Forthcoming 2000
3/29/99

Competition in U.S. Telecommunications Services Four Years After the 1996 Act

Robert W. Crandall
The Brookings Institution

Jerry Hausman
Massachusetts Institute of Technology

For more than fifty years, the U.S. telecommunications sector was a regulated private monopoly, dominated by AT&T. During most of this period, the Federal Communications Commission (FCC) and a variety of state authorities controlled the relative prices of telephone service and restricted entry. In the 1970s, the first breath of liberalization swept over the sector as the FCC began to allow limited competition in the market for interstate dedicated business connections. This competition spread eventually to all long-distance services -- against the FCC's wishes.[1] At the same time, the FCC won a battle with state regulators to open the market for terminal equipment -- telephone handsets, answering machines, modems, etc. -- to competition.[2]

[1] The FCC attempted to block MCI's entry when MCI launched its "Execunet" business long-distance service without FCC permission. MCI successfully fended off the FCC in court [MCI Telecommunications Corp. v FCC, 561 F.2d 365 (DC Cir. 1977), cert. Denied, 434 U.S. 1040 (1978)] and MCI Telecommunications Corp. v. FCC, 580 F.2d 590 (D.C. Cir. 1978), *cert. Denied*, 439 U.S. 980 (1978). The FCC was left to scramble for a policy that would alllow MCI and other competitive carriers to interconnect with AT&T's local companies.

[2] The states challenged the FCC's right to invalidate state tariffs that required the use of telephone-company supplied terminal equipment. [N. Carolina Utility Commission v FCC, 552 F.2d 1036 (4th Cir. 1977)] Presumably, the state regulators saw competition in terminal equipment as a threat to their attempt to maintain high rates for company-provided business equipment in return for low local residential rates.

A lengthy antitrust case developed out of AT&T's use of its local facilities to frustrate competition in long-distance services and terminal equipment, resulting in the breakup of AT&T in 1984 and a twelve year quarantine that prevented the divorced local Bell Operating Companies from offering long-distance services. After 1984, rivalry in long-distance services grew steadily, and the terminal-equipment market became robustly competitive. However, competition in local telecommunications grew very slowly, because state regulators limited entry and controlled local rates, and long-distance rates remained substantially above their competitive levels. For twelve years, the AT&T trial court wrestled with a large number of difficult issues in implementing the decree, and the Regional Bell companies chafed at their continued exclusion from long distance services. The long-distance carriers were equally concerned about the slow progress towards competition in local markets, a problem beyond the reach of the AT&T decree. As a result, the Congress was finally prodded to reform the entire telecommunications regulatory structure through the passage of the 1996 Telecommunications Act. This legislation opens local telecommunications markets to competition, seeks to complete the earlier market-opening process in long-distance services (including freeing the Bell Operating Companies from their quarantine), and creates an economic environment that will lead to the "deployment of advanced telecommunications and information technologies and services to all Americans."[3]

The 1996 Act invites regulators to "forbear" from regulation of new services whenever such

[3] Preamble to Conference Report.

forbearance is in the "public interest," but unlike earlier exercises in deregulating network industries, the Act provides a massive increase in the scope of regulation and an unfortunate u-turn from the FCC's decision to substitute price-cap regulation for cost-based regulation.[4] The Act requires regulators to establish cost-based wholesale prices of incumbents' facilities so that entrants may be relieved of the burden of building their own facilities. Moreover, the Act not only retains a system of regulatory cross-subsidies erected by the states and the FCC over several decades, popularly described as "universal service" policies, but it also extends them to new services and to new recipients. Furthermore, the Act requires that the federal portion of these subsidies are to be funded by an explicit charge or tax levied on telecom company service revenues.

In this paper we examine the effects of the 1996 Act on competition, telecom rates, and economic welfare four years after its passage, focusing in particular on the regulatory micro-management of competition that the Act has unleashed. We show that despite the early legal and regulatory uncertainties that have plagued the implementation of the Act, local competition has begun, albeit slowly. A simpler framework, under which local competition might have developed even more quickly and the restrictions on Bell Company entry into long-distance services might have been lifted sooner, would have promoted competition without risking deleterious effects on the investment in new

[4] The Commission had instituted price-cap regulation – a regulatory regime that limits the rate of annual price increases for various groups or "baskets" of services – in order to divorce rate increases from cost increases. This change was instituted to simplify the regulatory process and to provide greater incentives for carrier efficiency since reductions in a carrier's costs would not require a reduction in regulated rates. Favorable effects on technological progress and innovations were also an expected result of the shift to price caps.

services by incumbent local carriers. The enormous welfare gains that are potentially available from the development of these new services and from the movement of the prices of traditional telecommunications services to competitive levels are being squandered in the belief that detailed regulation is the best route to competition. A much less regulatory regime, stressing open entry and a much simpler regime of reciprocal compensation for interconnection would have been far more effective in promoting entry and investment.

Current Market Structure and the Need for Further Liberalization

The U.S. was once the leader in opening its interstate telecommunications markets to competition. The FCC allowed limited entry into long distance services in 1969-71 although entrants were only allowed to offer dedicated, private lines to business customers. In the mid 1970s, MCI audaciously entered ordinary, switched long distance markets without FCC permission and fended off the FCC 's attempts to block its entry in federal courts.[5] The states regulate intrastate services, including the regular flat-rate local service that most residences and small businesses use to connect to the network. For the most part, until 1996, state regulators discouraged or blocked entry into these local services and even into intrastate long distance so as to maintain a politically-crafted pricing policy of subsidizing residential local service from long-distance and business service charges.

The AT&T case. The antitrust case filed by the Justice Department against AT&T in 1974 was

largely the result of disputes that arose over entrants' attempts to interconnect with AT&T's local companies to complete their calls or to attach their terminal equipment – handsets, answering machines, key telephones, etc. Had the FCC pursued a deliberate policy of allowing entry and requiring equal access to all competitors, these disputes might have been avoided and the antitrust action rendered unnecessary[6]

The AT&T litigation resulted in a settlement in 1982 that required AT&T to divest its local operating companies into seven separate Regional Bell Operating Companies (RBOCs). The RBOCs were barred by the resulting decree from offering long distance service outside their local areas, from manufacturing equipment, and from offering information services. The information-services ban was overturned by an appellate court in 1991, but the other restrictions remained in place until 1996. The decree required the divested local Bell companies to reconfigure their network switching systems so as to interconnect all long-distance carriers on equal terms. The result was a substantial acceleration in the rate of expansion of the long-distance entrants and a corresponding decline in AT&T's share of long-distance revenues.

Long-distance competition. Despite the apparent success of the AT&T decree in stimulating long-distance competition, the long-distance sector remained quite concentrated into the mid 1990s. The Hirschman-Herfindahl Index of concentration, based on carrier revenues, was has declined steadily

---

[5] See fn. 1, above.

[6] Canada pursued just such a policy in 1992-93 and has not experienced the problems that triggered the

from more than 8000 in 1984 to 2640 in 1998, but it is still far above the Department of Justice's Merger Guidelines standard of 1800 for a highly-concentrated industry.[7] Long distance rates have fallen substantially since the AT&T divestiture, but a large part of the decline reflects lower costs, particularly the decline in the regulated charges paid to local companies to connect their calls. In 1998, residential customers were still paying an average of 15.8 cents per minute for interstate long-distance service even though the long-run incremental cost of the service plus local carrier access charges were no more than 6 cents per minute.[8] In short, further entry and more vigorous competition is still needed to move rates to competitive levels, but the most likely entrants – the Bell operating companies – have been barred from entering by the AT&T decree and the enforcement of the 1996 Act.

Local competition. While the long-distance markets had at least a moderate degree of competition by 1996, competition in the local-services market had only just begun. Entry into local telecommunications had been allowed in a limited range of services, generally to connect large businesses to (interstate) long-distance carriers, including long-distance companies. As late as early 1996, only six states allowed entrants to serve the dispersed residential and small business subscribers. By limiting entry, state regulators were able to erect a rate structure for local connections that favored residential subscribers, particularly those in rural areas or the outskirts of urban areas. Business lines,

---

AT&T monopolization case.

[7] Based on data published annually in FCC, Statistics of Commmunications Common Carriers.

[8] The average price per minute is from PNR's large national household sample of telephone bills. In 1996, the average interstate access charges per conversation minute paid by long-distance carriers to originate and terminate their calls were slightly less than 4 cents per minute (FCC, Telephone Trends, September 1999, Table 1.2) and transmission and switching costs were no more than 2 cents per minute (Robert W. Crandall and Leonard Waverman, Affidavit submitted in support of Application of Ameritech Michigan for Provision of In-Region, InterLATA Services in Michigan, 1998.)

intrastate long-distance, interstate access (for long-distance carriers), and advanced services have been generally priced substantially above long-run incremental cost so that residential lines can be priced below long-run incremental cost, particularly in rural areas.

