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*Make or Buy? Unbundled Elements as Substitutes for Competitive  
Facilities in the Local Exchange Network*

T. Randolph Beard and George S. Ford

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***Make or Buy? Unbundled Elements as Substitutes for  
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*Abstract:* In this paper, we estimate demand curves for unbundled loops sold by incumbent local exchange telecommunications carriers to their retail rivals. Of primary interest are the cross-price effects between unbundled loops purchased with and without unbundled switching. As expected, we find downward-sloping demand curves for unbundled elements, with own-price elasticities in the elastic region of demand. Interestingly, however, we also find no evidence of positive cross-price elasticities between alternative modes of unbundled element entry.

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## I. Introduction

The unbundling provisions of the Telecommunications Act of 1996 are designed to promote competition in local exchange markets. Six years after passage, the legal and policy debate over these provisions continues to rage without resolution. One question that lies at the heart of the debate is whether unbundling (both as implemented and in general) reduces the demand available to facilities-based entrants, thereby deterring competitive local exchange carriers (“CLECs”) from investing in their own telecommunications facilities? This paper provides evidence and analysis regarding this question by estimating demand curves for unbundled loops leased with and without unbundled switching, and adds to the relatively sparse body of empirical guidance on the subject. To our knowledge, this paper is the first attempt to estimate the own-price and cross-price elasticities of demand for unbundled loops and switching.

With the cross-price elasticity of demand of loops purchased without unbundled switching, the question of substitution among alternative entry modes (*i.e.*, with and without switching) can be evaluated in a manner consistent with standard antitrust analysis of market definition. A high, positive cross-price elasticity indicates that, for a small increase in the price of one product (switching), the quantity demanded of some other product (loops without switching) is substantially increased. If the cross-price elasticity is negative and large, then a price increase for one product will reduce the demand for the other. In the case of high cross-price elasticity (positive or negative), the courts have frequently concluded that the two goods or services are in the same market.<sup>1</sup> Separate markets for the goods or services are indicated if the cross-price effects are low. Thus, whether or not loops leased with and without unbundled switching are in the “same market” is addressed in this paper, using a method familiar to both antitrust and regulation.<sup>2</sup>

Our findings are summarized as follows.

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<sup>1</sup> AMERICAN BAR ASSOCIATION ANTITRUST SECTION, ANTITRUST LAW DEVELOPMENTS (3d ed. 1992), Vol. I, at 282-93.

<sup>2</sup> *Id.*; see also, *e.g.*, In re Review of the Commission’s Regulations Governing Television Broadcasting, *Further Notice of Proposed Rulemaking*, 10 FCC Rcd 3524 (1995), available at [http://ftp.fcc.gov/Bureaus/Mass\\_Media/Notices/fcc94322.txt](http://ftp.fcc.gov/Bureaus/Mass_Media/Notices/fcc94322.txt).

- 1) The demand curves for unbundled loops and switching slope downward, and have elasticities in the elastic region of demand;
- 2) Cross-price elasticities are not distinguishable from zero, implying that mandated access is not serving as a substitute for CLEC deployed switching; and
- 3) Finally, a simple test of “impairment” is conducted, and unbundled switching is found to satisfy the standard set forth in the Act.

## II. Empirical Model

The purpose of this empirical analysis is to estimate reasonable approximations of the ordinary demand for unbundled loops purchased with or without unbundled switching.<sup>3</sup> We first define the variables in our model. The total number of unbundled loops purchased in a state for the provision of local telephone service ( $Q_T$ ) includes the quantity of loops purchased without unbundled switching ( $Q_L$ ; UNE-Loop) and with unbundled switching ( $Q_S$ ; UNE-Platform), so that  $Q_T = Q_L + Q_S$  (the subscript  $S$  is used for the Platform to indicate that the Platform CLEC purchases “switching” with the loop). The quantities  $Q_L$  and  $Q_S$  are our dependent variables, and the demand elasticities for  $Q_T$  are easily computed from the econometric estimates.

