

# **An Analysis of the Extent and the Means of Entry into Local Telecommunications Markets**

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This Version: 2005-07-26

*This paper examines the determinants of both the extent and the means of competitive entry in local telecommunications markets. Panel data are used to analyze the number of lines that competitive local exchange carriers (CLECs) lease from regional Bell operating companies (RBOCs) using two alternative arrangements: leasing only the wires that connect a customer's premises to the phone network, or leasing all of the network elements that are needed to provide phone service. The estimates suggest that while the revenue potential of a market tends to have a large impact on the observed level of entry, the effect of the regulated rates at which the CLECs lease the elements is limited. The results suggest that entrants may factor regulatory uncertainty into their entry decisions, and that local conditions may materially affect the implementation of federal regulatory policy.*

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I thank Donald Stockdale and Ellen Burton of the FCC for their insights into the FCC data. I am indebted to Chunrong Ai, David Gabel, Mark Jamison, and especially David Sappington for their valuable advice.

## 1. Introduction.

A primary goal of the Telecommunications Act of 1996 (TA96) was to facilitate competition in the local telecommunications market. TA96 included provisions that allowed for three broadly defined means of entry by competitive local exchange carriers (CLECs): construction of an entire network by the entrant; reselling the incumbent's services at a discounted cost below the retail price; and leasing parts of the incumbent's network. Given the large fixed costs required to provide telecommunications services, construction of entire networks by entrants was considered suited only for services supplied to large businesses, while reselling of the incumbents' services was viewed as a temporary means to give entrants a foothold in the market.

Many entrants have focused on leasing parts of the incumbents' networks (known as unbundled network elements, or UNEs) to serve customers.<sup>1</sup> There are two ways in which entrants can provide phone service by leasing UNEs. Under a UNE-L (short for UNE-Loop) arrangement, the entrant rents from the incumbent the phone line that connects a customer's residence or premises to the central office. 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 is through a UNE-P (short for UNE-Platform) arrangement. The key difference between UNE-L and UNE-P service is that in UNE-P arrangements, the entrant leases all of the UNEs needed to provide telephone service. In other words, the entrant simply combines the UNEs that are required to provide service and does not have to own any of the necessary equipment.<sup>2</sup>

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<sup>1</sup> The rates at which CLECs can lease UNEs are set by state public utility commissions and are based on a TELRIC methodology chosen by the FCC. (See Quast (2005) for a description of the TELRIC methodology and how these rates are set.) TELRIC rates tend to be relatively low, thus by determining that a network element should be unbundled, the FCC is in effect making that element available at a low cost to CLECs.

<sup>2</sup> Incumbents have been quick to point out that there is no actual difference between reselling the incumbents' services and the use of UNE-Ps by entrants. Given the cost of leasing UNE-Ps for entrants and the resale discount rates, reselling the incumbents' services is typically more costly for CLECs than providing service under a UNE-P arrangement. However, UNE-P is more risky for CLECs 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 UNE-P cost, in which case the CLEC would face a negative gross profit under a UNE-P arrangement whereas under a resale arrangement the CLEC's cost would fall by the same percentage as the retail price.

Almost ten years since TA96 became law, data are now available to help determine whether the goals of the Act have been realized. Figure 1 indicates that since 2001 the number of lines leased by the regional Bell operating companies (RBOCs)<sup>3</sup> to CLECs has increased relatively steadily over time. The state average has increased from under 200,000 lines in July 2001 to over 400,000 lines three years later. However, Figure 2 indicates that the increases in entry differ greatly by means of entry. During the period, the maximum average number of UNE-L lines is roughly 80,000, while the maximum number of UNE-P lines is almost four times that amount. Further, while the number of UNE-P lines has increased steadily, the state average of UNE-L lines rose through January 2003, but has remained relatively flat since.

An analysis of Figures 1 and 2 leads to important questions regarding telecommunications market dynamics. First, what market factors influence the level of competitive entry? Second, after accounting for differing market conditions, what effects (if any) did regulatory policy have on the observed level of entry? This paper will attempt to answer these and related questions by estimating the effects of market and regulatory factors on the level of observed entry.

The answers to these questions are of interest to both policymakers and researchers. On one level, the answers shed light onto the effectiveness of TA96 and its implementation by the FCC and state public utility commissions. Not only can these answers inform the ongoing debate regarding regulation of U.S. telecommunications markets,<sup>4</sup> 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 inputs from their competitors (as in a UNE-P arrangement) or buy the inputs themselves (as in a UNE-L arrangement). The choices of entrants could have important implications for long-term competition.

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<sup>3</sup> The RBOCs are the local phone companies that were divested from AT&T in 1984. While CLECs can rent UNEs from other incumbents in areas not served by an RBOC, the vast majority of UNE entry has occurred in RBOC regions.

<sup>4</sup> See Section 2.2 for a brief summary of some of the issues involved.

