financial support from the University of Florida Department of Economics, the University of Florida Public Policy Research Center, the Telecommunications Policy Research Conference, and the University of Florida Public Utilities Research Center. I am also grateful for technical and research support provided by the University of Florida Department of Epidemiology and Health Policy Research. Finally, I thank my wife, Daniela Quast, for her unwavering support and her ability to feign interest in the notion of endogeneity.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

THE TELECOMMUNICATIONS ACT OF 1996 AND MEDICAID HEALTH MAINTENANCE ORGANIZATIONS

By

Troy Clarence Quast

August 2006

Chair: David Sappington
Major Department: Economics

We analyzed the effects of the landmark Telecommunications Act of 1996 (TA96). We also investigated whether the method of provider compensation affects the level of care provided by Medicaid health maintenance organizations (HMOs).

We examined the rates set by state public utility commissions (PUCs) that competitors must pay to lease parts of the local network from the largest incumbent U.S. telecommunications suppliers (RBOCs). The results indicate that rates in the smaller states in each RBOC region are strongly influenced by the largest state in the region. Rates are lower where the level of competitive entry is lower, while they are higher in states where the governor is a Republican. The analysis suggests that different states have employed different methodologies in implementing TA96.

We investigated entry in local telecommunications markets. Panel data are used to analyze the number of lines that competitive local exchange carriers (CLECs) lease from RBOCs using two alternative arrangements: leasing only the wires that connect a customer's premises to the phone network (loop-based entry), or leasing all of the network elements that are needed to provide phone service (platform-based entry). The estimates suggest that while the two types of entry are generally affected by different

market factors, there appears to be cost-based substitution between them. Also, loop-based entry is more responsive to changes in economic conditions in smaller states, while platform-based entry is more responsive in larger states.

Using data for all of the Medicaid HMO enrollees in a large state, my coauthors and I found that enrollees in HMOs that pay their doctors exclusively via fee-for-service arrangements are more likely to receive services for which the HMO's doctors receive additional compensation. Further, these enrollees are less likely to receive services for which the HMO's doctors do not receive additional compensation. These findings suggest that financial incentives may influence the behavior of doctors in Medicaid HMOs, and thus the health care received by Medicaid participants enrolled in HMOs.

CHAPTER 1
INTRODUCTION

The federal government in the United States often attempts to harness competitive market forces to achieve policy outcomes. Politicians and analysts frequently claim that policies that are based largely on market incentives are best suited at resolving observed inefficiencies in the economy. Two important areas in which this approach has been attempted are telecommunications and health care. One of the hallmarks of the Telecommunications Act of 1996 (TA96) was its focus on introducing competition into the industry, which its supporters claimed would lowering price and result in greater deployment of technology. Likewise, a prominent component of Medicaid reform has been to move enrollees into health maintenance organizations (HMOs). Many believe that when HMOs assume responsibility for the health care of Medicaid participants, costs are lowered and quality increases. This study analyzes how these policies have been implemented and whether they have been successful.

First, we investigate how state governments have implemented TA96. State public utility commissions have been given somewhat vague guidelines as to how to set the rate at which entrants can lease portions of the incumbent telephone company's network. We find that the commissions may have looked to neighboring states for guidance as to how these rates. Further, the commissions may have been influenced by the level of existing entry when determining the rates.

Second, we explore the factors that determine where entry occurs in local telecommunications markets and the means by which entrants choose to enter. Beginning

in late 2000, entrants could either lease part or all of the incumbent firm's network in order to provide service. Regression results indicate that the relative cost of the two forms of entry may influence the means of entry chosen by firms. Further, the factors that influence the level of entry vary by the size of the market.

Finally, we analyze how the means by which primary care physicians are paid may influence the quality of care they provide. Using data from Medicaid HMOs, we compare the quality of care provided by physicians who are paid a flat rate per enrollee versus the quality of care provided by physicians who are paid per service provide. The results suggest that doctors who are paid a flat rate per enrollee may be less likely to provide check-up visits to children than doctors who are paid per service provided.

CHAPTER 2
HOW STATE GOVERNMENTS IMPLEMENT FEDERAL POLICIES:
THE TELECOMMUNICATIONS ACT OF 1996

Introduction

A primary goal of the TA96 (Table A-1) was to encourage competitive entry into the local telecommunications market, under the presumption that such entry would lower prices and increase social welfare. One of the means by which entrants[1] were to enter this market was by leasing unbundled network elements (UNEs). The legislation decreed that entrants could lease certain segments of the incumbent's[2] network[3], thus allowing for competition where it would otherwise be unprofitable or infeasible. The rates at which entrants could lease the UNEs could play an important role in the degree of entry observed.[4] The only rate-setting guidance offered by TA96 was that the rates were to be priced at cost plus possibly a reasonable profit, determined without reference to a rate-of-return proceeding, and set by the state public utility commissions.[5]

Given the ambiguity in how the UNE rates were to be set, the Federal

---

[1] Entrants into local telecommunication markets are referred to as Competitive Local Exchange Carriers, or CLECs.

[2] Specifically, this paper analyzes the rates at which Regional Bell Operating Companies (RBOCs) lease UNEs to entrants. RBOCs are the regional monopolies that were created in the split-up of AT&T in 1984.

[3] The question as to which segments the incumbent should be forced to lease has been litigated extensively (see Lichtman and Picker, 2003).

[4] As discussed in Lichtman and Picker (2003, pp 22-23), excessively low rates can discourage entrant investment in their own networks and foster excessive reliance on UNEs. Conversely, exceptionally high rates may encourage inefficient investment by entrants. The effect of the rates on incumbent investment is ambiguous.

[5] 47, USC § 252(d).

Communications Commission (FCC) interpreted TA96 as giving it the authority to proscribe the methodology the states should use in determining the rates. The FCC decided that the rates should be based on total element long-run incremental costs (TELRIC), the hypothetical costs of implementing the least-cost network given the current locations of the incumbent's wire centers.[6]

The state commissions were left with the unenviable task of operationalizing the vague "TELRIC" notion. Figure 1-1 depicts UNE loop rates for three pairs of arguably comparable states: New Hampshire and Vermont; Kentucky and Tennessee; and Wyoming and Utah. The charts suggest that the state commissions operationalized the TELRIC concept differently over time. For example, when Wyoming and Utah first set rates in 1997, the UNE rate in Utah was only $2.00 less than the rate in Wyoming. By 2003 that difference had increased five-fold. This type of variability across states and over time is representative of the experiences in many states and suggests the states varied a great deal as to how they implemented the TELRIC methodology.[7]

Understanding how the state public utility commissions set UNE rates can provide valuable lessons, both in telecommunications regulation and in the formation of federal policies. Any evaluation of the success of TA96 at promoting competitive entry must account for how states implemented the Act. Given the widespread criticism that

---

[6] The FCC's decision was challenged numerous times in the courts, both regarding whether the commission had the authority to dictate the rate-setting methodology and also whether the TELRIC methodology was consistent with TA96. The Supreme Court eventually decided both issues in favor of the FCC. (AT&T v. Iowa Utilities Board (1999), Verizon, et al v. FCC, et al (2002)) More recently, the Washington, D.C. Court of Appeals recently ruled that incumbents should not be forced to lease switching equipment to entrants at TELRIC rates, and the FCC subsequently revised their rules to adhere to that decision (FCC (2005)). However, local loops, the focus of this paper, continue to be included by the FCC as a UNE that the incumbents must lease at TELRIC rates.

[7] Further, the Department of Justice recommended rejecting applications by some incumbents for permission to sell interLATA service on the grounds that the state commissions had not correctly calculated TELRIC rates (e.g., see Department of Justice (1997, 1998, and 2000)).

TA96 did not spur the level of entry that was anticipated, it is important to disentangle effects due to the execution of TA96 versus the Act itself. Beyond telecommunications, the UNE rate experience provides an opportunity to analyze the behavior of state officials charged with implementing federal policy. According to TA96, the state commissions are to base the rates only on state-specific cost factors. However, given the vague TELRIC definition of cost and the discretion given to the states, it is possible that additional factors influence how these rates are set. An analysis of these factors can provide insight as to how state officials implement federal policies, and may apply to other policy areas such as education or environmental regulation.

Previous studies have analyzed the determinants of UNE rates. De Figueiredo and Edwards (2004) examine the UNE rate in place in the three two-year election cycles from 1998 through 2002. The authors find that states with Democratic state legislatures and relatively large political contributions by entrants have lower UNE rates. Further, elected commissions are found to set higher rates, while states in which the utility commission has imposed retail price caps tend to have lower UNE rates. Lehman and Weisman (2000) explore UNE rates set immediately following the implementation of TA96. They also find that elected commissions set higher rates while price caps lead to lower rates. Beard and Ford (2004) test whether the UNE rates for certain combinations of network elements in 2002 are correlated with the rates proposed by incumbents or entrants. They find that the rates set by state commissions can be explained as splitting the difference between the preferred rates of the two parties. Eisenach and Mrozek (2003) regress the observed UNE rate against a cost estimate produced by the FCC Hybrid Cost Proxy Model (see further description of this model in Section 4.2) and find that costs explain

only half of the variation in UNE rates.[8]

This paper extends these studies in several important directions. First, the present analysis is based on a unique data set that contains the UNE loop rates for each state since TA96 was enacted and when those rates were ordered. Further, unlike previous studies, it is known whether the rate was the result of a voluntary reduction by the incumbent. Second, the analysis examines the potential for information spillovers across states.[9] Given the ambiguity of the TELRIC notion and the lack of experience state utility commissions had with the concept, it is possible if not likely that many states looked to other states for guidance. Specifically, the influence of the rates set by the commission in the largest state in each incumbent region (the "leader") on the other states in the region (the "followers") is tested. Third, whereas in previous papers the form of retail rate regulation was assumed to be exogenous, the analysis corrects for the potential endogeneity of this variable. Fourth, the impact of the level of entry on UNE rates is measured.

Four primary conclusions emerge from this research. First, less than 50% of a change in the estimated cost of providing a UNE is reflected in the UNE rate two years later. Second, a $1 increase in the leader state's rate results in a roughly $0.75 increase in the rates of the follower states two years later. Conversely, a state's rate does not appear

---

[8] Another area in which state utility commission telecommunications regulation has been analyzed is how retail rates are set. Donald and Sappington (1995) find that state commissions are more likely to choose incentive regulation where the incumbent can gain more, rates are especially high, and elected state leaders are churned by voters. Smart (1994) observes that retail rates are lower in states where the commissioners are elected and that control of the governorship and state legislature only has an impact on prices when the offices are held by different political parties.

[9] There is a large literature regarding strategic interaction between governments, especially in the areas of environmental, welfare, and tax policy (see Brueckner (2003) for a survey). However, the information spillovers in UNE rates do not appear to be strategic, i.e., the state commissions do not appear to take into consideration the reactions of other commissions when setting their own UNE rates.

to be affected by changes in the rates of the follower states. Third, applications for permission to sell long-distance services and lower levels of competitive entry tend to put downward pressure on rates. Fourth, Republican leadership in a state is associated with higher UNE rates.

These conclusions suggest that smaller state utility commissions rely on the work of larger state commissions to help determine the regulated rates that they choose for their state. Further, non-cost factors such as the market and political environment may influence the rates set by the commissions. These results indicate that information spillovers and factors beyond those specified in TA96 may influence how state governments implemented this federal policy.

The paper is organized as follows. Section 2 presents background information on how UNE rates are set. Section 3 describes the hypothesized UNE rate determinants. Section 4 details the econometric methodology and the data used. Section 5 discusses the estimation results, while Section 6 provides conclusions and areas for further research.

Background Information on Unbundled Network Element (UNE) Rate Proceedings

Steps Involved in Setting UNE Rates

Before reviewing the formal analysis, consider how UNE rates have been determined by the states.

Immediately following the passage of TA96, state public utility commissions were often forced to arbitrate interconnection agreements between incumbents and entrants without having the luxury of completing a formal cost study. To prevent the delay of interconnection agreements, the commissions often decided on a UNE rate based solely on the proposed cost studies and testimony submitted by the two sides. When the commission completed its own cost study, the rates from the study replaced the

temporary placeholder rates in the existing interconnection agreements.[10]

Following the initial cost study, the states had complete discretion as to when to review the UNE rates, if at all. Most interconnection agreements between the incumbents and entrants last three years, so the states often revise the UNE rates to coincide with the expiration of the agreements. However, sometimes commissions revise the rates before the end of this three-year cycle, while on other occasions they review the rates less frequently.

While practices differ to some extent, most states follow the same procedures when modifying UNE rates. First, the commission announces that it will review the UNE rates and that hearings will be held. Before these hearings take place, the incumbent and the entrant submit their own cost models and expert testimony. Following the hearings, the commission reviews the material and testimony and sometimes will ask for further information from the parties. After this stage, the commission announces its decision on a cost model and the proper inputs for it. This decision will often include what it thinks the resulting UNE rates are, but it will ask the incumbent or entrant to run the model chosen by the commission with the proscribed inputs and report the resulting rates. The initial commission decision regarding the model and inputs may also be appealed. (The state typically has discretion as to whether it will allow an appeal to be heard.) This process can last as long as two years.

The cost studies performed by the state commissions involve decisions on many parameters, ranging from labor costs to the costs of telephone poles. In its most general form, the TELRIC studies consider three types of costs: operating costs, depreciation

[10] Note that some states were able to complete a TELRIC cost study quickly enough so that they did not have to implement the placeholder rates.

costs, and the cost of capital.

Influence of Neighboring States

As described above, the TELRIC methodology that the FCC ordered the commissions to follow to set UNE rates is both complicated and vague. The states are forced to estimate the costs that a provider of the loops would incur if they were to build the network today using an efficient technology. Specifying the efficient technology is a daunting task in itself. In addition, the commission must determine the hypothetical cost of installing the efficient technology throughout the incumbent's service area. Such an analysis requires considerable resources, and can be particularly burdensome for states that have relatively small staffs and budgets. Given these challenges, it is not surprising that smaller states look to larger states for guidance in setting UNE rates.

The state commissions in an incumbent's region share a working relationship that is conducive to collaboration in setting UNE rates. For example, regional associations of state commissions that are carved almost exactly on incumbent regional lines meet annually or semiannually.[11] The meetings typically include working sessions where commission staff members that work in telecommunications discuss current issues and listen to incumbent and entrant representatives present their views on upcoming regulatory matters. The potential for information spillovers among states was further highlighted in a recent survey by the National Association of Regulatory Commissioners of state commissions. When the state commissions were asked if they would be interested in working with other states in a matter closely related to UNE rates, many of them

[11] The Qwest utility commissions comprise of the Qwest Regional Oversight Committee, the BellSouth commissions are part of the Southeastern Association of Regulatory Utility Commissioners, the Verizon commissions are members of either the New England Conference of Public Utility Commissioners or the Mid-Atlantic Conference of Regulatory Utilities Commissioners, while all but two of the SBC states are members of the Mid-America Regulatory Conference.

indicated that they believed such coordination would be useful and has been useful in the past (NARUC TRIP Task Force, 2003).[12]

Figure 1-2 provides additional evidence that information spillovers may be present within incumbent regions. The charts show for each state in January 2001 the UNE rate set by the state and an estimate of the TELRIC loop cost using a cost model developed by the FCC known as the Hybrid Cost Proxy Model. While the ability of the this model to accurately calculate TELRIC costs has been hotly disputed, the model provides a consistent measure across states and over time of the relevant TELRIC cost, under specified assumptions. For most states, the UNE rate set by the state is lower than the model estimate. However, the difference varies considerably by incumbent. For instance, the UNE rates in the Ameritech states are roughly half of the model cost estimate, while in the Qwest states the UNE rates are typically roughly equal to the cost estimate. These inter-regional differences are consistent with the notion that the state commissions within an incumbent region base their UNE rates in part on the rates of their neighbor states.

It is unlikely that all states within an incumbent's region have an equal influence on each other. Within each region there appears to be a leader state that other states in that region look to for guidance in their UNE rate proceedings. The leader state not only has the most resources available in that region to conduct a UNE rate study[13], but it may also

---

[12] The Kansas utility commission replied, "The Commission believes it would be especially beneficial and cost effective for the five original Southwestern Bell Telephone Company states to coordinate efforts." The Rhode Island commission stated, "RI has a very small staff and would be interested in coordinating logistics with other states in Verizon's territory…" Wyoming's response included, "The Commission is considering the possible benefits of a regional approach such as participating in a coordinated effort of the Qwest ROC (Qwest Regional Oversight Committee)."

[13] An appropriate measure of the resources available would be the number of commission employees or the commission's budget. However, state utility commissions are organized differently across states and state comparisons of these measures are problematic. For example, Arizona's is part of the state's Corporation Commission, which also handles issues regarding securities and insurance. Data on the

have been the first state in which the incumbent applied for permission to sell long-distance services in its territory[14]. The FCC encouraged smaller states to use the information provided by leader states in their UNE rate cost studies:

> We recognize that many states lack the extensive resources that were dedicated to the process by New York and Texas, as detailed in our orders in those states…
>
> We encourage states with limited resources to take advantage of the efforts devoted by New York and Texas in establishing TELRIC-compliant prices, by relying where appropriate on the existing work product of those states. (FCC, 2001, p 40)

There is considerable evidence that follower states look to the leader states for guidance. For example, in the BellSouth region, it was reported that the Kentucky commission closely monitored the UNE rate proceeding in Florida and even discussed Florida's findings with the Florida commission and its staff (Caldwell, 2002, paragraph 131). In the SBC region, the Kansas commission suggested that they delay their UNE proceeding in order to wait until the ongoing Texas study was completed (Kansas Corporation Commission, 2000, p 2). In Nevada, the commission approved a stipulation between the incumbent and the entrants that set UNE rates based on the proceedings of the California commission (Public Utility Commission of Nevada, 2002). According to a recent trade press article, follower states in Verizon's region halted their UNE rate cases to see how the New York would decide its rate (*State Telephone Regulation Report*, 2004).

The influence of a leader state's rate on rates in follower states may be influenced by incumbent behavior. To illustrate, incumbents have encouraged the influence of leader

---

number of employees and budget for the Arizona commission are available only for the state corporation commission. As a proxy for state commission resources, the number of telephone access lines is used.

[14] Under Section 271 of TA96, in order for an incumbent to receive permission to sell long-distance services in a state, it had to file an application with both the FCC and the state that demonstrated that the local telephone service market was open to competition. One of the criteria by which the application was judged was whether the UNE rates were based on TELRIC estimates.

state rates by benchmarking follower states' rates to them when applying for permission from the FCC to sell long-distance services. For instance, in 2002 Qwest voluntarily lowered their UNE rates in eight states in order to benchmark them to the rates set by Colorado (FCC, 2002).[15] The incumbents also urge follower states to base their rulings on decisions by the leader states. For example, in an Alabama UNE rate case BellSouth urged the Alabama commission to adopt the Florida commission's position regarding the timing of UNE rates, while in Georgia BellSouth argued for the approach that Florida adopted to allocate costs between regular telephone service and data service.

Hypothesized UNE Rate Determinants

If the states followed the TELRIC methodology to the letter, the TELRIC cost would perfectly determine the UNE rate. However, as described above and demonstrated in Figures 1-1 and 1-2, it does not appear that costs alone explain the UNE rates. Therefore, other variables are included in the model to account for the variation in rates.

To control for information spillovers across states, the rates of the other states in the same incumbent region are included in the model.[16,17] To test for the effect of the leader state on the follower states, the model includes the rate of the leader state interacted with a dummy variable that equals one if the state is a follower state. This variable will capture how the follower states respond to changes in the leader's rate. If the

[15] Specifically, Qwest voluntarily lowered the rates to the level in Colorado adjusted for the difference in average costs according to the FCC's cost model.

[16] The regions are muddled somewhat by the mergers that have taken place among the incumbents. For instance, Pacific Telesis and Ameritech were acquired by SBC in 1998 and 1999, respectively, while Verizon (formerly Bell Atlantic) acquired NYNEX in 1997. Given their geographic locations and the timing of the acquisitions, Pacific Telesis and Ameritech are treated separately from SBC while the former Bell Atlantic and NYNEX are treated as one entity.

[17] The identification strategy employed to capture information spillovers is closely related on the strategic interaction literature cited above. Specifically, the lagged rates of neighboring states are interacted with dummy variables in order to isolate the effects of interest. See Fredriksson and Millimet (2002), Fredriksson, List, and Millimet (2004), and Hayashi and Boadway (2001).

coefficient on this variable is statistically significant, one can conclude that the rates in the follower states are influenced by the leader state's rate.

However, it may be the case that the follower states also are influenced by the rates in the other follower states. Therefore, also included in the regressions is the weighted average[18] of the follower states' rates interacted with a dummy variable that equals one if the state is a follower state. If there are information spillovers between the follower states, the coefficient on this variable will also be statistically significant.

It may also be the case that the leader states are influenced by the rates in the other states in the incumbent's region. To test for this, the weighted average of the follower states' rates is interacted with a dummy variable that equals one if the state is a leader. Thus, any influence of the follower states on the leader states is captured in this variable.[19]

Characteristics of the state commissions may also influence UNE rates. Under the theory of regulatory capture, the longer a commissioner has served, the more amenable s/he might be to setting a rate favorable to the incumbent. Applied to UNE rates, this theory suggests that the longer the commissioners have served the higher the UNE rates will be. There may also be an influence due to the political affiliation of the commissioners. However, it is unclear as to the direction of this influence. One may surmise that Republicans generally favor less regulation and less aggressive (i.e., higher)

---

[18] The weights are based on the number of switched access lines per state. The results do not change when weights based on population are used.

[19] The analysis in this paper focuses on the influence of neighboring states within the incumbent's region. It is possible that some commissions might have influence that extends beyond the incumbent's region. However, given the limited degrees of freedom available, it is not possible to simultaneously control for nation-wide influences of all of the leader states. Initial estimates that test for the influence of one national leader state at a time suggest that such effects may be present. However, the qualitative conclusions reported below persist in settings that admit national leadership patterns. As stated in the conclusion, further analysis of this issue is warranted.