**GENERALLY, THE ESTIMATED DEMAND CURVES FOR UNBUNDLED LOOPS ARE**

$$\ln Q_L = \alpha_0 + \alpha_1 \ln P_L + \alpha_2 \ln P_S + \sum_{j=3}^n \alpha_j \mathbf{Z} + \varepsilon_L \quad (1)$$

$$\ln Q_S = \beta_0 + \beta_1 \ln P_L + \beta_2 \ln P_S + \sum_{j=3}^n \beta_j \mathbf{Z} + \varepsilon_S \quad (2)$$

where  $P_L$  is the loop price,  $P_S$  is the price for unbundled switching, the vector  $\mathbf{Z}$  represents  $n$  other demand-relevant factors that influence the demand for

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<sup>3</sup> In conjunction with unbundled switching, UNE-Platform CLECs purchase unbundled transport. Thus, we include transport in unbundled switching.

loops of both types, and  $\varepsilon_L$  and  $\varepsilon_S$  are econometric error terms that measure the unobserved determinates of loop demand. The price of unbundled switching is included in both demand equations, measuring cross-price elasticity in Equation (1) and own-price elasticity in Equation (2). All variables are measured at the state level, and only Regional Bell Companies are represented in the sample. Descriptive statistics and variable descriptions and sources are provided in Table 1.

#### A. Prices and Elasticities

Given the specification of Equations (1) and (2), own-price elasticities of demand ( $\eta_{i,i} = \partial Q_i / \partial P_i \times P_i / Q_i$ ) are measured by coefficients  $\alpha_1$ ,  $\beta_1$ , and  $\beta_2$ . The cross-price elasticity ( $\eta_{i,j} = \partial Q_i / \partial P_j \times P_j / Q_i$ ) is measured by  $\alpha_2$ . Because demand curves slope downward, we expect both  $\alpha_1$  and  $\beta_1$  to be negative, and the log-log specification implies that these coefficients measure the (constant) own-price elasticity of demand for unbundled loops of each type. Joint consumption of loops and switching in the loop-switching combination implies that  $\beta_2$  measures the own-price elasticity of demand for unbundled switching. Additionally, this joint consumption of the loop and switching elements for the UNE-Platform suggests that the quantity effect on the demand for loop-switching combinations of a \$1.00 price increase of either  $P_L$  or  $P_S$  should be roughly equal. This equality implies that  $\beta_1/w = \beta_2/(1-w)$ , where  $w$  is the loop's share of total combination cost [ $P_L/(P_L + P_S)$ ]. The Wald Test can be used to test whether this equality (*i.e.*, restriction) holds.

The price of unbundled switching  $P_S$  is a cross-price for the demand for loops purchased without switching, and the sign of  $\alpha_2$  will indicate the demand relationship of unbundled and self-supplied switching. If a decrease in the price of unbundled switching leads to a substitution of unbundled switching for self-supplied switching, then  $\alpha_2$  will be positive. A negative sign on  $\alpha_2$ , alternatively, suggests that unbundled and self-supplied switching are complements because a decrease in the price for switching increases the demand for loops purchased without switching.<sup>4</sup> If  $\alpha_2$  is not different from zero, then the entry modes are unrelated in demand.

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<sup>4</sup> Beard *et al.* present a formal, theoretical model illustrating the complementary and substitution relationships that may exist between unbundled switching and self-supplied switching. Beard, T. Randolph, George S. Ford & Thomas W. Koutsky, *Facilities-based Entry in Local Telecommunications: An Empirical Investigation* (unpublished manuscript, available at [www.phoenix-center.org](http://www.phoenix-center.org)) (Footnote Continued. . .)

### B. *Other Variables*

Other variables in the demand equation (making up the vector  $\mathbf{Z}$ ) include the total demand for the final good (local service) measured as the total local service revenues of the Bell Company in the state ( $SIZE$ ). This variable is included in the model because a loop demand curve is a derived demand. A priori expectations are that demand is positively related to market size. Given the specification of the model (log-log), an estimated coefficient on  $SIZE$  less (greater) than 1.00 indicates that demand increases less (greater) than proportionately to market size.

