

Competition in Local Telecommunications

THERE'S MORE COMPETITION THAN YOU THINK

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The Telecommunications Act of 1996 created a framework for competition in local telecommunications. Under its rules and under the jurisdiction of state regulatory authorities, competitive local telephone companies were to gain access to some or all parts of the incumbent's network through known wholesale tariffs and offer retail local telephone service. As customers

adopt other technologies for communications—mobile wireless service, broadband for email, messaging, and information retrieval—additional competitive pressures are put on the core voice telephone market. The substitution of usage and access from local telephony to other modes of communication is regarded as intermodal competition and is the subject of this paper. This study concerns local telecommunications competition between incumbent and competitive service providers in the United States. In addition to measuring competition from within the wireline market, we find significant intermodal competitive impacts resulting from wireless and high-speed development. We report empirical results from an econometric model that measures line loss impacts between carriers and the effects of wireless and high-speed services on the wireline market. The paper offers interpretation of the strategic and policy implications of these results.

One of the primary objectives of the Telecommunications Act of 1996 was to open local telecommunications markets to competition. These markets are dominated by incumbent monopoly franchise carriers, particularly—in most major markets—the former regional Bell operating companies (RBOCs). Recognizing that local markets constituted bottlenecks, the Act mandated that the local exchange networks be unbundled into constituent parts: loops, network interface devices, switching, dedicated and shared transport, signaling and call-related data bases, and operations support systems (including operator services and directory assistance). Competitive service providers would be able to acquire services for

ABBREVIATIONS USED IN THIS PAPER

CLEC: COMPETITIVE LOCAL EXCHANGE CARRIER

DSL: DIGITAL SUBSCRIBER LOOP

FCC: FEDERAL COMMUNICATIONS COMMISSION

ILEC: INCUMBENT LOCAL EXCHANGE CARRIER

ISP: INTERNET SERVICE PROVIDER

LAN: LOCAL AREA NETWORK

MSA: METROPOLITAN STATISTICAL AREA

MSO: MULTIPLE SYSTEM OPERATOR

RBOC: REGIONAL BELL OPERATING COMPANY

UNE: UNBUNDLED NETWORK ELEMENTS

VOIP: VOICE OVER INTERNET PROTOCOL

some or all of these unbundled network elements (UNE) through wholesale prices.¹ For example, a competitive local exchange carrier (CLEC) is permitted to rent space in the central office (operations center) of an incumbent local exchange carrier (ILEC) and co-locate its equipment in order to lease access to the ILEC's switching facilities at wholesale rates that are regulated by the state. The incentive to the RBOCs to open their vast local markets in this process was that they would gain access to long dis-

¹All of these elements taken as a whole constitute the entire local platform, and the wholesale pricing is denoted as UNE-P.

tance markets, which had been closed to them.

Figure 1 presents a stylized representation of the local telecommunications network, including the local telephone loop that provides access to the customer's premise and the service provider's central office that contains switching facilities of the ILEC and co-located equipment owned by the competitive carrier. Alternative forms of access from mobile wireless service and cable television are also shown because providers of these services offer forms of communications access and usage that compete directly with voice telecommunications services and with dial-up Internet access provided through additional telephone lines. We also show electric power companies as potential providers of broadband service in the future.

The wholesale pricing practices used to determine prices for each of the telephone network elements and the issue of whether the resulting prices are set at appropriate levels is beyond the scope of this paper. Indeed, the efficacy of this whole policy approach has been hotly debated. Nonetheless, competition in local networks has been substantial, particularly during the high growth years in the telecommunications and information technology industries, as competitors penetrated the traditional local wireline base of the incumbents.

Technology Marches On

The larger communications market has not stood still while local exchange competition—wireline loop competition—was developing. Changes in all communications technologies developed rapidly; and the evolution of the Internet as a vehicle for electronic communications, as a means for information retrieval, and as a conduit for commercial transactions was a development beyond anyone's vision—or at least any short-run network plan.

At the same time a less regulated mobile wireless industry was expanding from a duopoly of cellular providers to a competitive market that included several more personal communications service providers. And although the U.S. mobile wireless market is characterized by competing network standards, adding to the total costs of service, it is an enormously competitive industry.