Several authors have analyzed the determinants of competitive entry into local telecommunications markets.<sup>5</sup> 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, not surprisingly, variables associated with higher demand correspond to higher entry, while variables associated 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 degrees 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), who use a pooled data set to analyze the determinants of UNE-L and UNE-P entry. Among their findings is that, for both UNE-L and UNE-P 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 UNE-L and UNE-P are not substitutes. 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 five important ways. First, panel data are used rather than cross-sectional data. Thus, the data will allow a more precise estimate of the effects of dynamic changes in the market environment on the level of entry observed. Second, the specification will allow for delayed responses by entrants to changes in market conditions. The existing research typically models the reactions of entrants to market conditions as instantaneous, which is somewhat unrealistic given information lags and the time it takes entrants to adjust their market strategies. Third, the influence of the political composition of

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<sup>5</sup> 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 Zolnierrek, Eisner, and Burton (2001).

state public utility commissions is estimated. Fourth, the effect of the connection charge that UNE-L entrants must pay whenever they gain a new customer is measured. The potentially dampening effect of the connection charge on UNE-L entry was cited by the FCC in its Triennial Review Order as an important basis for its treatment of UNE-P entry.<sup>6</sup> Fifth, the empirical methodology corrects for potential endogeneity in a key market variable.

This paper offers three significant conclusions regarding CLEC entry. First, the revenue potential of a market tends to have a large impact on the observed level of entry. Second, and somewhat surprisingly, the regulated rates at which CLECs lease the elements have a limited effect on observed entry. Third, Republican state public utility commissions tend to encourage UNE-L entry and discourage UNE-P entry.

The paper is organized as follows. Section 2 presents background information on the functional and regulatory differences between UNE-L and UNE-P 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.

## **2. Background information on UNE-based entry.**

### **2.1. UNE-L versus UNE-P entry.**

To properly interpret the results below, it is important to understand the differences between UNE-L and UNE-P entry.

As stated earlier, when a CLEC acquires a customer under a UNE-L arrangement, the CLEC leases only the UNEs associated with the wire that connects the RBOC's wire center to the customer's premises (known as the local loop). In order to provide service, a CLEC must provide

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<sup>6</sup> For example, see FCC (2003), 295-298.

its own switching equipment<sup>7</sup> and pay the RBOC for the space it rents and the power it uses in the RBOC's buildings where the switching and related equipment are housed.<sup>8</sup>

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

An important difference between UNE-L and UNE-P entry is how RBOC customers are switched to a CLEC's service. Lines that are used to serve customers under a UNE-L arrangement must be physically disconnected from the RBOC's switching equipment and reconnected to the CLEC's equipment. This transfer, known as a hot-cut, requires that both an RBOC and CLEC technician be present in order to perform a "seamless migration"<sup>9</sup> of the customer to the CLEC's network. For each hot-cut that is performed, the CLEC must pay the RBOC a connection charge to compensate the RBOC for the labor involved. Conversely, to transfer an RBOC customer to a CLEC who employs a UNE-P strategy, computer software is used that allows for the process to be fully automated. The CLEC must only pay a nominal administrative fee to the RBOC to transfer the customer.

## **2.2. History of UNE-P.**

While there has been nearly universal agreement that allowing CLECs to lease the local loops as in UNE-L entry is beneficial to long-run competition, there has been heated disagreement (even among FCC commissioners) as to the effects of allowing CLECs to follow a UNE-P strategy. Advocates of allowing UNE-P entry typically point to the technical and financial

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<sup>7</sup> While switches can have many functions, the key role that they serve for CLECs to provide telephone service is that they connect the RBOC's loop to the CLEC's network.

<sup>8</sup> CLEC switches require economies of scale to be cost-effective. Thus, CLECs 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 CLEC then not only has to pay for the aggregation equipment, but also must pay the RBOC to move its traffic to its switch.

<sup>9</sup> 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.

difficulties CLECs face when using UNE-L arrangements to serve residential customers.<sup>10</sup> Those critical of forcing RBOCs to provide UNE-P provisioning argue that the option discourages CLEC investment in telecommunications equipment, which was one of the goals of TA96.<sup>11</sup>

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 UNE-P entry. There are two main regulatory requirements for UNE-P to be feasible: CLECs must be able to “re-bundle” UNEs and all of the necessary network elements must be unbundled by the FCC.

Soon after TA96 took effect, CLECs realized that for certain customers they could realize greater profit margins if they simply leased all of the UNEs necessary for them to provide phone service, rather than providing any of the necessary equipment themselves.<sup>12</sup> In response, the RBOCs soon began to charge additional fees for “re-bundling” the network elements, as is done in UNE-P arrangements. The FCC then ruled that the RBOCs could not charge these re-bundling fees. Litigation soon followed, culminating with the Supreme Court ruling in 2002 in *Verizon vs FCC* that CLECs can legally re-bundle UNEs at no additional charge from the RBOCs.