The mix of total demand between residential and business customers also may influence Loop demand. Two explanatory variables are included to measure the mix of demand: 1) the ratio of business-to-residential retail rates ( $RESRAT$ ); and 2) the percent of total, analog, switched access lines that are used to serve residential consumers ( $RESSHR$ ). The two demand-mix variables,  $RESRAT$  and  $RESSHR$ , both measure the extent to which market demand is residential in nature. Generally, unbundled loops and self-supplied switching are used to serve businesses, whereas unbundled loop-switching combinations are used to serve residential and small business customers. So, it is reasonable to expect negative signs on both variables in the  $Q_L$  equation, and positive signs in the  $Q_S$  equation.<sup>5</sup>

Both the New York and Texas public service commissions have exhibited leadership in promoting competition, and competitor penetration in these two states is considerably higher than average. Thus, a dummy variable that equals one for New York and Texas ( $DNYTX$ ), zero otherwise, is included in the model. New York and Texas are the leaders in promoting competition via unbundled elements, so positive signs are expected on  $DNYTX$ .

The Bells' ability to provide long distance telecommunications service may influence demand, so we include a dummy variable for states in which the Bell Companies have received 271 approval ( $D271$ ). Both New York and Texas have

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<http://www.telepolicy.com>). In that study, the effects of the availability and price of unbundled switching on number of CLEC deployed switching entities were evaluated using econometric methods. The study found that higher switching prices and unrestricted access to switching led to more, not less, switch deployment by CLECs.

<sup>5</sup> At current CLEC penetration rates (less than 10% on average), it is not clear that factors relevant at the margin (such as residential share and prices) will impact current demand.

271 approval, so the 271 dummy variable measures the influence of 271 approval absent the leadership effect of these two states. No *a priori* expectation is made about 271 status (*D271*), and it is important to keep in mind that the dummy variable *D271* measures the effect of 271 approval once the “leadership effect” of New York and Texas (both 271 approved states) is taken into account.<sup>6</sup>

A dummy variable indicating states with high non-recurring charges (*DNRC*), and the percent of the state’s population density (*METPOP*), are both included as additional regressors.<sup>7</sup> The variable *METPOP* is measured as the percent of a state’s population living in metropolitan areas. Non-recurring charges are sunk costs and, consequently, deter entry, so a negative sign on *DNRC* is expected.<sup>8</sup> Population density (*METPOP*) is expected to positively affect demand for unbundled loops purchased without switching due to density economies for self-supplied switching, but no *a priori* expectation is made with respect to the variable’s effect on loop-switching combinations.

Finally, since our data was collected in June and December of 2001, a dummy variable indicating the “as of” date of the data (*DSAMPLE*) is included as a regressor. A positive and statistically significant coefficient indicates that, on average, demand increased over the six-month period between June 2001 and December 2001.

### III. Results

The two equations are estimated (as a system) by weighted least squares.<sup>9</sup> Results are summarized in Table 2. Due to limitations on the availability of data

<sup>6</sup> The loop penetration rates (total loops divided by total access lines) in New York and Texas are much higher than average (about 19% for these two states to the average of 5% for the others), and this difference is statistically significant (t statistic = 7.56).

<sup>7</sup> For every unbundled loop or loop-switching combination leased from the incumbent LEC, the CLEC must pay the ILEC a non-recurring charge (“NRC”) to cover the labor costs of the migration (ordering and provisioning). A high NRC is defined to be an NRC exceeding \$50.

<sup>8</sup> We do not have data on the non-recurring charges for loops purchased without switching. We assume that the loop-switching non-recurring charge is highly correlated with the loop non-recurring charge. Depending on the correlation, the variance of *DNRC* in the  $Q_L$  equation may be large (implying a low t-statistic).

