WORKING
PAPERS

TELECOMMUNICATIONS BYPASS
AND THE "BRANDON EFFECT"

Steven G.

Telecommunications Bypass and the "Brandon Effect""

Steven G. Parsons

Southwestern Bell Telephone

Michael R. Ward

Federal Trade Commission

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Abstract: The creation of a charge for long distance companies to access the local

telephone companies' switched network created the incentive to bypass the local switched network

in order to avoid access charges that were substantially above cost. This paper explores the

implications of a federal regulatory policy of a target total dollar switched access revenue

requirement. In particular, the paper focuses on the so called "Brandon Effect" in which bypass

incentives are attenuated when there is a target total dollar switched access revenue. Empirical

analysis confirms the "Brandon Effect" on bypass decisions.

* The views expressed here do not necessarily reflect those of either Southwestern Bell Telephone or the Federal Trade Commission. This paper is an extension of Parsons and Ward (1991). We would like to thank Paul Brandon, Tim Daniel, Peter Griffes, Alex Larson, Doug Mudd, Bob Rogers, Richard Shin and Ken Troske for comments and suggestions and Dolly Howarth for research assistance.

1. Introduction

The divestiture of AT&T and the FCC's order on access charges accentuated a conflict between

telecommuniCations policy and competitive forces. In particular, prior to the divestiture of AT&T, the price of long

distance service gradually grew in order to offset a growing fraction of the cost of basic local telephone service

assigned to long distance operations (Johnson (1982». After 1983, the Federal Communications Commission (FCC)

maintained this subsidy by requiring long distance companies to pay a per-minute-of-use fee as part of the switched

access charge.' Since switched access charges are substantially in excess of local exchange company costs of

providing switched access, competitive pressures are driving long distance companies to seek lower priced

alternative means of connecting to end users; they are seeking to "bypass" the local switched network and its

attendant charges.

Long distance companies purchase telephone access, usually from the Local Exchange Companies (LEes),

since long distance networks generally do not reach customers' telephones. The decision to bypass essentially entails

a comparison of the long distance companies' cost of bypass and the price of switched access provided by the LEC.

Previous studies have focused on the lower cost of bypass for large and geographically concentrated customers (see,

for example, Bellcore (1984), Britman, and BellcorJack 0.05 Tc Tc -0049 0 T6 (focused 0.0034 Tc 1.007 0 -2.697 Td (alternaRohlf0.0067 T eve ers

in part, on the degree to which the attendant switched access price increase is internalized. Thus, larger long

distance companies have lower shadow prices for switched access.

The attenuation of the long distance companies' incentive to bypass due to the regulators' desire to capture

a fixed revenue requirement from

presents and discusses empirical fmdings for the existence and significance of the Brandon Effect. This is followed by a brief conclusion.

2. A Description of the Access Market
A long distance telephone company operates a communications network that connects local telephone exchanges, hence, it is called an Interexchange Carrier (IC). The LECs, such as the regional Bell Operating Companies and GTE, transport long distance telephone calls between customers' premises and the nearest termination point of an ICs' network. These services are collectively called carrier access and represent nearly half of all IC costs. AT&T's 1984 divestiture effectively precluded the Bell operating companies from offering long distance service.

States regulate prices for intrastate services, and the FCC regulates prices for interstate services, such as
interstate switched access. Until recently, ICs and LECs operated under rate-of-retum regulation. 2 To accomplish
joint regulatory oversight, some LEC assets are allocated to the intrastate and interstate jurisdictions for cost recovery in a necessarily arbitrary way. The costs assigned to the interstate jurisdiction are primarily recovered
through a switched access charge on each minute of long distance connection and, beginning in 1985, a Subscriber
Line Charge billed as a flat rate monthly charge on each telephone line. 3
In Smith v. minois Bell Tel. Co. (1930), the courts ruled that since AT&T's long distance service used at1oi03533 -2.4

costPr

to underlying economic costs. j The FCC's 1983 Access Charge Plan formalized this cost assignment and cost recovery mechanism with an additional charge, called a Carrier Common Line Charge, on the switching function of switched access. At first, the non-AT&T ICs had "nonpremium" connections to the LECs (e.g., customers were required to dial extra digits to reach non-AT&T ICs); the additional charge for nonpremium access was set at 45% of that for premium service obtained by AT&T. The divestiture agreement required the LECs to install equipment to provide equal access to any IC asking for it. The equal access equipment is currently in place for nearly all (91 %) IC customers. 6
In devising its access charge plan, the FCC eventually recognized that if usage-sensitive access charges
greatly exceeded marginal costs, ICs and high volume customers would have an incentive to make alternate connections between the customer's premises and the IC's network in order to bypass the LEC and avoid switched access charges. Thus, the FCC decided that part of the basic local exchange costs allocated to the interstate jurisdiction should be recovered through a fixed recurring monthly Subscriber Line Charge billed to the customer rather than the usage sensitive switched access charges billed to the Ie. 7 Economists had argued that these costs were incurred because customers had access to the network and did not rise with usage, thus movement toward a recurring monthly charge increased efficiency by aligning prices more closely with costs.8 A Subscriber Line Charge was gradually institute<f that lowered switched access charges but did not eliminate them. In 1984, the average switched access price was $.173 per conversation minute; by 1991 it was $.072 Tj 0.04 ovement