In terms of the availability of UNEs, the network element that has been at the heart of the UNE-P debate is the RBOC switches, specifically switches that are used to service residential and small business customers.<sup>13</sup> While the debate among the FCC commissioners has often been very contentious, until recently RBOC switches have always been available to CLEC as UNEs. However, in March 2004, the U.S. Court of Appeals in Washington, D.C. ruled that the FCC

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<sup>10</sup> The connection charges and labor costs involved in a hot cut are claimed to be prohibitively expensive for CLECs, 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. CLECs complain that customers associate the delay with the CLEC to whom they are transferring service, and thus the customer immediately perceives a lower quality of service with the entrant (FCC (2003), 290-291).

<sup>11</sup> See, for example, Crandall, Ingraham, and Singer (2004).

<sup>12</sup> To be precise, the CLEC must still provide equipment necessary for billing, marketing, and customer service functions.

<sup>13</sup> The FCC defines this classification as any customer with four access lines or fewer.

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 UNE-P as known by market participants.<sup>14</sup> Partly in response to these developments, AT&T and MCI subsequently announced that they were exiting the residential market (Young (2004)).

### **3. Hypothesized determinants of UNE-L and UNE-P entry and lag length.**

This section outlines the likely determinants of UNE-L and UNE-P entry. The determinants can be classified as describing the revenue potential, costs, and regulatory environment.

Measures of revenue potential reflect the profits a CLEC 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.<sup>15</sup> The RBOC'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 size of the market. UNE-L arrangements are typically used to serve medium to large businesses. Therefore, the size of the market for UNE-L entry in a state is approximated by the number of Fortune 500 companies located in the state. UNE-P arrangements are typically used to serve residential customers. Thus, the size of the market for UNE-P entry in a state is approximated by the number of residents of the state.

The level of entry is also likely to be affected by the costs a CLEC expects to incur in providing service. A main source of costs for CLECs is the payments they must pay to RBOCs to lease network elements. As noted above, those rates are determined by state public utility commissions and do not vary by CLEC within a given state. For UNE-L entry, there are two UNE rates that are especially important: (1) the monthly price they must pay to RBOCs to rent

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<sup>14</sup> Rather than abruptly make RBOC 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.

<sup>15</sup> Unfortunately, within a state and across customer types there may be several retail prices being charged.

the local loop; and (2) the fee charged by the RBOC to transfer an RBOC customer's line to its own equipment (i.e., to perform a hot cut). One would expect both rates to have a negative effect on the level of UNE-L entry. In terms of UNE-P entry, the process used to transfer a customer to a CLEC's network is fully automated and incurs only a nominal charge. However, under a UNE-P arrangement the CLEC must pay the RBOC to lease its switching equipment, as well as to lease the local loop. This total charge is referred to as the UNE-P rate and, as it increases, UNE-P entry is expected to decline.

Regulatory factors also may influence entry in ways that are not entirely clear. One such factor is whether the RBOC has obtained permission to sell long-distance services to its local service customers.<sup>16</sup> On one hand, since approval is based on a determination by the state public utility commission and the FCC that the RBOC's local service market is open to competition, one could expect that CLEC entry would be higher in markets where the RBOC has received this approval. On the other hand, the RBOC's newfound ability to sell long-distance service may make it more difficult for entrants to win customers. Another potentially ambiguous influence is the political composition of the state public utility commission. Among the ways state public utility commissions affect CLEC entry (beyond setting UNE rates) is by forcing the RBOC to adjust their hot-cut processes and computer systems through which CLECs order and are billed for services for newly acquired customers.<sup>17</sup> 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 UNE-P. 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.<sup>18,19</sup>

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<sup>16</sup> This approval process is based on Section 271 of TA96 and, when granted, is often referred to as Section 271 approval.

<sup>17</sup> For example, states have implemented various approaches in forcing RBOCs to implement procedures to migrate customers to CLECs (FCC (2003), 309-310).

<sup>18</sup> 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.

One of the advantages of a panel data analysis is the ability to control for effects specific to a state or a time period 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., income and cost differences). Year fixed effects for 2002 and 2003 are also included to capture effects that are specific to a given year. The 2004 fixed effect is separated into a January 2004 and July 2004 effects to capture any effect from the U.S. Court of Appeals decision in early 2004.

The time it takes CLECs to respond to changes in these factors is important to consider. When CLECs have operations established in a state, they may be able to respond quickly to changes in market conditions. However a significant amount of time may pass between the point when a CLEC decides to enter a state, it sets up operations in that state, and it begins to acquire customers.<sup>20</sup> This delay is exacerbated when a CLEC enters via a UNE-L arrangement and must install switching and related equipment. An econometric investigation of the proper length of lags<sup>21</sup> indicates that when estimating the level of UNE-P entry, the value of the variables in the current period and six months prior should be included. When estimating the level of UNE-L entry, the variables in the current period, six months prior, and a year prior should be included.

#### **4. Model specification and data used.**

##### **4.1. Model specification.**

Given that the level of UNE-L and UNE-P entry are highly related,<sup>22</sup> it is appropriate to

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<sup>19</sup> Another regulatory variable that could have a significant effect on CLEC entry is whether the RBOC 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 RBOCs. Therefore, this effect is captured in the fixed effects analysis to follow.

<sup>20</sup> For example, before a CLEC can lease UNEs from an RBOC, it must negotiate an interconnection agreement with the RBOC and have it approved by the state public utility commission.