<sup>9</sup> By estimating as a system using weighted least squares, the estimates are more efficient relative to ordinary least squares estimates of the individual equations because the procedure increases the degrees of freedom and corrects for heteroskedastic disturbances. See PINDYCK, ROBERT S., & DANIEL L. RUBINFELD, *ECONOMETRIC MODELS & ECONOMIC FORECASTS* (3<sup>rd</sup> ed. 1991). Because there are no cross-equation restrictions, the estimated parameters are identical to single-  
(Footnote Continued. . . .)

for prices and quantities, the final sample consists of 134 system observations, or 67 (balanced) observations for each equation. The  $R^2$  of Equation (1) is about 0.85 and Equation (2) is 0.77, indicating that a large amount of the variation of loop demand of both types is explained by the regressions.

Econometric specification errors such as omitted variables, endogenous explanatory variables, errors in measurement, and an incorrect functional form can each cause least-squares estimates to be biased, inconsistent, and inefficient.<sup>10</sup> The RESET test is a rather general test of specification error, and is capable of detecting all of the specification problems listed above (Ramsey 1969), and the test is particularly sensitive to omitted variables and incorrect functional form. The null hypothesis for RESET is 'no specification error,' so specification error is indicated if the null-hypothesis is rejected. The RESET F-statistics are provided in Table 2, and neither test statistic is statistically significant even at the 10% level, so there is no evidence of specification error (*i.e.*, null-hypothesis of "no specification error" cannot be rejected at standard significance levels). Accordingly, we can be reasonably certain that our model does not suffer from these important specification errors.

#### A. Price Elasticities

##### 1. Loops

As indicated by theory, the demand curves for unbundled loops of both types slope downward, with an elasticity of about -1.7 for both  $Q_L$  ( $\alpha_1$ ) and  $Q_S$  ( $\beta_1$ ).<sup>11</sup> Both elasticities are in the elastic region of demand, indicating that quantity demanded responds more than proportionately to any given percentage change in price. A 10% increase in the loop price will decrease quantity demanded for

equation ordinary least squares estimation. However, the standard errors of the two procedures are not the same.

<sup>10</sup> This class of error violates the least squares assumption of a null mean for the theoretical disturbance vector. The RESET Test is valid only for least-squares regressions. Ramsey's RESET Test is performed by including as regressors the powers of the predicted values of the regression. The joint significance of these additional regressors is evaluated, and the null hypothesis of "no specification error" is rejected if the RESET F-Statistic exceeds the critical value (*i.e.*, the test of the joint restriction that all of the additional coefficients equal zero is statistically significant).

<sup>11</sup> James Eisner and Dale Lehman (2001) surprisingly conclude that the demand curve for unbundled loops slopes upward. Eisner, James & Dale Lehman, *Regulatory Behavior & Competitive Entry* (unpublished manuscript, available at [http://www.sbc.com/public\\_affairs/long\\_distance\\_news/california/](http://www.sbc.com/public_affairs/long_distance_news/california/)).

each type of loop by about 17%. We cannot reject the hypothesis that the two elasticities are equal using the Wald Test ( $\chi^2 = 0.01$ ). Thus, our estimates suggest that it is reasonable to conclude that an increase or decrease in the loop rate for unbundled elements has an equivalent effect on all forms of loop purchases, and that the percentage quantity response of both quantities will exceed the percentage price change.

The effects of prices on the total quantity of competitive services provided using unbundled loops can be computed from the estimated coefficients of the demand equations. In fact, the own-price demand elasticity for total loops ( $Q_T$ ) is simply the weighted average of the two elasticities measured by  $\alpha_1$  and  $\beta_1$ , because in our sample,  $Q_L/Q_T$  is approximately equal to 0.50. The simple average of the two own-price elasticities is  $-1.7$ , and this value measures the total, own-price elasticity of demand for unbundled loops of both types. Across loops of all types, a 10% increase in the price of an unbundled loop alone will decrease the quantity of loops sold by about 17%, all else being equal.