UNE rates. Conversely, it may be the case that Republicans are sympathetic towards small businesses, and therefore may favor lower UNE rates to benefit both small-business consumers of telecommunications services and entrants. Prior studies have debated whether states that enact incentive-based retail rate regulation enact lower UNE rates[20]. Further, the incumbent's retail rates may influence the level of UNE rates, as state commissioners may regard the retail rate as an upper bound on what an entrant could afford to pay for a UNE. Finally, UNE rates may systematically differ if they were set in an arbitration case immediately following the enactment of TA96.

Beyond the state commissions, there may be state-specific influences that vary by time. For instance, the political affiliation of the governor or the state legislature may influence how the state sets UNE rates. Not only can the governor and state legislature have a direct influence on the state utility commission through appointments and budgetary powers, but their political affiliation may be a proxy for the political sentiment of the citizens and reflect the general regulatory environment in the state. As described in the previous paragraph, the direction of this effect is ambiguous.

The incumbent's federal regulatory status may play an important role in how UNE rates are set. As noted above, the FCC and state commissions had to certify that the incumbent's UNE rates were TELRIC-based before the incumbent was allowed to sell long-distance phone service. Therefore, one might expect that the UNE rates in the period immediately prior to the FCC's decision were lower than they would have otherwise been. Some incumbents also voluntarily lowered their UNE rates during the application process in the hope of securing permission to provide long-distance service. If the

[20] Lehman and Weisman (2000) argue that state commissions can unfairly shift risk to incumbent firms by enacting a retail price cap and setting a relatively low UNE rate.

incumbents were in fact lowering their UNE rates below the rates that would have prevailed otherwise, one would expect these voluntary reductions to result in lower UNE rates. However, the incumbent might have made voluntary reductions that were not as drastic as would otherwise have been ordered by the state during the application process. If so, the incumbent might have been able to secure a more favorable UNE rate by pre-empting action by the state. In such a case, the marginal effect of the voluntary reduction could be positive.

Lastly, the level of observed UNE entry may affect the UNE rates. If the commission views the level of entry as relatively low, certes paribus, it may be inclined to lower UNE rates to encourage additional entry. Thus, one would expect a positive coefficient on this variable.

Model Specification and Data Used

Model Specification

As noted above, UNE rates changed infrequently in some states. Consequently, UNE rates often exhibit a high degree of stationarity. However, relatively frequent data are required to capture the exact timing of the rate decisions. To allow for frequent data and the stationarity of the lagged dependent variable, the lagged rate is included as an explanatory variable.[21]

Including the lagged dependent variable as an explanatory variable in a panel data regression complicates the econometric analysis. When an OLS fixed-effects estimator is used, a negative bias of order 1/T is introduced in the coefficient on the lagged dependent variable (Nickell, 1981). OLS estimation of the model in first differences partially

[21] In the econometrics literature this is referred to a dynamic panel data model.

corrects the bias, but does not entirely alleviate the endogeneity of the lagged dependent variable. Arellano and Bover (1995) and Blundell and Bond (1998) derive a generalized methods of moments estimator (known as system GMM) that simultaneously estimates the model in levels and first differences. Blundell and Bond (1998) perform Monte Carlo simulations that demonstrate the system GMM estimator is superior to both the OLS fixed effects and GMM estimations using first differences only. Further lagged values of the levels and first difference of the dependent variables are used as instruments for the lagged dependent variable.[22] The system GMM estimator is appropriate when the coefficient on the lagged dependent variable is 0.8 or greater. For this estimator to be valid, the lagged dependent variable must have a constant correlation with the state effects and be uncorrelated with present and past values of the error term. Further, it is assumed that the error terms have a mean of zero and are not serially correlated. Robust standard errors that are consistent in the presence of heteroskedasticity and autocorrelation within states are used in calculating t-statistics.

Data Used

Summary statistics of the data used are provided in Table 1-1. The sample is comprised of quarterly data. The date in which a state enters the sample is determined by the date the utility commission in that state and the corresponding leader state ordered its initial UNE rates. That date ranges from April 1997 to October 1997. Data for all states included in the analysis run through the end of 2003. Correlation coefficients between the non-UNE rate explanatory variables are provided in Table 1-2.

The dependent variable in the analysis is the statewide average recurring rate for

[22] In the estimations that follow, the previous four quarters of the level of the lagged dependent variable are used as instruments in the first differences equation, while one lag of the first difference of the lagged dependent variable is used as an instrument in the levels equation.

the local loop in a quarter.[23,24,25] The local loop consists of the wires that connect a customer's premises to the incumbent's wire center. The local loop is the network element that is the most costly to replicate, and so is the element that entrants would most likely lease from the incumbent.[26] The rates used in the study were obtained primarily from state commission orders and incumbent documents. Unlike data sets used in earlier studies, the exact date on which the rate was ordered is known and will be integral in examining the issue of interstate interdependence

The cost variable is a measure of the monthly cost of the loop. Beginning in 2000 the FCC published annual TELRIC estimates. As noted above, while parties have debated whether the model over- or under-estimates costs, it does provide a reference over time and across states. However, these data are not available prior to 2000. Therefore the cost variable used here is constructed from two different data series. For the period prior to 2000 the cost variable equals the embedded, or historical, cost of the loop as reported by the National Exchange Carrier Association regarding universal service funding. For 2000 forward, the cost variable is the estimate from the FCC's model. While the variable is not ideal, it should capture the factors that account for the discrepancies in costs, such as

---

[23] Specifically, it is weighted average of the monthly rate for the 2-wire copper in the various density zones in the state. The weights are the number of lines in each density zone.

[24] Another option is to use the rate set for the loop in the densest areas of the state, known as the urban zone rate. However, many states did not de-average rates by zone until 2000 and did so at differing times. Thus, to be able to model rates since TA96 was implemented, statewide average rates must be used.

[25] Data for Alaska and Hawaii are not included as they are not part of any of the major incumbent regions. Arkansas is also not included because the commission in that state ruled that it did not have the authority to conduct a cost study to set UNE rates. Rates in the District of Columbia are not included, as the focus is on rate setting by state utility commissions. Rates for Connecticut are not included as it is geographically surrounded by Verizon states but the incumbent in the state is owned by SBC.

[26] Some entrants serving large business customers built their own networks and therefore did not have to rent any network elements from the incumbent.

population density, wire center locations, and local cost levels.[27]

As explained in Section 2, UNE rate proceedings are often lengthy. As such, it takes time for commissions to incorporate new information in their cost studies. Further, state commissions may not learn the results of proceedings in other states for some time or may be in an earlier stage of their UNE rate study. Therefore, it is appropriate to model with a lag the influence of the rates of the other states. However, as the number of lags included in the model increases, the number of explanatory variables increases quickly[28], thus limiting degrees of freedom. With this constraint in mind, the model is estimated using two different lag structures. The first includes the neighbor states' rates over each of the last four quarters, thus spanning one year. The second structure includes the neighbor states' rates from each of the last four half-years, thus spanning two years.[29]

As described above, characteristics of the state utility commissions may also influence UNE rates. To control for the length of time commissioners have served, the average tenure of the commissioners is included. The political ideology of the commission is captured in the fraction of commissioners that describe themselves as Republican. The effect on UNE rates of the form of retail rate regulation is captured in a dummy variable that equals one if the state employs rate of return regulation on either residential or business services.[30] However, this variable may be endogenous, as

---

[27] The results do not change substantially when embedded costs are used for the entire period.

[28] For each lag of other states' rates that is included in the estimation, three explanatory variables are added (the weighted average of the neighbor rates interacted with the leader and follower dummy variables and the leader's rate interacted with the follower dummy variable).

[29] Given the rates of other states enter the model with a lag, they are treated as exogenous from the perspective of the commission setting current rates.

[30] Retail rate regulation schemes are quite complex, as some plans can have price caps on some services and another form of incentive regulation on other products. By using a dummy variable that reflects whether the state employs rate-of-return regulation on either residential or business basic services, the complications posed by the idiosyncrasies of the various incentive-based regulation plans are avoided.

unobserved factors may be jointly determining the form of retail rate regulation and the UNE rate. To correct for this endogeneity, variables that measure customer satisfaction as reported by the FCC's ARMIS database are used as instruments.[31] The average retail rate for the incumbent is calculated using FCC ARMIS data and is lagged one year to account for the information delays in UNE rate proceedings outlined above.[32] Finally, a dummy variable is also included that takes the value of one if the rate was set during an arbitration case immediately following the passage of TA96, and zero otherwise.[33]

Two explanatory variables are employed to account for the political sentiment of the state's elected officials and its citizens. A dummy variable is included that equals one if the governor is a Republican and zero otherwise. Another variable is included that equals the percent of the state legislators that are Republican. To determine the potential interactive effects between the ideology of the commission and the governor, the product of the two variables is included as an explanatory variable.

Dummy variables are also used to capture the effects of the status of the incumbent's application to sell long-distance service in that state. A dummy variable is included that equals one if the rate was set during the year prior to the incumbent's application up to the date of the FCC's decision. To measure the marginal impact of the

---

As this variable takes a value of one when rate-of-return regulation is used, the expected sign of the coefficient of this variable is positive given Lehman and Weisman's (2000) analysis.

[31] These variables are used as instruments because while UNE rate proceedings typically pit incumbents against entrants, retail rate regulation proceedings tend to be disputes between the incumbent and consumer groups. Therefore, while these satisfaction variables affect the form of retail rate regulation, they do not affect the level of UNE rates. The econometric evidence supports this logic, as the tests of joint significance indicate that the instruments are correlated with the form of retail rate regulation while the C-statistic values indicate they are not correlated with UNE rates. See Appendix A for details.

[32] Given the variable enters the estimation with a lag, endogeneity is not expected to be a concern. A C-test confirms that the variable is not endogenous. See Appendix A for details.

[33] Specifically, the arbitration rates used in this study are those from arbitrations between AT&T and the local incumbent.

incumbent making a voluntary reduction, a dummy variable is included that equals one if the rate was the result of a voluntary reduction by the incumbent in conjunction with its application.

The level of competitive entry in the state is controlled for by the number of UNE lines leased by entrants. To account for delays in commissions incorporating information into their decisions, the variable is lagged one year. Endogeneity may be present, as the level of entry is likely determined in part by the future UNE rate, which in turn (given the stationarity of UNE rates) is likely correlated with the present rate. The state unemployment rate lagged one year is used as an instrument for this variable.[34] To allow for meaningful comparisons across states, the number of leased lines is divided by the standard deviation of the variable for that state.

Finally, dummy variables for each calendar year are included in the analysis to account for shocks common to all states in a given year not captured by the other explanatory variables.

Estimation Results

Coefficient Estimates

Table 1-3 summarizes the coefficient estimates from the basic model. Column (1) lists the estimates from the lag structure spanning one year, while the estimates corresponding to a lag structure spanning two years are listed in Column (2). The estimation diagnostic tests indicate that the system GMM approach is valid with this data set. The tests for autocorrelation demonstrate that there is first-order autocorrelation in first differences, but no autocorrelation of higher order. This indicates that the error terms

[34] The logic behind the use of the variable is that the level of economic activity affects the level of UNE entry but not UNE rates. The econometric results suggest that these instruments are valid. See Appendix A for details.

are not serially correlated. Further, the specification passes the Hansen tests of overidentification, which tests whether the moment conditions beyond those needed to identify the parameters are valid.[35] Finally, the coefficient on the lagged dependent variable is over 0.8 in both specifications, which confirms that the system GMM estimator is appropriate.

The estimates from both columns indicate that the cost variable is statistically significant, at either a 90% or 95% statistical confidence level depending on the specification. Of the neighbor rates, the leader's rate lagged six months has a statistically significant impact on the followers' rates, while the followers' rates do not have a statistically significant impact on the rates of other followers or leaders.

The dummy variables that capture the effect of the incumbent's application to sell long-distance services are negative and statistically significant. The negative coefficient on the variable that indicates whether the incumbent made a voluntary reduction in the application process suggests that the incumbents were not engaging in strategic behavior. In the two-year lag specification, the dummy variable that captures the effect of a Republican governor is positive and statistically significant. Finally, the level of UNE entry appears to have a statistically significant effect at a 90% confidence level. Somewhat surprisingly, none of the variables that capture commission characteristics are statistically significant.

Economic Effects

The presence of the lagged dependent variable as an explanatory variable implies that the coefficient estimates only measure short-run effects. Furthermore, the coefficient

[35] See Appendix A for further details.

estimates do not clearly convey the economic significance of the explanatory variables. Table 1-4 details the effects on UNE rates from a change in an explanatory variable that lasts two years.[36] The effects reported in Table 1-4 are based on the coefficient estimates in the specification that includes two years of lagged neighbor UNE rates[37].

According to the estimates, a one-dollar increase in the cost variable on average leads to a $0.40 increase in the UNE rate two years later. This increase is highly statistically significant. However, an F-test as to whether a $1 increase in the cost variable leads to $1 increase in UNE rates is rejected at over a 99% confidence level. Thus, UNE rates do not perfectly reflect changes in cost (as measured by the available variable).[38]

The estimates suggest that UNE rates are significantly affected by changes in the leader's UNE rate. Figure 1-3 depicts the effect over two years on followers' rates after a one dollar increase in the leaders' rate and the corresponding 95% confidence interval. As the figure shows, the average effect after one year is to increase the followers' rate by roughly $0.60, while after two years, the effect reaches almost $0.80. Table 1-4 reports that a one standard deviation ($3.37) in the leader's rate leads to a $2.47 increase in the followers' rates. Conversely, the estimates suggest that the effect of followers' rates on other followers is not statistically significant. Thus, the results suggest that the leader

[36] Long-run effects that are based on permanent changes in the explanatory variable are reported in Appendix A.

[37] The corresponding effects based on the specification that includes one year of lagged neighbor rates are very similar and are contained in Appendix A.

[38] It is worth repeating that the cost variable used here (based mostly on the FCC's cost model) is not universally considered a valid cost proxy. Thus, while a $1 increase in the cost variable is not realized in the UNE rate, one could argue that the cost variable overstates TELRIC costs to such a degree that changes in costs are in fact fully realized in changes in UNE rates.

states do in fact have a significant impact on the other states in the incumbent's region.[39]

Of the variables that capture characteristics of the state utility commission, the effect of average tenure has the expected sign, but is not statistically significant. In regards to political ideology, neither the effects of the ideology of the commissioners nor the ideology of the commissioners interacted with the ideology of the governor are statistically significant. This may be due to the potentially conflicting effects described above. The effect of the rate-of-return retail rate regulation variable is positive as expected but statistically insignificant and only a third of the effect found by Lehman and Weisman (2000). The lack of statistical significance and smaller estimated effect may be due in part to the evolving nature of incentive regulation plans and the difficulty in classifying them (as noted above). Furthermore, the average retail rate also is statistically insignificant. Finally, while the AT&T arbitration rate has the expected sign, it too is not statistically significant.

However, the election of a Republican governor is associated with a $1.15 increase in UNE rates two years later that is statistically significant. One may attribute this effect to two, perhaps not mutually exclusive effects: a preference for less-aggressive regulation and favorable treatment for large corporations.[40] The effects of both the percent of

---

[39] The estimate of the effect of the followers' rate on the leader's rate is somewhat surprising. While it is only roughly two-fifths of the size of the leader's effect on the followers, it is statistically significant at a 90% confidence level. From the coefficient estimates, it appears this effect exists four quarters after the followers change their rates. A possible explanation is that there is a feedback effect. For example, if rates are generally falling, the following pattern may be present: The leader lowers its rate, which is followed six months later by the followers. One year after the followers' rate change, the leader again lowers its rate again, which causes the leader's rate to appear to be influenced by the followers' rate change. Also, given that the coefficient estimates of the effect of the followers' rates on the leaders are not statistically significant, the statistical significance of the overall effect is being driven largely by covariance between the coefficients on the followers' rates and the lagged dependent variable.

[40] One concern with this result could be that Republican governors tend to be elected in less urban, and thus higher UNE-cost, states. However, the average UNE rate in states with Republican governors is virtually identical to the average in states with Democratic governors.

Republican state legislators and the interaction of the Republican governor and commission political affiliation are statistically insignificant.

The variables that capture the long-distance application status of the incumbent indicate that those applications had a strong influence on the UNE rates. On average, UNE rates set during the period prior to applications to enter the long-distance market are roughly $2.00 lower two years later. When the incumbent voluntarily lowered the UNE rate this effect more than doubled.

Finally, the observed level of entrant use of incumbent UNE lines is both statistically and economically significant. A one standard deviation decrease in UNE lines is associated with UNE rates falling roughly $4.00. As UNE rates are generally falling during this period, the positive coefficient may also reflect that UNE rate reductions are more modest when UNE entry is relatively strong.

Conclusion

This paper analyzes the factors that determine the rates that state utility commissions set for access to the incumbent's telecommunications network. The results suggest that factors other than cost influence the rates. The rate set by the largest state in each incumbent region appears to influence the rates set by other states in that region. Further, rates tend to be higher in states where the governor is a Republican and lower in the period prior to an incumbent applying for permission to sell long-distance services and when observed competitive entry is lower.

Beyond providing insights into telecommunications regulation, these results may have implications for other areas in which the federal government delegates implementation of policies to state agencies. While state agencies may possess valuable local knowledge, it is possible that the intent of the federal policy will not be perfectly

realized through the actions of the states. Information spillovers across states and factors outside the scope of the federal mandate may affect how the policy is implemented. Other policy areas in which this type of analysis may provide some insight include state implementation of the No Child Left Behind Act and environmental policies as dictated by the EPA.

The findings in this paper could be extended in several directions. For example, the rates used in this paper are the monthly rates for the local loop. The commissions also set one-time connection fees for these loops that are also important to entrants considering entering a state. Also, while the local loop is arguably the most important network element, the states set rates for many other network elements. Analyses of these additional rates could shed further light on the factors that influence state commissions. Finally, as noted in footnote 20, initial tests for nation-wide information spillovers suggested that states may have influence outside the incumbent's region. Further analysis into this issue could provide additional insight into how state agencies implement federal regulations.

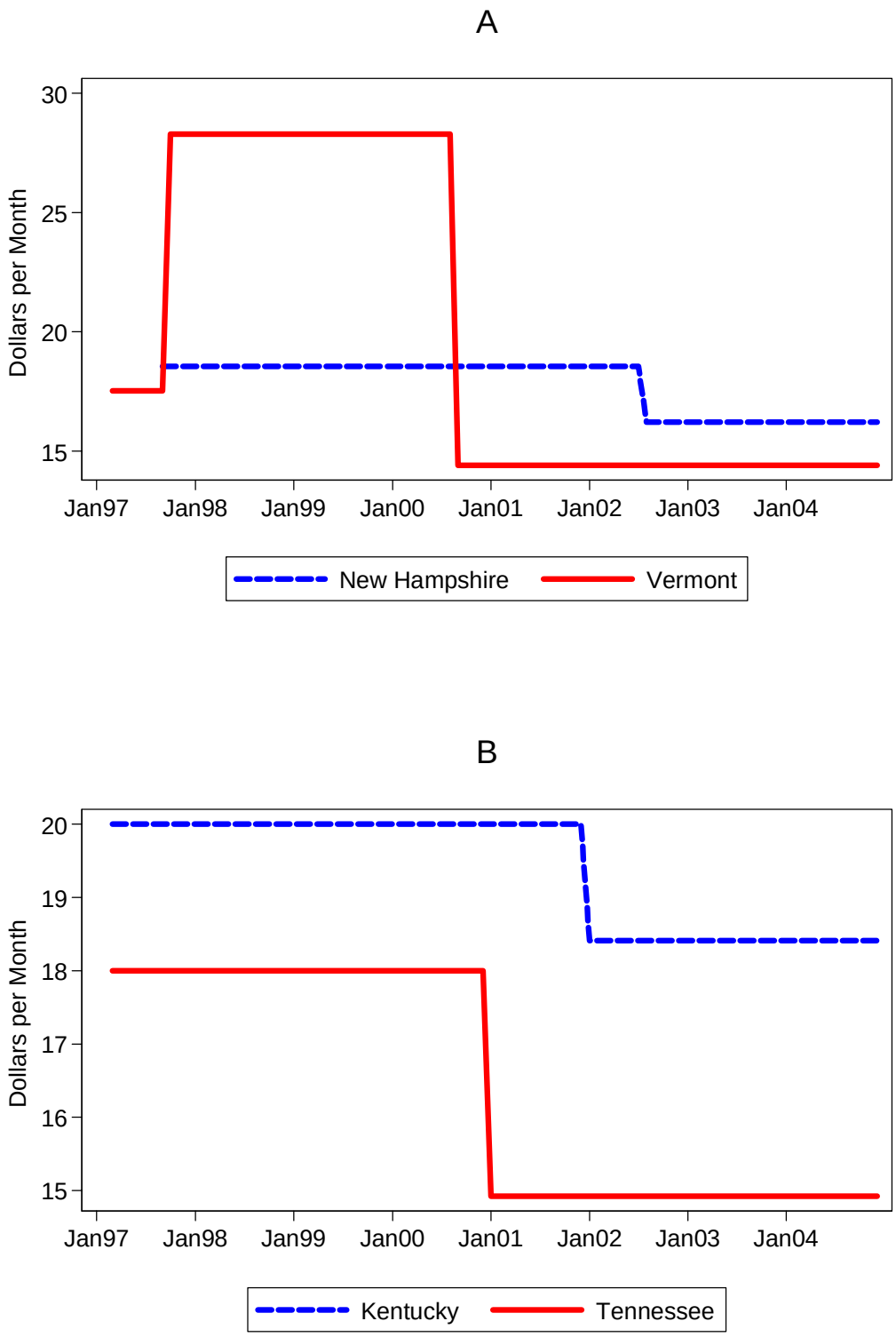


Figure 1-1 Comparison of UNE Rates. A) New Hampshire and Vermont. B)Kentucky and Tennessee. C) Wyoming and Utah.