FIGURE 1

THE LOCAL COMMUNICATIONS NETWORK

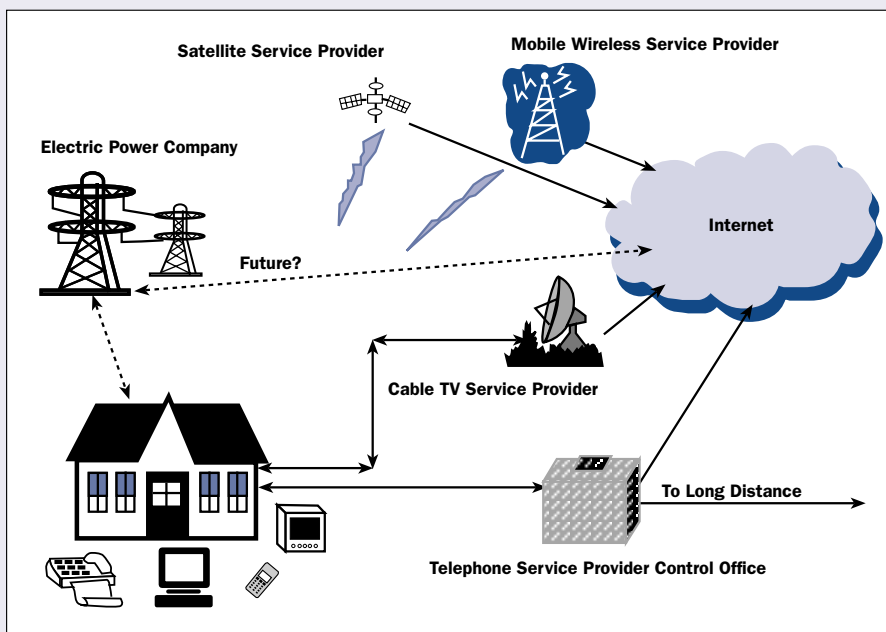
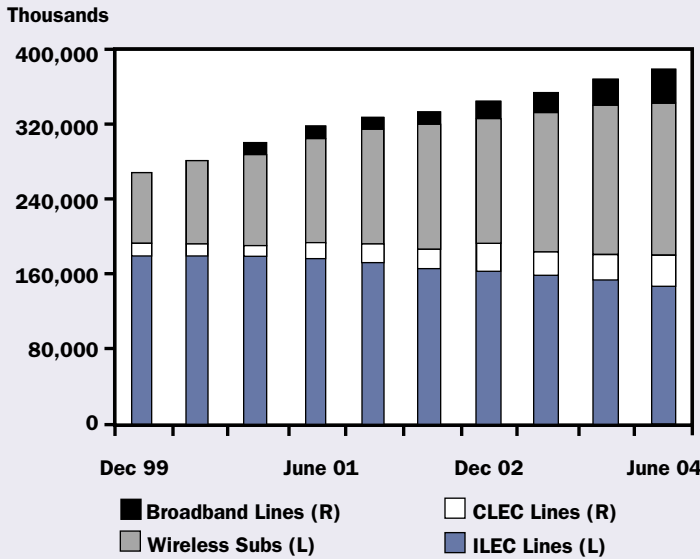


FIGURE 2

TOTAL COMMUNICATIONS ACCESS—MARKET SHARES



Source: Federal Communications Commission (FCC) Competition and High-Speed Development Reports

Competition and the expansion of digital, nationwide networks have resulted in dramatic declines in the cost of service to end users and much more innovation in handset functionality and services. Wider geographic calling areas and a variety of calling bundles have stimulated subscribership to nearly half of the total population, and it is continuing to grow. Few would doubt the impact that mobile wireless service has had on retail long distance service, credit card calling, and operator services. The impact on local service may not appear to be as obvious, but the empty public coin stations at airports and other locations are some testament to the value of mobility. Indeed, although high-speed wireless technology (for data and video) is in its nascent stages, the technological possibilities and market potential are substantial and would create a viable alternative to wired communications markets.

Competition between incumbent carriers and competitive carriers has been continuing with regulatory rules in place to adjudicate the degree and speed of deregulation. However, the downturn in the economy beginning in 2000 and weakness in the industry caused both incumbents and competitors to suffer declines in core markets. Figure 2 shows that the local wireline market, as measured by total lines, has shrunk. There are several reasons for this. The first is that the cyclical downturn had an effect on both ILECs and CLECs alike. The industry has always been cyclical, but when links in the Internet supply chain broke and liquidity became scarce with tighter monetary

policy, whole parts of the industry imploded. By the end of 2002, there were roughly one-third as many CLECs operating as there were two years prior (ALTS, 2003). The collapse of many startup Internet service providers (ISPs) led to financial hardships for competitive carriers with whom they shared joint marketing ventures.

Moreover, the continuing decline in lines signals further restructuring in the industry. End-user adoption of technological alternatives to traditional telecommunications is pressing ahead at a rapid pace. Demographics and price differentials are driving expansion in wireless traffic, including substitution for local and especially long distance usage, which has been impacted by expanded wireless calling areas and pricing. The commercial and consumer craving for increased bandwidth and greater speeds is seemingly unfulfilled. Dial-up Internet connections are being abandoned in favor of digital subscriber loop (DSL) connections provided by incumbent and competitive carriers in local markets and by cable modem service through local cable opera-

tors. Displacement of an RBOC's additional lines by its own DSL service is clear cannibalization, resulting in increased revenue but at potentially higher cost. Of course, displacement by a competitor's DSL or cable modem service has a more harmful, direct competitive effect on profitability. When communications is viewed broadly across service types, the growth in wireless and broadband and decline in switched lines are quite vivid as Figure 2 shows. The broadband displacement of additional lines used for dial-up Internet access is clearly part of the story behind the graphical display. The number of wireless subscribers is approaching the total number of fixed access lines and will play a greater role in primary communications access, not just as a secondary mobile link. Reasonable market projections suggest that the substitution of wireless service for traditional telephone lines will likely grow as well.