<sup>21</sup> Specifically, the adjusted R-squared values were compared for regressions using various potential lengths. The lag lengths specified resulted in the highest adjusted R-squared values. (For background on determining optimal lag lengths, see Greene (2003), 564-565.)

<sup>22</sup> Insofar as when a CLEC decides to enter a market by leasing unbundled elements, the CLEC must choose either one of these entry methods.

estimate them simultaneously. Furthermore, the inclusion of the RBOC's average revenue as an explanatory variable may introduce endogeneity into the estimation, as the level of CLEC entry may influence the RBOC's average revenue.<sup>23</sup> To account for both of these potential problems, a three-stage-least squares approach is employed.

However, in order to estimate this regression an instrumental variable must be identified that is correlated with the RBOC's average revenue,<sup>24</sup> but not with the level of entry after controlling for the other explanatory variables. The Lifeline program is an effort coordinated by the FCC and state PUCs that helps pay for basic phone service for low-income consumers. RBOCs are obligated to publicize the 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 RBOC. As such, it is likely that the extent to which the RBOC's customers participate in this program is correlated with the RBOC's average revenue. Conversely CLECs typically do not participate in this program,<sup>25</sup> and thus the effect on entry of the fraction of the RBOC's customers that are Lifeline subscribers should be minimal.<sup>26</sup> Thus, the fraction of the RBOC's total switched access lines that are provided to Lifeline subscribers

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<sup>23</sup> Only one paper regarding entry in telecommunications reviewed by the author addresses the potential endogeneity of average revenue (or price) or profit. Abel (2002) attempts to address the endogeneity by lagging the profit term by one period.

<sup>24</sup> As the lagged levels of the RBOC's average revenue are predetermined, only the contemporaneous level must be instrumented.

<sup>25</sup> Specifically, some states require CLECs to offer the discounted rates to low-income consumers but, unlike RBOCs, most CLECs do not receive subsidies from the government to cover these mandated discounts. Moreover, unlike RBOCs, most CLECs are not obligated to publicize the lower rates for low-income consumers, nor are they required to market their services to all customers in their service area. These effects tend to result in less marketing by CLECs to low-income consumers. (See AT&T (2004).)

<sup>26</sup> A potential concern is that the fraction of RBOC lines that are to Lifeline subscribers is closely related to the relative strength of the state's economy, and thus with the level of CLEC entry into a market. If this were true, this instrument would not be valid. However, the states have a great deal of latitude in how they implement in the Lifeline program, and the varying levels of use across states tend to be a function more of the methods by which consumers are enrolled in the program and their edibility is determined than local economic conditions. For example, in 2002 the percent of eligible households that enrolled in Lifeline ranged from 3.3% in West Virginia to 131.9% in California. (See FCC (2004), K-15.)

intuitively meets the two criteria for instrument validity outlined above. Furthermore, the estimates indicate that this instrument also statistically satisfies the necessary criteria.<sup>27</sup>

#### 4.2. Data used.

Summary statistics of the data used are provided in Table 1. The sample is based on semi-annual data by state for the period January 2001 to July 2004.<sup>28,29,30</sup> Correlation coefficients between the explanatory variables are provided in Table 2.

The dependent variables in the estimations are the number of UNE-L and UNE-P lines leased by CLECs from RBOCs as reported by the RBOCs to the FCC in Form 477 data submissions (<http://www.fcc.gov/wcb/iatd/comp.html>).

In regards to revenue potential, the RBOC revenue per line for a state is obtained from ARMIS data submitted by the RBOCs to the FCC (<http://www.fcc.gov/wcb/armis/>).<sup>31</sup> The state population is taken from the U.S. Census (<http://www.census.gov/popest/datasets.html>) and the number of Fortune 500 companies is taken from *Fortune* magazine. The number of residential

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<sup>27</sup> Specifically, the instrumental variable is statistically significant when the average revenue per line is regressed on all of the exogenous variables and the instrumental variable. Further, in regressions where the number of UNE-L and UNE-P lines are regressed on the exogenous variables, the average revenue per line, and the instrumental variable, the instrumental variable is not statistically significant. These estimates are available from the author upon request.

<sup>28</sup> 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 number of UNE-P lines leased 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.

<sup>29</sup> The data regarding the level of entry, UNE rates, and the RBOC's average revenue are based on the RBOC's service territory within a state, rather than on the entire state. Typically the two differ in that the RBOC service area may not include some of the relatively rural areas within a state. However, as most of the CLEC entry occurred in non-rural areas, this discrepancy between the data sets should not materially affect the results.

<sup>30</sup> The RBOC revenue per line, state population, number of Fortune 500 companies, and Lifeline subscriber data are reported annually. The missing data points are calculated by linearly interpolating the data.

<sup>31</sup> 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 a CLEC could obtain and has been used by other authors, e.g., Ai and Sappington (2005) and Abel (2002).