## 2. Switching

Turning to the price for unbundled switching ( $P_S$ ), we first consider the own-price effect of switching on the demand for loop-switching combinations (Eq. 2). The estimated own-price elasticity of demand for unbundled switching is  $-1.12$ , which indicates that a 10% change in price produces an 11% change in quantity demanded. The estimated elasticity is statistically significant at better than the 1% level (t statistic  $-3.59$ ). As previously mentioned, for loop-switching combinations, the loop and switching components are purchased jointly. This joint consumption suggests that the effect on quantity demanded of a \$1.00 price increase of either  $P_L$  or  $P_S$  should be roughly equal, and the Wald Test indicates that the restriction  $\beta_1/w = \beta_2/(1 - w)$  is valid.<sup>12</sup> This finding implies that it is the total price for the loop-switching combination that matters, not the individual prices for each component.<sup>13</sup>

The price elasticity of demand of total loops with respect to  $P_S$  is  $-0.51$ . Thus, a 10% increase in the price of unbundled switching will reduce the total amount

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<sup>12</sup> The adjusted elasticities are  $-3.06$  and  $-2.44$ , and the test of equality produces a  $\chi^2$  statistic of 0.27. We note that the hypothesis that  $\beta_1 = \beta_2$  cannot be rejected.

<sup>13</sup> For a recent paper estimating the own-price elasticity of demand of loop-switching combinations, see Robert B. Ekelund Jr. & George S. Ford, *Preliminary Evidence on the Demand for Unbundled Elements* (unpublished manuscript, available at <http://www.telepolicy.com>).

of competition provided over unbundled loops by 5%. This demand elasticity is statistically significant at better than the 5% significance level ( $\chi^2 = 8.27$ ).

### 3. *Unbundled Switching and UNE-Loop*

Perhaps the most policy-relevant finding of the econometric model is that the cross-price elasticity of  $Q_L$  with respect to  $P_S$  (0.10), though positive and small (0.10), is not statistically different from zero (t statistic = 0.58). Thus, our results imply that the two modes of entry (with or without unbundled switching) are unrelated in demand, being neither substitutes nor complements, all else being equal. The policy implication is clear: at current prices, unbundled switching is not a substitute for self-supplied switching, and increases in the switching price will not increase the quantity of loops serving end users with CLEC-deployed switching equipment.<sup>14</sup>

#### B. *Other Variables*

Market size (*SIZE*), which measures total expenditures for local service, increases the demand for loops of both types. The coefficients are less than 1.00, so the increase in demand is less than proportionate to the increase in market size.<sup>15</sup> Demand for unbundled loop-switching combinations, other things constant, is not higher in markets where demand is more intensely residential; both *RESRAT* and *RESSHR* are statistically insignificant in the  $Q_S$  equation. Nor does the residential-business mix of demand appear to influence the demand for unbundled loops purchased without switching.<sup>16</sup>

New York and Texas, two leading states in the promotion of competition in local exchange markets, have a higher demand for loops leased with and without unbundled switching, and these effects are statistically significant, though statistical significance is much higher in the  $Q_S$  equation. Once the higher

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<sup>14</sup> The recent study by Beard *et al.* found that a lower switching price increases the count of CLEC deployed switching equipment. See Beard *et al.*, supra n.4. Our present finding suggests that the available demand to switch-based CLECs is not reduced by lower switching prices. Thus, lower switching prices unambiguously encourage facilities deployment.

<sup>15</sup> Statistically, we cannot reject the hypothesis that the coefficients on *SIZE* are equal across equations.

<sup>16</sup> In contrast to the result on *RESRAT*, Ros and McDermott found that higher business rates relative to residential rates impedes facilities-based entry by CLECs. See Agustin J. Ros & Karl McDermitt, *Are Residential Local Exchange Prices Too Low?*, in *EXPANDING COMPETITION IN REGULATED INDUSTRIES* (Michael A. Crew ed., Kluwer Academic Publishers 2000).

demand levels in New York and Texas are taken into account, approval for Bell Company entry into long distance under Section 271 of the 1996 Act (*D271*) is not an important determinant of the demand for loop-switching combinations. With respect to the demand for loops purchased without switching, Section 271 approval negatively affects demand, and this result is statistically significant (t statistic = -1.99).<sup>17</sup> High non-recurring charges reduce demand for both types of loops (*DNRC*), and both estimated coefficients are statistically significant at better than the 10% level. Population density (*METPOP*) increases the demand for loops purchased without switching, but has no statistically significant effect on the demand for loop-switching combinations.