The threat of bypass resulted in prices for access that more closely reflect the cost of service. One

response to this threat was the imposition of the Subscriber Line Charge and concurrent reductions in switched

access chargeS. Special access prices are based on circuit capacity rather than actual use, as with switched access,

and can be thought of as volume discounts for large and more demand elastic customers. Switched access rates are

averaged over geography and density, with substantial differences in the LEC's cost of service. Bypass has

generally occurred where the cost of providing alternate access is the lowest. LECs have asked regulators for the

ability to set prices closer to actual costs in response to bypass competition. Originally, the competition was

relegated to the provision of dedicated carrier access. However, third-party access providers have asked regulators

for interconnection to LEC facilities primarily to offer switched transport service. If such I provision provision to provision of of fa g

The types of special access more suited to switched access charge avoidance are voice grade lines, W A TS

lines, and DSI (high capacity) connections. Voice grade lines and WATS lines are specifically designed to carry

voice traffic .. DSI connections have greater capacity, enabling up to 24 simultaneous voice-grade connections. A

higher capacity connection,

(1)

Initially, the marginal cost to the Ie of switched access is assumed to be a fixed constant, ordinarily its nominal price. The marginal cost of bypass is increasing with the amount of bypass. to Equation (1) has an interior solution if the marginal cost of bypass is below the marginal cost of LEe access for the first customer and above that for
the last.
Let r be the price of switched access and c be the constant marginal cost to the LEe of providing this
access. Then total switched access expenditures for lei are r Ai and marginal Ie costs of LEe switched access are

(2)

The derivative drldAi is determined by assuming that the total revenue, R, from switched access is constant, and
the price is determined by dividing switched access revenue by the total switched access demanded, r = R / �~� Aj • a n

Equation (4) indicates that ICs choose the level of switched access and bypass such that the marginal cost

of bypass is equated with a value which can be less than the price of switched access. Moreover, this shadow price

varies inversely with the IC's share of LEC switched access. In essence, a fixed revenue level for LECs from

switched access causes an IC to have a diminished incentive to bypass, and this effect is greater for a larger IC.

Consider the monopsonist IC and the fringe IC as polar opposites. A monopsonist IC (Wi = 1) has a shadow price

of switched access equal to zero and the revenue is transferred as a lump sum tax. The fringe IC (Wi"'" 0) has a

shadow price close to the full switched access price, r.

The source of the difference in shadow prices between small and large ICs is important to understand. This

form of regulation, seeking a constant dollar amount of switched access revenue, confers a strategic compliment

attribute to switched access. As one IC uses more switched access, the switched access price to all users falls, and

thus, all rcs' costs fall. As an IC's share of switched access rises, the portion of the complementarily that is

internalized also rises. For a switched access is attrge a that strategi.00hTjTj 0.05 Tck 3.Tc 14 T7 Tc 2d (thatEffect.0034 10.80.f01 0 9.8 417.

differentials). Since AT&T's share of switched access has fallen dramatically, this feedback appears to be small

relative to other factors. In addition,

Since special access is the primary mode of switched access avoidance, it is used as a surrogate for total bypass. Also available, but not at the individual IC level, are price indices for switched and special access for each month and state. Information on the demand for long-distance service and cost of inputs into the production of access are also used.

Estimating individual factor demand equations for switched and special access is problematic for two reasons. First, the data are not rich enough to estimate reliably the necessary parameters. The prices of both factors of production are likely to enter both factor demand equations. Since these prices are likely to be endogenous, separate instrumental variables would be required for each price variable. Such instrumental variables are not available. Second, the switched access expenditure share by IC, a key explanatory variable, is almost surely correlated to the level of switched access demand. Again, the advisable strategy is to find instrumental variables for the share. However, it is difficult to imagine a variable that affects this share that does not belong in the demand equation itself.
Alternatively, the ratio of the factors of demand is estimated as a function of the ratio of factor prices and
other variables. The coefficient of the price ratio yields an elasticity of substitution between switched access and bypass. Using this approach, instrumental variables are needed for only one variable, the price ratio, at the cost of the assumption of a constant elasticity of substitution. An IC's relative factor proportions of switched access and bypass is not likely to be affected by the IC's share of total switched access expenditures (other than through the shadow price of switched access). Thus, for AT&T and the accs,

A1T QtySwAcclt
QtyBypass;1T

A1T[PrcSwAcc;1T A1T] = f ,SwAccShrlt ,X ... A1T IQ PrcBypasslt

QtySwAcc::C

C
occ[PrcSwAcc::C

c OCc]

- - - - oo-c = f occ,SwAccShrlt ,XIt QtyBypasslt PrcBypasslt

(5)

(6)

are estimated, where X is a vector of exogenous factor demand shifting variables and k and t subscript state and month.

