Intermodal Competition in Local Exchange Markets

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Abstract

- The local telecommunications market has traditionally focused on the landline, wired, public switched telephone network. Hence, the relevant product market for public policy tends to be defined in terms of the local loop. However, the availability of high-speed Internet access services, provided by local telephone companies, cable companies, and satellite service companies, offer alternatives to dial-up services typically used with local dialtone lines. Consequently these alternatives may deteriorate the installed base of lines. In addition, the widespread and increasing adoption of mobile services provides yet another communications alternative for voice and data services. Just as in the transportation world where competition must be examined across rail, truck, air and barge modes, it appears that alternative modes of communications ought to be considered concurrently for public policy. In this study, we will attempt to model local competition between Incumbent Local Exchange Carriers (ILECs) and Competitive Local Exchange Carriers (CLECs) but explicitly account for competitive effects from alternative modes of communication. Doing so will permit us to test whether the product market definition ought to be extended beyond the borders of the local loop. Using published FCC and other governmental data at the state level, we will develop a model of local competition using both cross-sectional and pooled techniques.

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Objectives

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- Test whether the product market definition of loop competition is too narrow.
  - Recognize the dramatic impact of mobile communications on voice markets.
  - Note that other forms of electronic communication (e.g., via the Internet) provide alternative means to communicate, albeit complementary to wireline access.
- Develop a model that would quantify competition in local telecommunications markets using variation across states as well as time.

Model Structure

Model Structure

Assume two profit maximizing Cournot competitors in a more general case of heterogeneous goods. Each faces an individual demand curve for the market segment for his/her good. The inverse demand curve is given by

$$p_i = a_i - b_{ii}q_i - b_{ij}q_j$$

Model Structure

Each firm is a Cournot competitor and therefore maximizes profit given the output decision of the other firm.

$$\pi_i = p_i q_i - c_i q_i = (a_i - b_{ii} q_i - b_{ij} q_{ij}) q_{ii} - c q_i$$

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Model Structure

The reaction curve for each firm is derived from the first-order conditions to yield,

$$R(1): q_1 = \frac{a_1 - c_1}{2b_{11}} - \frac{b_{12}}{2b_{11}} q_{12}$$

$$R(2): q_2 = \frac{a_2 - c_2}{2b_{22}} - \frac{b_{21}}{2b_{22}} q_{21}$$

for firms 1 and 2 respectively.

Model Structure - Restrictions

- Let firm 1 be the dominant firm and therefore capture a greater share of rents from a larger market segment and perhaps a lower cost structure. Then

$$a_1 > a_2 \;,\; c_1 \leq c_2 \;; \quad \text{and} \quad b_{11} < b_{22}$$

Therefore,

$$\frac{a_1 - c_1}{2b_{11}} > \frac{a_2 - c_2}{2b_{22}}$$

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Model Structure - Restrictions

The price effects for the dominant firm, firm 1 should be smaller than for firm 2. (See previous chart.) For both firms, however the own price effect should be greater than the cross price effect, that is,

$$b_{ii} > b_{ij}$$

However as goods become less heterogeneous (or because there are lower switching costs or other impediments for goods substitution)

$$b_{ij} \rightarrow b_{ii}$$

Description of the Data

Description of the Data

- State data on ILEC lines, CLEC lines, high-speed lines, wireless carriers for all sample periods were obtained from semiannual releases of the FCC Local Competition Reports.
- Prices for local access lines and UNE loops were obtained from the Office of the Consumer Advocate, Public Service Commission of West Virginia.
- State economic and demographic data were obtained from the Bureau of Labor Statistics and the Bureau of Economic Analysis via DRI•WEFA.

Estimation

Estimation – Equation Specification

Using OLS we estimated the reduced form equations

$$q_1 = \alpha_1 - \beta_1 q_1 + \delta_1 x + \phi_1 z$$

$$q_2 = \alpha_2 - \beta_2 q_2 + \delta_2 x + \phi_2 z$$

where,

$$\alpha_i = \frac{a_i - c_i}{2b_{ii}}, \quad \beta_i = \frac{b_{ij}}{2b_{ii}},$$

x is a variable(s) measuring intermodal competition, and
z is a variable(s) related to relevant market size, economic conditions.