More technologies are on the way—voice over Internet protocol (VoIP) to name just one. VoIP will enable users to make voice calls through their broadband connection anywhere in the world. Calls are routed over the Internet rather than through the traditional local and long distance switched networks. To the end user, these technologies are just elements in a portfolio of communications service alternatives. To a service provider these new technologies are disruptive because they shake the revenue streams of existing services that they displace and threaten the value of the legacy capital that provides them. Often in regulatory forums new technologies seem to be ignored because the

focus of deregulation is narrowly directed towards the single market provided by the single technology—competition in the wireline loop. Our research was designed to address the extent to which intermodal competition affects local competition. If it does, then the scope of deregulation needs to be widened to account for it.

Research Results

We estimated two equations for ILEC and CLEC reaction curves respectively. We developed a pooled cross-section and time-series model with fixed effects using semiannual data from June 2000 through June 2002 for U.S. states and the District of Columbia. The specifications and the estimation results can be seen in Tables 1 and 2 for the ILEC reaction curve and CLEC reaction curve respectively. A more detailed discussion is included in the Appendix.² All variables are weighted by density (population/square mile) for several reasons. First, there are clear economies of density and scope in the construction of physical networks for multiproduct communications services. Network externalities in demand tend to be realized much faster, and consequently markets tend to develop more readily in more densely populated areas. In addition, density weighting quantitatively allows for the technological limitations of wireline services that are distance-sensitive. Also, DSL is currently limited to within 18,000 feet of the serving office unless there is additional investment for boosting the signal. For all of these reasons we believe that density would affect the response variables directly rather than as a component of the fixed effects. The specifications that we show include the identical variables for intermodal effects: Wireless Subscribers/Density, DSL Lines/Density, and Coax (cable modem)/Density. This allows a direct comparison of effects on local competition.

²The state-specific fixed effects are shown in Table 5 in the Appendix for ILEC and CLEC equations respectively. The estimation excludes Alaska and Hawaii because of data limitations. All of these constant terms are positive, as expected, and those for the ILEC are greater than those in the CLEC market, which indicates the dominant shares of ILECs in the local line market across states. Each of these fixed effects terms picks up the economic and regulatory variation within the state. For example, income per capita differences across states are subsumed in that term as are general economic conditions. We also expect that variation across states towards specific regulatory conditions, such as variations in retail-wholesale margins, or whether or not a Section 271 approval has been given, would also be realized in these constant terms.

TABLE 1

DEPENDENT VARIABLE: ILEC LINES/DENSITY			
METHOD: GLS (CROSS SECTION WEIGHTS)			
SAMPLE: SEMI-ANNUAL 2000:1 2002:1, 50 STATES PLUS O.C.			
	Variable Coefficient	Std. Error	t-Statistic
CLEC LINES/DENSITY	-0.618	0.038	-16.1
WIRELESS SUBSRIBERS/DENSITY	-0.047	0.005	-10.0
DSL LINES/DENSITY	-1.179	0.077	-15.4
COAX LINES (CABLE)/DENSITY	-0.701	0.010	-68.7
AR(1)	-0.374	0.008	-49.5
Adjusted R-squared	0.99857		
S.E. of regression	1095034		
Mean dependent variable	3.34E+10		
S.D. dependent variable	1.10E+11		
Sum squared residual	6.04E+13		
Durbin-Watson statistic	2.40		

Examining the ILEC reaction curve first we see that the coefficient on CLEC Lines in the ILEC Lines response function is -0.6 , which indicates that for an expansion of 10 CLEC lines, the ILEC will lose six.³

The coefficient of -0.05 on the wireless subscriber variable in the ILEC response function implies that for every 100 wireless subscribers 95 use the service in addition to their wireline service but five use wireless exclusively. This is an important result because it suggests that *roughly five percent of the market uses mobile wireless exclusively* and raises the question of how much that estimated proportion will increase over time.

The coefficient of -1.2 on the DSL variable implies that for ten DSL lines, the ILEC loses 12. This result at first appears to be surprisingly large and raises the question of why more than one line might be exchanged for one DSL line. However, the DSL variable includes higher speed DSL service available in business markets that are conducive to networking multiple access points. Also, during part of the sample period, wireless local area network (LAN) technologies became commercially available to consumer and business markets.⁴ This technology permits

³Despite the fact that it is somewhat higher than the -0.5 limit for homogeneous goods it does imply that the ILEC demand curve is less elastic than the CLEC demand curve and reflects the regulatory constraints on ILEC pricing responses.

⁴Wireless local area networks are sometimes referred to as WiFi. Networks are provided by way of a set of protocols that enable multiple users to access a single point of contact, or hub, in a business or home to get access to the Internet. Universities were among the first large institutions to adopt this technology for students to access the Internet from anywhere on campus. Some retail carriers are also providing these kinds of services commercially to subscribers in venues such as cafes, restaurants, and airports.