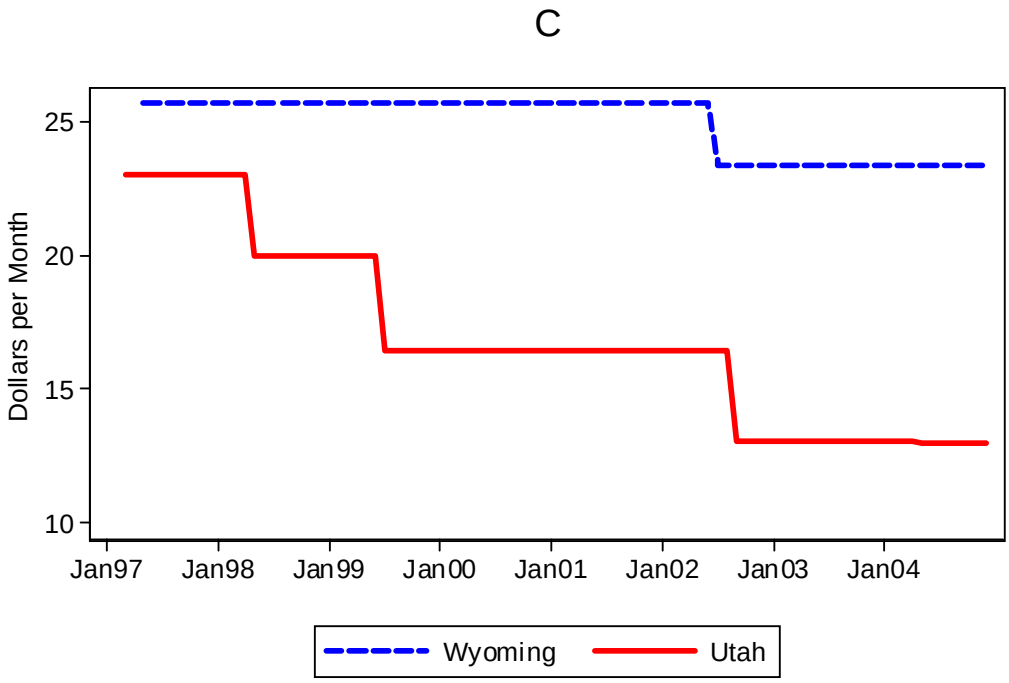
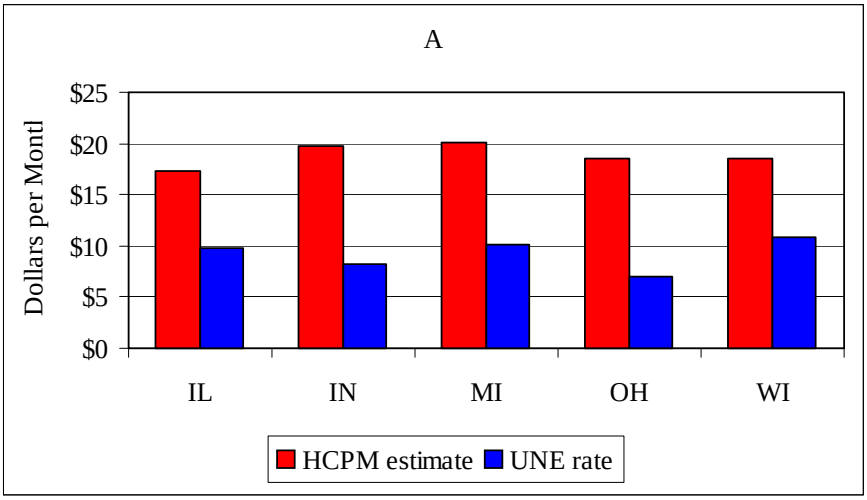
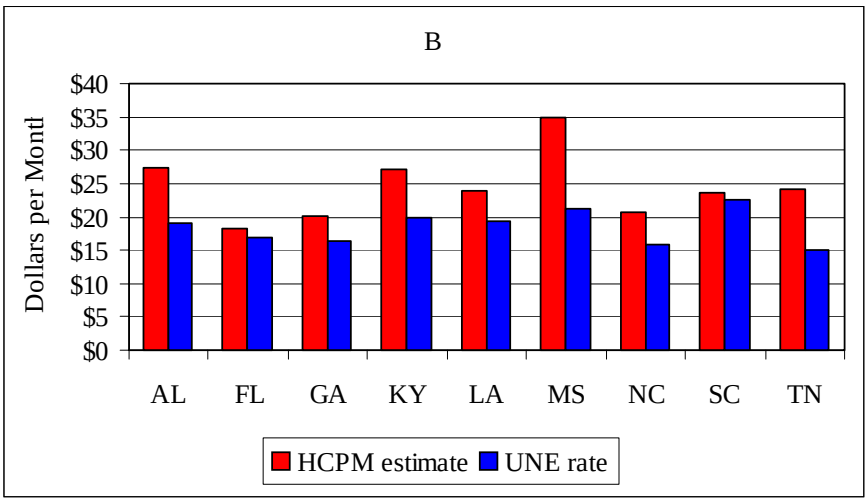


Figure 1-1 Continued





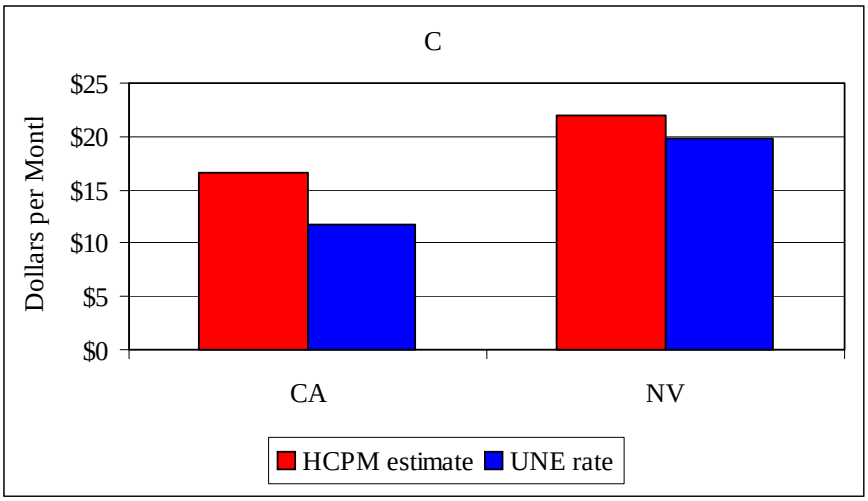
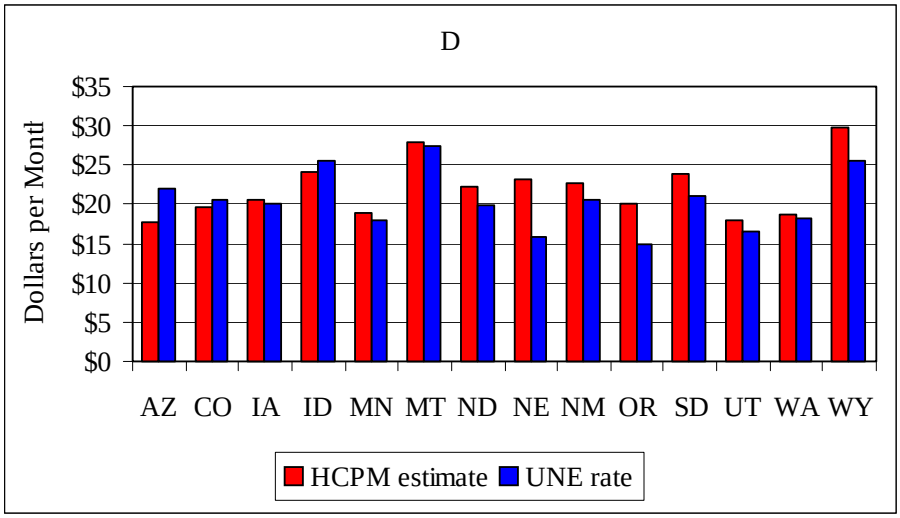
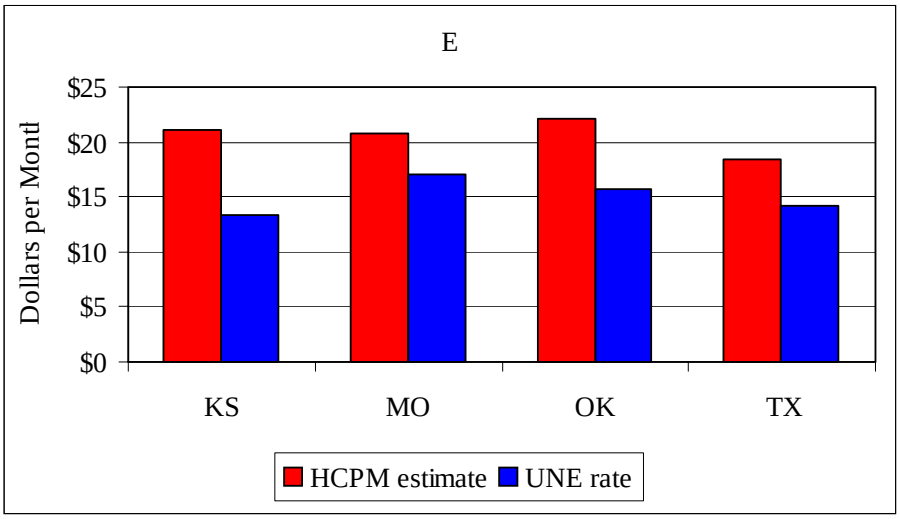


Figure 1-2 HCPM Estimate versus UNE Rate. A) Ameritech. B) BellSouth. C) Pacific Telesis. D) Qwest. E) Southwestern Bell. F) Verizon.





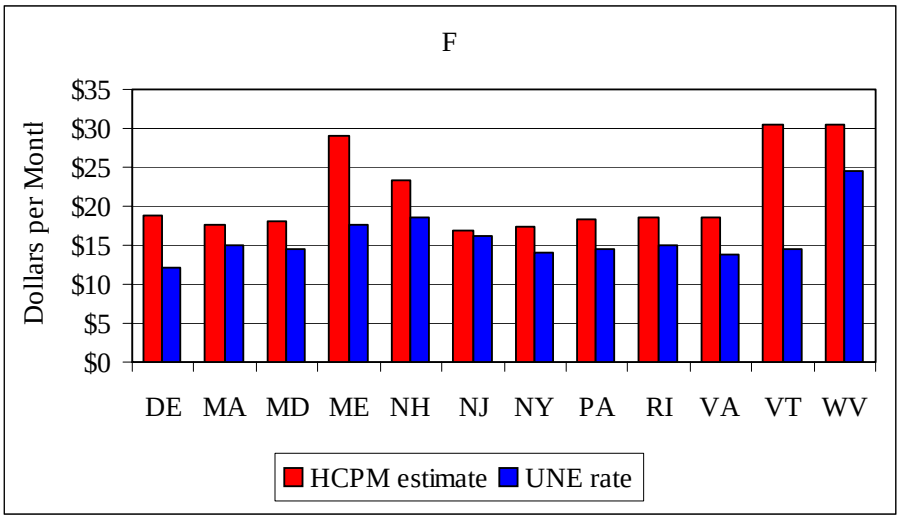


Figure 1-2 Continued.

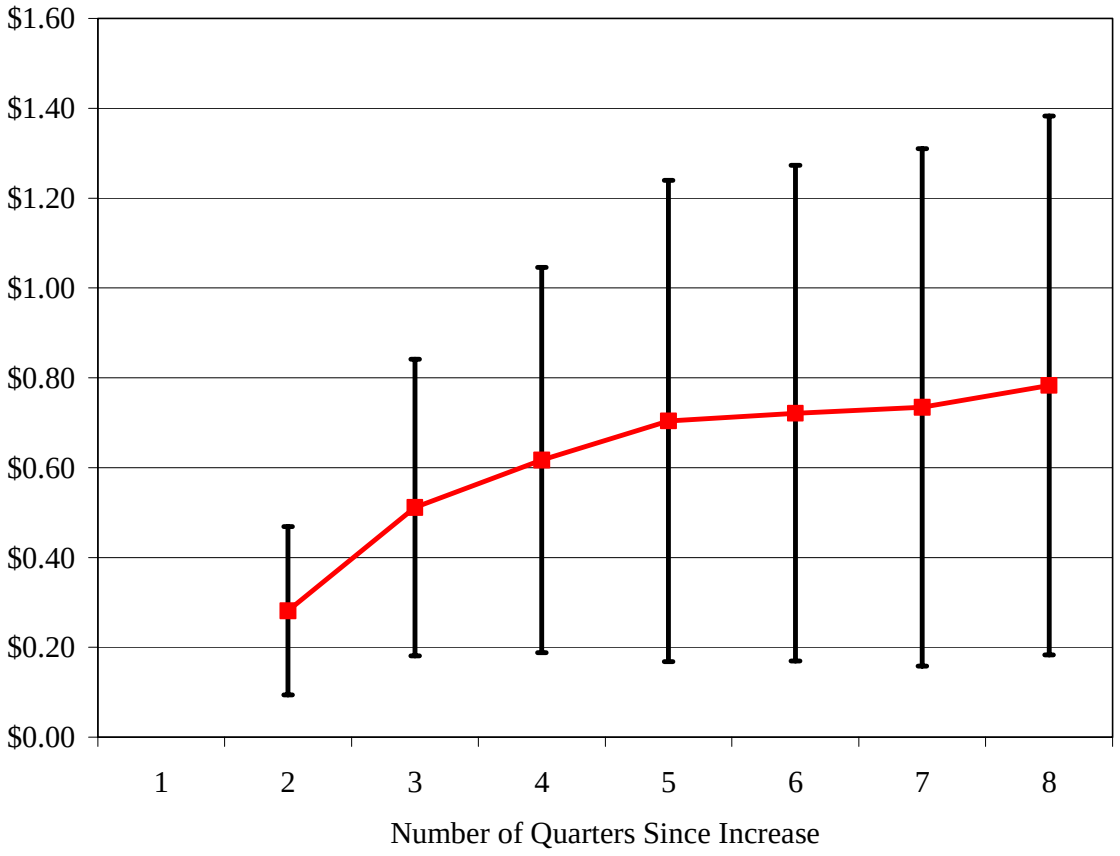


Figure 1-3 Cumulative effect of $1 increase in the leader's rate on the follower's rate.

Table 1-1 Summary Statistics

Variable	Mean	Minimum	Maximum	Standard Deviaion
Lagging Neighbor States' Rates One Year (n = 1103)				
UNE Rate (All States)	$16.62	$7.01	$28.82	4.59
UNE Rate (Leader States)	$15.30	$9.81	$20.65	3.41
UNE Rate (Weighted Average of Follower States)	$15.80	$8.13	$27.22	3.14
Cost Variable	$21.27	$13.97	$41.78	4.38
Percent of Commissioners Republican	46.3%	0.0%	100.0%	30.7
Average Tenure of Commissioners (year	5.2	0	22.5	3.1
Rate of Return Retail Rate Regulation	0.18	0	1	0.39
Governor Republican	0.6	0	1	0.49
Percent of Legislature Republican	0.5	0.13	0.89	0.14
AT&T Arbitration	0.16	0	1	0.37
Period Prior to Section 271 Decision	0.25	0	1	0.43
Voluntary Reduction	0.07	0	1	0.26
UNE Entry (Lagged One Year, Divided by Standard Deviation)	0.54	0	2.77	0.69
Average Retail Rate	$29.16	$14.45	$44.44	5.16
Lagging Neighbor States' Rates Two Years (n = 919)				
UNE Rate (All States)	$16.44	$7.01	$28.29	4.49
UNE Rate (Leader States)	$15.11	$9.81	$20.65	3.37
UNE Rate (Weighted Average of Follower States)	$15.65	$8.13	$20.51	3.13
Cost Variable	$21.24	$13.97	$35.86	4.22
Percent of Commissioners Republican	45.8%	0.0%	100.0%	30.8
Average Tenure of Commissioners (year	5.2	0.1	22.5	3.0
Rate of Return Retail Rate Regulation	0.17	0	1	0.37
Governor Republican	0.6	0	1	0.49
Percent of Legislature Republican	0.5	0.13	0.89	0.14
AT&T Arbitration	0.11	0	1	0.31
Period Prior to Section 271 Decision	0.29	0	1	0.45
Voluntary Reduction	0.09	0	1	0.28
UNE Entry (Lagged One Year, Divided by Standard Deviation)	0.64	0	2.77	0.71
Average Retail Rate	$29.53	$14.45	$44.44	5.22

Table 1-2 Correlation Matrix of Non-UNE Rate Variables

	Cost Var.	% Comms. Rep.	Avg Tenure of Comms.	ROR Retail Rate Reg.	Gov. Rep.	% Legis. Rep.
Cost Var.	1.00					
% Comms. Rep.	-0.23	1.00				
Avg Tenure of Comms.	0.24	0.00	1.00			
ROR Retail Rate Reg.	0.23	-0.08	-0.02	1.00		
Gov. Rep.	-0.07	0.44	0.01	-0.04	1.00	
% Legis. Rep.	0.04	0.20	0.11	0.27	0.12	1.00
AT&T Arb.	0.17	-0.14	0.00	0.10	0.14	0.10
Long-Dist. App.	0.00	0.03	-0.01	-0.26	-0.06	0.04
Vol. Reduct. By Incumb.	0.01	0.10	0.06	-0.12	0.08	-0.01
Gov. Rep. * % Comms. Rep.	-0.18	0.80	-0.01	0.00	-0.08	0.78
UNE Entry	-0.11	0.07	-0.07	-0.29	-0.12	-0.05
Avg. Retail Rate	0.43	0.01	0.15	-0.09	-0.12	-0.06

Table 1-2 Continued

	AT&T Arb.	Long-Dist. App.	Vol. Reduct. By Incumb.	Gov. Rep. * % Comms. Rep.	UNE Entry	Avg. Retail Rate
AT&T Arb.	1.00					
Long-Dist. App.	-0.06	1.00				
Vol. Reduct. By Incumb.	0.13	0.49	1.00			
Gov. Rep. * % Comms. Rep.	0.19	0.00	0.05	1.00		
UNE Entry	0.04	0.50	0.37	-0.01	1.00	
Avg. Retail Rate	-0.19	0.21	0.08	-0.04	0.12	1.00

Table 1-3 Coefficient Estimates from One-Year and Two-Year Lag Specifications

Explanatory Variable	One-Year Specification	Two-Year Specification
UNE Rate, Lagged One Quarter	0.876 ***	0.815 ***
	(17.18)	(12.37)
Effect of Leader's Rate on Followers		
Lagged One Quarter	-0.012	
	(-0.15)	
Lagged Two Quarters	0.164 *	0.281 ***
	(1.73)	(3.02)
Lagged Three Quarters	-0.016	
	(-0.22)	
Lagged Four Quarters	-0.058	-0.081
	(-1.64)	(-0.89)
Lagged Five Quarters		
Lagged Six Quarters		-0.054
		(-0.90)
Lagged Seven Quarters		
Lagged Eight Quarters		0.038
		(1.16)
Effect of Followers' Rates on Other Followers		
Lagged One Quarter	0.001	
	(0.20)	
Lagged Two Quarters	0.076	-0.112
	(0.54)	(-1.27)
Lagged Three Quarters	-0.080	
	(-0.73)	
Lagged Four Quarters	-0.016	0.009
	(-0.33)	(0.89)
Lagged Five Quarters		
Lagged Six Quarters		0.026
		(0.34)
Lagged Seven Quarters		
Lagged Eight Quarters		0.012
		(0.15)
Effect of Followers' Rates on Leaders		
Lagged One Quarter	0.048	
	(0.62)	
Lagged Two Quarters	-0.060	0.028
	(-0.70)	(0.37)
Lagged Three Quarters	0.003	
	(0.04)	
Lagged Four Quarters	0.065	0.045
	(1.69)	(1.06)
Lagged Five Quarters		
Lagged Six Quarters		0.008
		(0.21)
Lagged Seven Quarters		
Lagged Eight Quarters		0.018
		(0.46)

Table 1-3 Continued

Explanatory Variable	One-Year Specification	Two-Year Specification
Cost	0.061 *	0.096 **
	(1.91)	(2.38)
Percent of Commissioners	0.000	-0.002
Republican	(-0.12)	(-0.97)
Average Tenure of	0.017	0.016
Commissioners	(1.10)	(0.93)
Rate of Return Retail Rate	0.187	0.154
Regulation	(0.28)	(0.20)
Governor Republican	0.211	0.263 *
	(1.53)	(1.85)
Percent of State Legislature	-0.244	-0.375
Republican	(-0.53)	(-0.69)
Percent of PUC Republican	-0.002	-0.002
Interacted with Governor	(-0.98)	(-0.85)
AT&T Arbitration	0.083	0.074
	(0.30)	(0.30)
Period Prior to Decision on	-0.481 **	-0.479 ***
Long-Distance Application	(-2.65)	(-2.48)
Voluntary Reduction by	-0.532 **	-0.636 **
Incumbent	(-2.45)	(-2.16)
UNE Entry (lagged 1 year,	0.770 *	0.999 *
divided by standard deviation	(1.72)	(1.92)
Average Retail Rate (lagged 1	0.008	0.011
year)	(0.77)	(0.79)
Overall F-Statistic	1894	1412
Number of Observations	1103	919
Arellano-Bond Test		
For AR(1) in First	-2.85 ***	-2.57 ***
Differences	(0.00)	(0.01)
For AR(2) in First	-0.22	-0.8
Differences	(0.82)	(0.42)
Hansen Test of Overidentified	1.76	2.59
Restrictions (p-value)	(0.94)	(0.86)

Notes - Year dummy variables are included and are generally statistically significant.
Unless otherwise noted, t-statistics are reported in parentheses.
*** - statistically significant at 99% confidence level
** - statistically significant at 95% confidence level
* - statistically significant at 90% confidence level

Table 1-4 Effects of Changes in Explanatory Variables on UNE Rates Two Years Later

Explanatory Variable	Effect of a One Unit Increase		Economic Effect[1]	
Effect of Neighbors' Rates				
Leader's Rate on Followers (C)	0.73	**	2.47	**
	(2.57)		(2.57)	
Followers' Rates on Followers (C)	-0.35		-1.10	
	(-1.03)		(-1.03)	
Followers' Rates on Leaders (C)	0.31	*	0.97	*
	(1.91)		(1.91)	
Effect of Other Explanatory Variables				
Cost (C)	0.40	***	1.68	***
	(3.65)		(3.65)	
Percent of Commissioners Republican (C)	-0.01		-0.31	
	(-1.10)		(-1.10)	
Average Tenure of Commissioners (C)	0.07		0.21	
	(0.96)		(0.96)	
Rate of Return Retail Rate Regulation (B)	0.67		0.67	
	(0.20)		(0.20)	
Governor Republican (B)	1.15	*	1.15	*
	(1.89)		(1.89)	
Percent of State Legislature Republican (C)	-1.63		-0.23	
	(-0.74)		(-0.74)	
Percent of PUC Republican Interacted with Governor Republican	-0.01		-0.37	
	(-0.81)		(-0.81)	
AT&T Arbitration (B)	0.32		0.32	
	(0.30)		(0.30)	
Period Prior to Decision on Long-Distance Application (B)	-2.08	**	-2.08	**
	(-2.27)		(-2.27)	
Voluntary Reduction by Incumbent (B)	-2.77	**	-2.77	**
	(-2.19)		(-2.19)	
UNE Entry (lagged 1 year, divided by state standard deviation) (C) [2]	4.35	**	4.35	**
	(2.42)		(2.42)	
Average Retail Rate (lagged 1 year) (C)	0.05		0.24	
	(0.81)		(0.81)	

[1] Economic effects for continuous explanatory variables are based on a one standard deviation increase in that variable, while economic effects for binary explanatory variables are based on a change in the variable from zero to one.