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Estimation – Equation Specification

From the model restrictions we expect that

$$\alpha_1 > \alpha_2$$

The more homogeneous the goods, or the easier to substitute, consequently

$b_{ij} \to b_{ii}$ and therefore, $\beta_i \to \beta_j \to \frac{1}{2}$

as in the standard Cournot case of homogeneous goods. We allow for asymmetries since CLEC services may be more differentiated to ILEC services, or there may be other frictions (impediments, switching costs, etc.).

Estimation – Variable List

- ILINES – ILEC lines
- CLINES – CLEC lines
- WCARRIERS – Number of wireless carriers
- HSPRATE – Penetration rate for high-speed lines
- BUSLINE – Average rate for business access lines
- LOOP – Average UNE loop rate
- POP – State population

- Note that high-speed lines is a statewide total over DSL, Cable modem (Coax), and satellite.

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Estimation - Findings

- The existence of wireless carriers has a decided competitive impact on both ILEC lines and CLEC lines, but ILECs are more adversely affected than are CLECs. This suggests that the product market definition should be wider to account for wireless.
- There is asymmetry in the reaction curves that imply that, despite likely brand strength, CLECs have a greater competitive effect on established ILECs than the reverse.
- The coefficient restriction for the constant term is met in all estimated equations suggesting ILEC dominance.

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Estimation - Findings

- ILEC and CLEC shares are greater the higher is the penetration rate of high-speed access. However the impact is asymmetric with ILECs tending to benefit more than CLECs. (That is, the higher the penetration, the stronger the ILEC market position.)
- ILEC and CLEC shares are lower when the retail-wholesale price difference is greater. Again, ILECs are more adversely affected than are CLECs. (That is, the higher the price difference, the worse the ILEC's competitive position.)

Estimation Results – Pooled

Sample: 2000:1 2001:1				
Dependent Variable: ILINES				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	384.069	104.877	3.662	0.000
CLINES	-1.023	0.094	-10.933	0.000
WCARRIERS	-89.805	9.731	-9.228	0.000
POP	0.731	0.008	90.350	0.000
HSPRATE	3.531	0.844	4.182	0.000
(BUSLINE-LOOP)	-7.079	2.136	-3.315	0.001
R-squared	0.995			
Adjusted R-squared	0.995			
S.E. of regression	307.210			
F-statistic	4764.809			
Prob(F-statistic)	0.000			
Mean dependent var	3941.115			
S.D. dependent var	4185.774			
Sum squared resid	11702881.000			
Durbin-Watson stat	0.557			

Dependent Variable: CLINES				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	156.999	74.285	2.113	0.037
ILINES	-0.480	0.044	-10.933	0.000
WCARRIERS	-48.492	7.481	-6.482	0.000
POP	0.385	0.029	13.118	0.000
HSPRATE	2.430	0.578	4.206	0.000
(BUSLINE-LOOP)	-3.741	1.489	-2.513	0.013
R-squared	0.840			
Adjusted R-squared	0.833			
S.E. of regression	210.397			
F-statistic	129.756			
Prob(F-statistic)	0.000			
Mean dependent var	347.431			
S.D. dependent var	514.960			
Sum squared resid	5489100.000			
Durbin-Watson stat	0.385			

Estimation Results – Cross Sections

Sample: 2000:1 2000:1				
Dependent Variable: ILINES				
Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
C	390.562	169.250	2.308	0.027
CLINES	-0.848	0.221	-3.845	0.000
WCARRIERS	-87.059	15.183	-5.734	0.000
POP	0.732	0.016	46.428	0.000
HSPRATE	4.420	2.058	2.148	0.038
(BUSLINE-LOOP)	-8.005	3.561	-2.248	0.031
R-squared	0.995			
Adjusted R-squared	0.995			
S.E. of regression	304.973			
F-statistic	1673.058			
Mean dependent var	3930.636			
S.D. dependent var	4263.363			
Sum squared resid	3534332.000			
Prob(F-statistic)	0.000			