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Economists often assume that factor input prices are determined exogenously from factor demand determination. However, for two different reasons, the price ratios in equations (5)-(6) could be endogenous to the quantity ratios. First, either the LEC could exercise market power in switched access usage or AT&T could exercise a degree of monopsony power. If either of these is the case, price will be a function of the quantity demanded. Second, both prices in these ratios are set by regulators seeking revenues to "recover" fixed costs; if demand decreases, prices will rise in order to satisfy the fixed total revenue level or fixed revenue requirement. Indeed, this is exactly the type of assumption necessary for the existence of the Brandon Effect. Thus, supply price determination equations,

ATT PrcSwAccJ:t

ATT PrcBypossl:t ! ATT QtySwAccJ:t ATT + QtySwAccJ:t ace 1 = g Z + ATT ace' J:t QtyBypOSSJ:t + QtyBypOSSJ:t
PrcSwAcc:;ce oce! �Q�t�y�S�w�A�c�c�~�T�T� + QtySwAcc::X] ------ = g Z +
ace ATT oce' J:t PrcBypassJ:t QtyBypOSSJ:t + QtyBypOSSI:t

(7)

(8)
are also estimated, where Z represents a vector of exogenous LEC supply shifting variables correlated with the price ratio. Equations (5)-(8) form a system of simultaneous equations to be estimated by instrumental variables techniques.

Data Description
The data available provide measures LEC i o n n

v a r i a

unused. Concrete data on the average number of lines used per OSI trunk does not exist; however, conversations

with Southwestern Bell experts lead us to believe that, on average, approximately 16 circuits are used per OSl

connection. Obviously, this number can vary over time, across ICs, or across states; unfortunately, however, we

have no information on the size or direction of the variation. Thus, special access lines are aggregated as the sum

of the WATS lines, voice-grade lines and 16 times OSI lines. The benefit of this construction is that digital data

lines are not included and the price measures are specific to the Ie.

The construction of the switched access share variable requires some discussion. First, while the switched

access share for AT&T is directly calculated as AT&T's switched access expenditure divided by total switched

access expenditure, the corresponding value for the accs is slightly more complicated. The switched access share

for the accs is calculated as the weighted average of the individual share's for MCI, Sprint and other ICs, where

the weights are the fraction of acc expenditure represented by MCI, Sprint or the other ICs. Furthermore, since

the other ICs share itself constitutes an aggregation of many small firms, its share is divided by ten in order to

approximate their average share. Second, the switched access share of revenue is possibly correlated with the ratio

of switched to special access quantity by construction (rather than due to the Brandon Effect). To avoid this

occurrence, for each IC and state in the sample, the IC's average share over the other four states is substituted.

The variables in X, those that shift factor demand for switched access relative to special access, include

variables affecting end-user demand and variables measuring the level of other IC factor inputs. Real disposable

income per capita is used to capture income effects and the number of residential and nonresidential lines are

included to reflect the size of these markets. Bypass is much more likely to occur in the provision l j 0.0135 Tc0.0065 T8ty474 Td827 0

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ftes

sa25per i-4 (l717- (thes)Tj 0.0196 T

Bypbles

employed here for this form of heteroskedasticity IS to weight observations by the population of the state it

represents.

Almost all variables included in the regressions are the natural logarithm of the underlying variable; the

exceptions, the net income and "excess" returns variables in the price equations, are due to the existence of negative

values of these variables. Thus, coefficient estimates usually can be interpreted as elasticities and, specifically, the

coefficient on price in the quantity equations is interpreted as the elasticity of substitution. The magnitude of the

coefficients on the net income and "excess" returns are more difficult to interpret.

5.

ex5 0. are

Alternatively, insignificance could be interpreted as implying that the

in the shadow prices and these, in turn, are projected onto the instrumental variables. These instrumental variables

purge both the nominal price

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Price of Central Office Switching Equipment and Transmission Equipment - are real price indices for central office

switching equipment and

Variable

Intercept

Price Ratio

Switched Access
Share
Income per capita

Corporate Bond
Yield to Maturity
Residential Lines

Non-Residential
Lines

Mining
Employment
Construction

Employment
Manufacturing
Employment
Transportation & Pub!.
Uti!. Employment
Retail & Wholesale
Trade Employment
Finance, Insurance, &
& Real Estate Emp!.
Services

Employment
Government

Employment

Rho

Number of Obs.

Adjusted

Estimate of Alpha

AT&T

accs

Table 2
Nonnested J Test Results
Nominal versus Shadow Price Models

Nominal
Price
Model

lAO'

(0.40)

1.53

(4.30)

This table presents coefficients and standard errors of ex in the equation

y = xl /31 + �(�x�X�2�~�2� + €

Shadow
Price
Model

- 0.88

(0.69)

- 0.56

(4.48)

where subscripts denote the competing models describing the data generating process. Superscripts reported in the table denote significance levels for a two-tailed test of ex greater than zero if less than 10 percent.

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Elasticity of Substitution

AT&T

accs

Table 3
Elasticities of Substitution
in Competing Models

Nominal
Price
Model

- 0.283
(0.13)

- 0.19

(0.17)

Shadow
Price
Model

-0.341
(O.()J)

-0.21

(0.18)

Standard errors are in parentheses and superscripts denote significance levels for a two-tailed test if less than 10 %. Observations are weighted by state population.

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