Lifeline subscribers is obtained from Universal Service Monitoring Reports prepared by the Federal-State Joint Board on Universal Service (<http://www.fcc.gov/wcb/iatd/monitor.html>) and ARMIS data.<sup>32</sup>

The monthly UNE-L and UNE-P 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>).<sup>33</sup> During the sample period examined in this paper, most state public utility commissions set rates that varied by different density zones within the state. In the estimations contained in this paper, the rates in the most urban (and thus the lowest rates) are used, as these are the areas most likely to be entered by CLECs in order to take advantage of economies of scale.<sup>34</sup> The UNE-L connection charges are obtained by reviewing state public utility commission and FCC documents and trade press, and by contacting the state commissions directly.<sup>35</sup>

To measure the effect of an RBOC receiving approval by the FCC to sell long-distance services, a dummy variable is included that equals one if the FCC has approved the RBOC's application in that period or earlier and zero otherwise ([http://www.fcc.gov/Bureaus/Common\\_Carrier/in-region\\_applications/](http://www.fcc.gov/Bureaus/Common_Carrier/in-region_applications/)). The percent of Republicans serving on state public

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<sup>32</sup> The ARMIS data are from Report 43-08 and are available by state and RBOC for 2003 and 2004. Conversely, the subscriber data from the Universal Service Monitoring Reports are available throughout the sample period but are only reported by state. To estimate the 2001 and 2002 data, the percent of the state Lifeline lines served by the RBOC in 2003 is applied to the 2001 and 2002 data from the Universal Service Monitoring Reports.

<sup>33</sup> Some participants in legal proceedings have disputed the way in which UNE-P rates 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, and it is unlikely that adjusting the assumed minutes of use will materially affect the results.

<sup>34</sup> The results do not materially differ when other rates (e.g., state-wide averages) are used instead. These estimates are available from the author upon request.

<sup>35</sup> A concern regarding the endogeneity of these rates could arise due to the potential for reverse causation. In particular, one could surmise that low levels of CLEC 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 CLEC 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.

utility commissions is derived by reviewing membership directories of the National Association of Regulatory Commissioners,<sup>36</sup> 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>). To control for potential interaction effects between the political affiliation of the state public utility commission and the Governor (e.g., the effects of a Republican commission become more pronounced when the Governor is a Republican), the product of these two variables is included as an explanatory variable.

## **5. Estimation results.**

### **5.1. Long-run coefficient estimates.**

Table 3 summarizes the long-run coefficient estimates<sup>37</sup> from estimating the number of lines CLECs acquired via UNE-L and UNE-P arrangements. Column (1) lists the coefficient estimates and t-statistics where the number of UNE-L lines is the dependent variable, while Column (2) lists those estimates where the dependent variable is the number of UNE-P lines. The R<sup>2</sup>s for the UNE-L and UNE-P regressions are 0.54 and 0.55, respectively.

Among the variables that measure revenue potential, the population and the number of Fortune 500 companies are statistically significant in both regressions. The population coefficient has the expected sign in the in the UNE-P equation, while the number of Fortune 500 companies has the expected positive effect on UNE-L entry and is statistically significant. The RBOC's average revenue has the expected positive effect on both types of entry, but is only statistically significant in the UNE-P entry regression.<sup>38</sup>

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<sup>36</sup> The dates of the membership directories used to construct this variable are February 1999, February 2002, February 2003, July 2003, and March 2004

<sup>37</sup> The long-run coefficient estimates are simply the sum of the coefficients on the various lags of the explanatory variables. The short-run coefficient estimates are available from the author upon request.

<sup>38</sup> When the average revenue per line is treated as exogenous, the coefficient estimates in both the UNE-L and UNE-P equations are negative and statistically significant in the UNE-P equation.

Perhaps the most surprising result that emerges from these estimates is the lack of statistical significance of all but one of the UNE costs that the CLEC must pay RBOCs. The only statistically significant UNE rate is the monthly UNE-L cost in the UNE-L entry equation. As expected, the UNE-L connection charge has a negative coefficient in the UNE-L entry equation and the monthly UNE-P cost has a negative coefficient in the UNE-P entry equation. The positive coefficient on the monthly UNE-P cost in the UNE-L entry equation and the positive coefficient on the monthly UNE-L cost in the UNE-P entry equation meet one of the two criteria for the two means of entry to be viewed as substitutes by CLECs. However, the lack of statistical significance of the coefficients precludes such a judgment.

The coefficients on the regulatory variables indicate that Republican state public utility commissions tend to encourage UNE-L entry and discourage UNE-P entry. However, the positive effect on UNE-L entry is mitigated somewhat when the governor is also a Republican. The effect of the RBOC gaining Section 271 approval on both types of entry is statistically insignificant.

None of the time fixed effects are statistically significant.

## **5.2. Economic effects.**

To obtain a sense of the relative importance of the effects measured by the coefficient estimates, the estimated long-run economic effects of the explanatory variables are detailed in Table 4. For continuous explanatory variables, the economic effect is found by multiplying the long-run coefficient estimate by the sample standard deviation of that explanatory variable. For binary variables, the economic effect is the effect on the dependent variable from that explanatory variable when it changes from zero to one (and is equal to the long-run coefficient estimate).