Static welfare losses. The regulated intrastate prices result in very large static economic welfare losses. In Figure 1, we show the average 1996 U.S. flat residential rate and two alternative estimates of local exchange carrier long-run (average) incremental costs (AIC),[9] each arrayed by density of lines. The "BCPM" estimate is taken from a local-carrier model proffered to the FCC; the "HCPM" estimate is derived from the FCC's own forward-looking cost model.[10] Clearly rates depart substantially from estimated average incremental cost, regardless of the model used to estimate costs. In most states, rates rise with increasing density, but the cost per line obviously declines. The resulting deficit -- $5.5 billion to $16.2 billion per year -- is recovered in large part from (above-cost) long-distance charges.[11] Were residential rates moved to the estimated AIC per line and long-distance charges reduced by the amount of revenues raised, there would be an improvement in annual economic welfare of $2.5 billion to $7.0 billion per year.[12] These losses are only from the distortions in residential rates. The static welfare losses from regulated business rates may even be higher.[13] Businesses account for approximately 60 percent of

---

9 These cost models estimate the average incremental cost of providing local service in a given area, not the long-run incremental cost of adding a line in any given area.

[10] We critique this model later in the paper. For the present, we simply use it to provide a lower bound on local-exchange service costs.

[11] Estimate based on state-by-state modeling of rates and costs by Robert W. Crandall and Leonard Waverman, Who Pays for Universal Service? When Subsidies Become Transparent. Brookings, 2000.

[12] Id. The potential welfare gains from full Ramsey pricing would obviously be greater.

[13] John Wenders and Bruce Egan estimated the total welfare loss from overpricing long-distance service to business and residential customers in 1983 at $10.7 billion per year. (John T. Wenders and Bruce L. Egan, "The Implications of Economic Efficiency for U.S. Telecommunications Policy," Telecommunications Policy, March 1986, pp. 33-40. Lewis Perl obtained very similar results in "Social Welfare and Distributional Consequences of Cost-Based Telephone Pricing," Paper presented at the Thirteenth Annual Telecommunications Policy Research Conference, April 23, 1985, for his low-cost, high demand elasticity calculation. Since that time, the average interstate long-

all long-distance calling and are faced with regulated prices of advanced services that are generally substantially above cost.[14]

Any estimates of the static welfare losses from mis-priced telecommunications services in a regulated environment are likely to be a substantial underestimate of the costs of regulation in this sector. Given decades of regulation, it is likely that estimates of network costs are overstated because regulation, rather than competition, has driven observed network costs.[15] In addition, regulation provides barriers to the introduction of new services. The welfare losses that result from regulatory delays in the introduction of new technologies and services are likely to be even greater than the static welfare losses from mis-pricing existing services given the rapid pace of technical change in telecommunications.

Welfare losses from delaying new services. The electronics revolution has generated enormous opportunities for the development of new telecom services. Unfortunately, these services must run a regulatory gauntlet before commercial introduction due to regulators' desire to protect existing service providers or certain consumers from the effects of competition and the loss of "universal service" subsidies for traditional services. Cellular telephony, voice mail, video service delivery over telephone

---

distance rate has fallen from 40 cents per minute to 11 cents per minute (1998 dollars), while the cost of long-distance service has fallen from about 13 cents per minute to about 3 cents per minute (1998 dollars)and the demand for long-distance service has expanded substantially. As a result, despite the decline in rates, the total annual welfare loss from current long-distance prices has actually increased from its 1983-85 level.

[14] It is generally believed that the high prices for high-speed business services have attenuated the incentives for local companies to offer high-speed digital subscriber line (DSL) services for Internet connections. These DSL services must be priced to compete with cable modems, and at these prices may substitute for the much higher-priced DS1 services that many businesses use today.

15 See Clifford Winston, "U.S. Industry Adjustment to Deregulation," Journal of Economic Perspectives, Summer 1998, pp. 89-110.

networks, and new satellite services have been delayed and (in the case of telephone-company delivery of video) even thwarted altogether by state and federal regulators. Cellular telephony could have been licensed by the FCC in the early 1970s, but the first system did not begin operation until 1983 because of the FCC's delay in licensing the requisite frequencies. This delay in licensing cellular has been estimated by Hausman to have cost consumers $33.5 billion (1994 $) per year.[16] Using a similar methodology, Hausman estimates that regulatory delay in allowing AT&T or its RBOC progeny to offer voice messaging services between 1981 and 1988 was $1.3 billion per year in 1994 dollars. There are no estimates of the cost of regulatory delays in offering direct broadcast satellite services, telephone-company video services, or new broadband services over local telephone company lines, but they are likely to have been substantial.

Toward increasing competition. Increased competition in telecom services could deliver huge static and dynamic welfare gains to American consumers. But such competition in local access services has been viewed as unattainable in a network industry such as telecommunications, with its attendant economies of scope and scale as well as its significant required investment in sunk costs. However, there has been no market test of this proposition because local competition has been blocked by state regulators until very recently. Despite the capital requirements for successful entry in local (wire-based) networks, entry is now occurring. Moreover, long distance services are currently offered by several national carriers despite the very large economies of scale in delivering data and voice through fiber-optics networks. While further competition in long-distance is surely desirable, long distance is not a

[16] Jerry Hausman, "Valuation and the Effect of Regulation on New Services in Telecommunications,"

natural or unnatural monopoly today.

Similarly, several large national firms are rushing to complete competitive terrestrial wireless networks in the wake of 1993 legislation that instructed the FCC to auction off substantial electromagnetic spectrum for such use. These wireless companies are spending $12 billion per year in building competing networks throughout the country now that the FCC no longer limits the number of competitors to two per market.[17] Significantly, this investment is occurring in a market in which prices are totally deregulated.[18]

The 1996 Telecommunications Act

The U.S. telecommunications sector operated for twelve years with the balkanized structure required by the AT&T decree. Widespread dissatisfaction with the lack of progress towards competition and the disputes that arose from enforcing the decree led Congress to pass the 1996 Telecommunications Act, which was signed into law in February 1996. The objective of this legislation is to open all telecommunications markets to competition, but the Act is far from an example of deregulation. Indeed, the Act erects a variety of new regulatory requirements that are supposed to guide, facilitate, or otherwise stimulate competition. The most important of these provisions involves the

---

Brookings Papers on Economic Activity: Microeconomics, 1997.

17 Cellular Telecommunications Industry Association, semiannual reports.

18 The rates charged for interconnecting wireless calls with the traditional wire-based network are subject to the requirements of the new 1996 Act, but there is no retail price regulation. Nor is there any regulatory requirement for selling services at regulated wholesale rates to other carriers.

opening of existing "incumbent" local exchange companies' (ILECs') networks to rivals so that the entrants can interconnect with them in any of a variety of ways. The incumbent companies are required to unbundle their networks into a set of components or functions and to offer them to their prospective rivals at cost-based prices.[19] In addition, entrants are to be afforded the opportunity to resell the incumbents' retail services by obtaining these services from the incumbents at their retail prices less the avoided cost of retailing the service. Finally, incumbents must exchange local traffic with entrants on equal terms.[20] All of these "interconnection" terms are to be negotiated or, failing negotiation, are to be determined in arbitrations conducted under the auspices of state regulators.[21]

The Act's requirements for interconnection may be viewed as the "stick" over the incumbent local-exchange carriers' heads, requiring them to assist in opening their erstwhile monopoly markets to competition.[22] In addition, the Act provides a "carrot" for the Regional Bell local companies,[23] allowing them to enter the long-distance market -- from which they were banished by the 1984 AT&T antitrust

[19] The FCC approach to setting wholesale rates does not take account of the sunk and irreversible costs of investment in telecommunications networks. For a further discussion see J. Hausman, "Valuation and the Effect of Regulation on New Services in Telecommunications," Brookings Papers on Economic Activity: Microeconomics, 1997; "Regulation by TSLRIC: Economic Effects on Investment and Innovation," Multimedia Und Recht, 1999, and "The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds., Real Options: The New Investment Theory and its Implications for Telecommunications Economics, 1999.

[20] 1996 Telecommunications Act , 100 Stat. 56, Section 251.

[21] Section 252.

[22] This is somewhat overstated. The ILECs faced competition from urban fiber rings and wireless carriers before 1996, but they controlled virtually the entire market for local access and exchange services for residential and small-business subscribers.