[2] This variable is already scaled by dividing by the standard deviation, so the economic effect is based on a one-unit increase.

Notes - (B) - binary explanatory variable, (C) - continuous explanatory variable, t-statistics are reported in parentheses.

*** - statistically significant at 99% confidence level

** - statistically significant at 95% confidence level

* - statistically significant at 90% confidence level

CHAPTER 3
THE EXTENT AND MEANS OF ENTRY INTO LOCAL TELECOMMUNICATIONS MARKETS

Introduction

A primary goal of the Telecommunications Act of 1996 (TA96) is to facilitate competition in the local telecommunications market. TA96 includes provisions that allow entrants[1] to lease parts of the incumbent's[2] network, known as unbundled network elements (UNEs), at relatively low rates determined by state public utility commissions. There are two ways in which entrants can provide phone service by leasing UNEs. Under a loop arrangement[3], the entrant rents from the incumbent the phone line that connects a customer's residence or premises to the local wire center. However, the entrant provides the equipment that connects the customer's line to the broader telephone network. The other means by which entrants can offer service is by leasing UNEs through a platform arrangement, which became widely available in 2000.[4,5] The key difference between loop- and platform-based entry is that in platform arrangements, the entrant leases all of the UNEs needed to provide telephone service. In other words, the entrant simply

---

[1] Entrants into local telecommunications markets are known as Competitive Local Exchange Carriers, or CLECs.

[2] Incumbents in local telecommunications markets are known as Incumbent Local Exchange Carriers, or ILECs.

[3] This is also referred to as UNE-L entry.

[4] This is also referred to as UNE-P entry.

[5] As described below, recent court rulings and revisions to FCC regulations have altered the regulatory treatment of platform-based entry.

rebundles the UNEs that are required to provide service and does not have to own any of the necessary equipment.[6]

A sufficiently long time series of data is now available to investigate the factors that determine the extent of entry via these two alternative arrangements. Figure 2-1 indicates that from July 2001 to July 2004 the national average of the fraction of incumbent[7] lines leased to entrants increased steadily. The average increased from just over 5% in July 2001 to almost 20% three years later. However, Figure 2-2 indicates that the increases in entry differ greatly by means of entry. During the 2001 – 2004 period, while the fraction of lines leased through a loop arrangement ranged between 2% and 4%, the fraction leased through a platform arrangement tripled from less than 4% to over 12%.

Figures 2-3 and 2-4 suggest that the evolution of entry has also differed significantly across states. Each dot in Figure 2-3 represents for a given state the fraction of lines leased through a loop arrangement in July 2001 and in July 2004. Dots near the 45-degree line represent states where the share of loop-based entry changed little between the two dates, while dots above the 45-degree line indicate that the share increased. As the figure indicates, while there are some states in which the share changed little, there

---

[6] Incumbents have been quick to point out that there is no actual difference between platform-based entry and reselling the incumbents' services, another option provided for under TA96. Given the cost of platform arrangements and the resale discount rates, reselling the incumbents' services is typically more costly for entrants than providing service under a platform arrangement. However, platform-based entry is more risky for entrants as they are not guaranteed a positive gross profit margin as they are under a resale arrangement. This risk would be realized if the retail price fell below the platform cost, in which case the entrant would face a negative gross profit under a platform arrangement whereas under a resale arrangement the entrant's cost would fall by the same percentage as the retail price.

[7] The largest incumbents in each state are the regional monopolies that were created in the court-ordered split-up of AT&T in 1984 and are commonly referred to as RBOCs (Regional Bell Operating Companies). While entrants can rent UNEs from other incumbents in areas not served by an RBOC, the vast majority of UNE entry has occurred in RBOC regions. For the remainder of this paper, the term incumbent will refer exclusively to RBOCs.

are also a number of states where the share increased substantially. Figure 2-4 displays the corresponding data for platform-based entry. While most states are above the 45-degree line, the extent to which they line above the line varies substantially.

Figures 2-1 through 2-4 raise important questions regarding telecommunications market dynamics, including the following two: What market factors influence the level of competitive entry via the two alternative means? What effects did state regulatory policies or the political environment have on the observed level of entry?

The answers to these questions are of interest to both policymakers and researchers. On one level, the answers shed light on the effectiveness of TA96 and its implementation. Not only can these answers inform the ongoing debate regarding regulation of U.S. telecommunications markets, but they may also provide guidance to regulators in other countries attempting to fashion policies. Further, the results supplement the existing body of literature regarding competitive entry. There has been scant prior research regarding how entrants choose whether to lease all of the inputs from their competitors (as in a platform arrangement) or buy some of the inputs themselves (as in a loop arrangement). The choices of entrants could have important implications for long-term competition.

Several authors have analyzed the determinants of competitive entry into local telecommunications markets.[8] These papers often use cross-sectional data sets to explain the level of competitive entry, as measured by the number of entrants or the number of telephone lines entrants have acquired. Typically these papers find that variables associated with higher demand correspond to higher entry, while variables associated

[8] Examples include Abel (2002), Abel and Clemments (2001), Alexander and Feinberg (2004), Brown and Zimmerman (2004), Jamison (2004), Lehman (2002), Lehman (2003), Roycroft (2005), and Zolnierek, Eisner, and Burton (2001).

with higher costs are correlated with a lower degree of entry. In regards to the effects of regulation, areas where retail price caps are used are generally associated with lower levels of entry, while the effects of the political composition of state public utility commissions differ across papers.

This paper is closely related to Beard and Ford (2002) and Beard, Ford, and Koutsky (2005). Beard and Ford (2002) use a pooled data set to analyze the determinants of loop- and platform-based entry. Among their findings is that, for both types of entry, as the cost of leasing the UNEs used in that type of entry increases, the level of entry falls. Their estimates of the cross-price elasticity of demand also suggest that entry via loop and platform arrangements are not substitutes. Beard, Ford, and Koutsky (2005) examine a cross-sectional data set to examine the deployment of equipment by entrants. Using proprietary data, they come to the conclusion that higher UNE leasing costs lead to decreased entrant equipment investment. Sappington (2005) constructs a theoretical model that suggests the price at which an entrant can lease an input may have little effect on its decision to lease the input from the incumbent supplier or make the input itself. This conclusion arises because the lease price influences the intensity of downstream competition such that the incumbent tends to price less aggressively when the lease price paid by the competitor is higher.

This paper improves upon the existing literature in at least four important ways. First, panel data are used rather than cross-sectional data. Thus, the data will allow for a more precise estimate of the effects of dynamic changes in the market environment on the level of entry observed. Second, the influence of the political composition of state public utility commissions is estimated. Third, the effect of the connection charge that loop

entrants must pay whenever they gain a new customer is measured. The potentially dampening effect of the connection charge on loop-based entry was cited by the Federal Communication Commission as an important basis for its regulatory treatment of platform-based entry.[9] Fourth, the empirical specification allows for the estimation of differential effects of the explanatory variables for varying levels of market size.

Four significant conclusions are offered. First, while the two types of entry are generally affected by different market factors, there appears to be cost-based substitution between them. Second, changes in the own monthly costs of the two forms of entry have limited effects, but loop-based entry decreases in response to increases in the connection charges entrants must pay incumbents when a customer is acquired. Third, loop-based entry tends to be more pronounced relative to platform-based entry as the degree of Republican representation on state public utility commissions increases. Fourth, loop-based entry is more responsive to changes in market conditions in smaller states, while platform-based entry is more responsive to market conditions in larger states.

The paper is organized as follows. Section 2 presents background information on the functional and regulatory differences between loop- and platform-based entry. Section 3 presents the determinants that are hypothesized to affect the level of entry. Section 4 details the econometric methodology and the data used. Section 5 presents the estimation results, while Section 6 provides conclusions and areas for further research.

[9] For example, see FCC (2003), 295-298.

Background Information on UNE-Based Entry

Loop-Based Versus Platform-Based Entry

To properly interpret the results below, it is important to understand the differences between loop-based and platform-based entry.

As stated above, when an entrant acquires a customer under a loop arrangement, the entrant leases only the UNEs associated with the wire that connects the customer's premises to the incumbent's wire center. This wire is referred to as the local loop. In order to provide service using a loop strategy, an entrant must provide its own switching equipment[10] and pay the incumbent for the space it rents and the power it uses in the incumbent's buildings where the switching and related equipment are housed.[11,12]

Conversely, under a platform arrangement, the entrant does not have to own any of the network equipment needed to provide phone service. The entrant in effect "re-bundles" all of the UNEs it needs to provide service.

An important difference between loop- and platform-based entry is how the incumbent's customers are switched to the entrant's service. Lines that are used to serve customers under a loop arrangement must be physically disconnected from the incumbent's switching equipment and reconnected to the entrant's equipment. This transfer, known as a hot-cut, requires that both an incumbent and entrant technician be

---

[10] While switches can have many functions, the key role that they serve for entrants to provide telephone service is that they connect the incumbent's loop to the entrant's network.

[11] Entrant switches require economies of scale to be cost-effective. Thus, entrants may install equipment in remote locations that allows them to aggregate traffic before reaching a switch that it owns (this process is known as back-hauling). However, the entrant then not only has to pay for the aggregation equipment, but also must pay the incumbent to move its traffic to its switch.

[12] This practice of renting space in an incumbent telephone facility is known as collocation.

present in order to perform a "seamless migration"[13] of the customer to the entrant's network. For each hot-cut that is performed, the entrant must pay the incumbent a connection charge to compensate the incumbent for the labor involved. Conversely, to transfer an incumbent's customer to an entrant who employs a platform strategy, computer software is used that allows for the process to be fully automated. The entrant must only pay a nominal administrative fee to the incumbent to transfer the customer.

History of Platform-Based Entry Regulation

While there has been widespread agreement that allowing entrants to lease the local loop is beneficial to long-run competition, there has been heated disagreement as to the effects of allowing entrants to follow a platform strategy. Advocates of allowing platform-based entry typically point to the technical and financial difficulties entrants face when using loop arrangements to serve residential customers.[14] Those critical of forcing incumbents to provide platform arrangements argue that the option discourages entrant investment in telecommunications equipment, which is one of the goals of TA96.[15] Among the FCC commissioners, this disagreement typically splits along party lines, with Democratic commissioners in support of the platform-based entry option and Republicans opposed.[16]

---

[13] A seamless migration is an industry term that describes a hot-cut where the customer does not lose phone service for any noticeable length of time.

[14] The connection charges and labor costs involved in a hot cut are claimed to be prohibitively expensive for entrants, especially as the churn rate among their customers is relatively high (WorldCom (2002)). In addition, when the hot cut is performed, the customer may lose service for a brief period of time. Entrants complain that customers associate the delay with the entrant to whom they are transferring service, and thus the customer immediately perceives a lower quality of service with the entrant (FCC (2003), 290-291).

[15] See, for example, Crandall, Ingraham, and Singer (2004).

[16] A notable exception to this generalization is the current Republican FCC Chairman Kevin Martin, who sided with the two Democratic commissioners in the 2003 Triennial Review Order (FCC (2003)) to continue the availability of platform-based entry.

Given the enormous financial stakes involved in the local telecommunications market, perhaps it is not surprising that there has been a great deal of regulation and litigation concerning platform-based entry. There are two main regulatory requirements for platform-based entry to be feasible: entrants must be able to "re-bundle" UNEs and all of the necessary network elements must be unbundled by the FCC.

Entrants eventually realized that for certain customers they could realize greater profits if they simply leased all of the UNEs necessary for them to provide phone service, rather than providing any of the necessary equipment themselves.[17] While incumbents began allowing entrants to lease the UNEs necessary in a platform arrangement in some states in 1999, the incumbents often charged additional fees for "re-bundling" the network elements. The FCC then ruled that the incumbents could not charge these re-bundling fees. Litigation soon followed, culminating with the Supreme Court ruling in 2002 in *Verizon vs FCC* that entrants can legally re-bundle UNEs at no additional charge from the incumbents.

In terms of the availability of UNEs, the network element that has been at the heart of the platform-based entry debate is the incumbent switches, specifically those that are used to service residential and small business customers.[18] While the debate among the FCC commissioners has often been very contentious, until recently most incumbent switches[19] have been available to entrants as UNEs at relatively low rates[20]. However, in

---

[17] To be precise, the entrant must still provide equipment necessary for billing, marketing, and customer service functions.

[18] The FCC defines this classification as any customer with four access lines or fewer.

[19] In its 1999 UNE Remand Order (FCC (1999)), the FCC ordered that incumbents did not have to lease certain switches located in the 50 largest MSAs.

[20] These rates are set by state public utility commissions and based on a TELRIC (total element long-run incremental cost) methodology. In essence, the UNE cost is to be based on the costs a hypothetical

March 2004, the U.S. Court of Appeals in Washington, D.C. ruled that the FCC rules did not comply with TA96. In June 2004, the Bush administration announced that it would not appeal the decision by the U.S. Court of Appeals, thus ringing the death bell of platform-based entry as known by market participants.[21] Partly in response to these developments, AT&T and MCI subsequently announced that they were exiting the residential market (Young (2004)). Finally, in February 2005, the FCC (2005) ruled that as of February 2006 incumbent switches would not be available to entrants at the low rates.[22]

Hypothesized Determinants of Loop- and Platform-Based Entry

This section outlines the likely determinants of loop- and platform-based entry. The determinants can be classified as describing the revenue potential, regulated costs, and political effects.

Measures of revenue potential reflect the profits an entrant would expect to earn. An obvious candidate would be the current retail price in that market, in so far as, *ceteris paribus*, the higher the retail price the more attractive a market is to a potential entrant.[23] The incumbent's average net revenue per line in that state is used as a proxy for these prices. Another variable of potential interest to entrants is the growth prospects of the market. One may expect that entrants will focus their efforts in areas where they expect

---

incumbent would incur using current technology and is not to be based on the actual historical investment by the incumbent. See Quast (2005) for further details.

[21] Rather than abruptly make incumbent switches unavailable as UNEs, the FCC ordered a 12-month transition phase during which switches would be available at slightly higher costs. However, after the 12-month transition the parties are to negotiate the rates at which switches can be leased.

[22] Many entrants have negotiated agreements with incumbents to continue leasing switches after they are no longer available at TELRIC rates. For instance, Qwest has negotiated such agreements with more than 60 entrants, while Verizon and BellSouth have negotiated such agreements with over 50 and 45 CLECs, respectively. (See BellSouth (2004); State Telephone Regulation Report (2005); and Telecom A.M. (2005).)

[23] Unfortunately, within a state and across customer types, several retail prices may be charged.

increases in the number of potential customers. To control for the effects of changes in the growth level in a state, the change in the unemployment rate is included as an explanatory variable.

The level of entry is also likely to be affected by the costs an entrant expects to incur in providing service. A main source of costs for entrants is the payments they must pay to incumbents to lease UNEs. As noted above, during the sample period those rates are determined by state public utility commissions and do not vary by entrant within a given state. For loop-based entry, there are two UNE rates that are especially important to entrants: (1) the monthly price they must pay to incumbents to rent the local loop and a connection device known as a line port; and (2) the fee charged by the incumbent to transfer one of its customers line to the entrant's equipment (i.e., to perform a hot cut). One would expect both rates to have a negative effect on the level of loop-based entry. In terms of platform-based entry, the process used to transfer a customer to an entrant's network is fully automated and incurs only a nominal charge. However, under a platform arrangement the entrant must pay the incumbent to lease its switching equipment and to transport calls over the long distance network, as well as to lease the local loop. This total charge is referred to as the platform rate and, as it increases, platform-based entry is expected to decline.

Political factors also may influence entry in ways that are not entirely clear. A potential influence is the political composition of the state public utility commission. Among the ways state public utility commissions affect entry (beyond setting UNE rates) is by forcing the incumbent to adjust their hot-cut processes and computer systems

through which entrants order and are billed for services for newly acquired customers.[24] Also, state commissions set right-of-way access regulations that can either help or hinder entrants who install their own equipment. One could imagine that a commission that is majority Republican would oppose governmental involvement in the market and thus limit their efforts at facilitating a relatively more involved regulatory design such as platform. However, it may also be the case that Republican allegiances to small businesses may predispose them to treat entrants favorably. Likewise, the effect of a Republican governor on competitive entry is not clear.[25,26]

While the factors described above may be expected to have certain effects on entry, these effects may differ substantially by the size of the market. For instance, a $1 increase in revenue per customer may lead to entrants attaining a greater additional market share in larger markets than in smaller markets, as entrants may already have a presence in larger markets and the incremental cost of acquiring an additional customer is relatively low. Conversely, changes in market conditions may have a greater impact in smaller markets, as entry in these markets is less certain and changes in potential profits can determine whether entrants choose to enter the market. To capture these potential differences across states, the model includes interaction terms between the factors listed above and the population of the state.

---

[24] For example, states have implemented various approaches in forcing incumbents to implement procedures to migrate customers to entrants (FCC (2003), 309-310). In the former Ameritech region, entrants accused SBC of not having adequate computer systems to allow for platform-based entry (see Kovacs (2002)).

[25] Note that while the discussion that follows refers to measurements of Republican influence, given the virtual binary political party environment, the results can be cast in terms of Democratic influence merely by replacing the reported result with its opposite.

[26] Another regulatory variable that could have a significant effect on entry is whether the incumbent is under price or rate of return regulation for their retail prices. During the sample period the type of retail rate regulation did not change for any of the incumbents. Therefore, this effect is captured in the fixed effects analysis.

One of the advantages of a panel data analysis is the ability to control for effects specific to a state that are not captured elsewhere. State fixed effects control for time-invariant effects that are not captured in the other explanatory variables and that are specific to a given state (e.g., operating cost differences).[27] In addition, time fixed effects are included to control for national effects specific to a given period.[28]

Model Specification and Data Used

Given that the levels of loop- and platform-based entry are highly related,[29] it is appropriate to estimate them simultaneously. Thus, a seeming unrelated regression (SUR) approach is employed.[30]

Summary statistics of the data used are provided in Table 2-1. The sample is based on semi-annual data by state for the period January 2001 to July 2004.[31,32,33] Correlation coefficients between the explanatory variables are provided in Table 2-2.

---

[27] Given that in the sample no state is served by more than one incumbent, state fixed effects also control for incumbent fixed effects.

[28] The model was also estimated without state and time fixed effects. Compared with the results reported below that include these fixed effects, the estimates without fixed effects indicate a stronger negative relationship between the level of entry and the monthly cost of that form of entry. These results are similar to those in Beard and Ford (2002), who do not include state fixed effects in their regressions. However, in the regressions without state and time fixed effects, the monthly cost of entry may reflect the attractiveness of entry into that state. For example, a high loop rate may be associated with lower entry, but high loop rates exist in areas where loop entry is relatively unattractive (e.g., Wyoming).

[29] Insofar as when an entrant decides to enter a market by leasing unbundled elements, the entrant must choose either one of these entry methods.

[30] As specified, the SUR model results in the same coefficient estimates as when each dependent variable is regressed separately. However, the SUR estimator is more efficient (assuming the model is correctly specified) and thus results in lower standard errors of the coefficient estimates.

[31] Alaska, Hawaii, and Washington, DC are not included in the analysis because of their particular geographic circumstances. Arkansas is not included due to difficulties in obtaining connection cost data, while for New Mexico those data could only be obtained for January 2003 forward. The fraction of lines leased in a platform arrangement by Verizon are not available for Maine and Vermont for January and July 2002, and for Delaware, New Hampshire, and West Virginia for July 2002 only. The resulting data set contains 271 observations.

[32] The data regarding the level of entry, UNE rates, and the incumbent's average revenue are based on the incumbent's service territory within a state, rather than on the entire state. Typically the two differ in that the incumbent service area may not include some of the relatively rural areas within a state. However, as

The dependent variables in the estimations are the fraction of incumbent lines leased by entrants using a loop arrangement and the fraction of lines leased using a platform arrangement. These variables are based on data reported by incumbents to the FCC in their Form 477 data submissions (http://www.fcc.gov/wcb/iatd/comp.html).[34]

In regards to revenue potential, the incumbent's revenue per line for a state is obtained from ARMIS data submitted by the incumbents to the FCC (http://www.fcc.gov/wcb/armis/).[35] The change in the unemployment rate is based on seasonally adjusted data reported by U.S. Bureau of Labor Statistics (http://www.bls.gov/data/home.htm).

As the level of entry may affect the average revenue, the average revenue may be endogenous to the level of competitive entry. To attempt to control for this potential endogeneity, three alternative strategies were also employed: using the lagged value of average revenue as the explanatory variable, using the lagged value of average revenue as an instrumental variable, and using as an instrumental variable the percent of the incumbent's lines that are used by participants in a low-income assistance program known as Lifeline.[36] The estimates from each of these specifications are very similar to those reported below.[37]

---

most of the entry occurred in non-rural areas, this discrepancy between the data sets should not materially affect the results.

[33] The incumbent's revenue per line is reported annually. The missing data points are calculated by linearly interpolating the data.

[34] As the UNE cost data are not available, the service areas of Verizon that were formerly GTE service areas are not included in the analysis.

[35] Specifically, the average revenue is calculated by dividing net revenue (ARMIS Report 43-01, Line 1090) by the number of lines (ARMIS Report 43-08). While a variable that more precisely measures the retail rate would be preferred, this variable should approximate the potential revenue an entrant could obtain and has been used by other authors, e.g., Ai and Sappington (2005) and Abel (2002).