TABLE 2

DEPENDENT VARIABLE: CLEC LINES/DENSITY
 METHOD: GLS (CROSS SECTION WEIGHTS)
 SAMPLE: SEMI-ANNUAL 2000:1 2002:1, 50 STATES PLUS O.C.

	Variable Coefficient	Std. Error	t-Statistic
ILEC LINES/DENSITY	-0.236	0.040	-5.9
WIRELESS SUBSCRIBERS/DENSITY	0.008	0.007	1.1
DSL LINES/DENSITY	0.514	0.143	3.6
COAX LINES (CABLE)/DENSITY	0.286	0.083	3.5
Adjusted R-squared	0.93475		
S.E. of regression	1036637		
Mean dependent variable	6544395		
S.D. dependent variable	5401416		
Sum squared residual	1.31E+14		
Durbin-Watson statistic	1.78		

multiple users of a single DSL (cable modem) connection to the Internet. We may be seeing the quantitative evidence of that market development as well. If so, this coefficient is a lower bound for what we might see in the future.

Finally, the coefficient of -0.7 on the Coax variable indicates that for every ten cable modem lines, the ILEC loses seven switched lines, although these are predominantly additional lines for dial up. Only in limited locations do cable providers offer telecommunications services. That will decidedly change as the cable industry expands voice service (most likely through VoIP) in which case a larger impact, directed at primary lines and not just secondary lines, can be expected.

In the CLEC reaction curve, we see that the coefficient of -0.24 is smaller than its counterpart in the ILEC equation. This indicates that expansion of an ILEC has a smaller result—for every ten line increase by an ILEC the CLEC loses but two. The ILEC clearly has a weaker competitive position. This is a reasonable result given the regulatory constraint of capped retail prices that the ILEC must maintain.

The signs on DSL and Coax, 0.5 and 0.3 respectively are positive in this case, suggesting that expansion of DSL and cable modem Internet access reinforces the competitive position and profitability of competitive carriers. This result is consistent with the typical joint marketing of competitive voice service and high-speed service by many large CLECs as was discussed earlier. The impact of coax is also consistent since CLECs count among their number several major cable multiple service operators (MSOs). (In the interest of symmetrical reporting, we included the wireless subscriber variable despite the statistical

insignificance of its coefficient.)

Conclusions and Implications

Our results show that there is a significant amount of competition within the local wireline market, not just from competitive carriers but from wireless and broadband services as well. To be sure, the level of competition in local telecom markets varies across states, as shown in Table 3; and it appears that more densely populated areas enjoy a greater diversity of communications alternatives and apparently greater intermodal competition. These are important for market strategies and deregulation policy.

Strategic Implications

Were the competing firms in these markets distinct and isolated in single markets the strategic behavior might be relatively limited. However, major ILECs include the RBOCs: Verizon Communications, SBC, BellSouth, and Qwest Communications. Besides providing high-speed services, as discussed above, they each have ownership interests in major wireless carriers as well. Moreover, major CLECs, such as Sprint, have interests in long distance (another competitive market that RBOCs have entered) and wireless service. Consequently, decisions that are made about how to compete in one market implicitly affect the competitive outcome in additional markets in which these carriers operate.

Is half a loaf better than none at all? Our model is based on interrelated demand across markets—product demand in one market is a substitute for (or complement to) demand in another market. It may well be in an RBOC's interest to move users from a dial-up use on an additional line to a DSL line from which a higher-profit might be earned. It may also be the case that even if a higher profit is not earned, cannibalizing its own line may be better than a total loss to a cable company that provides high-speed service. The RBOCs faced a similar situation in the early 1990s with a monopoly on switched access service while facing competition from a substitute service, private line, or special access service.

Multimarket dependencies give more reason to bundle services. Strategic alliances and mergers may serve a similar purpose. If an RBOC with a major share of the wireless market were to acquire another wireless carrier, the stand-alone merger may invoke an antitrust response

because of the increased concentration in the wireless industry of the RBOC. However, there may be a greater difficulty if the acquisition of more dominance in the wireless market would enable the RBOC to offer greater bundles in communications services to sustain dominance in the local market.

New technologies can create strategic advantages across markets. Our research incorporates the effects of interdependent market demand, implicitly accounting for cross elastic demand. The notion that supply can be linked across markets is equally relevant for assessing multimarket competition, and this is an important area for additional research. Providing local service by an incumbent or a facilities-based competitor requires a substantial financial investment in physical capital that underlies the network. Not only can this capital generate large economies of scale in each of the markets served through the network (wireline, broadband, and to some extent, wireless), but it can also give rise to economies of scope across markets, thereby linking costs of services. Consequently, marginal profit in one market can increase because of expansion of capital in another market. In this case, joint cost reductions can arise across markets as volume expands in one. Strong synergies could permit an incumbent carrier to extend market power from a core monopoly market to prevent competitive expansion in the non-core, competitive market. For example, if a RBOC dominated the local market exclusively and competed in the high-speed service market, it could sustain its bottleneck more readily in the core services market because joint costs would fall as joint profits expanded. Deregulation of the local market would be singularly focused on opening the local bottleneck.