[23] These are the local companies that were spun off from AT&T in 1984. The non-Bell local companies, such as Frontier, Sprint, or GTE are not barred from long-distance markets; hence, there is no "carrot" for them.

decree -- if they meet a detailed 14-point "checklist" of market-opening requirements. Few carrots have been harvested under this provision, however, for reasons we detail below.[24]

The 1996 Act provides much more than a prescription for regulated competition in telecommunications. It makes major changes in universal-service policy; mandates new subsidies for schools, libraries, and rural health facilities; substantially deregulates cable-television rates; liberalizes broadcast-ownership rules; and even regulates entry into the provision of alarm services. The universal-service policies are to be supported by fees (taxes) levied on all telecommunications services and are to be portable so that new entrants can receive the same payments as incumbents for offering services in areas where rates are below cost. In this paper, however, we focus only on the provisions directly related to opening markets traditional telecommunications services markets to competition.[25]

Unbundling and wholesale rates. Competitive telecommunications networks can only survive if they interconnect with one another. Otherwise, each subscriber would have to use separate terminal equipment for each of the competitive networks, an obvious inconvenience. No subscriber would want to have four or five separate telephone lines, handsets, and modems in his or her home or office.

[24] In the first four years under the new Act, the RBOCs have succeeded in obtaining approval to offer in-region long-distance service in only one state. Bell Atlantic received approval for offering service in New York in December 1999.

[25] For a discussion of the new subsidy programs and "universal service" policies, see Robert W. Crandall and Leonard Waverman, "Who Pays for Universal Service? When Telephone Subsidies Become Transparent," The Brookings Institution, draft, 1999.For a discussion of the increased taxation from these policies and the extremely large loss of economic efficiency and reduction in consumer welfare caused by the FCC's implementation of these policies see J. Hausman, "Taxation By Telecommunications Regulation," Tax Policy and the Economy, 12, 1998 and J. Hausman and H. Shelanski, "Economic Welfare and Telecommunications Welfare: The E-Rate Policy for Universal Service Subsidies," Yale Journal on Regulation, 1999.

However, interconnection can take a variety of forms.

The simplest form of interconnection is simply the exchange of traffic. Indeed, national and international carriers, Internet service providers, and adjacent local telephone carriers already exchange traffic at a variety of switching centers with apparent ease. The cost of such exchanges for voice-grade traffic is now measured in the tenths of a penny per minute although international exchanges often take place at prices of 50 cents or more per minute because of a lack of competition in the telecom sectors of many countries.[26]

The 1996 Act provides a prescription for interconnection that is very different from the simple exchange of traffic. Using somewhat vague language, the Act requires local telecommunications carriers to interconnect at "any technically feasible point" and to provide access to their "unbundled network elements"(UNEs) at just and reasonable prices that are "determined without reference to a rate-of-return or other rate-based proceeding." An unbundled network element is a network component or function that a competitor may lease in order to deliver its services. Indeed, under the FCC's rules, implemented in August 1996, a competitor could lease everything from its incumbent rival, thereby obviating the need to invest in any network facilities whatsoever.

The FCC further required that these elements be leased to entrants at "forward-looking" costs,

[26]These rates are falling dramatically with the onset of liberalization in many countries and the prodding of the Federal Communications Commission.

using an approach called "total element long run incremental cost" or TELRIC. Although these wholesale, carrier-to-carrier rates are to be part of the interconnection agreement negotiated between each entrant and each incumbent on a state-by-state basis, the rates are supposed to be guided by the FCC's forward-looking cost model or a similar model developed for each state.

These unbundling and wholesale-pricing requirements have generated enormous controversy, resulting in numerous court challenges and a recent Supreme Court decision reversing a part of the FCC's rules.[27] Specifically, the Court questioned the broad, sweeping requirement that every network element be provided to competitors.[28] However, the Supreme Court upheld the Commission's right to prescribe the cost standard for pricing these network elements, but the Court was not asked to address the question of how such costs could possibly be estimated by regulators. Therefore, the TELRIC basis for establishing wholesale prices remains. The FCC has recently relaxed the unbundling requirements only modestly while extending them in new directions, such as the requirement that incumbent companies actually share customer access lines with entrants rather than simply lease them.[29]

---

[27] AT&T Corp v. Iowa Utilities Board, 119 S.Ct. 721 (1999).

[28] For a consumer-welfare approach to unbundled elements, rather than the FCC's competitor welfare approach, see J. Hausman and G. Sidak, "A Consumer-Welfare Approach to Mandatory Unbundling of Telecommunications Networks", forthcoming Yale Law Journal, 1999.

[29] FCC, Third Report and Order and Fourth Further Notice of Proposed Rulemaking, CC Docket 96-98, September 15,1999.Specifically, the Commission removed operator and directory services from the list of unbundled elements, but it added "subloops" -- or the part of the loop from the fiber/copper wire interface in digital loop carrier systems. In addition, the FCC decided not to require unbundling of new equipment required for advanced broadband services, such as digital subscriber line access multiplexers and packet switches. As this paper is being written, the FCC is adopting new unbundling requirements that mandate not only the unbundling of the customer line or "loop", but the sharing of the line between competitors and entrants. This line-sharing would allow entrants to use the upper frequencies for higher-value services, leaving the lower frequencies to incumbents for traditional voice services.

Resale. In addition to unbundling, the 1996 Act requires local carriers to allow entrants to resell their services. Such resale simply transfers the marketing and billing functions from the existing local carrier to the new (reselling) entrant. The technical details of the service are unchanged; only the identity of the seller changes. Incumbent local carriers must offer all of their retail services to their competitors for resale, charging them their full retail price less a discount for the "avoided costs" of marketing and billing the service. These discounts have typically been established through negotiations and arbitrations in the range of 15 to 25 percent.[30]

The resale requirement has not been as controversial as the unbundling requirements because resale does not provide the entrant with as much freedom to offer a bundle of new services with the assistance of the incumbent's facilities. However, substantial debates have arisen over the avoided-cost discounts needed to make such resale profitable.[31]

Retail prices. The 1996 Act is noticeably silent on retail telecommunications prices, except for mandating that explicit rural subsidies be sufficient to keep local rates in high-cost, rural areas at levels comparable with urban rates. Incumbent carriers' intra-state services are still regulated by state commissions, and most of these commissions continue to administer a distorted rate structure. (Recall **Figure 1**) Intrastate long-distance rates and access charges as well as interstate access charges

[30] See **Table 4**, below.

[31] The FCC even forced SBC to increase its resale discounts as a condition for approving the recent SBC acquisition of Ameritech. The increased discounts were not based on the results of any economic analysis; instead they were a required payment to allow SBC to proceed with its acquisition.

continue to cover the deficit between local per-line costs and local rates. While the 1996 Act prescribes cost-based wholesale rates, it does not require the state commissions to move retail rates towards cost. Indeed, the Commission has increased the distortions between retail rates and costs by increasing access charges to fund the internet subsidies to schools and libraries.[32]

New services and forbearance from regulation. The 1996 Act has a provision (Section 706) that would permit a local carrier to escape regulation altogether if the FCC makes an affirmative decision to "forbear" from regulating an "advanced" telecommunications service .This provides the incumbent carrier with at least a theoretical possibility of building new, advanced facilities which may offer services without the burden of wholesale or retail regulation. Unfortunately, the FCC's only proposal for such forbearance requires that incumbents use structurally separate subsidiaries to deliver the unregulated, advanced service.[33]

Long-distance entry by the Bell companies. The Act explicitly frees the Bell Operating Companies from the restrictions on long-distance entry imposed by the 1984 AT&T consent decree, but only after they satisfy a detailed checklist of market-opening requirements spelled out in Section 271. In practice, this means that each company must pass through a series of three regulatory proceedings for each state -- one at the state level, one at the U.S. Department of Justice, and one at

---

[32] As expected, these increased access charges have been passed on to consumers by the long distance carriers.

[33] Advanced Services Order and NPRM, CC Docket Np. 98-147, March 31, 1999.

the FCC. The Section 271 requirements are generally labeled "interconnection" requirements, but they are in essence a large number of requirements for non-discriminatory access to services, facilities, and unbundled elements. As of this writing, only one Bell company – Bell Atlantic in New York -- has been able to satisfy the three regulators that it has achieved such non-discrimination along each of the Act's prescribed dimensions. For the most part, Section 271 approval has been stalled by entrants' complaints that the Bell companies have failed to install "operating and support" systems that would allow for instantaneous transfer of customers from the Bells to the entrants at a very high transfer rate.

A Critique of the 1996 Act

Having briefly detailed its essential elements, we now ask if the various provisions of the new Telecom Act reflect a sound approach to market liberalization, given the U.S. experience with deregulation in numerous other sectors. From the outset, we note that the Act represents a major step backward from the recent tendency of state regulators and the FCC to abandon cost-based regulation in favor of price caps.[34] Wholesale rates and universal-service subsidies are now to be determined by cost models. While the Act opens all telecom markets to competition, even the erstwhile protected local markets, it establishes a framework for entrant-incumbent cooperation in facilitating entry that has not been prescribed for any other of the recently deregulated sectors of the economy. The result has been four years of protracted regulatory disputes and litigation that show little sign of abating.