[36] The Lifeline program is an effort coordinated by the FCC and state public utility commissions that helps pay for basic phone service for low-income consumers. Incumbents are obligated to publicize the

The monthly loop and platform UNE costs are obtained from surveys of state public utility commissions by Billy Jack Gregg of West Virginia's Office of the Consumer Advocate (http://www.cad.state.wv.us/Une Page.htm).[38] During the sample period examined in this paper, most state public utility commissions set rates that varied by different density zones within the state. For the loop monthly cost, the monthly loop and port cost in the urban zone used[39], as these are the areas most likely to be entered by entrants who utilize a UNE-L entry strategy. For the platform monthly cost, the variable used is the incremental cost of providing service to customers via a platform-based entry strategy in the suburban zone, as entrants typically serve residential customers via a

---

availability of this service and are encouraged to sign up as many participants as possible, which therefore influences their customer mix. Further, one can imagine that low-income customers are more likely to participate in the Lifeline program the higher the retail price charged by the incumbent. As such, it is likely that the extent to which the incumbent's customers participate in this program is correlated with the incumbent's average revenue. The first-stage F-statistic confirms that the variable is sufficiently correlated with the incumbent's average revenue (or, in the language of the instrumental variable literature, it is sufficiently relevant). Conversely, entrants typically do not participate in this program. Also, differences in how state utility commissions administer the Lifeline program result in the fraction of participants being uncorrelated with state income. Thus, the effect on entry of the fraction of the incumbent's customers that are Lifeline subscribers should be minimal and the variable should be exogenous to the level of entry. While these arguments suggest that the variable is exogenous, there is potential correlation between how state utility commissions administer the Lifeline program and how they treat competitive entry. Further, there does not exist a test to determine if an instrument is exogenous in an exactly identified model such as this. Thus, it is not clear that this candidate instrument is sufficiently exogenous to be valid.

[37] While none of these three strategies is perhaps ideal, only one existing telecommunications entry paper reviewed by the author has attempted to address this issue (Abel (2002)), and it employs the first strategy listed above. Further, concerns about endogeneity are mitigated by the fact that often many of the incumbent's retail rates are either regulated or published in tariffs that must be approved by state utility commissions. Thus, the response in average revenue to changes in entry may be delayed or diminished.

[38] Some participants in legal proceedings have disputed the way in which platform arrangement costs are calculated in these data (see Willig, et al, 2002). Switching rates are typically based on minutes of use, and the rates reported by Gregg are based on 1000 minutes of use. Criticisms of the Gregg rates center on whether 1000 minutes of use is an appropriate benchmark. However, there is no other source of consistently reported UNE rates over this period. Perhaps more importantly, as the fixed effects estimator is based on deviations from the state mean for each explanatory variable, mismeasurement bias is unlikely. Specifically, if the minutes of use used to calculate the platform arrangement cost is consistently either less or more than the actual minutes of use, the coefficient estimates will not be affected.

[39] Data on collocation costs are not available.

platform-based entry strategy.[40] The loop connection charges are obtained by reviewing state public utility commission and FCC documents and trade press, and by contacting the state public utility commissions directly.[41]

The percent of Republicans serving on state public utility commissions is derived by reviewing membership directories of the National Association of Regulatory Commissioners,[42] while the political affiliation of the Governor in a state is obtained from the U.S. Statistical Abstract (http://www.census.gov/prod/www/statistical-abstract-04.html) and the National Governors Association website (http://www.nga.org).

Estimation Results

Estimates without Population Interactions

Coefficient estimates

Table 2-3 summarizes the coefficient estimates and t-statistics from estimating the fraction of lines entrants acquired via loop and platform arrangements. The estimations are first performed including each group of explanatory variables individually, and then including all of the explanatory variables. The table indicates that the estimates do not vary substantially according to whether the other groups of explanatory variables are included in the regression.

---

[40] Due to difficulty in comparing these costs across states, costs for transporting calls between switches are not included in the Gregg UNE-P cost estimate.

[41] A concern regarding the endogeneity of the UNE rates could arise due to the potential for reverse causation. In particular, one could surmise that low levels of entry may persuade state public utility commissions to lower UNE rates. However, any such response by state commissions could only occur with a substantial lag, as the commissions would only learn of the level of entry with a lag and can only revise UNE rates after a lengthy set of proceedings. Quast (2005) finds that it takes approximately one year for the level of UNE entry to affect UNE rates set by state commissions. Thus, UNE rates can be treated as exogenous.

[42] The dates of the membership directories used to construct this variable are February 1999, February 2002, February 2003, July 2003, and March 2004

Of the variables that measure revenue potential, the average revenue has a positive and statistically significant effect on the platform share, while its effect on loop share is statistically insignificant. The lack of significance in the loop share equation may reflect that this variable is a better indicator of the average residential price than the average business price. The change in the unemployment rate is statistically insignificant for both types of entry.

In regards to the variables that measure costs, those that measure the own monthly cost have negative coefficients. Specifically, the coefficient on the loop monthly cost in the loop share equation and the coefficient on the incremental platform cost in the platform share equation are negative. However, neither is statistically significant. In contrast, the loop connection charge is negative and statistically significant. In the platform share equation, the coefficient on the loop monthly cost is positive, suggesting that there may be substitution to platform-based entry as the monthly loop cost increases.

The coefficients on the regulatory variables indicate that Republican state public utility commissions are associated with higher shares of loop-based entry and lower shares of platform-based entry.[43] Conversely, Republican governors are associated with less loop-based entry.

Economic effects

To obtain a sense of the relative importance of the explanatory variables, Table 2-4 details the effect of a one-standard deviation increase in each explanatory variable on the share of loop and platform-based entry.[44]

---

[43] Conceivably, the Republication state commission variable could simply reflect that Republican commissions set lower loop rates and higher platform rates. However, the very low correlation between the UNE rates and commission political affiliation (see Table 2-2) mitigates this concern.

[44] For binary explanatory variables, the economic effect is calculated as the effect from a change in the

The largest effect in either equation is associated with average revenue in the platform share equation. A one-standard deviation increase in the average revenue ($9.60) is associated with an increase of over 2 percentage points in the share of the incumbent's lines leased in a platform arrangement, which translates to a roughly 33% increase in the platform share when measured at the mean of 6.1%.

Of the cost variables, a one-standard deviation increase in the loop connection charge ($25.80) decreases the level of entry by almost 0.2 percentage points. Measured at the mean of 2.6%, this effect translates to an approximately 6% decrease in the loop share, which validates to some extent the FCC's concern regarding the dampening effect of this charge on loop-based entry.[45] The economic effect of the monthly loop cost on platform-based entry is non-trivial, which suggests that for some customers entrants utilize a platform strategy when the monthly loop cost increases. Surprisingly, the own-cost economic effects are not only statistically insignificant but also relatively small.

The political affiliation of the state utility commissions has divergent effects on the two means of entry. When adjusted for the difference in means, the absolute value of the economic effects is roughly equal for loop and platform-based entry. As mentioned above, this may reflect a preference on the part of Republican commissioners to promote the entry option that entails less regulatory intervention. The negative effect of Republican governors on loop-based entry is interesting, given the estimated preference of Republican commissioners and the absence of an effect on platform-based entry. This effect may reflect a concern on the part of entrants that Republican governors discourage

---

explanatory variable from zero to one.

[45] Note that this effect does not capture the effects of logistic difficulties entrants may face when attempting to connect a customer to its network via a loop arrangement.

regulation and are thus more likely to advocate policies that are favorable to incumbents. The lack of effect on platform-based entry may reflect the low fixed costs that platform-based entry requires, and the resulting ability of an entrant to exit a market relatively quickly.

Estimates with Population Interactions

Coefficient estimates

As described above, the estimates in Table 2-3 and Table 2-4 and estimates in prior studies assume that the effects of the explanatory variables do not vary across states. However, the effects of market and political factors may well differ by the size of the state. To account for such potential variation, the model is also estimated such that each explanatory variable is interacted with the state population.

Table 2-5 details the coefficient estimates and t-statistics that result from including population interactions. For each explanatory variable, two coefficients are reported: the coefficient on that variable and the coefficient of the variable multiplied by the state population. As such, one can interpret the second coefficient as the additional effect of the explanatory variable as the population is increased.

For the variables that measure revenue potential, the strong effect of the average revenue on the platform share persists when population interactions are included. However, whereas previously average revenue did not have a statistically significant effect in the loop share equation, the average revenue interacted with the population does. Further, the coefficient on the uninteracted average revenue variable is larger than the estimate in Table 2-3 and falls just short of a statistical significance level of 90%.

Market size effects also appear to be important in measuring the effects of costs on entry share. For the loop connection charge in the loop share equation, the negative

coefficient on the uninteracted variable and the positive coefficient on the interacted variable suggest that the connection charge has a negative effect on entry in smaller markets, but the effect diminishes in larger markets. Conversely, the negative effect of the monthly incremental platform cost on platform-based entry tends to increase as the population increases. The effects of the own monthly costs also appear to differ by market size.

Of the political variables, in contrast to the results in Table 2-3 and Table 2-4, it appears that there may be an effect on platform-based entry associated with Republican governors when population effects are taken into account. Specifically, in small states Republican governors are associated with greater loop-based entry, but the effect diminishes as the state's population increases.

Economic effects

To estimate the economic effects implied by the estimates in Table 2-5, Table 2-6 calculates the effect on entry share of a one-standard deviation in each explanatory variable for two representative population sizes: the 25th percentile and the 75th percentile (2.2 and 7.4 million, respectively).[46] The first two columns detail the economic effects on the loop share while the last two columns detail the economic effects on the platform share.

The economic effects on the loop share differ significantly by population. None of the statistically significant explanatory variables for the 25th percentile of population has a statistically significant effect for the 75th percentile of population. Specifically, the effects of the loop connection charge and the political affiliation of the utility commission

[46] The economic effect is calculated as the standard deviation of the explanatory variable times the sum of the coefficient on the uninteracted variable plus the population times the coefficient on the interacted variable.

and governor become statistically insignificant as the size of the state increases. Further, the effect of the monthly loop cost is nearly statistically significant at the 25th percentile but not at the 75th percentile.

The effects on loop share may be diminished in larger states because loop-based entry is less responsive to changes in revenue and costs in larger markets. Loop-based entrants may already be present in larger markets because they contain the most potential customers, and thus even a small profit margin per customer translates to large profits in that market. Further, incumbent prices to business customers have historically been well above cost in order to cross-subsidize lower prices to residential customers. Loop-based entrants may have previously entered these larger markets to undercut the inflated incumbent business prices and may therefore be less affected by changes in revenue and costs.

The differential effect of Republican commissioners on loop share in smaller states may also be due in part to differences in entry conditions. In large markets loop-based entry may be sufficiently profitable that substantial entry will occur regardless of state regulatory policy. In contrast, given the relative difficulty of attracting loop-based entry in small states, Republican state commissions may adopt policies that are especially favorable to loop-based entry and thus the commissions have a larger effect on the level of entry.

However, the effects of the explanatory variables on platform share offer more of a mixed picture. The positive effect of the loop monthly cost is quite similar in the two market sizes, but the effects of the other explanatory variable differ. In contrast to the effects on loop share, the economic effects on platform share tend to become more

pronounced as the population increases. For instance, the effect of the average revenue per line is over 20% larger at the 75th population percentile than at the 25th percentile. Also, the monthly incremental platform cost has a statistically significant effect in larger states whereas in smaller states it does not.

These findings may reflect in part how platform-based entrants attract customers. Platform-based entrants tend to target residential customers in broad geographic markets (such as an MSA or state) and use mass marketing to acquire customers. In smaller states like Wyoming, an incremental increase in per customer profit may not justify the fixed marketing costs of entering the state due to the limited number of potential customers. Conversely, when per customer profit levels increase in a large state such as California, the same increase in marketing efforts can reach a much larger population and thus may justify the additional expense.

The negative effect of Republican commissioners on platform-based entry may also be due to a difference in the ability of small and large states to attract entry. Republican commissions may have a preference for loop-based entry over platform-based entry, but in small states it may be difficult to attract loop-based entry. Thus, the desire to have any form of entry may offset whatever preferences the commissioners possess. In larger states, commissioners can perhaps be more selective as to which type of entry to encourage, thus Republican commissioners may discourage platform entry.

The economic effect of the loop connection charge on platform-based entry also differs by market size. The positive effect in small states can be explained by substitution from loop-based to platform-based entry as the cost of loop-based entry increases. However, the negative effect in large states implies that increases in the loop connection

charge deter both types of entry. A possible explanation is that some platform-based entrants in larger states enter those markets with the intent to in the long-term to convert to a loop-based arrangement. When the cost of loop-based entry increases, some of these entrants may decide that it is less profitable to pursue such a strategy and they may elect to curtail their platform-based operations.

Conclusion

This paper analyzes the factors that determine the level of entry in local telecommunications markets given two alternative entry strategies. The estimates suggest that while generally the two types of entry are affected by different market factors, there appears to be cost-based substitution between them. Changes in the own monthly costs of the two forms of entry have limited effects, but loop-based entry decreases in response to increases in the connection charges entrants must pay incumbents when a customer is acquired. Loop-based entry tends to be more pronounced relative to platform-based entry as the degree of Republican representation on state public utility commissions increases. Finally, loop-based entry is more responsive to changes in economic conditions in smaller states, while platform-based entry is more responsive to market conditions in larger states.

The results in this paper may suggest some potential lessons regarding the effects of TA96 and potential revisions to it. Proponents of platform-based entry can point to the negative effect of loop connection charges as evidence of the need for an alternative to loop-based entry. On the other hand, critics of platform-based entry can argue that, given the positive effect of the monthly loop cost on the platform share, loop-based entry is hindered by the existence of the platform-based entry option. Also, the results suggest that the local interests of state regulators need to be taken into account when they are

charged with implementing federal policies. Finally, given the differing effects across states of different sizes, policymakers need to consider how to fashion policies that achieve national goals but recognize local market conditions.

The findings in this paper could be extended in several directions. First, if the data become available, a more disaggregated analysis of the entry decision could provide more precise results. Market conditions can vary greatly within a state, but the available data do not allow for an analysis of that granularity. Also, as noted above, the monthly loop cost variable used in the regressions does not include collocation costs, while the estimate of the incremental cost of platform-based service does not include costs related to transporting calls between switches. Including these additional costs would allow for a more complete analysis. Additionally, a more precise measure of the retail price may uncover a more important role for it in determining the level of entry. Finally, a complete analysis would simultaneously estimate the effects of other types of telecommunications entry, such as cellular phones and the emerging presence of new technologies such as voice-over-internet-protocol.

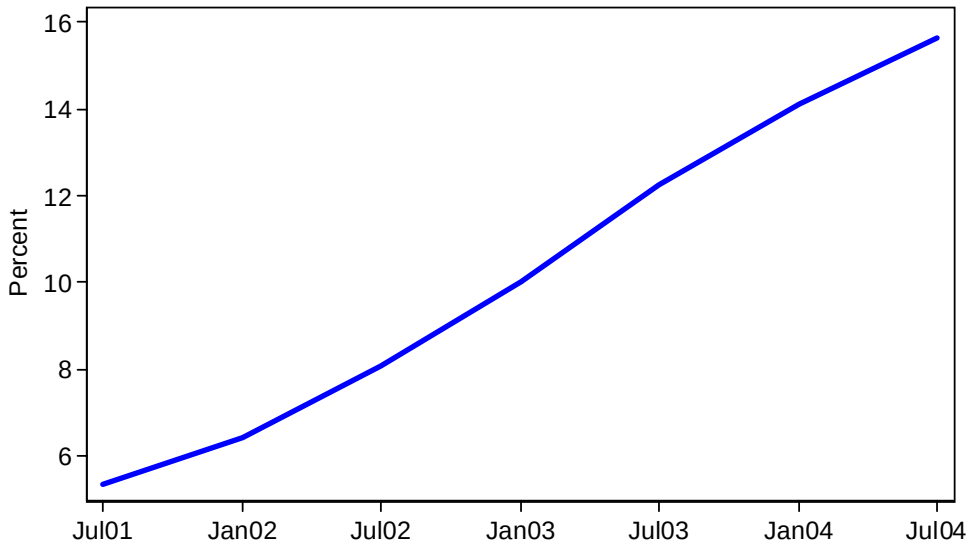


Figure 2-1 Fraction of Incumbent Lines Leased by Entrants (National Average).

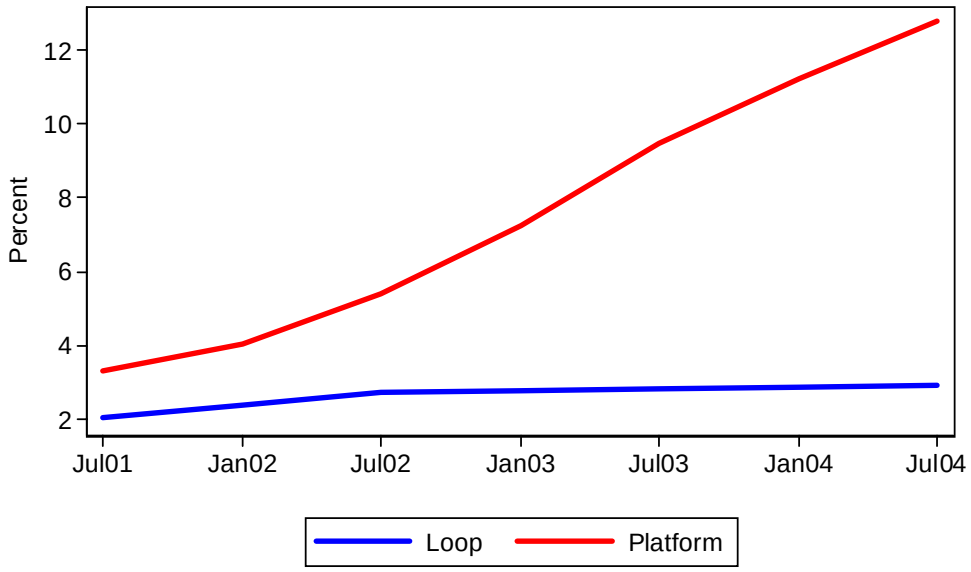


Figure 2-2 Fraction of Incumbent Lines Leased by Entrants by Means of Entry (National Average).

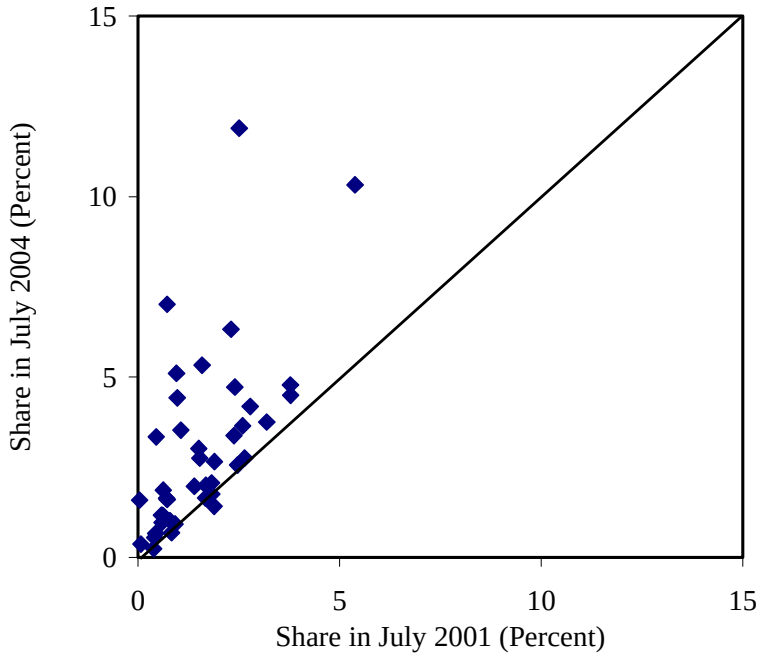


Figure 2-3 Loop Share of Incumbent Lines, July 2001 and July 2004.

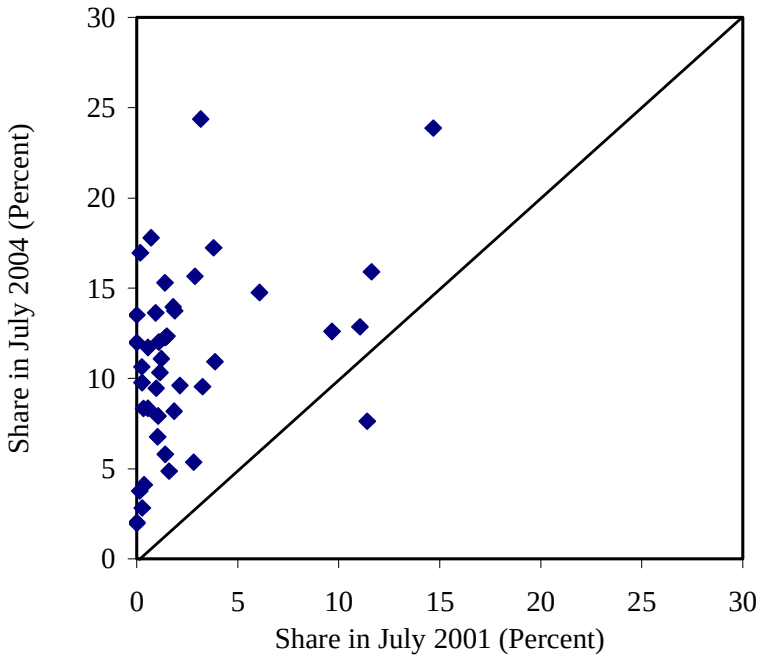


Figure 2-4 Platform Share of Incumbent Lines, July 2001 and July 2004.

Table 2-1 Summary Statistics.

Variable	Mean	Minimum	Maximum	Standard Deviation
Dependent Variables				
Share of Entrant Loop Lines	2.6	0.04	11.9	2.0
Share of Entrant Platform Lines	6.1	0.00	24.4	5.2
Explanatory Variables				
Incumbent Average Revenue per Line	$61.12	$45.16	$101.19	$9.60
Change in Unemployment Rate	0.13	-1.3	2.2	0.61
Loop Monthly Cost	$13.90	$4.77	$28.14	$3.80
Loop Connection Charge	$45.69	$3.33	$159.76	$25.80
Platform Incremental Monthly Cost	$7.25	-$0.17	$24.81	$4.70
Percent of Commission Republican	53.2	0.0	100.0	33.3
Governor Republican	0.56	0.00	1.00	0.5
Interaction Variable				
Population (millions)	6.3	0.5	35.9	6.5

Table 2-2 Correlation Matrix of Explanatory Variables.