But consider the possibility that if both the incumbent and competitor enjoy these economies, expansion by one firm could lead to a mutual expansion of output and more competitive prices. That is, when in a market a RBOC faces a competitor like a large cable operator or other competitive carrier that enjoys cross-market synergies as well, both would have a profit incentive to expand market share across markets. As they did so collectively, output would expand, prices would fall, and a more efficient market would result (Swann, 1997).

It may be the case that when there are substantial scale and scope economies across markets—markets in which service demands are linked as well—competition may be better served by fostering multimarket competition than through piecemeal policy focused on one market. This may be especially true when incentives to invest in innovation and technology are important. Economies of scale limit the number of firms that can operate efficient-

ly in the market. But when investment in new technology is important, as it is in communications, having firms of some size competing for share across markets may be a greater inducement to invest in new capital than to impose resale of incumbent facilities in a single market by smaller service providers. This issue begs for more research to support public policy.

Public Policy Implications

Intermodal substitution implies a wider product market definition for assessing competition. The research presented here provides some evidence in the deregulation debate. The finding that intermodal competition is significant in the communications market and that local competition is enhanced by it suggests regulatory policies ought to account for these effects—perhaps without regard to CLEC line share. Otherwise, ILECs will be overly constrained in responding to market competition in the core wireline market.

Deregulation should be based on the relevant geographic market. One of our findings is that the degree of competition is related to the density of the market area. Since the variables in the model are weighted by density, the greater the density on average the larger is the predicted competitive response. That is, on average, larger markets (more densely populated states) are more competitive than smaller markets. However tantalizing it might be to extrapolate these results to the regional (e.g., metropolitan statistical areas—MSAs), urban/rural) subdivisions within the state, we cannot legitimately do so from our results because our results are based on state-level data only and account for market size across states. Nor do our results suggest that more densely populated states have more competition in every case. Table 3 ranks CLEC market share by state and indicates that there are several less dense states that have had penetration rates higher than the national average of 17 percent.⁵

Nevertheless, intuition suggests that within states there may be one or more definable geographic areas, likely to be fairly densely populated, in which there is a large degree of intramodal and intermodal competition. These areas might be completely deregulated and subject to FCC jurisdiction or antitrust policy, while less competitive areas would remain within the oversight of the state regulatory body. For example, if there is a substantial amount of competition in the Chicago metropolitan area but none in the rest of the state of Illinois, it might be in

⁵Several states are not shown because of data limitations for CLEC lines in the period. They are Alaska, Hawaii, South Dakota, Vermont, West Virginia, and Wyoming.

the interests of consumers, businesses, competitors, and the state's economy to deregulate the Chicago MSA (or similarly defined area) but maintain regulatory oversight over competitive developments elsewhere in the state.

Simply put, the boundaries by which telecommunications have been traditionally defined are expanding. New technologies offer a wider set of alternatives that create competition in more narrowly defined markets. By adopting an approach to product and geographic market definition similar to the concepts in the Department of Justice Merger Guidelines, telecommunications deregulation may enhance competition, mitigating harm to service providers while safeguarding segments of consumers.

Epilogue

Since the completion of our research there have been some important events in the ever-changing telecom landscape that relate to several of the issues that we have raised here. They are important because of the possible

market outcomes and policy approaches that may result.

The Rise and Fall of UNE-P: In mandating that incumbent networks be divided up into parts, access to which could be leased by competitors, the Telecommunications Act of 1996 provided for three broad approaches towards opening the local incumbent telecommunications markets to competition. Facilities-based competition envisioned that a competitor would provide a complete end-to-end solution competitive network. An alternative approach was that competitors would invest in their own network equipment and transport facilities but lease access to one or a few of the essential unbundled network elements (UNE), such as the line to the customer—sometimes known as “the last mile.” A last approach was to lease *all* of the unbundled network elements of the incumbent's network—the entire network platform—at a bundle rate, called UNE-P. Doing so was tantamount to complete resale of the local network, since minimal capital investment was required to enter this way and a competitor