[34] The FCC shifted from cost-based regulation to price caps in 1989 (for AT&T) and 1990 (for the local carriers' interstate rates). California was among the first states to adopt price cap regulation for local carriers in 1989.

Unbundling.. The requirement that incumbents unbundle their networks and lease the pieces ("elements") to entrants is rooted in the fact that local telecommunications networks are expensive to build, and certain parts of them may be "essential facilities" or monopoly bottlenecks. But this provision was enacted without any guidance from historical experience. While it may be uneconomic for entrants to build parallel connections to subscribers' facilities, there is no empirical evidence on this matter, and there is certainly no reason to believe that all local network facilities are essential bottlenecks. Surely the FCC's first order, requiring the unbundling of everything was too sweeping, but it has not recanted despite considerable evidence that entrants can and do build their own facilities.[35] Hausman and Sidak have proposed an economic approach to determine which local network facilities are essential bottleneck facilities.[36] They note that competitors certainly can install their own switches, inter-office transport facilities and network intelligence.[37] Wireless and long-distance companies do so routinely; why should local (wireline) competitors be any different? Indeed, as we shall show, there has been very little demand for even those facilities that arguably can be defined as "essential facilities," namely, the copper wires extending from the incumbent's local switch to the subscriber.

A more troubling aspect of the unbundling requirements, however, is their imposition in a sector in which technology is changing extremely rapidly. Today's network is not static -- it is steadily evolving

[35] See the "UNE Fact Report" submitted by the U.S. Telephone Association in FCC CC Docket xxxx for data on the existence of competitive facilities throughout the country.

[36] Hausman and Sidak, "A Consumer Welfare Approach..."

[37] Indeed, mandatory unbundling in Canada extends only to the ILECs' "essential" facilities and excludes these non-essential elements that the FCC decreed must be shared. See *Local Competition* (1 May 1997), No. 97-8, ¶ 74 (C.R.T.C.).

into new, more advanced networks, such as those designed to deliver high-speed Internet services. If an incumbent local network operator leases part of its current network to its rivals, will it be able to adopt new technology without these rivals' (entrants') assent? Surely, one would not want these new competitors using the regulatory process simply to delay or frustrate their rivals' attempts to innovate. Furthermore, extensive unbundling at below-cost prices reduces the investment incentives for entrants and incumbents alike. Entrants are less likely to build their own facilities if their incumbent rivals' networks are available to them at even lower costs. Incumbents are less likely to invest in innovative services or facilities if their future returns are truncated by the prospect of having to lease such facilities to their rivals at below-cost prices. Given the uncertainty regarding technology, the current regulatory approach is likely to slow down the adoption of new technology in the wireline telephone network, in direct contradiction of the 1996 Act's stated purpose of encouraging "deployment of advanced telecommunications and information technologies and services to all Americans."

The history of transportation regulation is littered with examples of such stratagems employed by carriers to block rivals new, innovative services. Once a new local telecom entrant begins to offer service using its rival's local loops, switches, and network intelligence, it has every incentive to demand that these facilities not be altered. The incumbent's only recourse may be to develop new network facilities, separate from the existing network, and simply to allow the existing network to atrophy. Alternatively, the incumbent may choose not to invest at all.[38]

[38] J. Hausman, in "Valuation and the Effect of Regulation on New Services in Telecommunications," Brookings Papers on Economic Activity: Microeconomics, 1997, recounts how competitors to the BOCs delayed the introduction of a new network service, voice mail, for over 10 years. He estimates that the loss to consumers from the

Regulating wholesale rates. Cost-based regulation has been in disfavor for a number of reasons that we need not review here. Although not the primary problem, an important problem is the difficulty that regulators have in determining the costs of providing the regulated service efficiently. How can federal or state regulators possibly know if arbitrated rates reflect the forward- or even backward-looking cost of each network element provided by an incumbent local carrier? Regulators are generally the last to know the level of costs, particularly in a dynamic industry such as telecommunications with its abundance of joint and common costs. Indeed, the FCC has spent most of the past four years building a detailed engineering model of forward-looking costs of an "optimized", but probably outdated network to use in guiding its universal-service policy. But this model is extremely controversial and is not generally employed. As we shall see, the federal-state regulatory process has already generated wildly different rates for wholesale elements across the states.

The forward-looking approach to estimating costs, even if it could be executed with accuracy, does not take account of the sunk and irreversible costs of network investment and therefore leads to below-cost unbundled element rates as one of the authors, J. Hausman, has demonstrated in a number of papers. Instead, the FCC approach assumes, incorrectly, that all network investment costs are only fixed costs, not sunk costs, which is sharply at odds with economic reality. This approach gives a "free option" to the entrants and decreases the economic incentive of existing carriers to invest in network improvements because it truncates the economic returns to new investment at the cost of the investment.

---

delay exceeded one billion dollars per year.

In addition, the FCC's forward-looking cost approach (TELRIC) provides an economic disincentive for investment by even new entrants into local telephone competition because it provides them with a subsidized price for the use of unbundled elements.[39] The FCC's approach uses a "contestable" market model for regulation of unbundled elements, which assumes no sunk costs.[40] This approach does not recognize the interaction of sunk investments and the considerable technological and economic uncertainty that exists in telecommunications. The result is a set of prices for the unbundled elements that are "too low", i.e. below economically efficient levels, tilting the "rent" or "invest" decision of new entrants toward the rent decision, rather than the invest decision.

One way to consider the problem is to examine its effect on a new investment by an incumbent local exchange carrier. Suppose a competitor wants to lease the unbundled elements associated with this investment. The incumbent could offer the new competitor a contract for the economic life of the investment—say 10 years for investment in the local subscriber line or "loop". The price of the unbundled element would be the total investment cost plus the operating costs each year for the unbundled element. If demand did not materialize or if prices fell, the new entrant would bear the

[39] This discussion is based on J. Hausman, "Valuation and the Effect of Regulation on New Services in Telecommunications," Brookings Papers on Economic Activity: Microeconomics, 1997; "Regulation by TSLRIC: Economic Effects on Investment and Innovation," Multimedia Und Recht, 1999, and "The Effect of Sunk Costs in Telecommunication Regulation," in J. Alleman and E. Noam, eds., Real Options: The New Investment Theory and its Implications for Telecommunications Economics, 1999.

[40] One of the founders of the TSLRIC (which mutated into the TELRIC) approach has now recognized that significant costs ore omitted by this approach. See W. Baumol, "Option Value Analysis and Telephone Access Charges", in J. Alleman and E. Noam, eds., Real Options: The New Investment Theory and its Implications for Telecommunications Economics, 1999.

economic risk of this outcome.[41] However, setting wholesale rates at forward-looking cost typically allows the new entrant to lease the unbundled element on a month-by-month basis. Thus, if demand does not materialize or if prices fall, the incumbent has to bear the risk for the business case of the new competitor. Thus, the incumbent has been required by regulation to give a free option to the new entrant -- the right but not the obligation -- to purchase the use of the unbundled elements. The monthly price of the unbundled element should be significantly higher than the price of the element based on a ten-year life because the monthly price must reflect the risk inherent in the sunk investments, or equivalently the value of the option given to the new entrant.[42] Regulators to date have not incorporated the value of the option, which arises from the sunk cost nature of much telecommunication investment, into their price setting.

Hausman has estimated the value of the free option, which is equivalent to the subsidy given new entrants by regulators.[43] The subsidy derives from uncertainty, and the anticipated decrease in the prices of capital goods due to technological progress. The expected change in (real) prices of most telecommunications services is negative given these decreases in the price of capital goods. As a result, the required markup on the component of unbundled elements reflecting the sunk investments and uncertainty is calculated to be approximately 3.3. [44] The ratio of sunk costs to fixed and variable costs

---

[41] The contract (or regulation) could allow the new entrant to sell the use of the unbundled element to another firm if it decided to exit the business.

[42] In contracts between unregulated telecommunications companies, e.g. long distance carriers, and their customers, significant discounts are given for multi-year contracts.

[43] See J. Hausman, op. cit., fn 39, above.

[44] For a further explanation of the calculations and sensitivity analysis see J. Hausman, op. cit.

will cause the overall markup on forward-looking cost to vary, but the markup will be significant given the importance of sunk costs in most telecommunications investments.

As an example, Hausman has applied this methodology to transport facilities or "links" and to switching ports, two of the unbundled elements identified by FCC regulation. The proportion of total costs accounted for by sunk costs for the transport links is 0.59, so that the markup factor for the overall investment (using a markup factor of 3.3) is approximately 2.35 times forward-looking cost. By contrast, the proportion of sunk costs for ports is about 0.10 ; hence, the markup factor becomes 1.23 times forward-looking cost. The markup over forward-looking cost that takes account of sunk costs and uncertainty is the value of the free option that regulators force incumbent providers to grant to new entrants; e.g. 1.35 times forward-looking cost for links and 0.23 times forward-looking cost for ports.