	Avg Rev	Unemploy Rate	Loop Mthly Cost	Loop Con Chrg	Plat Incr Mthly Cost	% PUC Rep	Gov Rep
Avg Rev	1.00						
Unemploy Rate	-0.14	1.00					
Loop Mthly Cost	0.25	0.10	1.00				
Loop Con Chrg	0.16	0.14	0.37	1.00			
Plat Incr Mthly Cost	0.31	0.08	0.25	0.15	1.00		
% PUC Rep	0.23	0.07	0.05	0.02	-0.01	1.00	
Gov Rep	0.13	0.05	0.07	-0.04	0.04	0.41	1.00

Table 2-3 Coefficient Estimates without Population Interactions.

	Specification #1		Specification #2		Specification #3		Specification #4	
Explanatory Variable	Loop	Platform	Loop	Platform	Loop	Platform	Loop	Platform
Revenue Potential								
Average Revenue per	0.010	0.185 ***					0.001	0.217 ***
Line	(0.48)	(3.05)					(0.04)	(3.58)
Change in	0.115	-0.051					0.164	-0.157
Unemployment Rate	(1.10)	(-0.17)					(1.56)	(-0.54)
UNE Rates								
Loop Monthly Cost			-0.032	0.194 ***			-0.033	0.186 ***
			(-1.32)	(2.87)			(-1.37)	(2.79)
Loop Connection			-0.006 **	0.002			-0.007 ***	0.008
Charge			(-2.10)	(0.31)			(-2.72)	(1.04)
Platform Incremental			0.010	-0.023			0.014	-0.028
Monthly Cost			(0.51)	(-0.44)			(0.76)	(-0.53)
Political								
Percent State Utility					0.009 **	-0.026 **	0.009 **	-0.026 **
Commission					(2.24)	(-2.36)	(2.34)	(-2.40)
Governor Republican					-0.225 *	0.001	-0.306 **	0.004
(Binary)					(-1.72)	(0.00)	(-2.33)	(0.01)
Within R-Squared	0.34	0.71	0.35	0.71	0.35	0.70	0.37	0.72
Number of Observations	314	314	314	314	314	314	314	314

Notes - t-statistics are reported in parentheses, coefficient estimates for state and time fixed effects and constant term omitted for brevity, *** - statistically significant at 99% confidence level, ** - statistically significant at 95% confidence level, * - statistically significant at 90% confidence level

Table 2-4 Economic Effects without Population Interactions.

Explanatory Variable	Loop	Platform
Revenue Potential		
Average Revenue per Line	0.01	2.08 ***
	(0.04)	(3.58)
Change in Unemployment Rate	0.10	-0.10
	(1.56)	(-0.54)
Costs		
Loop Monthly Cost	-0.13	0.71 ***
	(-1.37)	(2.79)
Loop Connection Charge	-0.18 ***	0.21
	(-2.72)	(1.04)
Platform Incremental Monthly Cost	0.03	-0.13
	(0.76)	(-0.53)
Political		
Percent State Utility Commission Republican	0.30 **	-0.87 **
	(2.34)	(-2.40)
Governor Republican (Binary	-0.31 **	0.00
	(-2.33)	(0.01)

Notes - Economic effects for continuous explanatory variables are based on a one standard deviation increase in that variable, economic effects for binary explanatory variables are based on a change in the variable from zero to one. t-statistics are reported in parentheses, *** - statistically significant at 99% confidence level, ** - statistically significant at 95% confidence level, * - statistically significant at 90% confidence level

Table 2-5 Coefficient Estimates with Population Interactions.

Explanatory Variable	Loop	Platform
Revenue Potential		
Average Revenue per Line	0.036	0.225 ***
	(1.50)	(3.42)
Interacted with Population	-0.010 ***	0.015 **
	(-3.82)	(2.03)
Change in Unemployment Rate	0.032	0.269
	(0.27)	(0.81)
Interacted with Population	0.011	-0.047
	(0.73)	(-1.14)
Costs		
Loop Monthly Cost	-0.059	0.186 *
	(-1.58)	(1.80)
Interacted with Population	0.006	0.002
	(1.04)	(0.09)
Loop Connection Charge	-0.016 ***	0.037 ***
	(-3.86)	(3.17)
Interacted with Population	0.003 ***	-0.008 ***
	(3.33)	(-3.73)
Platform Incremental Monthly Cost	0.035	0.099
	(1.18)	(1.23)
Interacted with Population	-0.004	-0.033 **
	(-0.64)	(-2.13)
Political		
Percent State Utility Commission Republican	0.011 **	-0.010
	(2.03)	(-0.63)
Interacted with Population	-0.001	-0.010
	(-1.25)	(-0.75)
Governor Republican (Binary	-0.342 *	0.895 *
	(-1.86)	(1.76)
Interacted with Population	0.019	-0.176 ***
	(0.99)	(-3.32)
Within R-Squared	0.44	0.76
Number of Observations	314	314

Notes - t-statistics are reported in parentheses, coefficient estimates for state fixed effects and constant term omitted for brevity,
*** - statistically significant at 99% confidence level, ** - statistically significant at 95% confidence level, * - statistically significant at 90% confidence level

Table 2-6 Economic Effects for the 25th and 75th Population Percentiles.

	Loop		Platform	
Explanatory Variable	25th Percentile	75th Percentile	25th Percentile	75th Percentile
Revenue Potential				
Average Revenue per Line	0.13	-0.36	2.47 ***	3.20 ***
	(0.65)	(-1.65)	(4.24)	(5.25)
Change in Unemployment Rate	0.03	0.07	0.10	-0.05
	(0.52)	(1.02)	(0.57)	(-0.25)
Costs				
Loop Monthly Cost	-0.17	-0.05	0.72 **	0.75 **
	(-1.62)	(-0.42)	(2.44)	(2.55)
Loop Connection Charge	-0.28 ***	0.08	0.52 **	-0.59 **
	(-3.47)	(0.83)	(2.31)	(-2.29)
Platform Incremental Monthly Cost	0.13	0.04	0.14	-0.67 **
	(1.28)	(0.33)	(0.49)	(-2.04)
Political				
Percent State Utility Commission Republican	0.33 **	0.20	-0.40	-0.63 *
	(2.06)	(1.54)	(-0.95)	(-1.79)
Governor Republican (Binary)	-0.30 *	-0.20	0.51	-0.41
	(-1.92)	(-1.56)	(1.19)	(-1.15)

Notes - t-statistics are reported in parentheses, coefficient estimates for state fixed effects and constant term omitted for brevity, *** - statistically significant at 99% confidence level, ** - statistically significant at 95% confidence level, * - statistically significant at 90% confidence level

CHAPTER 4
DOES THE FORM OF DOCTOR COMPENSATION AFFECT THE QUALITY OF CARE IN MEDICAID HMOS?[1]

Introduction

The Medicaid program, already one of the largest social programs in the United States, is growing rapidly. Between 1996 and 2004, the number of Medicaid enrollees increased by roughly one-third, from 33 million to 44 million (U.S. HHS (2004), 3). In an attempt to control the cost of the Medicaid program and to improve the quality of care provided to enrollees, many states have moved enrollees into HMOs (also known as managed care organizations). During the same 1996 to 2004 time period, the fraction of Medicaid enrollees in managed care organizations increased by approximately one-half, from 40% to over 60% (U.S. HHS (2004), 3). The trend towards managed care does not appear to be slowing. For instance, in December 2005 the governor of Florida signed a bill that requires all of the state's Medicaid enrollees eventually be enrolled in HMOs (Farrington (2005)).

State Medicaid programs often contract with HMOs to care for the health care needs of Medicaid participants. The HMOs, in turn, contract with doctors and other health care providers to deliver necessary health care services. HMOs can differ in many ways, including the manner in which they pay their doctors. FFS and capitated payment arrangements are common. Under a FFS arrangement, the doctor is paid according to the

[1] This paper is co-authored with Betsy Shenkman (Department of Epidemiology, Health Policy Research and Pediatrics, University of Florida) and David Sappington (Department of Economics, University of Florida).

services she provides to an enrollee. Under a capitated payment arrangement, the doctor is paid a fixed amount per enrollee regardless of the health care services actually provided to the enrollee. Consequently, a doctor paid via FFS can increase her revenue by providing additional services. In contrast, the revenue a capitated doctor receives is not affected by the health care services she provides.

This paper investigates whether the means by which HMOs compensate their doctors influence the quality of care the HMO's enrollees receive. Using data for all of the Medicaid HMO enrollees in a large state,[2] we find that enrollees in HMOs that pay their doctors exclusively via FFS arrangements are more likely to receive services for which the HMO's doctors receive additional compensation. Further, these enrollees are less likely to receive services for which the HMO's doctors do not receive additional compensation. These findings suggest that financial incentives may influence the behavior of doctors in Medicaid HMOs, and thus the health care received by Medicaid participants enrolled in HMOs.

Numerous studies have analyzed whether the form of physician pay influences the level of care provided to HMO enrollees. The papers suggest such a link often is present. For example, Hillman, Pauly, and Kerstein (1989) report that hospitalization rates are higher for enrollees whose physicians are paid via FFS rather than capitation. Stearns, Wolfe, and Kindig (1992) find that specialist referrals, hospital admissions, and hospital length of stays fell when an HMO switched from FFS physician payment to capitation payment. Ransom et al. (1996) report that gynecologists tend to provide fewer elective surgical procedures when their payment method is changed from FFS to capitation.

---

[2] The state is not identified, to preserve confidentiality of key data.

Shrank et al. (2005) find that fewer cataract procedures are performed when physicians are moved to capitation. In contrast, Conrad et al. (1998) do not find any significant effects of physician payment method on health care utilization.

Our analysis enhances the literature in three important respects. First, we examine differences in the behavior of FFS and capitated doctors for services that have different effects on the doctors' expected profits. As noted, we find that FFS doctors deliver more services that increase their profit than capitated doctors. However, corresponding differences are not detected on services that do not increase physician profit. Second, we consider services for which there are clearly stated and widely accepted norms for the proper level of care. Consequently, we are able to assess whether financial incentives affect the extent to which actual care departs from the most appropriate level of care. Third, we examine the health care services delivered to Medicaid enrollees, who often are especially at risk of not obtaining the proper level of care.

The paper is organized as follows. Section 2 describes the services we analyze and explains how the profits of FFS and capitated doctors are affected by the delivery of these services. Section 3 describes our data and empirical specification. Section 4 presents our findings. Section 5 provides conclusions and directions for future research.

Background Information

Preventive care is a major focus of the Medicaid program, especially for children. Preventative care can both reduce treatment costs and avoid painful and debilitating illness. Routine well-child visits and the provision of asthma medications are two important forms of preventive care. Annual well-child visits allow doctors to monitor enrollees' health and to deliver essential, routine health care services such as immunization shots. Asthma is considered to be an epidemic and affects over 4 million

children in the U.S. (US HHS (2000), 2). Proper treatment of asthma conditions can reduce asthma attacks, emergency room visits, and morbidity.

While both well-child visits and asthma medications can be beneficial to enrollees, these two forms of preventive care can affect the profits of doctors differently. In the state studied here, the cost of a well-child visit is borne by the doctor that performs the well-child. In contrast, the Medicaid program pays for prescribed asthma medications. Consequently, the amount of asthma medication prescribed has no direct financial impact on either the HMO or its doctors. This difference in the incidence of the costs of well-child visits and asthma medications is an important element of the ensuing analysis.

Because they are reimbursed for each service they provide, FFS doctors increase their revenue with every well-child visit they perform. In contrast, FFS doctors do not receive greater revenue when they prescribe additional asthma medications. In fact, to the extent that the prescribed asthma medications control the symptoms of asthma and thereby reduce future office visits, additional prescriptions can reduce the doctor's revenue.

Capitated doctors receive no additional revenue when they perform a well-child visit, but do incur the cost of providing the visit. The well-child visit may reduce future costs by allowing the doctor to detect an ailment and treat the enrollee before complications arise and the requisite care becomes more costly. However, Medicaid enrollees often have limited spells in the program, which reduces the likelihood that the capitated doctor would bear the costs of later treatment. As noted above, capitated doctors do not bear the costs of prescribed asthma medications. Furthermore, the

medications can reduce the costs of the capitated doctor by limiting the need for office visits.

This paper compares the extent to which FFS and capitated doctors in Medicaid HMOs provide well-child visits and asthma medications. Given the differences in the compensation structures the FFS and capitated doctors face, our findings may provide some useful evidence about how financial incentives affect the quality of care received by HMO enrollees.

Data and Empirical Specification

Our data is of two types: enrollment and encounter data and data from interviews. The enrollment and encounter data is for every healthy[3] Medicaid enrollee in an HMO in the state in question in 2004. This enrollment data contains demographic information for each enrollee; the encounter data records the enrollee's usage of medical services, including office visits, medical treatments, and pharmaceutical prescriptions. The encounter data also documents diagnoses made by the physician when treating the enrollee.

The interview data is derived from interviews with personnel from the HMOs. The HMOs in our sample are required to answer questions posed by the state regarding various characteristics of their organization. Among the questions asked is how the HMO compensates its doctors.[4]

The dependent variables in the analysis are based on measures established in the Health Plan Employer Data and Information Set (HEDIS) developed by the National

---

[3] Specifically, the sample is limited to enrollees with a clinical risk grouping (CRG) score of one.

[4] Unfortunately, data for each HMO are aggregate data, not data on how the HMO compensates each individual provider.

Committee for Quality Assurance (NCQA) (NCQA, 2002). HEDIS measures are used to evaluate the care received by HMO enrollees and are widely used by industry participants. These measures are based on diagnosis codes and treatment codes found in enrollee encounter data and the ages of the enrollees.[5] The measures are binary: one indicates that the proper care was provided; zero indicates otherwise. The measures are based on treatment received over a twelve month period and specify the age ranges of the enrollees to be included. The treatment period examined in the analysis below is January 2004 - December 2004.

The first HEDIS measure analyzed is whether the enrollee received at least one well-child visit during the treatment period. Two age cohorts are analyzed: children between 3 and 6 years of age; and adolescents between the ages of 12 and 21.[6] The success rates for the younger and older age cohorts are 50% and 32%, respectively, in our sample.

The second HEDIS measure we analyze is whether children with persistent asthma were prescribed appropriate medications.[7] This measure is based on two years of data. Data from 2003 are examined for evidence of persistent asthma. Data for 2004 are examined for evidence of appropriate medication. The age cohorts employed for this analysis are 5 through 9 and 10 through 18. The success rates for these cohorts on this measure in our sample are 51% and 54%, respectively.

---

[5] The measures used in this paper are based on the administrative specification of the measures.

[6] The two measures are named, “Well-Child Visits in the Third, Fourth, Fifth, and Sixth Years of Life” (page 177) and “Adolescent Well-Care Visits” (page 180).

[7] The measure is named “Use of Appropriate Medications for People with Asthma” (page 104).

The explanatory variables reflect HMO operating characteristics and enrollee demographics. The HMO operating characteristic of primary interest is whether the HMO compensates all of its doctors via FFS arrangements. During the HMO interviews, each HMO is asked to report the percent of its doctors that are paid via FFS arrangements. The distribution of answers was bimodal, with five of the eight HMOs in our sample stating that they pay roughly 100% of their doctors via FFS[8] and three HMOs stating that they pay 85%[9] of their doctors via FFS. This bi-modal distribution underlies our treatment of this variable as binary.

Two other variables are included to control for the practices of the HMO: whether HMO case managers work directly with the primary care physicians[10] and whether the HMO makes reminder calls to enrollees immediately prior to their well-child visits. (This latter variable is included only in the analyses of the HEDIS well-child visit measure.) The other variables included to control for characteristics of the HMO are the for-profit/non-profit status of the HMO, the number of enrollees (Medicaid and otherwise), the percent of the HMO's enrollees that are in Medicaid, and the number of years the HMO has been operating in the state in any capacity.

Table 3-1 lists the HMO attributes included in the estimation. As the table indicates, there is significant heterogeneity among the HMOs for each of the variables employed in the analysis. The smallest HMO has roughly 35,000 enrollees while the largest has approximately nine times that number. The HMOs also vary significantly in

---

[8] Specifically, the reported percentages were 100%, 100%, 100%, 99%, and 99%.

[9] Specifically, the reported percentages were 84%, 85%, and 85%.

[10] HMO case managers are responsible for ensuring that children with chronic conditions receive appropriate care.

their operating practices and in the extent to which their enrollment is limited to Medicaid enrollees.

Table 3-2 presents the success rate for the two HEDIS measures for each value of the binary HMO attributes. Children in HMOs that paid all doctors via FFS arrangements had higher well-child visit success rates than HMOs that paid only some of their doctors via FFS. In addition, children in HMOs where case managers worked directly with primary care physicians had higher asthma medication success rates.

The demographic variables we employed are gender, race, age, and whether the enrollee resides in a rural area. Table 3-3 presents the values of the demographic variables in our sample. Hispanics outnumber blacks and whites, while the vast majority of enrollees reside in non-rural areas. The data in Table 3-4 indicate that, relative to whites and blacks, Hispanic children had a higher success rate for well-child visits and lower success rate for asthma medications. Also, non-rural children had higher success rates for well-child visits and lower success rates for asthma medications.

The two equations estimated are:

(1) $$WCHILD_{i,j} = \alpha + \beta_1 X_i + \beta_2 Z_j + \varepsilon_{i,j}$$

(2) $$ASTHMA_{i,j} = \delta + \gamma_1 X_i + \gamma_2 Z_j + \mu_{i,j}$$

where

$WCHILD_{i,j}$ is the HEDIS well-child measure for enrollee *i* in HMO *j*

$ASTHMA_{i,j}$ is the HEDIS asthma medication measure for enrollee *i* in HMO *j*

X_i are enrollee demographic variables

Z_j are HMO attribute variables

Although the dependent variables are binary, the large number of observations in our sample ensures that regression via ordinary least squares is consistent.[11] To account for unobserved HMO-level effects (see Moulton (1990)), the observations are clustered by HMO and location.[12]

Findings

Table 3-5 presents the regression estimates. The first two columns in Table 3-5 contain the estimates for the well-child visit measure for the two age cohorts. The last two columns contain the estimates for the asthma medication measure for the two age cohorts.

The first row of data in Table 3-5 presents the coefficient estimates for the variable that indicates whether the HMO pays all of its doctors via a FFS arrangement. For both age cohorts, the well-child visit success rate for enrollees in HMOs that pay all of their doctors via FFS is six percentage points higher than for those enrolled in HMOs that pay some of their doctors via capitation. Given the mean success rates, this difference implies that the average probability that an enrollee receives a well-child visit is 10-20% higher in an HMO that pays all of its doctors via FFS.

The opposite conclusion arises with regard to the asthma medication measure. For both age cohorts, the success rate is lower for HMOs that pay all of their doctors via FFS. The effect is statistically significant for the 5-9 year old cohort. The estimates imply that

---

[11] As a specification test, the model was also estimated via probit. The results are largely unchanged and are reported in Appendix Table B-1.

[12] By clustering the observations, the estimates of the coefficient standard errors are adjusted to allow for the possibility that the observations within each group are not independent. The enrollees are grouped here by the HMO in which they are enrolled and the metropolitan area in which they reside.

the probability that the recommended asthma medications are prescribed is approximately 5% lower in HMOs that pay all of their doctors via FFS than in other HMOs.[13]

These findings suggest that financial incentives may affect the services doctors provide to Medicaid enrollees. In particular, the services that increase the revenue of FFS doctors (well-child visits) are provided more frequently in HMOs where all doctors are compensated via FFS. Furthermore, the services that could reduce the future revenues of FFS doctors (asthma medication prescriptions) are provided less frequently in HMOs where all of the doctors are paid via FFS.

The other variables that measure HMO attributes generally are not statistically significant in our regressions. A larger number of enrollees is associated with a higher success rate on the well-child visit measure. However, the effect is of limited statistical and economic significance. The probability that an enrollee in the 5-9 year cohort receives the recommended asthma medications is higher in HMOs where the case manager works directly with the primary care physician. This effect may be due to case managers working with children with severe asthma to ensure that they receive the appropriate medications. The finding that the probability that an enrollee in the 10-18 year cohort receives the recommended asthma medication declines as the percentage of HMO enrollees in Medicaid increases may reflect practice style effects in HMOs that serve both commercial and Medicaid populations. HMOs may tend to provide relatively high service quality to commercial populations in an effort to retain these profitable

[13] To control for the possibility that the effects are being driven by spurious interaction between the variables measuring HMO attributes, the model was also estimated where the other HMO attributes were replaced by HMO dummy variables. The results, reported in Appendix Table B-2, are largely unaffected. (The HMO attributes and HMO dummy variables cannot be included simultaneously due to perfect multicollinearity among the two sets of variables.)

clients. To the extent that Medicaid and commercial enrollees receive the same basic health care services within an HMO, HMOs with a larger concentration of commercial enrollees may provide higher quality care to their Medicaid enrollees.

Hispanic children in our sample have a higher likelihood of receiving an annual well-child visit and a lower likelihood of receiving asthma medications than black children and white children. This result is interesting in light of the "Hispanic paradox" that suggests Hispanics tend to have better health outcomes than non-Hispanics of similar socio-economic status (Franzini, Ribble, and Keddie (2001)). Within age cohorts, younger children generally are more likely than their older counterparts to receive well-child visits and asthma medications. (The exception is for asthma medications for the 5-9 year cohort.) The finding that 4-year-olds receive well-child visits with relatively high frequency likely reflects the fact that parents often take their children to the doctor to obtain the immunizations required to enter kindergarten. Rural residence is associated with reduced (but statistically insignificant) performance on the well-child measure and increased (and statistically significant) performance on the asthma medication measure for the younger cohort. Families that live in rural regions likely have to travel farther for well-child visits, which may reduce the likelihood of such visits. However, because they tend to live farther from the doctor's office or the emergency room, parents of rural families may take particular precautions to be sure their asthmatic children do not develop serious conditions that would require long trips to receive immediate care.