Dependent Variable: CLINES				
Variable	***Coefficient***	***Std. Error***	***t-Statistic***	***Prob.***
C	169.226	109.361	1.547	0.130
ILINES	-0.330	0.086	-3.845	0.000
WCARRIERS	-37.496	11.418	-3.284	0.002
POP	0.283	0.059	4.814	0.000
HSPRATE	1.474	1.338	1.101	0.278
(BUSLINE-LOOP)	-3.519	2.295	-1.533	0.134
R-squared	0.809			
Adjusted R-squared	0.784			
S.E. of regression	190.277			
F-statistic	32.270			
Mean dependent var	283.409			
S.D. dependent var	409.695			
Sum squared resid	1375809.000			
Prob(F-statistic)	0.000			

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Estimation Results – Cross Sections

Sample: 2000:2 2000:2

Dependent Variable: ILINES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	136.277	155.528	0.876	0.386
CLINES	-1.033	0.139	-7.424	0.000
WCARRIERS	-89.434	14.288	-6.259	0.000
POP	0.728	0.012	60.123	0.000
HSPRATE	7.197	1.559	4.616	0.000
(BUSLINE-LOOP)	-4.629	3.099	-1.494	0.143
R-squared	0.996			
Adjusted R-squared	0.996			
S.E. of regression	265.469			
F-statistic	2202.243			
Mean dependent var	3822.756			
S.D. dependent var	4206.995			
Sum squared resid	2748467.000			
Prob(F-statistic)	0.000			

Dependent Variable: CLINES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	50.035	116.066	0.431	0.669
ILINES	-0.567	0.076	-7.424	0.000
WCARRIERS	-54.249	12.211	-4.442	0.000
POP	0.440	0.051	8.715	0.000
HSPRATE	4.536	1.239	3.661	0.001
(BUSLINE-LOOP)	-2.498	2.326	-1.074	0.289
R-squared	0.873			
Adjusted R-squared	0.857			
S.E. of regression	196.657			
F-statistic	53.709			
Mean dependent var	352.022			
S.D. dependent var	519.919			
Sum squared resid	1508280.000			

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Estimation Results – Cross Sections

Sample: 2001:1 2001:1

Dependent Variable: ILINES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	174.480	272.695	0.640	0.526
CLINES	-0.969	0.144	-6.748	0.000
WCARRIERS	-87.727	23.234	-3.776	0.001
POP	0.713	0.014	50.128	0.000
HSPRATE	5.484	1.684	3.256	0.003
(BUSLINE-LOOP)	-6.278	4.169	-1.506	0.141
R-squared	0.995			
Adjusted R-squared	0.994			
S.E. of regression	313.779			
F-statistic	1411.667			
Mean dependent va	4082.268			
S.D. dependent va	4178.491			
Sum squared resic	3446010.000			
Prob(F-statistic)	0.000			

Dependent Variable: CLINES

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25.486	212.880	0.120	0.905
ILINES	-0.584	0.087	-6.748	0.000
WCARRIERS	-49.807	19.671	-2.532	0.016
POP	0.447	0.056	7.961	0.000
HSPRATE	3.930	1.336	2.941	0.006
(BUSLINE-LOOP)	-4.866	3.236	-1.504	0.142
R-squared	0.859			
Adjusted R-squared	0.839			
S.E. of regression	243.582			
F-statistic	42.719			
Mean dependent var	411.098			
S.D. dependent var	607.243			
Sum squared resid	2076624.000			
Prob(F-statistic)	0.000			

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Caveats and Refinements

Caveats and Refinements

- Need to explore state-specific effects.
- Experiment with split samples (e.g. 271 states) to test different responses to local and intermodal competition
- The implicit simultaneity suggests that 2SLS might yield more efficient results.
- The low DW in the pooled model is not likely a result of 1st order serial correlation but omitted variables related to the underlying dynamic process (e.g., DSL/Cable/Satellite high-speed developments).
- Need to disaggregate DSL, cable modem, satellite high-speed.

Caveats and Refinements

- Our data is aggregated at the state level. We believe that richer estimates would result from a variety of samples at more relevant, lower levels of geography (e.g. wire center/cable franchise/county).
  - If possible the geographic samples should encompass all combinations of competitive availability.
    - For example, counties in which there is no cable franchise, both ILEC and cable with DSL and cable modem, etc.
    - Split samples to reflect geographic market characteristics (e.g., 271 vs. non-271 areas, areas that encompass a spectrum of competitive alternatives).

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