### C. *A Test for Impairment*

When determining which network elements are to be made available as unbundled elements to CLECs, the Telecommunications Act requires the FCC to consider, “at a minimum, whether ... the failure to provide access to such network elements would impair the ability of the telecommunications carrier seeking access to provide the services that it seeks to offer.”<sup>18</sup> The impairment standard is CLEC-specific (“*the telecommunications carrier seeking access*” and “*services that it seeks to offer*”), and a reasonable interpretation of the standard is whether the quantity of services supplied by the CLEC without access to the unbundled element is less than the quantity of services sold with the unbundled element.<sup>19</sup>

If a network element were easily replicable, then lack of access to the element would have no impact on the quantity of services sold. In the same way, any increase in the price of the element would have no effect on observed output of the CLEC (or CLECs as an aggregate), since a seamless migration to self-supplied elements would occur. Therefore, our empirical model allows a straightforward test of impairment.

The impairment standard is assessed by testing whether or not an increase in the price of switching has a (material) impact on the ability of a CLEC to provide service it seeks to offer (local exchange service using unbundled loops). Because our data are aggregate CLEC activity, our test of impairment is limited

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<sup>17</sup> Both Verizon in New York and SBC in Texas have 271 authority.

<sup>18</sup> 47 U.S.C. § 251(d)(2)(B).

<sup>19</sup> For a discussion of the impairment standard, see *Some Thoughts on Impairment*, Z-Tel Policy Paper No. 5 (available at [www.telepolicy.com](http://www.telepolicy.com)).

to an evaluation of all CLEC purchases of unbundled loops, rather than the more appropriate analysis of a single CLEC.

Two conditions serve as a test of impairment. First, as the price of unbundled switching rises, the quantity of loop-switching combinations declines. If switching is easily replicable, then the quantity of loops purchased without switching should increase in proportion to the loss of loop-switching combinations. A test of this condition is whether  $\alpha_2 Q_L = -\beta_2 Q_S$  (where the quantities are measured at their mean values). Alternatively, the same information is gleaned from the condition  $\partial Q_T / \partial P_S = 0$ . As described above, neither condition holds; an increase in the price of unbundled switching reduces the quantity of loop-switching combinations (with elasticity -1.1) and has no effect on the quantity of loops purchased without unbundled switching, so that  $\alpha_2 Q_L < -\beta_2 Q_S$ .<sup>20</sup> Further, the price elasticity of all loops ( $Q_T$ ) with respect to the switching price is -0.52 ( $\partial Q_T / \partial P_S > 0$ ), and this elasticity is statistically different from zero. Thus, our results suggest that at least some CLECs are impaired in their ability to provide service without access to unbundled switching.

#### IV. Conclusion

Our econometric model indicates that demand curves for loops, whether purchased with or without unbundled switching, are downward-sloping and presently in the elastic region of demand. Likewise, the demand for unbundled switching is in the elastic region of demand. Most significantly, our empirical model provides no support for a substitution between unbundled and self-supplied switching at current element prices; the estimated cross-price elasticity with respect to loops purchased without switching and the price of unbundled switching is not statistically different from zero.

In addition, our empirical results are used to construct and perform a simple test of the impairment standard of the 1996 Telecommunications Act. The impairment standard requires the FCC to consider (at a minimum) whether a lack of access to an unbundled element will reduce meaningfully the ability of a CLEC to provide the services it seeks to offer. This standard suggests a rather straightforward empirical test, and our econometric estimates indicate that impairment exists with respect to unbundled switching. This test, however, is imperfect, given the aggregate nature of the data. Impairment, as defined by the 1996 Act, must be evaluated on a CLEC-by-CLEC basis.

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<sup>20</sup> The null-hypothesis of equality of the two terms is rejected easily ( $\chi^2 = 10.6$ , Wald Test).

Empirical analysis is always subject to the quality of the data used and validity of the model's specification. The former we can do little about, and the latter we have addressed with careful model selection and a standard statistical test for specification error. As with all empirical analysis, however, this paper should be considered as but an element in a portfolio of evidence. Further research is always desirable.