Conclusions

We have examined whether the form of doctor compensation affects the quality of care received by Medicaid HMO enrollees. Our findings suggest that financial incentives may influence the services that doctors deliver to enrollees.

Further research is required to determine whether our findings persist in other settings. The HEDIS measures we employed require that an enrollee be a member of the HMO for almost the entire period in question.[14] Therefore, our findings pertain only to enrollees with relatively stable enrollment. These enrollees may not be entirely representative, as many Medicaid enrollees move in and out of Medicaid frequently.

It would be ideal to be able to identify exactly which doctors are paid via FFS and which are paid via capitation. This information would permit more precise measurement of the effects of doctor compensation arrangements on the quality of care they provide.

Finally, time series data for each enrollee would allow for the inclusion of enrollee fixed effects. Such effects would control for time-invariant, unobservable characteristics of each enrollee, and would thereby improve the precision of the analysis.

[14] For the well-child visit measure, the enrollee must be enrolled in the same HMO for 11 of the 12 months in question. For the asthma medication measure, the minimum enrollment in the same HMO is 22 of the previous 24 months.

Table 3-1 HMO Attributes.

Attribute	HMO #1	HMO #2	HMO #3	HMO #4	HMO #5	HMO #6	HMO #7	HMO #8
Providers Paid Only via FFS	no	no	yes	yes	yes	yes	no	yes
Markets Served	4	1	4	1	1	1	3	1
Total Enrollees	292,091	97,606	36,311	34,016	115,230	70,503	116,853	100,710
Years in State	6	8	5	4	17	5	6	7
Fraction of Enrollees in Medicaid	76%	37%	100%	46%	10%	100%	80%	24%
For-Profit	yes	no	no	no	yes	no	yes	no
Check-Up Visit Reminder Calls	yes	no	no	no	no	yes	no	yes
Case Manager Works with PCP	no	yes	no	yes	no	yes	no	no

Table 3-2 HEDIS Success Rates by HMO Attribute.

	Check-Up Visits		Asthma Medications	
	Ages 3-6	Ages 12-21	Ages 5-9	Ages 10-18
Total	50%	32%	51%	54%
Are All Providers Paid on a Fee-For-Service Basis?				
Yes	51%	35%	50%	54%
No	48%	30%	52%	53%
Does HMO Place Reminder Calls?				
Yes	51%	33%	n/a	n/a
No	47%	31%	n/a	n/a
Does Case Manager Work with Primary Care Physician?				
Yes	50%	33%	55%	57%
No	48%	32%	50%	53%
Is HMO a For-Profit HMO?				
Yes	51%	32%	50%	52%
No	48%	32%	52%	57%

Table 3-3 Demographic Characteristics By Population.

	Check-Up Visits		Asthma Medications	
	Ages 3-6	Ages 12-21	Ages 5-9	Ages 10-18
Total	82,227	62,475	1,971	1,756
Gender				
Male	41,320	30,899	1,155	985
Female	40,957	31,576	816	771
Race				
White	10,290	9,153	288	291
Black	15,699	19,684	585	707
Hispanic	54,315	31,800	1,038	727
Other	1,973	1,838	60	31
Rural				
Non-Rural	79,283	60,026	1,890	1,693
Rural	2,994	2,449	81	63

Table 3-4 HEDIS Success Rates by Population.

	Check-Up Visits		Asthma Medications	
	Ages 3-6	Ages 12-21	Ages 5-9	Ages 10-18
Total	50%	32%	51%	54%
Gender				
Male	50%	32%	51%	52%
Female	50%	33%	51%	56%
Race				
White	45%	30%	56%	59%
Black	47%	32%	54%	54%
Hispanic	52%	33%	48%	52%
Other	49%	29%	57%	39%
Rural				
Non-Rural	50%	32%	50%	54%
Rural	45%	30%	70%	57%

Table 3-5 OLS Regression Estimates.

	Dep. Var.: Check-Up Visit		Dep. Var.: Asthma Medication	
Explanatory Variable	Aged 3-6	Aged 12-21	Aged 5-9	Aged 10-18
HMO Operating Characteristics				
Providers Paid Only via FFS	0.06 ***	0.06 ***	-0.03 **	-0.02
	(3.50)	(3.29)	(2.12)	(-0.54)
Total Enrollees (Medicaid & Commercial, hundred thousands)	0.04 *	0.02	-0.02	-0.01
	(1.80)	(0.81)	(0.82)	(-0.87)
Percent of Enrollees in Medicaid	0.04	-0.01	-0.04	-0.22 ***
	(0.96)	(0.20)	(1.24)	(-3.93)
For-Profit	-0.01	0.02	0.04	-0.02
	(0.18)	(0.43)	(0.75)	(-0.37)
Check-Up Visit Reminder Calls	-0.02	-0.02		
	(1.16)	(0.77)		
Case Manager works with PCP	0.005	0.03	0.08 ***	0.02
	(0.24)	(1.46)	(3.57)	(0.51)
Years Operating in State	0.004	0.003	0.02 ***	-0.01
	(0.76)	(0.49)	(3.95)	(-1.31)
Enrollee Characteristics				
Age Dummy 1	0.10 ***		-0.03 *	
	(13.37)		(1.77)	
Age Dummy 2	0.17 ***			0.11 ***
	(38.55)			(3.59)
Age Dummy 3	0.06 ***			
	(14.80)			
Age Dummy 4		0.22 ***		
		(22.07)		
Age Dummy 5		0.10 ***		
		(11.27)		
Male	0.001	-0.01 **	0.01	-0.04 *
	(0.21)	(2.49)	(0.76)	(1.86)
Black	0.01	0.01	0.03	-0.04
	(1.40)	(1.30)	(0.61)	(1.15)
Hispanic	0.07 ***	0.03 **	-0.06	-0.09 **
	(5.86)	(2.41)	(1.23)	(-2.34)
Other	0.03 **	-0.02 *	0.07	-0.22 *
	(2.10)	(1.81)	(0.82)	(-1.98)
Rural	-0.03	-0.03	0.14 **	-0.01
	(1.62)	(1.10)	(2.41)	(-0.19)
# Observations	82277	62475	1971	1756
R-squared	0.02	0.02	0.02	0.02

Notes -

The t-statistics reported in parentheses are based on Huber-White robust standard errors clustered at the HMO-market level.

The age dummy variables differ across specifications:

In the check-up visit regressions, age dummy 1 corresponds 3 years, age dummy 2 corresponds to 4 years, age dummy 3 corresponds to 5 years, age dummy 4 corresponds to 12-15 years, and age dummy 5 corresponds to 16-18 years.

In the asthma medications regressions, age dummy 1 corresponds to 5-7 years and age dummy 2 corresponds to 10-14 years.

*** - 99% confidence level, ** - 95% confidence level, * - 90% confidence level

CHAPTER 5
CONCLUSIONS

This dissertation analyzed government attempts at using market forces to achieve policy outcomes in two important areas, telecommunications and health care. The chapters analyzed how state governments implemented TA96 and the effects of market-oriented polices in the telecommunications and health care sector.

A number of significant results emerge. First, the manner in which the policies are executed may be inconsistent with the goals of the policy. Our analysis of TA96 suggests that state public utility commissions may have been influenced by decisions in larger states and by factors outside of the policy's guidelines. Second, firms may respond to incentives that policymakers may not foresee. In the investigation of local telecommunications markets, it was shown that responses by entrants to market factors may vary by the size of the market. Thus, national policies may not be well-suited to heterogeneous markets. Third, the details of how firms operate may have substantial effects in how the level of quality they provide. Our results demonstrate that the way in which physicians in Medicaid HMOs are paid may influence the level of care that they provide to enrollees.

APPENDIX A

This appendix describes some of the details of the data and specification tests used in the analysis in Chapter 1.

Data Notes

UNE Rates

For 18 of the 919 observations de-averaged rates were reported and a statewide average was neither reported nor could be calculated based on the available data. In those instances a simple average of the de-averaged rates was used as the statewide average rate.

In December 1997 the Texas PUC set both a statewide rate that was effective immediately and de-averaged rates that were to take effect a month later. In this analysis the initial statewide rate is ignored.

The former Pacific Telesis region includes only two states, California (the leader) and Nevada. Thus, Nevada is the only follower state and the rates of other follower states in the region do not exist. To keep Nevada in the sample and given that SBC now controls the former Pacific Telesis and Ameritech regions, the rates of the follower states in the former Ameritech region are used as a proxy for the other follower rates for Nevada.

Cost Estimate

The HCPM data were received via email from the FCC.

Both the embedded and HCPM cost estimates are reported annually. Quarterly values are obtained via linear interpolation of the data.

For each year except 2000, the HCPM cost estimate is provided only for the cost of the entire line, which includes, in addition to the loop cost, the cost for line port, EO usage, signaling, transport, billing/bill inquiries, and directory listing. To obtain an estimate of the loop cost for those years, the fraction of the line cost that is attributable to the loop in 2000 is applied to the total line costs in the other years.

PUC Characteristics

Data regarding PUC commissioners were derived from *Profiles of Regulatory Agencies of the United States & Canada: Yearbook 1995-1996* (NARUC) and NARUC membership directories (specifically, directories dated January 1998, February 1999, February 2002, February 2003, July 2003, and March 2004).

Besides being reported as either a Democrat or Republican, a commissioner could also be listed as independent or have no reported political affiliation. For the purposes of this analysis, those commissioners who were reported as independent of for whom a political affiliation was not reported are equally Democrat and Republican. (For example, if a state's PUC is composed entirely of independents and/or commissioners for whom their political affiliation is not reported, the value of the variable percent of commissioners that are Republican for that PUC would be 0.5.)

The type of retail rate regulation employed in each state is derived from reports in the *State Telephone Regulation Report* (1/25/96, 2/8/96, 3/20/97, 4/3/97, 4/3/98, 4/17/98, 8/20/99, 9/3/99, 9/29/00, 10/13/00, 10/27/00, 2/15/02, 3/1/02, 3/15/02, 5/9/03, 5/23/03, 6/6/03, 7/30/04, 8/13/04, and 8/27/04). For some of the descriptions of the regulatory

plans, only a year was given for the beginning or the end of the plan's duration. In those instances, the exact dates were inferred from the prior or succeeding plan.

The three residential customer satisfaction variables used as instruments for the form of retail rate regulation come from the annual FCC ARMIS Report 43-06. Specifically, they are the percent of customers surveyed that are dissatisfied with the RBOC's installation, repair, and billing services. Quarterly values are obtained via linear interpolation of the data.

Estimates of retail rates are somewhat problematic as retail rates can vary across customers and regions within a state. The proxy used in this analysis is the RBOC's local network services revenue (Row 520 from ARMIS report 43-03) divided by the number of switched access lines.

State Political Variables

The gubernatorial data are obtained from the Book of the States (The Council of State Governments, 1996-1997, 1998-1999, 2001-2002, 2002, 2003) and the CNN.com web page "2004 Election Results" (http://www.cnn.com/ELECTION/2004/pages/results/governor/ full.list/). The state legislature data are obtained from Statistical Abstracts of the United States (U.S. Census Bureau, 2002, 2003, 2004-2005) and the National Conference of State Legislatures website (2005 Partisan Composition of State Legislatures, http://www.ncsl.org/ncsldb/elect98/ partcomp.cfm?yearsel=2005).

As Nebraska's legislature is non-partisan, for this analysis the percent of state legislatures that are Republican is assumed to be 50%.

Section 271 Status

Data regarding RBOC applications to provide long-distance service are obtained from the FCC web page "RBOC Applications to Provide In-region, InterLATA Services Under § 271" (http://www.fcc.gov/Bureaus/Common_Carrier/in-region_applications/).

Level of Competitive UNE Entry

The data reported are from two series of (non-overlapping) reports of RBOC survey responses. The 1997 and 1998 data are from voluntary surveys completed by the RBOCs and are reported in the December 1998 and August 1999 FCC *Local Competition* reports produced by the Industry Analysis Division in the Common Carrier Bureau. The data for 1999 forward are based on RBOC responses to the mandatory Form 477 survey and are obtained from reports entitled *Selected RBOC Local Telephone Data*. Both data series can be found at http://www.fcc. gov/wcb/iatd/comp.html.

The UNE line count used in this analysis includes both UNE-L and UNE-P lines. UNE-L lines are where the CLEC leases only the local loop, whereas UNE-P lines involve the CLEC leasing switching unbundled elements in addition to the local loop.

For some states the first report of the number of UNE lines is made some time (at most one year) after the CLECs are able to begin leasing the lines. The data for the period prior to this first report is linearly interpolated by assuming that zero UNE lines were being leased prior to a rate being set.

Finally, the data are reported on a quarterly, annual, or semi-annual basis depending on the time period. Quarterly values are obtained when necessary via linear interpolation of the data.

Tests of Instrument Validity and the Exogeneity of the Average Retail Rate Variable

This section outlines how the validity of the instruments used in the UNE rates regressions is tested. The first sub-section describes the tests performed to determine if the instruments are not correlated with the error term, while the second sub-section details the test used to determine if the instruments are sufficiently correlated with the endogenous explanatory variables.

The third sub-section explains the econometric test used to confirm that the lagged average retail rate is exogenous to the determination of UNE rates.

(This section borrows heavily from Baum, Schaffer, and Stillman (2004).)

Tests of Instruments' Orthogonality to the Error Process

When there are more instruments than endogenous variables (i.e., the model is overidentified), one can test whether all of the instruments are orthogonal to the error term. In GMM estimation the overidentifying restrictions can be tested with Hansen's J statistic, which if found to be greater than a threshold value indicates that the instruments are not exogenous or that they should be included as explanatory (rather than instrumental) variables in the regression. The J statistics are reported in Table A-2. The J statistics for the base model suggest that the instrument set as a whole is orthogonal to the error term.

One can also test whether subsets of instruments are orthogonal to the error process. The test statistic (referred to as the C statistic) is the difference in J statistics between the specification that includes all the instruments and the specification that excludes the instruments to be tested. If the C statistics exceeds a threshold value, there is cause for concern that the tested instruments are not valid. Table A-2 also details the C statistics for the instrument sets used for each of the three endogenous explanatory

variables. The C-statistics indicate that the instrument sets used for the three endogenous variables are neither correlated to UNE rates nor endogenous.

Tests of Instrument Relevance

In addition to being orthogonal to the error term, instruments also must be sufficiently correlated with the endogenous explanatory variables. To test for this, each endogenous explanatory variable is regressed on all of the exogenous and instrumental variables in the model. The coefficients on the instruments are then tested for whether they are jointly equal to zero. To be valid, the coefficients should not jointly equal zero.

This test is complicated by the use of the system GMM estimator. By definition, the system GMM estimator estimates two equations simultaneously, one in levels and the other in first differences. The equation in levels is estimated along with the equation in first differences because estimations in first differences with highly persistent dependent variables result in weak instruments (Bond, 2002, p 154).

Table A-3 reports the results of the tests of instrument relevance for each of the three endogenous explanatory variables for the equations in both levels and first differences. The chi-square values suggest that the instruments easily pass the threshold test for relevance except for the form of retail rate regulation variable in the first differences equation. As noted above, this result is not worrisome as it is addressed by the system GMM estimation.

Test of the Exogeneity of the Lagged Average Retail Rate

One may be concerned that the average retail rate variable is endogenous, even though it is lagged one year. To test for this the C statistic can be used where the J statistic from the model assuming the variable is endogenous is subtracted from the J

statistic assuming the variable is exogenous. The results of this test are shown at the bottom of Table A-2 and confirm that the variable is exogenous.

Additional Results

This section describes additional results from the model.

Table A-4 contains the economic effects two years after a change in an explanatory variable based on the coefficient estimates the one-year lag specification. Table A-5 details the long-run economic effects based on the coefficient estimates from both the two-year and one-year lag specifications.

Table A-1 Acronyms Used

Acronmym	Full Term	Definition
TA96	Telecommunications Act of 1996	Legislation that provided framework for competitive entry into local telecommunications markets
RBOC	Regional Bell Operating Company	Incumbent telecommunications companies mandated by TA96 to lease parts of their networks to entrants
CLEC	Competitive Local Exchange Company	Competitive entrants in local telecommunications markets
UNE	Unbundled Network Element	A portion of the incumbent's network that CLECs can lease to provide phone service
PUC	Public Utility Commission	State commissions charged with state telecommunicatoins regulation and implementing parts of TA96
FCC	Federal Communications Commission	Federal agency charged with implementing parts of TA96
TELRIC	Total Element Long-Run Incremental Cost	Methodology for calculating costs based on the long-run costs of an efficient provider using current technology
HCPM	Hybrid Cost Proxy Model	A cost model developed by the FCC to estimate TELRIC costs

Table A-2 Tests of Overidentifying Restrictions

Equation /Test Statistic	One-Year Lag Specification	Two-Year Lag Specification	Degrees of Freedom
Base Model			
Hansen's J Statistic	1.76 (0.940)	2.59 (0.858)	6
Excluding Instruments for Lagged Dependent Variable			
Hansen's J Statistic	0.25 (0.617)	0.34 (0.561)	1
C-Statistic	1.51 (0.912)	2.25 (0.814)	5
Excluding All ROR & Entry Instruments			
Hansen's J Statistic	0.67 (0.714)	0.51 (0.777)	2
C-Statistic	1.09 (0.896)	2.08 (0.721)	4
Excluding ROR Instruments			
Hansen's J Statistic	0.91 (0.824)	1.27 (0.737)	3
C-Statistic	0.85 (0.837)	1.32 (0.724)	3
Excluding Entry Instruments			
Hansen's J Statistic	1.21 (0.944)	1.04 (0.960)	5
C-Statistic	0.55 (0.458)	1.55 (0.213)	1
Assuming Average Retail Rate Endogenous			
Hansen's J Statistic	1.42 (0.992)	1.33 (0.932)	5
C-Statistic	0.34 (0.560)	1.26 (0.262)	1

Notes - C-Statistics are based on comparisons to base model, p-values are reported in parentheses

Table A-3 Tests of Instrument Relevance

Endogenous Regressor / Equation	One-Year Lag Specification	Two-Year Lag Specification
Lagged Dependent Variable		
Levels Equation	160.23 (0.000)	133.20 (0.000)
First Differences Equation	2449.49 (0.000)	1814.71 (0.000)
Form of Retail Rate Regulation		
Levels Equation	25.16 (0.000)	23.39 (0.000)
First Differences Equation	6.71 (0.568)	6.37 (0.606)
Level of CLEC UNE Entry		
Levels Equation	57.24 (0.000)	56.65 (0.000)
First Differences Equation	67.13 (0.000)	62.85 (0.000)

Notes - Chi-square test statistics are reported with p-values in parentheses.
Chi-square test statistics are from joint-significance tests of the instruments in the first-stage regression.

Table A-4 Effects of Changes in Explanatory Variables on UNE Rates Two Years Later Using One-Year Lag Specification

Explanatory Variable	Effect of a One-Unit Increase	Economic Effect[1]
Effect of Neighbors' Rates		
Leader's Rate on Followers (C)	0.441 **	1.50 **
	(2.16)	(2.16)
Followers' Rates on Followers (C)	0.015	0.07
	(0.08)	(0.08)
Followers' Rates on Leaders (C)	0.237 *	0.61 *
	(1.68)	(1.68)
Effect of Other Explanatory Variables		
Cost (C)	0.319 **	1.40 **
	(2.58)	(2.58)
Percent of Commissioners Republican (C)	-0.001	-0.03
	(-0.13)	(-0.13)
Average Tenure of Commissioners (C)	0.089	0.28
	(1.13)	(1.13)
Rate of Return Retail Rate Regulation (B)	0.985	0.99
	(0.28)	(0.28)
Governor Republican (B)	1.11	0.54
	(1.61)	(1.61)
Percent of State Legislature Republican (C)	-1.29	-0.18
	(-0.55)	(-0.55)
Percent of PUC Republican Interacted with Governor Republican	-0.012	-0.48
	(-0.89)	(-0.89)
AT&T Arbitration (B)	0.439	0.44
	(0.30)	(0.30)
Period Prior to Decision on Long-Distance Application (B)	-2.35 ***	-2.35 ***
	(-2.84)	(-2.84)
Voluntary Reduction by Incumbent (B)	-2.80 **	-2.80 **
	(-2.32)	(-2.32)
UNE Entry (lagged 1 year, divided by state standard deviation) (C) [2]	4.06 **	4.06 **
	(2.01)	(2.01)
Average Retail Rate (lagged 1 year) (C)	0.041	0.21
	(0.78)	(0.78)

[1] Economic effects for continuous explanatory variables are based on a one standard deviation increase in that variable, while economic effects for binary explanatory variables are based on a change in the variable from zero to one.

[2] This variable is already scaled by dividing by the standard deviation, so the economic effect is based on a one-unit increase.

Notes - (B) - binary explanatory variable, (C) - continuous explanatory variable, t-statistics are reported in parentheses.