New services. The 1996 Act allows the FCC to forbear from regulation of advanced telecommunications services if such forbearance advances the "deployment on a reasonable and timely basis" of these services. However, the FCC's approach to this problem is entangled with the controversies surrounding network unbundling and restrictions on Bell-company provision of long-distance (interLATA) services. To date, the FCC has agreed to forbear from regulating advanced services provided by the local carriers, but only if these carriers provide such services through separate subsidiaries. In addition, it has relaxed the long-distance restrictions on Bell companies only in those cases where such restrictions are demonstrably impeding the delivery of advanced services to rural areas. Thus, Bell companies cannot build advanced networks that cross LATA boundaries. In addition,

the FCC recently ruled that local carriers must share their access lines with competitive carriers wishing to offer only advanced, high-speed services. The result is a set of polices that continues to regulate incumbents' advanced services and the leasing of their facilities to entrants offering similar services, but leaves the entrants' services unregulated. These regulations, promulgated largely to accelerate entry, are likely to reduce the incentives for the incumbent local carriers to invest in new advanced data networks that would provide faster Internet access to "all Americans" as called for by the 1996 Act.

The Act as a political compromise. The intensely regulatory nature of the 1996 Act reflects the nature of the political compromise struck by the Congress, not the considered judgment of lawmakers reflecting on the earlier successes of deregulation. The Bell companies wanted relief from the restrictions on long-distance entry imposed on them by the AT&T decree. The long-distance companies, obviously not eager to allow Bell entry into their market without some offsetting concessions, pressed Congress to facilitate their entry into the provision of local services. The compromise that was struck released the Bell companies from the long-distance quarantine, but only after they succumb to extremely onerous new regulatory conditions for the benefit of new entrants. Apparently, no one paused to ask if this new regulatory superstructure could possibly work in light of the previous history of regulation and deregulation, nor if such regulation could adapt to changing technology and the need to provide investment incentives to diffuse this technology.

The 1996 Act After Four Years

Local competition. The principal measure of success for the 1996 Act must be the degree to which it opens local telecommunications markets to competition. A modicum of local telecom competition has existed in the United States for more than a decade. New carriers built high-capacity fiber-optic ring networks in most major business districts in the United States long before 1996. These companies, known as Competitive Access Providers (CAPs), generally marketed only to mid-size and large businesses because of state regulation, which kept residential rates generally below cost and generally discouraged entry.[45] After the passage of the 1996 Act, a large number of other new local competitors emerged, building some facilities but relying heavily on resale of the incumbent local carriers' services. These new competitors are now known as Competitive Local Exchange Carriers (CLECs).

By the middle of 1999, the competitive local carriers -- CAPs and CLECs -- had garnered about 3.4 percent of the country's local telephone access lines.[46] (See **Table 1**) New entrants, such as e.spire, McLeod, RCN, WinStar, and Electric Lightwave have been expanding rapidly and now account for an estimated 2.3 percent of the country's access lines. In addition, the older

CAPs, such as Teleport and MFS, continue to expand. These CAPs, the largest of which have been acquired by MCI/WorldCom and AT&T, and the long-distance companies account for another 1.1

[45] For an analysis of this competitive entry see J. Hausman, "Proliferation of Networks in Telecommunications," ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation, University of Michigan Press, 1996.

[46] Merrill Lynch (1999).

percent of the country's access lines. Thus, slightly more than three years after the passage of the 1996 Act, the competitors had succeeded in capturing about 3.4 percent of the nation's access lines.

In the growing economy of the 1990s, this loss of lines to competitors is not even noticeable. The large Bell companies' access-line growth is indistinguishable from the national growth rate. The incumbents have not yet suffered large losses of customers. However, because the competitors have generally targeted business customers, their share of local telecom revenues is much greater than their share of lines. Merrill Lynch estimates that the competitors' share of local revenues grew from 2.7 percent in the fourth quarter of 1987 to 4.9 percent at the end of 1998 and to 6.3 percent in the first quarter of 1999.[47] In certain large cities, such as New York City, the competitors' shares are much larger, with some estimates exceeding 35 percent for medium and large business customers. FCC data, on the other hand, show that local competitors (CAPs, CLECs, and others) accounted for only 2.2 percent of total local company revenues in 1997 and 3.5 percent in 1998.[48]

Indeed, many of the new competitors bypass the residential subscriber completely because residential customers are so geographically dispersed and often are purchasing their local service from the regulated incumbent carriers at rates that state regulators have held below cost. As we have seen, business rates are generally set much higher by state regulators in order to generate the revenues to

[47] Id.

[48] FCC, Industry Analysis Division, Common Carrier Bureau, Trends in Telephone Service, September 1999, p. 9-6.These data are obtained directly from local carriers who are required to file periodic reports on their revenues to the FCC.

subsidize residential connections. Moreover, businesses are likely to be much more concentrated geographically, making them attractive targets for the new competitors. regulators have held below cost.

Nevertheless, recent data from FCC surveys of the incumbent local carriers show that a surprising 40 percent of all resold lines are residential lines.[49] One would not have expected residential resale to be particularly attractive given that the monthly gross margin on such service is only about $4 per line ($20 times 20% resale discount).[50] This anomaly cannot be due to business-residential arbitrage since the service must remain with the residential subscriber. It is possible that the ILECs have mis-classified some of the lines, but this cannot explain the 1.2 million lines classified as residential resale. One possibility is that resellers are offering standard voice service to poor credit risks, who are repeatedly disconnected by the regulated incumbent carriers for non-payment of bills, and the new, higher-valued high-speed (DSL) services to more credit-worthy subscribers. Because of regulation, the incumbents' rates often must be the same to all subscribers regardless of their credit histories. The new entrants are not constrained by retail price regulation; hence, their rates may reflect the credit histories of their subscribers. In addition, the new entrants may be capitalizing on the fact that the incumbent local companies have been slow to roll out new services, partly because of concern over regulatory requirements.[51]

---

[49] FCC, Local Competition, Industry Analysis Division, Common Carrier Bureau, August 1999, Table 3.2.

[50] Resale is more attractive than building one's own capacity in many residential areas because the service is obtained from the incumbent at a discount from residential rate that is already below cost. However, even at the 18-22 percent avoided-cost discount, it would appear that resale of residential services is not likely to be a lucrative business strategy.

[51] Some of this uncertainty has been dispelled by the FCC's recent decision not to require unbundling of

Since 1996, local competition has taken one of three forms: resale, use of unbundled elements, or facilities-based competition. According to the FCC survey, the established local carriers had provided competitors with 3.6 million lines for resale by mid 1999.[52] In addition, the incumbents had leased 685,000 loops to their competitors, but the use of unbundled loops was increasing rapidly.[53] Given that the competitors had an estimated 6.2 million lines in service by the end of 1998, we may thus estimate that about 1.9 million of these competitive lines -- or about 1.1 percent of total U.S. lines -- represented competition offered solely over an entrant's own facilities, surely a paltry result more than three years after the opening of the market to competitive entry, particularly given the fact that the CAPs had already attracted a substantial share of these lines before the passage of the 1996 Act.[54] However, as we shall show below, their enormous market capitalization suggests that the capital markets expect them to expand substantially in the next few years.

The slow take-up of unbundled loops is perhaps surprising given the low wholesale rates established for these unbundled elements in some states. As of June 1999, leased local loops constituted less than 1 percent of switched access lines in every state except Nevada, New York, and Tennessee.

ILEC packet switches or DSLAMs.

[52] Federal Communications Commission, Industry Analysis Division, Common Carrier Bureau, December 1999, Tables 3.2 and 3.4.

[53] Id., Tables 3.3 and 3.5

[54] This compares favorably with Merrill Lynch's estimate of 1.28 "on-net" (own-facilities) lines for the CLECs as of the third quarter of 1998.

(See **Appendix Table 1.**) Even in states where the incumbent reports a substantial share of resold lines, there is still little reliance on leased loops. Part of the reason for the disinterest in this wholesale market is undoubtedly that the entrants have been waiting for an even more attractive regulatory option -- the entire bundle of network facilities in a (reconstituted) package of unbundled network facilities at regulated prices that are well below the resale rate. The pursuit of this goal led to a protracted period of legal and regulatory disputes over the right of entrants to demand the entire "UNE platform", a dispute that continues. As part of its negotiations with the FCC to gain approval of the NYNEX merger, Bell Atlantic agreed to offer the entire wholesale platform in New York, and as a result the number of leased loops has risen from 49,000 loops at the end of 1998 to 138,000 in June 1999.[55] Even with the opportunity to lease the entire network at UNE rates, entrants had still only leased 1.2 percent of Bell Atlantic's 11.8 million New York loops by mid 1999.