TABLE 3

CLEC SHARE BY STATE, JUNE 2004 *

State	Total Lines	CLEC Lines	Share	Density	State	Total Lines	CLEC Lines	Share	Density
Rhode Island	662,640	213,787	32.3%	1029.8	Florida	11,418,566	1,785,001	15.6%	315.2
New York	12,369,803	3,684,036	29.8%	406.4	Alabama	2,362,118	365,060	15.5%	88.7
Michigan	6,062,886	1,575,267	26.0%	177.4	Ohio	6,677,236	979,885	14.7%	279.2
Arizona	3,229,626	814,194	25.2%	49.1	Tennessee	3,294,083	475,312	14.4%	141.7
Utah	1,228,687	288,009	23.4%	28.6	Maine	803,981	113,957	14.2%	42.3
Massachusetts	4,429,798	997,760	22.5%	820.8	Indiana	3,596,991	501,936	14.0%	172.7
Kansas	1,419,642	316,946	22.3%	33.3	Iowa	1,431,479	199,115	13.9%	52.7
Nebraska	941,817	205,560	21.8%	22.6	Oregon	2,011,039	267,121	13.3%	37.1
Illinois	7,999,510	1,672,522	20.9%	227.6	Oklahoma	1,834,673	242,737	13.2%	51.1
Pennsylvania	8,345,018	1,706,036	20.4%	275.8	Washington	3,770,375	494,375	13.1%	92.1
New Jersey	6,468,140	1,319,513	20.4%	1164.4	Missouri	3,337,339	430,538	12.9%	82.8
New Hampshire	840,913	170,433	20.3%	143.6	Arkansas	1,335,196	162,996	12.2%	52.3
Minnesota	2,981,979	604,152	20.3%	63.5	Louisiana	2,323,851	283,333	12.2%	103.2
Virginia	5,069,885	994,588	19.6%	186.5	North Carolina	5,016,818	576,538	11.5%	172.6
Georgia	5,022,293	977,358	19.5%	149.9	Connecticut	2,375,074	272,385	11.5%	718.9
District of Columbia	1,131,004	215,421	19.0%	9174.1	Kentucky	2,060,305	218,810	10.6%	103.6
Texas	12,459,719	2,320,273	18.6%	84.4	Nevada	1,421,795	149,735	10.5%	20.4
Wisconsin	3,381,645	626,809	18.5%	100.8	Mississippi	1,279,798	131,218	10.3%	61.4
Colorado	2,937,715	498,583	17.0%	43.9	South Carolina	2,251,706	226,284	10.0%	137.7
California	23,202,576	3,723,815	16.0%	227.5	New Mexico	970,814	76,469	7.9%	15.4
Maryland	3,854,786	615,757	16.0%	563.6	North Dakota	288,383	22,502	7.8%	9.2
Delaware	590,276	92,810	15.7%	418.2	Idaho	714,312	47,398	6.6%	16.5
					Montana	501,752	19,204	3.8%	6.3
					National	180,086,735	31,983,229	17.8%	

*Excludes Alaska, Hawaii, South Dakota, Vermont, West Virginia, and Wyoming

Source: Federal Communications Commission

merely re-sold capacity acquired at this wholesale rate.

Only the largest and most capital-rich competitors could engage in custom networks that completely bypassed the existing public network. The UNE approach permitted competitors to evaluate entry options in a buy-or-lease sense; and many elements, such as switching, could be bought outright and linked to the incumbent's network. But while the UNE-P approach was the most entry-friendly, it was at the same time the most controversial. At the heart of the controversy was whether the bundled platform price permitted adequate cost-recovery by incumbent network providers. The controversy, and years of litigation, ended in December 2004 when the FCC ruled that incumbents would no longer be compelled to provide wholesale UNE-P rates.⁶ The debate about this issue is beyond the scope of this paper. However, we would expect that loop competition—competition within the landline access market—is likely to be less than under the UNE-P price regime. Consequently, competition from alternative technologies and services—*intermodal competition*—becomes even more important in sustaining single market wireline competition.

Shrinking Markets—Horizontal and Vertical Integration: Over the past several months before this article's publication, several important mergers affecting markets in the alphabet soup of telecommunications have been proposed, are currently pending, or have been completed. In the wireless market, Cingular Wireless—a joint venture of SBC and Bell South, two major regional Bells—has acquired AT&T Wireless. Sprint, the long distance carrier and holding company for Sprint PCS, has offered to merge with Nextel wireless. On the landline side of the telecom world, SBC has offered to merge with AT&T—the original long distance carrier and one-time CLEC. Verizon, a major regional Bell and partner with Vodafone in Verizon Wireless, has for the moment outbid Qwest Communications, the remaining regional Bell, for the right to acquire MCI, late of MCI-WorldCom fame and long distance provider.

Will consolidation in the wireless market affect competition adversely? Will vertical re-integration of local and long distance harm competition? These are the fundamental economic questions that will be raised and adjudicated as these ventures are evaluated. Another question that is relevant to this paper is whether in a world of interconnection—literally and figuratively—among landline, wireless and broadband (Internet) markets, any major

multimarket service provider has the market power to extend pricing power in several markets. Clearly, there are ample opportunities for product bundling across markets that could lessen competition for single market competitors while potentially stimulating competition between multimarket competitors.

Geography Matters—The Last Mile Revisited: The key question for competition in local markets that ultimately must be answered is how a CLEC can get to the customer. As Figure 1 illustrated, there are only two ways—a wire of some kind or a wireless technology. Typically, there are three wires into a customer's premises: the telephone line, the cable TV line, and the electric power line. Usually there is only one of each kind of line and only one dominant company supplies each in a local geographic market.⁷ Without competitive carriers in local wireline telephone markets, what is the alternative?

New Technologies and Entry: With less direct competitive entry in local telephone markets by other telephone service providers, it falls to intermodal competition—from other wire services and technologies to the premises or from wireless technologies—to provide sufficient checks on the pricing and service quality of the dominant suppliers in each market.