*** - statistically significant at 99% confidence level

** - statistically significant at 95% confidence level

* - statistically significant at 90% confidence level

Table A-5 Effects of Changes in Explanatory Variables on UNE Rates in the Long-Run

Variable	One-Year Lag Specifiation		Two-Year Lag Specifiation	
	Effect of a 1-Unit Increase	Economic Effect[1]	Effect of a 1-Unit Increase	Economic Effect[1]
Effect of Neighbors' Rates				
Leader's Rate on Followers (C)	0.63	2.16	1.00 **	3.36 **
	(1.67)	(1.67)	(2.47)	(2.47)
Followers' Rates on Followers (C)	-0.067	-0.31	-0.345	-1.08
	(-0.21)	(-0.21)	(-0.98)	(-0.98)
Followers' Rates on Leaders (C)	0.467 ***	1.21 ***	0.534 ***	1.67 ***
	(3.38)	(3.38)	(4.79)	(4.79)
Effect of Other Explanatory Variables				
Cost (C)	0.489 ***	2.14 ***	0.521 ***	2.20 ***
	(3.93)	(3.93)	(5.17)	(5.17)
Percent of Commissioners Republican (C)	-0.002	-0.07	-0.011	-0.38
	(-0.13)	(-0.13)	(-1.20)	(-1.20)
Average Tenure of Commissioners (C)	0.136	0.42	0.087	0.26
	(1.11)	(1.11)	(0.96)	(0.96)
Rate of Return Retail Rate Regulation (B)	1.510	1.51	0.834	0.83
	(0.29)	(0.29)	(0.20)	(0.20)
Governor Republican (B)	1.71	0.84	1.42 *	1.42 *
	(1.53)	(1.53)	(1.75)	(1.75)
Percent of State Legislature Republican (C)	-1.97	-0.28	-2.03	-0.28
	(-0.57)	(-0.57)	(-0.77)	(-0.77)
Percent of PUC Republican Interacted with Governor	-0.019	-0.77	-0.011	-0.45
	(-0.78)	(-0.78)	(-0.77)	(-0.77)
AT&T Arbitration (B)	0.672	0.67	0.401	0.40
	(0.30)	(0.30)	(0.30)	(0.30)
Period Prior to Decision on Long-Distance Application (B)	-3.890 **	-3.89 **	-2.590 *	-2.59 *
	(-2.24)	(-2.24)	(-1.90)	(-1.90)
Voluntary Reduction by Incumbent (B)	-4.29 *	-4.29 *	-3.44 *	-3.44 *
	(-1.78)	(-1.78)	(-1.96)	(-1.96)
UNE Entry (lagged 1 year, divided by state standard deviation) (C) [2]	6.22 **	6.22 **	5.40 **	5.40 **
	(2.18)	(2.18)	(2.60)	(2.60)
Average Retail Rate (lagged 1 year) (C)	0.063	0.33	0.058	0.30
	(0.77)	(0.77)	(0.80)	(0.80)

[1] Economic effects for continuous explanatory variables are based on a one standard deviation increase in that variable, while economic effects for binary explanatory variables are based on a change in the variable from zero to one.

[2] This variable is already scaled by dividing by the standard deviation, so the economic effect is based on a one-unit increase.

Notes - (B) - binary explanatory variable, (C) - continuous explanatory variable, t-statistics are reported in reported in parentheses

*** - statistically significant at 99% confidence level, ** - statistically significant at 95% confidence level, * - statistically significant at 90% confidence level

APPENDIX B

This appendix contains additional regression results described in Chapter 3.

Table B-1 Marginal Effects from Probit Regressions.

	Dep. Var.: Check-Up Visit		Dep. Var.: Asthma Medication	
Explanatory Variable	Aged 3-6	Aged 12-21	Aged 5-9	Aged 10-18
HMO Operating Characteristics				
Providers Paid Only via FFS	0.05 ***	0.06 ***	-0.03 **	-0.02
	(3.51)	(3.27)	(2.00)	(0.53)
Total Enrollees (Medicaid & Commercial, hundred thousands)	0.04 *	0.02	-0.02	-0.01
	(1.80)	(0.79)	(0.84)	(0.88)
Percent of Enrollees in Medicaid	0.04	-0.01	-0.04	-0.22 ***
	(0.96)	(0.19)	(1.21)	(3.90)
For-Profit	-0.01	0.02	0.04	-0.02
	(0.18)	(0.38)	(1.21)	(0.37)
Check-Up Visit Reminder Calls	-0.02	-0.02		
	(1.16)	(0.75)		
Case Manager works with PCP	0.005	0.03	0.09 ***	0.02
	(0.24)	(1.43)	(3.59)	(0.51)
Years Operating in Texas	0.004	0.003	0.04	-0.01
	(0.76)	(0.49)	(0.79)	(1.32)
Enrollee Characteristics				
Age Dummy 1	0.10 ***		-0.03 *	
	(13.08)		(1.79)	
Age Dummy 2	0.17 ***			0.11 ***
	(38.56)			(3.58)
Age Dummy 3	0.06 ***			
	(14.63)			
Age Dummy 4		0.23 ***		
		(19.93)		
Age Dummy 5		0.12 ***		
		(11.20)		
Male	0.001	-0.01 **	0.01	-0.04 *
	(0.20)	(2.48)	(0.76)	(1.85)
Black	0.01	0.01	0.03	-0.05
	(1.39)	(1.37)	(0.61)	(1.15)
Hispanic	0.07 ***	0.03 **	-0.06	-0.09 **
	(5.85)	(2.46)	(1.21)	(2.33)
Other	0.03 **	-0.02 *	0.07	-0.22 *
	(2.10)	(1.75)	(0.82)	(1.93)
Rural	-0.03	-0.03	0.15 **	-0.01
	(1.62)	(1.08)	(2.32)	(0.19)
# Observations	82277	62475	1971	1756
R-squared	0.02	0.02	0.02	0.02

Notes -

The t-statistics reported in parentheses are based on Huber-White robust standard errors clustered at the HMO-market level.

The age dummy variables differ across specifications:

In the check-up visit regressions, age dummy 1 corresponds 3 years, age dummy 2 corresponds to 4 years, age dummy 3 corresponds to 5 years, age dummy 4 corresponds to 12-15 years, and age dummy 5 corresponds to 16-18 years.

In the asthma medications regressions, age dummy 1 corresponds to 5-7 years and age dummy 2 corresponds to 10-14 years.

*** - 99% confidence level, ** - 95% confidence level, * - 90% confidence level

Table B-2 OLS Regression Estimates with HMO Fixed Effects.

	Dep. Var.: Check-Up Visit		Dep. Var.: Asthma Medication	
Explanatory Variable	Aged 3-6	Aged 12-21	Aged 5-9	Aged 10-18
HMO Operating Characteristics				
Providers Paid Only via FFS	0.03 **	0.03 *	-0.04	-0.07 ***
	(2.14)	(1.66)	(1.32)	(2.82)
Enrollee Characteristics				
Age Dummy 1	0.10 ***		-0.03 *	
	(13.45)		(1.76)	
Age Dummy 2	0.18 ***			0.11 ***
	(39.12)			(3.48)
Age Dummy 3	0.06 ***			
	(14.77)			
Age Dummy 4		0.22 ***		
		(22.01)		
Age Dummy 5		0.10 ***		
		(11.31)		
Male	0.001	-0.01 **	0.01	-0.04 *
	(0.22)	(2.55)	(0.68)	(1.89)
Black	0.02 *	0.02 **	0.03	-0.04
	(1.83)	(1.99)	(0.64)	(1.12)
Hispanic	0.07 ***	0.03 ***	-0.06	-0.07 **
	(6.20)	(2.90)	(1.20)	(2.00)
Other	0.03 **	-0.02 *	0.08	-0.21 *
	(2.23)	(1.66)	(0.81)	(1.84)
Rural	-0.03 *	-0.03	0.14 **	-0.01
	(1.93)	(1.48)	(2.51)	(0.19)
# Observations	82380	62518	1974	1758
R-squared	0.02	0.03	0.02	0.03

Notes -

HMO fixed effect coefficients omitted for brevity.

The t-statistics reported in parentheses are based on Huber-White robust standard errors clustered at the HMO-market level.

The age dummy variables differ across specifications:

In the check-up visit regressions, age dummy 1 corresponds 3 years, age dummy 2 corresponds to 4 years, age dummy 3 corresponds to 5 years, age dummy 4 corresponds to 12-15 years, and age dummy 5 corresponds to 16-18 years.

In the asthma medications regressions, age dummy 1 corresponds to 5-7 years and age dummy 2 corresponds to 10-14 years.

*** - 99% confidence level, ** - 95% confidence level, * - 90% confidence level

LIST OF REFERENCES

Abel, Jaison. “Entry into Regulated Monopoly Markets: The Development of a Competitive Fringe in the Local Telephone Industry.” *Journal of Law and Economics*. 2002, *45*(2), pp. 289-316.

Abel, Jaison and Michael Clements. “Entry Under Asymmetric Regulation.” *Review of Industrial Economics*. 2001, *19*(2), pp. 227-242.

Ai, Chunrong and David Sappington. “The Impact of State Incentive Regulation on the U.S. Telecommunications Industry.” *Journal of Regulatory Economics*. 2002, *22*(2), pp. 133-160.

Alexander, Donald and Robert Feinberg. “Entry in Local Telecommunications Markets.” *Review of Industrial Economics*. 2004, *25*(2), pp. 107-127.

Andrews, Edmund. "Communications Bill Signed and the Battles Begin Anew." *The New York Times*, February 8, 1996, A1.

Arellano, Manual and Olympia Bover. "Another Look at the Instrumental Variable Estimation of Error Component Models." *Journal of Econometrics*, 1995, *68*(1), pp. 29-51.

AT&T. Petition of AT&T Corp. for Limited Reconsideration. Federal Communications Commission WC Docket No. 03-109. July 21, 2004.

Baum, Christopher, Mark Schaffer and Steve Stillman. "Instrumental Variables and GMM: Estimation and Testing." *The Stata Journal*, 2003, *3*(1), pp. 1-31.

Beard, Randolph and George Ford. “Make or Buy? Unbundled Elements as Substitutes for Competitive Facilities in the Local Exchange Network.” Phoenix Center Policy Paper No. 14. 2002, downloaded on September 23, 2003 from http://www.phoenix-center.org/pcpp/PCPP14 Final.pdf.

Beard, T. Randolph and George Ford. "Splitting the Baby: An Empirical Test of Rules of Thumb in Regulatory Price Setting." Applied Economic Studies Working Paper. 2004. downloaded on October 11, 2004 from http://www.aestudies.com/library/uneprice.pdf.

Beard, Randolph, George Ford, and Thomas Koutsky. “Mandated Access and the Make-or-Buy Decision: The Case of Local Telecommunications Competition.” *Quarterly Review of Economics and Finance*. 2005, *45*(1), pp. 28-47.

BellSouth. “2004 Annual Report.” downloaded on August 22, 2004 from http://www.bellsouth.com/investor/pdf/ annualrpt04.pdf.

Besley, Timothy and Anne Case. "Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Competition." *The American Economic Review*, 2004, *85*(1), pp. 25-45.

Blundell, Richard and Stephen Bond. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics*, 1998, *87*(1), pp. 115-143.

Bond, Stephen. "Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice." *Portuguese Economic Journal*, 2003, *1*(1), pp. 141-162.

Bound, John, David Jaeger, and Regina Baker. “Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variables is Weak.” *Journal of the American Statistical Association*. 1995, *90*(430), pp. 443-450.

Brown, Keith and Paul Zimmerman. “The Effect of Section 271 on Competitive Entry into Local Telecommunications Markets: An Initial Evaluation.” *Information Economics and Policy*. 2004, *16*(2), pp. 215-233.

Brueckner, Jan. "Strategic Interaction Among Governments: An Overview of Empirical Studies." *International Regional Science Review*, 2003, *26*(2), pp. 175-188.

Caldwell, D. Daonne. "Affidavit of D. Daonne Caldwell." *In the Matter of Joint Application by BellSouth Corporation, BellSouth Telecommunications, Inc. and BellSouth Long Distance, Inc. for Provision of In-Region, InterLATA Services in Alabama, Kentucky, Mississippi, North Carolina, and South Carolina.* WC 02-150. June 30, 2002.

“California Passes Nation’s First Cellphone Recycling Bill”. *State Telephone Regulation Report*, September 10, 2004, p 10.

Conrad, Douglas, Charles Maynard, Allen Cheadle, Scott Ramsey, Miriam Marcus-Smith, Howard Kirz, Carolyn Madden, Diane Martin, Edward Perrin, Thomas Wickizer, Brenda Zierler, Austin Ross, Jay Noren, and Su-Ying Liang, “Primary Care Physician Compensation Method in Medical Groups: Does if Influence the Use and Cost of Health Services for Enrollees in Managed Care Organizations?” *Journal of the American Medical Association*, 1998, *279*(11), pp. 853-858.

Crandall, Robert, Allan Ingraham, and Hal Singer. “Do Unbundling Policies Discourage CLEC Facilities-Based Investment.” *Topics in Economic Analysis & Policy*. 2004, *4*: Article 14.

de Figueiredo, Rui José P. and Geoff Edwards. "Why do Regulatory Outcomes Vary so Much? Economic, Political and Institutional Determinants of Regulated Prices in the US Telecommunications Industry." 2004. http://ssrn.com/abstract=547263

Department of Justice. Evaluation of the Department of Justice: *In the Matter of Application of SBC Communications Inc. et al. Pursuant to Section 271 of the) Telecommunications Act of 1996 to Provide In-Region, InterLATA Services in the State of Oklahoma.* CC Docket No. 97-121. May 16, 1997.

Department of Justice. Evaluation of the Department of Justice: *In the Matter of Second Application by BellSouth Corporation, BellSouth Telecommunications, Inc., and BellSouth Long Distance, Inc., for Provision of In-Region, InterLATA Services in Louisiana.* CC Docket No. 98-121. August 19, 1998.

Department of Justice. Evaluation of the Department of Justice: *In the Matter of Joint Application by SBC Communications Inc., Southwestern Bell Telephone Company, and Southwestern Bell Communications Services, Inc. d/b/a Southwestern Bell Long Distance for Provision of In-Region, InterLATA Services in Kansas and Oklahoma.* CC Docket No. 00-217. December 4, 2000.

Donald, Stephen and David. E.M Sappington. "Explaining the Choice Among Regulatory Plans in the U.S. Telecommunications Industry." *Journal of Economics and Management Strategy*, 1995, *4*(2), pp. 237-265.

Eisenach, Jeffrey and Janusz Mrozek. "Do UNE Rates Reflect Underlying Costs?" CapAnalysis Working Paper, December 16, 2003.

Farrington, Brendan. "Bush Signs Medicaid Overhaul into Law." Associated Press Newswires. December 16, 2005.

Federal Communications Commission. *Third Report and Order and Fourth Further Notice of Proposed Rulemaking: In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996.* FCC 99-238. November 5, 1999.

Federal Communications Commission. *Memorandum Opinion and Order: In the Matter of Joint Application by SBC Communications Inc., Southwestern Bell Telephone Company, and Southwestern Bell Communications Services, Inc. d/b/a Southwestern Bell Long Distance for Provision of In-Region, InterLATA Services in Kansas and Oklahoma.* FCC 01-29. January 22, 2001.

Federal Communications Commission. *Memorandum Opinion and Order: In the Matter of Joint Application by Qwest Communications International, Inc. for Authorization to Provide In-Region, InterLATA Services in the States of Colorado, Idaho, Iowa, Montana, Nebraska, North Dakota, Utah, Washington, and Wyoming.* FCC 02-332. December 23, 2002.

Federal Communications Commission. *Report and Order and Order on Remand and Further Notice of Proposed Rulemaking: In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*. FCC 03-36. August 21, 2003.

Federal Communications Commission. *Report and Order and Further Notice of Proposed Rulemaking: In the Matter of Lifeline and Link-Up*. FCC 04-87. April 29, 2004.

Federal Communications Commission. *Order on Remand: In the Matter of Unbundled Access to Network Elements Review of the Section 251 Unbundling Obligation of Incumbent Local Exchange Carriers*. FCC 04-313. February 4, 2005.

Franzini, L., J.C. Ribble, and A.M. Keddie. "Understanding the Hispanic Paradox." *Ethnicity and Disease*, 2001, *11*(3), pp. 496-518.

Fredriksson, Per, John List, and Daniel Millimet. "Chasing the Smokestack: Strategic Policymaking with Multiple Instruments." *Regional Science and Urban Economics*, 2004, *34*(4), pp. 387-410.

Fredriksson, Per and Daniel Millimet. "Is there a 'California Effect' in U.S. Environmental Policymaking." *Regional Science and Urban Economics*, 2002, *32*(6), pp. 737-764.

Greene, William. *Econometric Analysis*. New York: Prentice Hall, 2003..

Hayashi, Masayoshi and Robin Boadway. "An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada." *Canadian Journal of Economics*, 2001, *34*(2), pp. 481-503.

Hillman, A. L., M. V. Pauly, and J. J. Kerstein. "How do Financial Incentives Affect Physicians' Clinical Decisions and the Financial Performance of Health Maintenance Organizations?" *New England Journal of Medicine*, 1989, 321(2), pp. 86-92.

Jamison, Mark. "Effects of Prices for Local Network Interconnection on Market Structure in the U.S." In E. Bohlin, et al , eds.: *Global Economy and Digital Society*. New York: Elsevier, 2004.

Kansas Corporation Commission. "Order Opening Docket, Assessing Costs and Soliciting Comments." *In the Matter of a General Investigation to Establish a Successor Standard Agreement to the Kansas 271 Interconnection Agreement Also Known as the K2A (Docket No. 04-SWBT-763-GIT)*. March 5, 2004.

Kovacs, Anna Maria. "The Status of 271 and UNE-Platform in the Regional Bells' Territories." *Commerce Capital Markets Regulatory Update*. May 1, 2002.

Lehman, Dale. "The Court's Divide." *Review of Network Economics*. 2002, *1*(1), pp. 106-118.

Lehman, Dale. "(How) Do Regulated Prices Affect Competitive Entry?" *Info*, 2003, *5*(1), pp. 20-27.

Lehman, Dale and Dennis Weisman. "The Political Economy of Price Cap Regulation." *Review of Industrial Organization*, 2000, *16*(4), pp. 343-356.

Lichtman, Douglas and Randal C. Picker. "Entry Policy in Local Telecommunications: *Iowa Utilities* and *Verizon*." *Supreme Court Review*, 2002, pp. 41-53.

McConnell, Brian. "An Introduction to Centrex." HelloDirect.com Customer Support Document. downloaded on August 9, 2004 from http://telecom.hellodirect.com/docs/Tutorials/CentrexIntro.1.032999.asp.

Moulton, Brent. "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units. *Review of Economics and Statistics*, 1990, 72(2), pp. 334-338.

NARUC Triennial Review Implementation Process (TRIP) Task Force. "Summary of State Responses to TRIP Questions." May 2003. downloaded on February 11, 2004 from http://www.naruc.org/associations/1773/files/ questions.pdf.

National Committee for Quality Assurance (NCQA). *HEDIS 2003 Technical Specifications*. NCQA: Washington, DC, 2002.

Nickell, Stephen. "Biases in Dynamic Model with Fixed Effects." *Econometrica*, 1981, *49*(6), pp. 1417-1426.

Quast, Troy. "How State Governments Implement Federal Policies: The Telecommunications Act of 1996." University of Florida Public Utility Research Center Working Paper, 2005, downloaded on June 6, 2005 from http://bear.cba.ufl.edu/centers/purc/publications/documents/ how_state_govts_ implement_fed_policies_000.pdf.

Ransom, Scott, et al. "The Effect of Capitated and Fee-for-Service Remuneration on Physician Decision Making in Gynecology." *Obstetrics and Gynecology*, 1996, *87*(5), pp. 707-710.

Rice, Thomas. "Physician Payment Policies: Impacts and Implications." *Annual Review of Public Health*, 1997, *18*(1), pp. 549-565.

Roycroft, Trevor. "Empirical Analysis of Entry in the Local Exchange Market: The Case of Pacific Bell." *Contemporary Economic Policy*. 2005, *23*(1), pp. 107-115.

Sappington, David. E.M. (2005). "On the Irrelevance of Input Prices for Make or Buy Decisions." *American Economic Review*. Forthcoming, downloaded on September 9, 2005 from http://bear.cba.ufl.edu/ sappington/PDF/Irrelevance of Input Prices 3-11-04.pdf.

SBC. Press release entitled, "SBC Calls Unbundling Rules and UNE-Platform Devastating." July 17, 2002, downloaded on June 22, 2004 from http://www.sbc.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=20189.

Shrank, William, et al. "Effect of Physician Reimbursement Methodology on the Rate and Cost of Cataract Surgery." *Archives of Ophthalmology*, 2005, *123*(12), pp. 1733-1738.

Smart, Susan. "The Consequences of Appointment Methods and Party Control for Telecommunications Pricing." *Journal of Economics and Management Strategy*, 1994, *3*(2), pp. 301-323.

State Telephone Regulation Report. "States Weigh in at FCC UNE Order Implementation Deadline." February 15, 2005.

Stearns, S. C., B. L. Wolfe, and D. A. Kindig. "Physician Responses to Fee-for-Service and Capitation Payment." *Inquiry*, 1992, *29*(4), pp. 416-425.

Supreme Court of the United States. *AT&T v. Iowa Utilities Board*. Case No. 0366. January 25, 1999.

Supreme Court of the United States. *Verizon et al v. FCC et al.* Case No. 0051. May 13, 2002.

Telecom A.M.. "Qwest-AT&T in Pact to Replace UNE-P." February 15, 2005.

United States Department of Health and Human Services (US HHS). "Action Against Asthma: A Strategic Plan for the Department of Health and Human Services." 2000, downloaded on March 23, 2006 from http://aspe.hhs.gov/sp/asthma/.

United States Department of Health and Human Services (US HHS). "2004 Medicaid Managed Care Enrollment Report." 2004, downloaded on March 18, 2006 from http://www.cms.hhs.gov/MedicaidDataSourcesGenInfo/04_MdManCrEnrllRep.asp.

United States Senate Committee on Commerce, Science, and Transportation. "Telecommunications Competition and Deregulation Act of 1995." *Senate Report 104-23*. March 30, 1995.

Wawro, Gregory. "Estimating Dynamic Panel Data Models in Political Science." *Political Analysis*, 2002, *10*(1), pp. 25-48.

Willig, Robert, et al. "Stimulating Investment and the Telecommunications Act of 1996." *Ex Parte* (filed by AT&T Corporation). Federal Communications Commission, CC Docket Nos. 01-338, 96-98, 98-147. October 11, 2002.

WorldCom. *Ex Parte*. Federal Communications Commission, CC Docket Nos. 01-338, 96-98, 98-147. November 15, 2002.

Young, Shawn. "MCI Reports Loss, Plans Dividend." *The Wall Street Journal*. August 6, 2004.

Zolnierek, James, James Eisner, and Ellen Burton. "An Empirical Examination of Entry Patterns in Local Telephone Markets." *Journal of Regulatory Economics*. 2001, *19*(2), pp. 143-159.

BIOGRAPHICAL SKETCH

I was born in Waverly, Minnesota, in August 1973 and moved to Ocala, Florida, in 1980.

In 1995 I received a Bachelor of Science degree in economics from the George Washington University in Washington, DC. After working for two years for National Economic Research Associates, I began graduate study at the University of Texas at Austin. I received my Master of Science in Economics in 1997. I then returned to National Economics Research Associates for two additional years, after which I began my studies at the University of Florida.

I am married to the former Daniela Portaro of Ocala, Florida. We have one son, Andres.