The use of resale reflected in **Appendix Table 1** is somewhat misleading because it combines "total service resale," which is required by the 1996 Act, and the resale of Centrex services -- discount multi-line business services -- which antedates the Act. The latter type of resale apparently exists only in Ameritech and US WEST states, and is a convenient mechanism for obtaining access to ILEC switches at economical rates for offering bundled local and long-distance service. This explains the relatively large share of resold lines in Iowa, North Dakota, and South Dakota shown in the Table. One company, McLeod, accounts for the overwhelming share of the resold lines in these states, and US WEST has

[55] The FCC also required SBC to offer a UNE platform in its regions as a concession for the FCC approving SBC's acquisition of Ameritech in October 1999.

attempted to limit the growth of such Centrex resale by filing new tariffs in each of its states that would prohibit future Centrex resale.

Wholesale rates. The most contentious issues in the implementation of the 1996 Act have been the FCC's decision to assume jurisdiction for establishing the rules for wholesale service and its prescription of forward-looking (TELRIC) prices for unbundled elements. Much of the past three years has been devoted to regulatory and legal challenges to these decisions. The result has been a confusing array of state arbitrations of interconnection agreements that are still hotly contested. Indeed, there is often no agreement among the parties as to the current level of rates for unbundled elements or wholesale discounts across the states.

The data on wholesale rates shown in **Table 2** have been assembled from a variety of industry sources and are subject to considerable dispute, even after four years. These rates are for business lines, and the unbundled loop rate is for the most dense, urbanized market in the state if the unbundled rates vary by population density. We focus on these business rates in the dense markets because the urban business subscriber is the most important target for the new competitors. Despite the fact that rates are apparently subject to a most-favored-entrant or "pick-and-choose" option, reported rates often differ substantially across entrants. We therefore show the rate for the largest entrants because they are likely to be the most important sources of competition. Note the large variance in wholesale rates despite the fact that the technology employed by the incumbents does not differ much across states -- particularly in the largest urban areas. For example, the unbundled

loop rates range from less than $5 per month to more than $30.[56] That is, a new entrant can lease a line in downtown Chicago for less than $5 per month, but must pay more than $25 per month for a similar line in downtown Denver. Obviously no "cost model," however imprecise, guides these results.

Similarly, wholesale discounts, which are supposed to reflect the avoided costs of marketing and billing, range from 12 percent to 26 percent of the business rate. This wide range might be understandable if it were inversely correlated with retail rates since the required discount would be lower for states with high rates. However, the resale discount is directly correlated with retail rates, but the correlation is not statistically significant. Obviously, the wholesale rates that have resulted from this system of regulated negotiation do not reflect any systematic measure of cost, forward- or backward-looking.

The Supreme Court recently upheld the FCC's right to provide the ground rules for establishing wholesale prices under the 1996 Act. This result had been anticipated, and many states had adopted some form of the FCC's forward-looking TELRIC standard anyway. But **Table 2** shows that there is enormous variance in the actual wholesale rates that emerge from the state-by-state arbitration process. This result demonstrates the difficulty of using regulatory arbitrations to determine the wholesale prices

[56] The shares shown in Table 3 reflect the RBOCs' shares of total lines for the entire state, not just the dense, urban markets. Most states have a single UNE rate for loops across the state;

for using the incumbents' network facilities. The resulting prices are the outcome of a political process wrapped in the guise of efficient regulation.

Retail rates. Had competition developed very rapidly, the distorted local rate structure evolved under state regulation would have come under substantial stress. But local competition has been slow to develop – as we have seen – and as a result there has been little or no movement in local retail rates since the passage of the Act. (See **Table 3)**[57] In virtually every state, local rates have not changed perceptibly despite the fact that they do not reflect the incremental cost of service and therefore could not survive in a competitive marketplace. Thus, one of the potential sources of large economic benefits -- rate rebalancing -- has been squandered for the first four years of implementing the 1996 Act.

Local Competition and the Cost of Entry

One of the major reasons for the slow pace of local entry and the limited use of leased loops is that the construction of local telecommunications networks requires substantial time and very large

[57] In earlier exercises of "deregulation," there was often substantial volatility and a sharp decline in prices charged by the erstwhile regulated carriers.(See Clifford Winston, " U.S. Industry Adjustment to Deregulation," Journal of Economic Perspectives, Volume 12, Summer 1998, pp. 89-110. Because competition has developed slowly in local telecommunications and retail rates remain regulated, this volatility has not yet emerged in U.S. telecommunications.

capital resources. Much of the investment is sunk costs which causes uncertainty about the future to have a significant effect on investment incentives.[58] Furthermore, the FCC has determined that the wholesale prices of network elements should be set below the true economic cost, surely reducing the incentive for entrants to invest in their own networks, directly contrary to the goals of the 1996 Telecommunications Act. **Figure 2** shows the market capitalization of all listed incumbent local companies (ILECs), long-distance carriers, and new entrants (CLECs). Note that the market cap of the 28 listed new entrants in Figure 2, already more than $160 billion, is five times that of the airline industry.

Most of these entrants are only beginning to build their local networks, and most are concentrating on only a few states for this initial effort. Yet, despite this slow progress and geographical concentration, they are already a very large presence in capital markets. Entry can easily require $1,000 or more per home passed for fiber-optics systems, including start-up losses. Since technology is changing very rapidly and a large share of this investment may be truly sunk, build-out plans must be cautiously conceived. Nevertheless, the current capitalization of the new entrants suggests that investors expect them to serve a substantial number of subscribers. If the present value of the cash flows from the average ultimate subscriber is $3,000, for example, CLECs already reflect the market's expectation that they will eventually serve more than 50 million homes.

58 See e.g. Dixit, A. and R. Pindyck, Investment Under Uncertainty, Princeton Univ. Press, Princeton, NJ, 1994 for a further discussion of the effect of uncertainty and sunk costs on investment incentives.

The size of many of these new local entrants and their ability to raise capital – all but a few have a market capitalization of $1 billion or more -- calls into question a regulatory strategy based on the need to subsidize entrants' access to incumbents' facilities. Had the regulatory climate not sown confusion, discord, and innumerable court challenges, capital formation by new entrants might have been even greater than that revealed in Figure 2. Equally important, in the absence of the ability to rely on resale and the leasing of network facilities at below-cost rates from incumbents, the new entrants would undoubtedly have moved more quickly to build their own networks, mobilizing even more capital and converting it into modern network facilities.

Long-Distance Competition

Until 1984, long-distance competition in the U.S. was hampered by continuing disputes between AT&T and the new entrants. The AT&T divestiture ended these disputes, and the AT&T decree's equal-access provisions placed entrants and incumbents on an equal footing with regard to access (interconnection) conditions and charges. In essence, the AT&T decree provided long-distance entrants what the reciprocal compensation requirements of the 1996 Act provided for local entrants after 1996.

The result of the 1984 equal-access provisions on long-distance competition in the U.S. appears to have been dramatic. As **Table 4** shows, AT&T began to lose market share rapidly after

1984. Even though competition had begun in the mid 1970s,[59] AT&T still had more than 90 percent of long-distance carrier revenues a decade later. In the next ten years, however, its share fell from 90.1 percent to 55.2 percent. In the first three years after the divestiture, it lost approximately 12.8 percent of its market share (11.5 percent divided by .901) -- a far greater share loss than has occurred in the local markets in the first three years after the passage of the 1996 Act.

U.S. long-distance rates continue to fall in the face of increasing competition and declining access charges. The FCC estimates that the average revenue per domestic interstate minute of long-distance service fell from $0.15 in 1992 to $0.11 in 1998.[60] About $0.02 of this decline is attributable to declining access charges collected by the local carriers and universal-service charges imposed by the FCC. The remainder is a reflection of competition and increased productivity. Most of this decline appears to be concentrated in business rates, not residential rates. On average, residences paid about $0.175 in 1996 and 1997 and 15.8 cents in 1998.[61] Given that business calling accounts for much more than half of all long-distance calls, business rates have averaged about 8 cents per minute in 1998, still somewhat above the long-run incremental cost of service -- access charges plus $0.015 per

[59] Switched long-distance competition was never formally authorized by the FCC, but in 1974, MCI -- which had been authorized to provide dedicated, private-line service -- began to offer its business customers a switched service. Its right to do so was upheld in the courts after a lengthy battle.

[60] Jim Lande, Telecommunications Industry Revenue, 1998, Table 9.

[61] Data obtained from PNR.

minute -- or $0.057 per conversation minute.[62] Residential rates remain far above the long-run incremental cost of physically delivering the service, creating the need for further market entry, but entry from the most likely sources -- the Bell companies -- has been blocked by continued disputes over the Bell companies' compliance with the detailed regulatory "checklist" in the 1996 Act.