The variables with the largest positive effects in both regressions are the variables that measure the size of the market, namely the number of Fortune 500 companies in the UNE-L entry equation and the population in the UNE-P entry equation. The number of Fortune 500 companies has the second largest positive effect in the UNE-P entry equation, which may reflect the (albeit

limited) use of UNE-P arrangements by CLECs to serve business customers. The relatively large negative economic effect of population in the UNE-L entry equation most likely reflects cost factors faced by UNE-L CLECs. Specifically, holding other factors constant, states that have a relatively large residential population will be more expensive for UNE-L CLECs to service business customers, since UNE-L arrangements are less costly when their customers are more densely located.<sup>39</sup> In effect, residential areas cause these CLECs to lose scale effects. Conversely, UNE-P entry does not exhibit these scale effects. The RBOC's average revenue has the third-largest positive effect on UNE-P entry, but the effect is not statistically significant in the UNE-L entry equation.

The largest negative effect on UNE-P entry is the percent of state public utility commissioners that are Republican. Conversely, this same variable has the second largest positive impact on UNE-L entry. The negative economic effect of a Republican governor interacted with the Republican percent of the state public utility commission is unexpected. This effect may be due to the need of Republican governors to appear as especially sensitive to consumer interests, as it is difficult to blame the PUC for insufficient consumer protection when the governor and the PUC commissioners are members of the same political party.

As mentioned above, the lack of statistical significance of the all but one of the UNE costs in either regression is somewhat surprising. Furthermore, in terms of economic significance, the magnitude of the effects of these rates is quite limited. One possible explanation for this result reflects how these costs are set. The rates are set in proceedings that involve highly technical analyses and often involve many experts who present highly divergent views. Furthermore, the rates are set by state public utility commissioners who may or may not be in office in the near future, either due to elections, job changes, or retirement. This environment lends itself to a non-trivial degree of unpredictability. It may be unclear to CLECs whether the UNE costs today will

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<sup>39</sup> While UNE rates take into account customer density, the rates used in this analysis are for only the most urban zones. Thus, these rates do not reflect the statewide density.

be in effect in one or two year's time, or whether the trend of past UNE rate changes will persist going forward. Thus, CLECs may discount the importance of current UNE costs when deciding whether to enter into or expand their operations in a given state. Another possible explanation may relate to Sappington's (2005) observation that a higher input cost induces the incumbent to compete less aggressively for retail customers. This decline in price competition may make the higher input cost less discouraging to entrants. Thus, CLECs may take into account the RBOC's reaction to their entry when the UNE cost is relatively high and not be deterred by the higher rate.

## **6. Conclusion.**

This paper analyzes the factors that determine the level of entry in local telecommunications markets. The estimates suggest that while the revenue potential of a market tends to have a large impact on the observed level of entry, the effect of the regulated rates at which CLECs lease the elements is limited. Further, the fraction of state public utility commissioners that are Republicans (Democrats) is associated with higher (lower) levels of UNE-L entry and lower (higher) levels of UNE-P entry.

The results in this paper provide valuable lessons regarding the effects of TA96 and potential revisions to it. Given the relative insignificance of the UNE costs, policymakers need to ensure that regulatory uncertainty does not prevent entrants from correctly responding to input prices set by regulators. Also, potential influences stemming from the political philosophies of those responsible for ensuring a fair market need to be taken into account when deciding on delegations made to state regulators.

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 faced by CLECs 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. Additionally, a more precise measure of the retail price may uncover a more important role for it in determining the level of CLEC 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.