Wireless technologies provide an alternative voice service into the customer's premises that eliminates the need for a line entirely. Wireless messaging services, which allow users to send text messages instead of making voice calls, are fast becoming a substitute for even wireless voice service. And although high-speed wireless is just beginning to be offered in U.S. markets, the potential from WiMAX technology—broadband speeds over wireless—is somewhere in the future.

A promising alternative to standard telephony, currently in its nascent stages, is VoIP; but who will provide broadband lines? Clearly, the incumbent telephone providers will, along with a VoIP package of their own. But they are not the only ones. Cable companies, which currently have over one-half of the broadband market, are poised to offer VoIP services in direct competition with incumbent telephone companies. Additional entry may also come from electric power companies using power lines to provide broadband access to customers.⁸ This technology, along with the possibility of local government provision of public high speed networks, may be particu-

⁶In the final order other elements were excluded from standard lease arrangements including switching, although there was some room for adjudication of competitive impairment.

⁷Even if each market is not a natural monopoly subject to public utility regulation as has traditionally been thought, it is costly to build plant and provide service from more than company.

⁸The FCC adopted rules designed to accommodate Broadband over Power Lines (BPL) in October 2004. This approach to provide broadband access has been used extensively in Germany and other EU countries.

larly helpful in bringing competitive broadband services to rural or underserved communities.

In this world of cross-entry, the RBOCs are moving quickly to install fiber optic service to the customer's premises, not just to offer higher speeds for data communications but of all services that have video content. Cable-telco competition revisited—*déjà vu* all over again! The once hoped-for competition from the 1970s and 80s may finally happen. Although it is not all clear exactly what the video content will be—maybe not just TV—but a host of multimedia information services.

What is clear is that there are an increasing number of communications alternatives—voice, data, and video—available now and more that are on the way. Consumers and commercial users will have a portfolio of choices available to them from several service providers but dominated by a few very large service providers operating in several related markets using a number of interconnected networks. One of the myriad challenges for public policy in a world of intermodal competition is to ensure that entry conditions permit alternative carriers to provide competitive alternatives in a single market. For example, if regulators do not permit broadband competitors wholesale access to the high-speed frequencies of incumbents' copper networks (line-sharing), competitive DSL and VoIP packages could be foreclosed from the wireline broadband and VoIP markets. A second challenge is that if the telecom universe is to be dominated by multimarket oligopoly there is reason to monitor product bundling. Although bundled prices may enhance competition among the largest suppliers, single product suppliers may be harmed and some consumer segments ill served as a result.

Appendix—Modeling Intermodal Competition

Our empirical measurements of competition were developed within a theoretical framework in which we assumed that two firms compete in each of three markets: local wireline, wireless, and broadband.⁹ In any given local market there is one dominant incumbent firm, the ILEC, which typically operates in the wireless and broadband markets as well.¹⁰ There may be several CLECs operating in the local wireline market, several of whom likely have ownership interests in the wireless or broadband markets also.¹¹ We abstract from the actual process

⁹The estimating equations are based on a theoretical model of Cournot duopoly in three markets with interdependent demands. Contact the authors or see Loomis-Swann (2005).

¹⁰All of the RBOCs have wireless interests and offer various broadband services to both consumers and enterprises.

¹¹Large CLECs such as Comcast, Time-Warner, and Cox have extensive broadband offerings in consumer and commercial markets. The two large long distance carriers, Sprint and AT&T, have broadband offerings in the

through which local markets are opened by representing competitive carriers as a single competitive firm that has entered into a market occupied by a single dominant firm. Specifically we model local wireline competition in a wider, multimarket Cournot model in order to account for the cross-market impacts on the local market as given by the reduced form equations below.

$$\begin{aligned} q_1 &= \alpha_1 - \beta_1 q_2 + \delta_1 W + \gamma_1 B + \phi_1 z \\ q_2 &= \alpha_2 - \beta_2 q_1 + \delta_2 W + \gamma_2 B + \phi_2 z \end{aligned}$$

where q , output, is measured as switched lines in service for competitors 1 (ILEC) and 2 (CLEC) respectively in the wireline market, W represents total wireless sales (subscribers), B represents total broadband sales (lines), and z is a vector of variables related to relevant market size or economic conditions. The coefficient β_1 measures the impact of a competitor's output on the other firm's sales in a given market. For example, β_1 measures how many lines the incumbent (firm 1) will lose in the wireline market as the CLEC (firm 2) expands its sales of lines. This is the slope of the reaction curve for the ILEC in the wireline market. Similarly, δ_1 and γ_1 measure how many of the ILEC's lines in service will be reduced as total sales of wireless and broadband service expand respectively.

The same interpretations apply to the second equation for the CLEC, firm 2 but by virtue of differentiation, we expect that β_1 and β_2 will differ for several reasons. In the standard Cournot framework, duopolists are seen to set output plans while regarding competitor's output as fixed, and then let prices adjust accordingly. In our telecommunications world, the dominant firm is not completely free to price as it would like because it is under some regulatory constraint, either rate-of-return regulation or price caps. More importantly, regulation in this market allows the competitor to lease network access at regulated, wholesale (UNE) prices from the incumbent, which can also distort the price response of the competitor. These characteristics put some restriction on our estimation unlike the standard model of two equally responsive duopolists.