The foregone welfare gains from blocking Bell-company entry into long-distance services are considerable. For example, assume that such entry had lowered interstate residential long distance rates by 4 cents per minute in 1998 -- still leaving them substantially above business rates. Assuming that residence account for 40 percent of all domestic interstate minutes,[63] this reduction would have generated consumer gains of $6.1 billion, including a transfer from producers of $5.4 billion and a reduction in deadweight loss of $0.7 billion. Given that intrastate long-distance is about one-third of long-distance services, the consequent liberalization of intrastate long distance could have generated another $3 billion in consumer gains.[64]

The Wireless Sector -- Competition without Regulation

[62] Lande, op.cit., (for access charges). The cost per minute for long-distance services is from Crandall and Waverman (1998).

[63] Crandall and Waverman, "Who Pays...?" Ch. 6.Total interstate domestic minutes in 1998 were 336 billion, according to Jim Lande, Telecommunications Industry Revenue: 1998. Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission.

[64] The Act does not require full liberalization in intrastate, intraLATA markets until Section 271 approval is granted to the Bell companies.

Competition in U.S. commercial wireless services had been slow to develop until very recently. For more than a decade, the U.S. had but two wireless (cellular) providers in each market because of an FCC decision to allocate only two 25 MHz licenses to each market. In addition, unlike Europe or Canada, the U.S. licensed wireless services on a geographically-fragmented basis. In 1993, however, the Congress forced a major change in U.S. wireless policy by instructing the FCC to auction spectrum, in part to solve the U.S. government's budget deficit and essentially to deregulate cellular pricing.[65] These auctions began in December 1994 and have resulted in the assignment of 120 MHz of additional wireless spectrum for "personal communications services" (PCS) throughout the country. In addition, an entrepreneurial company -- Nextel -- has succeeded in transferring another 10 -15 MHz of spectrum from a dispatch-mode service to a commercial wireless service that competes with cellular and PCS service providers.

Wireless rates. The first of the new PCS services began in late 1995, based upon the first two 30 MHz blocks of spectrum that were auctioned between December 1994 and March 1995. Since that time, a large number of companies have begun building facilities. All but 28 of the Top 100 metropolitan markets in the U.S. now have at least five wireless competitors -- two cellular providers, two to four PCS services, and Nextel.[66] The effect of the resulting competition on wireless rates in the U.S. has been stunning. (See **Figure 3**.) Throughout the 1984-1995 period real, inflation-adjusted cellular rates had fallen at a rate of 3 to 4 percent per

[65] In 1993 about 1/2 of the states regulated cellular prices at either the wholesale or retail level.

[66] See Merrill Lynch (1999) for data on the number of carriers by market.

year.[67] Between 1995 and 1999, however, real cellular rates fell at a rate of 17 percent per year as PCS service providers offered service at prices per minute that were more than 50 percent lower than existing cellular rates. Surprisingly, the evidence shows that with open entry, only one new player is required to drive rates sharply lower (**Table 5)**. Subsequent entrants have no further statistically-significant effect on rates. Of course, this could be an ephemeral result -- the increase in the number of competitors from three to six or seven competitive, national players may still have a major effect on both rates and service quality.

[72] See J.Hausman, "Cellular Telephone, New Products and the CPI," Journal of Business and Economics Statistics, 1999.

The capital requirements for building these new PCS systems are considerable. The PCS providers have been spending between $1.5 billion and $2.2 billion per year on their infrastructure. The established cellular companies have been spending even more, upwards of $3 billion per year, to convert their infrastructure from analog to digital. And both have been spending heavily to subsidize a portion of the annual $6 billion investment in consumer handsets.[68] All told, wireless companies have been spending more than $12 billion per year over the past three years.[69] Were this investment directed to wireline services, it could have resulted in providing facilities for serving perhaps 30 million subscribers --far more than the CLECs and CAPs currently serve. Competition in a very capital-intensive sector -- the wireless sector -- followed immediately upon the liberalization of entry conditions. Subscriber rates fell dramatically, and they continue to fall as the new PCS companies fill out their networks.

The only new regulation imposed on the wireless industry by the 1996 Telecommunications Act was the imposition of "reciprocal compensation" on wireless-wireline interconnection. Prior to 1996, these rates for exchanging traffic were often in excess of 2 cents per minute; today, they are in the 0.5 to 0.7 cents per minute range because wireless companies are

[68] Dennis H. Leibowitz, et.al., The Wireless Communications Industry, Donaldson, Lufkin and Jenrette, Summer 1999, Tables 14B, 14C, 15A, and 15B.

[69] Cellular Telecommunications Industry Association, semi-annual surveys.

afforded the same interconnection rates as the new CLECs. Otherwise, competition has increased dramatically without unbundling, resale, or other new forms of regulation. Indeed, wireless services are essentially fully exempt from retail-price regulation. The result has been a major decline in real wireless prices.

Wireless rates have continued to decline, perhaps at an accelerating rate. In May 1998, AT&T introduced a flat-price nationwide calling plan that allowed a subscriber to make calls to and from anywhere in the continental U.S. for a single rate of $0.11 per minute to $0.15 per minute, depending on the volume of calling. Roaming charges were simply eliminated under this plan. The other carriers followed with $0.10 per minute plans, and Bell Atlantic even has one plan that offers nationwide calling at only $0.0833 per minute. These sharp declines in the price of wireless calling are now sparking interest in developing wireless as an alternative to wireline service. Indeed, AT&T is promoting its service in Texas as the alternative to a subscriber's second line.

Subscriber penetration. The U.S. has lagged some European countries in cellular penetration, in large part because of its fragmented wireless industry and the need for subscribers to roam onto other systems at high prices. The development of national service by AT&T, Sprint, and Nextel as the others -- Bell Atlantic, AirTouch, SBC, Western Wireless, and U.S. Cellular -- expand their footprints has led to national pricing without roaming charges. While subscriber penetration is still only about 25 percent of the population, it is now growing rapidly.

As long as the U.S. subsidizes residential wireline connections, U.S. penetration may remain below that

realized by Hong Kong, Italy, and the Scandinavian countries, but we have not yet witnessed the full effect of the sharp decline in U.S. wireless rates. Nor has the U.S. been able to implement "calling-party-pays" tariffs, thereby freeing wireless subscribers to leave their lithium-ion powered handsets on continuously to receive calls.

Wireline-wireless substitution. There is substantial casual empirical evidence that wireless service is a substitute for traditional wireline telephone service in several countries. Subscriber line growth has stopped in several Scandinavian countries and is likely to turn negative as wireless service becomes virtually universal. Some forecast that many European countries will have more than 70 percent penetration of wireless service, meaning that virtually every adult will have a portable wireless handset.[70] Our preliminary analysis suggests that wireless services may already be a weak substitute for wireline telephone service in the United States, but the new low-priced bulk pricing plans may not have are so recent that they probably have not induced a major shift from wireline to wireless service yet -- particularly given the recent declines in consumer long-distance rates.

First, it is clear that heavy users of wireless services are also intensive users of wireline services, but -- more importantly -- their ratio of wireless to wireline expenditures increased between 1997 and 1998. (**Table 6**) We have estimated a logit model of the probability of a household subscribing to a cellular (or PCS) service in 1998 using PNR data, and we find that the probability of wireless

[70] Linda J. Mutschler and Paul Wuh, The Next Generation III: Wireless in the U.S. Merrill Lynch, 10 March 1999.

subscription is directly related to the level of intraLATA rates in the state in which the subscriber resides. This relationship is stronger in 1998 than in 1997 as we would expect.[71] In addition, the demand for intraLATA minutes by a household is directly related to the lowest available price of cellular service (for 100 monthly minutes of use) in 1997 and 1998. Both results suggest that intraLATA long distance and cellular service are substitutes.[72] Moreover, the demand for cellular service is far more price elastic (-0.6) than is the

demand for traditional wireline service (-0.004).[73] As real wireless prices continue to fall and the real cost of residential connections rises due to the rebalancing forced by local competition, we should see a substantial increase in the usage of wireless service from its current 6 percent of total minutes of use in the U.S.

There is another form of wireless telecommunications that could compete with wireline telephony, particularly in areas of low population density. "Fixed" wireless service, which connects fixed subscribers to the network through signals transmitted through the radio spectrum from terrestrial towers, is already in use in many developing countries in areas of low density. It could be deployed to a

[71] We have been unable to estimate the effect of wireline prices on cellular usage because of problems in the minutes of use data in the PNR data sets.

[72] Given the extremely low level of local residential rates, households are unlikely to disconnect from the wireline network even when cellular or PCS rates plummet. Hence, we focus only on the relationship between intraLATA rates and cellular demand.