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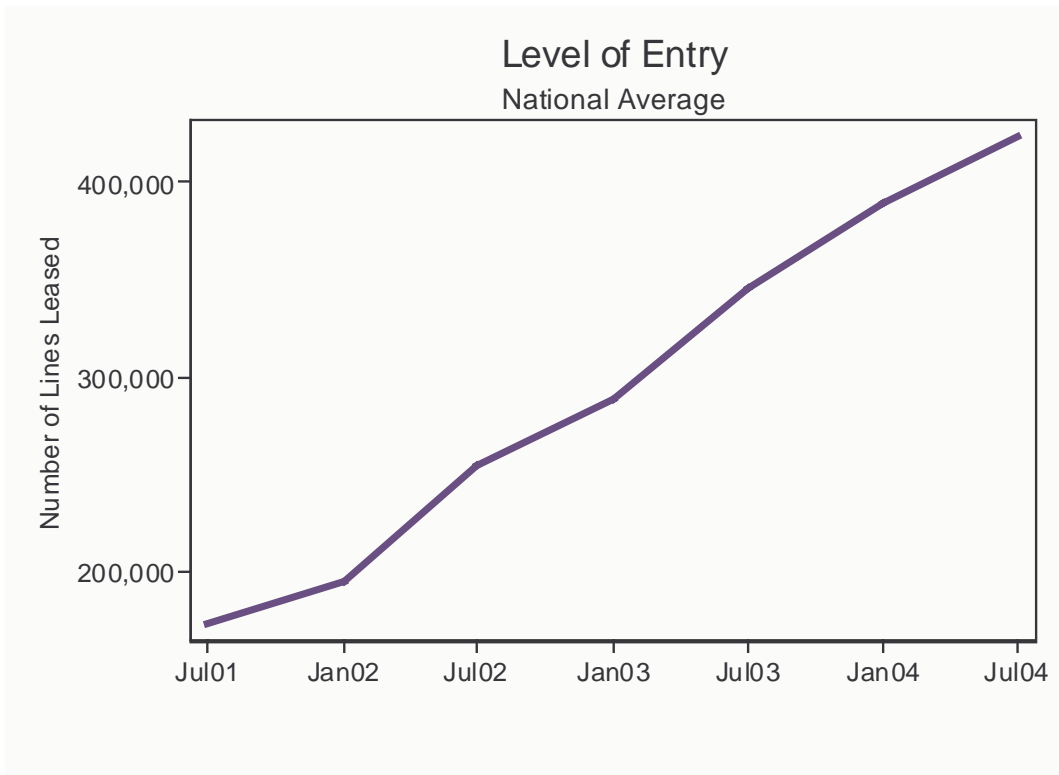
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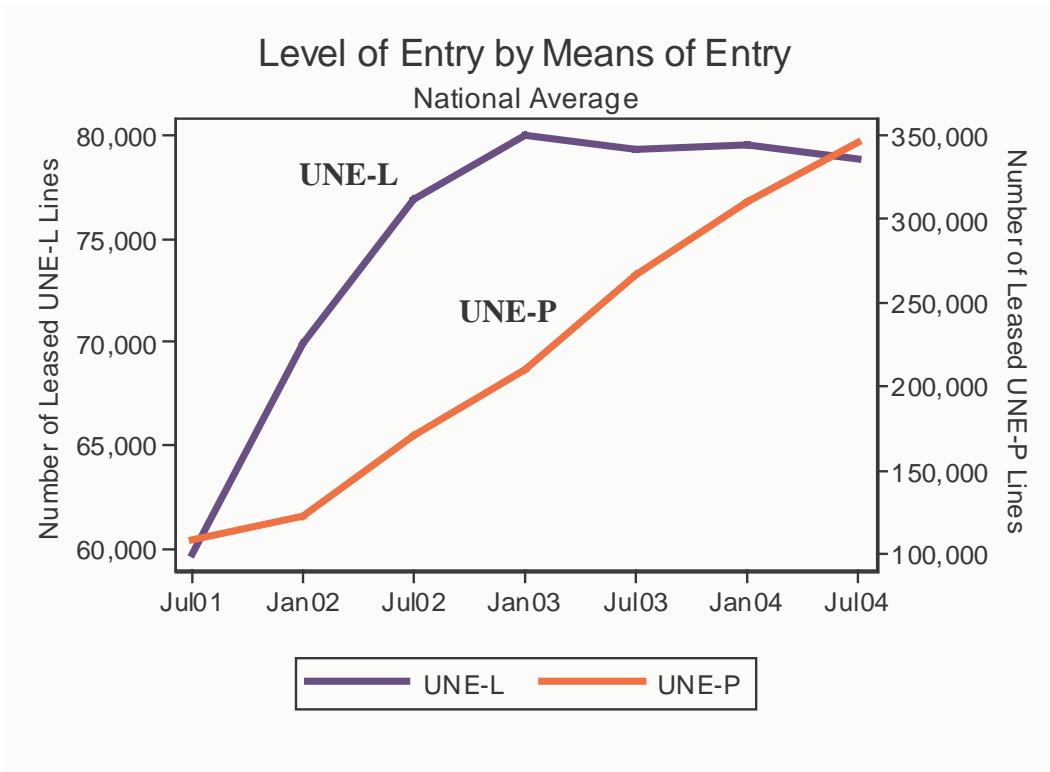
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**FIGURE 1**



**FIGURE 2**



**TABLE 1**  
**SUMMARY STATISTICS**

Variable	Mean	Minimum	Maximum	Standard Deviaion
<b><u>Dependent Variables</u></b>				
UNE-L Lines Leased to Entrants	81,296	282	492,995	101,945
UNE-P Lines Leased to Entrants	246,395	12	2,542,511	424,525
<b><u>Explanatory Variables</u></b>				
<b><u>Market Potential</u></b>				
Incumbent Average Revenue	\$61.56	\$45.16	\$101.19	9.83
Population (thousands)	6,252	496	35,894	6538
Number of Fortune 500 Companies Located in State	10.9	0	56	13.6
<b><u>Costs</u></b>				
UNE-L Monthly Cost	\$11.62	\$2.59	\$26.69	3.8
UNE-L Connection Charge	\$44.20	\$3.33	\$159.76	23.6
UNE-P Monthly Cost	\$15.07	\$4.77	\$31.04	4.0
<b><u>Regulatory</u></b>				
Section 271 Approval	0.75	0.00	1.00	0.43
Percent of PUC Commissioners Republican	52.9	0.0	100.0	33.6
Governor Republican	0.55	0.00	0.01	0.5
PUC Republican Interacted with Governor Republican	34.8	0	100	39.7
<b><u>Instrumental Variable for Incumbent Average Revenue</u></b>				
Fraction of Incumbent's Lines to Lifeline Subscribers	0.026	0.001	0.149	0.025