Essentially, we empirically estimate these Cournot reaction curves for ILECs and CLECs respectively in the wireline market and allow for market differentiation between the two. These relationships indicate the impact of one competitor's expansion of market share on the market share and profit of the other firm. Each of these reaction curves is negatively sloped suggesting the zero sum

local market and wireless interests. Both have announced their likely exit from the local telephone market and AT&T wireless will likely become part of Cingular Wireless.

TABLE 4

FIXED EFFECTS					
STATE *	ILEC	CLEC	STATE *	ILEC	CLEC
Alabama	29431593	7440154	Montana	86121425	19695989
Arizona	70528528	18958404	Nebraska	47010757	12916931
Arkansas	32788686	7435026	Nevada	75834455	17638199
California	117000000	28965737	New Hampshire	6140864	1767314
Colorado	73811741	21749586	New Jersey	6238205	1510716
Connecticut	3739098	948674	New Mexico	64703196	14681230
Delaware	1433402	345419	New York	33145270	12691277
District of Columbia	108353	33084	North Carolina	32191838	8041106
Florida	40746150	10733715	North Dakota	36502685	8735866
Georgia	37840439	10621794	Ohio	27146626	6547368
Idaho	46981985	10666135	Oklahoma	37184690	10378232
Illinois	39052139	12278445	Oregon	62318986	15215454
Indiana	22549360	5883832	Pennsylvania	32144033	9972239
Iowa	30194634	8887774	Rhode Island	643895	180638
Kansas	50601528	15595464	South Carolina	18070692	4300947
Kentucky	21694614	5315557	South Dakota	34911023	8311540
Louisiana	26601347	7061100	Tennessee	26499936	6875510
Maine	19915181	4664350	Texas	166000000	52024710
Maryland	7229887	1756067	Utah	46457618	13524012
Massachusetts	5957211	1707281	Vermont	6232694	1377208
Michigan	38909677	11197373	Virginia	25969859	7340743
Minnesota	52923426	15829009	Washington	46373628	11918769
Mississippi	22690250	5788758	Wisconsin	35142240	10431025
Missouri	45671133	11869020	Wyoming	51122383	11592139

* Excludes Alaska and Hawaii
Source: Federal Communications Commission (FCC)

nature of the competitive actions. But, because each competes in wireless and broadband markets, the wireline reaction curve necessarily includes the feedback from competitive effects in other markets.

Expansion of a competitor's share of wireless or broadband will therefore have a negative effect on wireline firms' profits and can be represented graphically by an inward shift of the reaction curve. Figure 3 represents the impact of wireless growth and the substitution of mobile wireless for wireline access on both ILEC and CLEC market shares. The degree of the shift, or impact, for each depends on the degree of substitution.

In estimation of pooled cross-section and time-series data, the "constant" term varies across states. These state-specific effects are shown in Table 4 for ILEC and CLEC equations respectively. The estimation excludes Alaska and Hawaii because of data limitations. All of these constant terms are positive, as expected, and those for the

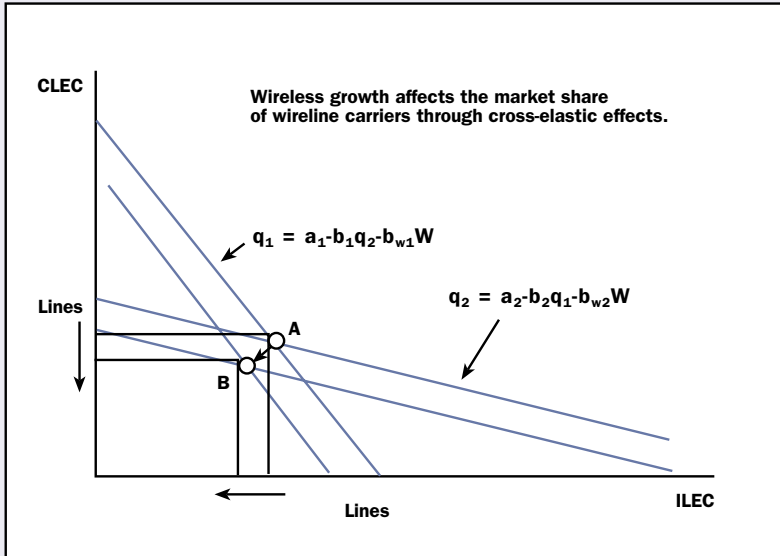
ILEC are greater than those in the CLEC market, which indicate the dominant shares of ILECs in the local line market across states. Each of these fixed effects terms picks up the economic and regulatory variation within the state that is not captured by the explanatory variables. For example, income per capita differences across states are subsumed in the fixed-effects terms as are general economic conditions. We also expect that variation across states towards specific regulatory conditions, such as variations in retail-wholesale margins or whether or not a Section 271 approval has been given, would also be realized in these constant terms. ■

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FIGURE 3

CROSS-MARKET EFFECTS ON COMPETITORS



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