**Table 1. Variable Definitions, Sources, and Descriptive Statistics**

Name	Description	Mean	St. Dev.	Source
$Q_L$	Quantity of unbundled loops sold on a standalone basis.	84,469	103,695	(1)
$Q_S$	Quantity of unbundled loops sold with unbundled switching.	148,580	359,948	(1)
$Q_T$	Total unbundled loops sold: $Q_L + Q_S$ .	233,049	419,107	(1)
$Q_L/Q_T$	Share of standalone unbundled loops to total loops.	0.502	...	...
$Q_S/Q_T$	Share of unbundled loops with switching to total loops.	0.498	...	...
$P_L$	Index of average price of an unbundled loop (mean-centered index).	1.00	0.30	(2)
$P_S$	Index of average price for unbundled switching (i.e., non-loop costs, indexed by average loop price).	0.915	0.45	(2)
$SIZE$	Size of the market measured as average monthly retail rate for local services multiplied by total access lines.	113M	107M	(1, 4)
$RESRAT$	Ratio of business to residential retail rates: $PRES/PBUS$	0.560	0.193	...
$PRES$	Average residential rate in the state.	21.10	3.44	(4)
$PBUS$	Average business rate in the state.	41.34	13.34	(4)
$RESSHR$	Percent of analog, switched lines that are residential ( $RESLINE/(RESLINE + BUSLINE)$ ).	0.752	...	(3)
$RESLINE$	Residential, analog, switched access lines.	2.35M	2.27M	(3)
$BUSLINE$	Business, analog, switched access lines.	0.94M	1.23M	(3)
$DNVTX$	Dummy variable that equals 1 if state is New York or Texas, 0 otherwise.	0.060	...	...
$D271$	Dummy variable for states granted 271 approval by the FCC: New York, Texas, Oklahoma, Kansas, Arkansas, Missouri, Massachusetts, and Pennsylvania.	0.179	...	...
$DNRC$	Dummy variable that equals 1 for states with loop-switching non-recurring charges exceeding \$50.	0.045	...	(2)
$METPOP$	Percent of state population living in metropolitan areas.	0.715	...	(5)
$DSAMPLE$	Dummy variable that equals 1 for data as of Dec. 2001, 0 for data as of June 2001.	0.537	...	...

(1) FCC Data acquired by Freedom of Information Act request made by the PACE coalition.

(2) Provided by Z-Tel Communications.

(3) ARMIS Form 43-08, 2001 data.

(4) Gregg (2001).

(5) [www.census.gov](http://www.census.gov).

**Table 2. Least Squares Estimates and Summary Statistics**

	$\ln Q_L$	$\ln Q_S$
Constant	1.317 (0.77)	5.893 (1.88) <sup>b</sup>
$\ln P_L$	-1.725 (-5.39) <sup>a</sup>	-1.654 (-2.82) <sup>a</sup>
$\ln P_S$	0.098 (0.58)	-1.122 (-3.59) <sup>a</sup>
$\ln SIZE$	0.563 (6.05) <sup>a</sup>	0.388 (2.28) <sup>a</sup>
$\ln RESRAT$	-0.133 (-0.51)	0.665 (1.39)
$RESSHR$	0.796 (0.43)	1.21 (0.35)
$DNYTX$	0.553 (1.65) <sup>b</sup>	2.589 (4.21) <sup>a</sup>
$D271$	-0.411 (-1.99) <sup>a</sup>	0.324 (0.85)
$DNRC$	-0.827 (-2.19) <sup>a</sup>	-1.247 (-1.80) <sup>b</sup>
$METPOP$	2.991 (5.64) <sup>a</sup>	-1.057 (-1.09)
$DSAMPLE$	0.275 (2.16) <sup>a</sup>	0.154 (0.66)
R <sup>2</sup>	0.85	0.67
RESET F	0.89	0.84

<sup>a</sup> Statistically significant at the 5% level.

<sup>b</sup> Statistically significant at the 10% level.

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