**TABLE 2****CORRELATION MATRIX OF EXPLANATORY AND INSTRUMENTAL VARIABLES**

	Incumbent Average Revenue Per Line	Population (thousands)	Number of Fortune 500 Companies Located in State	UNE-L Monthly Cost	UNE-L Connection Charge	UNE-P Monthly Cost	Section 271 Approval	Percent of PUC Commissioners Republican	Governor Republican	PUC Republican Interacted with Governor Republican	Fraction of Incumbent's Lines to Lifeline Subscribers
Incumbent Average Revenue Per Line	1.00										
Population (thousands)	-0.12	1.00									
Number of Fortune 500 Companies Located in State	-0.16	0.90	1.00								
UNE-L Monthly Cost	0.31	-0.38	-0.49	1.00							
UNE-L Connection Charge	0.20	-0.26	-0.35	0.34	1.00						
UNE-P Monthly Cost	0.21	-0.40	-0.43	0.91	0.26	1.00					
Section 271 Approval	0.23	-0.04	-0.04	-0.05	-0.19	-0.18	1.00				
Percent of PUC Commissioners Republican	0.24	0.18	0.22	0.00	0.02	0.02	-0.13	1.00			
Governor Republican	0.15	-0.01	0.04	0.07	0.00	0.08	0.01	0.36	1.00		
PUC Republican Interacted with Governor Republican	0.24	0.11	0.17	0.05	0.04	0.08	-0.12	0.71	0.80	1.00	
Fraction of Incumbent's Lines to Lifeline Subscribers	-0.17	0.47	0.37	-0.13	-0.19	-0.15	0.12	-0.14	0.09	-0.03	1.00

**TABLE 3**  
**LONG-RUN COEFFICIENT ESTIMATES**

Explanatory Variable	Dependent Variable	
	Leased UNE-L Lines	Leased UNE-P Lines
<b><u>Market Potential</u></b>		
Average Revenue	252 (0.10)	11397 ** (2.23)
Population (thousands)	-15 ** (-2.16)	687 *** (9.54)
Number of Fortune 500 Companies	2914 ** (2.40)	22476 ** (2.37)
<b><u>Costs</u></b>		
UNE-L Monthly Cost	-1738 ** (-2.06)	13648 (1.60)
UNE-L Connection Charge	-73 (-1.37)	-7 (-0.01)
UNE-P Monthly Cost	540 (0.70)	-7459 (-0.99)
<b><u>Regulatory Environment</u></b>		
Section 271 Effect (Binary)	-2166 (-0.30)	-31136 (-1.09)
Percent PUC Republican	295 *** (3.28)	-3163 *** (-3.72)
Governor Republican (Binary)	4697 (1.07)	30639 (0.68)
PUC Republican Interacted with Gov. Republican	-171 *** (-2.60)	-516 (-0.77)
<b><u>Time Fixed Effects</u></b>		
Year 2002	-6610 (-0.51)	-45956 (-1.36)
Year 2003	-898 (-0.15)	12167 (0.61)
July 2004	-435 (-0.13)	27014 (1.32)
R-Squared	0.54	0.55
Number of Observations	271	271

**Notes:**

Coefficient estimates in the UNE-L equation are based on including two lags of the explanatory variable. Coefficient estimates in the UNE-P equation are based on including one lag of the 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 4**  
**ECONOMIC EFFECTS**

Explanatory Variable	Effect on the Dependent Variable	
	Leased UNE-L Lines	Leased UNE-P Lines
<b><u>Market Potential</u></b>		
Average Revenue	2477 (0.10)	112033 ** (2.23)
Population (thousands)	-98070 ** (-2.16)	4491606 *** (9.54)
Number of Fortune 500 Companies	39630 ** (2.40)	305674 ** (2.37)
<b><u>Costs</u></b>		
UNE-L Monthly Cost	-6604 ** (-2.06)	51862 (1.60)
UNE-L Connection Charge	-1720 (-1.37)	-172 (-0.01)
UNE-P Monthly Cost	2160 (0.70)	-29836 (-0.99)
<b><u>Regulatory Environment</u></b>		
Section 271 Effect (Binary)	-2166 (-0.30)	-31136 (-1.09)
Percent PUC Republican	9912 *** (3.28)	-106277 *** (-3.72)
Governor Republican (Binary)	4697 (1.07)	30639 (0.68)
PUC Republican Interacted with Gov. Republican	-6789 *** (-2.60)	-20640 (-0.77)
<b><u>Time Fixed Effects</u></b>		
Year 2002	-6610 (-0.51)	-45956 (-1.36)
Year 2003	-898 (-0.15)	12167 (0.61)
July 2004	-435 (-0.13)	27014 (1.32)
R-Squared	0.54	0.55
Number of Observations	271	271

**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