[73] See J. Hausman, "Valuation and the Effect of Regulation on New Services in Telecommunications," Brookings Papers on Economic Activity: Microeconomics, 1997 for estimates of cellular price elasticities. See J. Hausman, T. Tardiff and A. Belinfante, "The Effects of the Breakup of AT&T on Telephone Penetration in the US," American Economic Review, 1993, for estimates of wireline price elasticities.

much greater degree in advanced countries such as the U.S. but for "universal service" pricing policies that keep rural rates below the long-run incremental cost of the wireline service. Were current telephone rates set efficiently, such wireless services might develop rather rapidly and provide substantial potential and actual competition for even the lightly-populated areas of the country.[74]

Payphone use. Decreased wireless prices and increased wireless penetration have already had a significant effect on payphone usage. The number of payphones has decreased by about 17 percent over the past three years. With integration of networks in the future, including voice and data networks to allow easy conversion from email to voice mail, and the ability to view email on hand-held mobile devices, a mobile telephone will likely become the chief instrument for voice messages in the future. Especially in a business setting, the ability to avoid voice mail tag is likely to lead to significant substitution of mobile voice for current wireline voice usage. One detriment to even high mobile usage is the relatively high tax rates levied on mobile usage by a combination of federal, state, and local tax rates.[75]

Regulation and Investment

74 Unfortunately, the 1996 Telecommunications Act allows states to exempt rural areas from competitive entry. Therefore, even if current rates were rebalanced to economically-efficient levels or explicit, transferrable subsidies were imposed to cover access deficits in rural areas, many states might still refuse to allow rural areas to enjoy the benefits of competition

75 See J. Hausman, "Efficiency Effects on the U.S. Economy from Wireless Taxation", NBER working paper, August 1999, forthcoming National Tax Journal, 2000.

As we have seen, the new 1996 Telecom Act provides extensive new regulation of the nation's existing local-exchange carriers, but leaves the wireless sector to develop on an unregulated basis. In addition, the 1996 Act provides a substantial modicum of rate deregulation for the cable television industry and allows cable companies to provide traditional and new advanced telecom services free of the wholesale and retail regulation that applies to their rivals in the local exchange sector. All three groups -- the local-exchange companies, cable television, and wireless service providers -- are important potential sources of new technologies and facilities for delivering broadband Internet connections. Indeed, AT&T has invested more than $100 billion in cable systems as part of a strategy to deliver the full range of video, data, and voice services to residential customers. The local-exchange companies have begun to deploy their own broadband service over their copper-wire distribution lines, called digital subscriber-line service (DSL). And wireless companies continue to invest in new digital technologies capable of offering ever greater bandwidth and features.

It is still to early to estimate the effects of the regulatory climate on investment strategies in any detail. However, a brief look at recent investment trends suggests that regulation may be a substantial drag on investment in the traditional telephone industry.[76] Despite the very large potential market for new, advanced broadband services for Internet connections, the wireline carriers -- incumbent local exchange companies, long-distance carriers, and the new competitive carriers -- have increased their

capital spending only modestly in recent years. At the same time, capital spending by the cable/broadcast sector and by wireless companies has soared. (See **Figure 4**.) Between 1993 and 1997, real broadcast/cable spending increased at an annual rate of 26 percent, largely due to cable-system digital upgrades, while wireless spending increased by over 40 percent per year. During this period the wireline carriers increased their capital spending at only 6 percent per year. Surprisingly, the rate of increase was virtually the same for the incumbent local companies and their principal potential rivals -- the long-distance carriers and the competitive carriers. Moreover, in 1998 -- the year in which DSL deployment began in earnest -- there was no further increase in the incumbent local companies' investment.[77] The slow growth in capital spending by entrants and incumbents alike in a sector that has recently been opened to competition should send off warning alarms that something is amiss. This difference in the investment behavior of the regulated and the unregulated sectors of the communications industry provides further evidence that FCC regulation of new services and FCC/state regulation of wholesale and retail rates is retarding capital formation.

Conclusion

Competition in U.S. telecom markets is only beginning in the local wireline access/exchange market. The complex regulatory structure developed by the U.S. to manage local competition has been extremely controversial and has created years of regulatory strife and litigation. "Regulated competition"

[77] FCC, Statistics of Communications Common Carriers, 1997/98 edition. The 1998 BEA data for the entire sector are not yet available.

may well be an approach which harms consumers while regulators attempt to help new competitors. Relying upon a return to a flawed system of cost-based regulation to provide entrants with extremely favorable access to incumbents' facilities, regulators are attempting to micro-manage the liberalization process in a manner that is quite unprecedented in the recent history of U.S. deregulation. Moreover, there is very little evidence that this management of competition is working very well. Rather, it appears to be mired down in a hopeless exercise of setting wholesale rates and limiting incumbents' ability to exploit the value of their own networks, stunting the incentives to invest in new facilities by existing carriers and delaying investments by the entrants as they wait for regulators to provide them with access to the full complement of incumbents' facilities at below-cost prices.

By contrast, competition in the partially deregulated long-distance market (prior to the recently announced MCI/WorldCom- Sprint merger) has increased, and competition in the totally deregulated wireless market is flourishing. Long distance rates, particularly business rates, are falling steadily. Residential rates are still substantially above long-run incremental cost, pointing out the need for further entry. Wireless rates are falling even more dramatically. New wireless pricing plans are emerging and wireless carriers are experimenting with new services in a totally deregulated market. It appears likely that wireless will soon be a sufficient source of competition for at least conventional voice/data wireline services to permit a substantial degree of deregulation of the nation's telecommunications service providers, but it is unlikely that such deregulation can or will occur, given the detailed mandates of the 1996 Act. Nor is it likely that a reconsideration of the 1996 Act by Congress would lead to better legislation and an improvement in the prospects for deregulation.

A recurring theme in this paper is that detailed cost-based regulation of wholesale rates is not a satisfactory approach for stimulating competition in this network industry. Rather, we would prefer an attempt by regulators to undo the regulatory-created barriers to entry built into the retail rate structure. As long as large numbers of subscribers – particularly residential subscribers in all but the most dense areas of the country – are provided local service at rates that are below long-run incremental cost, entrants will have little incentive to offer these subscribers service. It would be better for regulators to attempt to eliminate the pricing distortions that they have already created than to erect an entire new set of distorted wholesale rates that will be difficult to eliminate in the future. An ounce of regulatory forbearance is surely much to be preferred over a pound of regulatory cure.

Table 1
Access Lines Served by Competitive Local Carriers, 1997-99
(000)

Company:	4Q97	2Q99
Allegiance	Na	122.3
CTE	13.0	60.8
E.spire	35.1	118.1
Electric Lightwave	34.3	121.5
Focal	9.3	106.7
Frontier	101.0	245.0
GST	28.9	206.5
Hyperion	25.0	191.3
ICG	93.0	446.4
Intermedia	81.3	277.7
ITCDeltacom	NA	56.0
McLeod	185.0	392.3
NEXTLINK	50.1	282.2
RCN	28.1	104.5
Teligent	NA	37.5
US LEC	49.2	302.7
WinStar	65.6	332.5
Others	172.0	727.7
TOTAL CLECs (% of Total U.S. Lines)	970.9 (0.6%)	4,131.5 (2.3%)
Long Distance Companies:		
AT&T (Including Teleport)	310.0	625.0
MCI WorldCom (Including MFS)	530.0	1,251.0
Sprint	74.4	167.9
Total Long-distance Cos: (% of U.S. Lines)	914.4 (0.5%)	2,043.9 (1.1%)
TOTAL COMPETITORS (% of U.S. Lines)	1,885.3 (1.1%)	6,175.4 (3.4%)

NA = not available
Source: Merrill Lynch (1999)

Table 2

The Distribution of RBOC Unbundled Business Loop Rates (UNEs) and Wholesale Discounts for Business Service, Lower 48 States, 1998

Unbundled Business Loop Rate -- Most Dense Area ($/Mo.)	Number of States	Share of Access Lines (%)
Less than 10	6	20.8%
10-14.99	15	48.0%
15-19.99	16	22.2%
20-24.99	6	5.5%
25 or More	4	3.6%
Wholesale Discount For Business Service(%)		
Less than 15	9	6.2%
15-17.49	11	30.4%
17.50-19.99	14	32.0%
20 - 22.49	12	22.8%
22.5 or more	2	3.7%

Source: Janney Montgomery Scott Inc. The Status of Agreements between the Major LECs and CLECs: Update, November 10, 1997; Industry sources.

Table 3

Average Monthly Residential and Single-Line Business Rates in Urban Areas, October 15 ($/Month)

Rate	1993	1994	1995	1996	1997	1998	1999
Residential	**19.95**	**19.81**	**20.01**	**19.95**	**19.88**	**19.76**	**19.87**
Single-Line Business	**42.57**	**41.64**	**41.80**	**41.81**	**41.67**	**41.28**	**41.00**

Source: FCC (1999).

Table 4
Market Shares of Revenues for U.S. Long-Distance Carriers, 1984-97 (Percent)

YEAR	AT&T	MCI	SPRINT	WORLDCOM	ALL OTHERS
1984	**90.1**	**4.5**	**2.7**		**2.6**
1985	**86.3**	**5.5**	**2.6**		**5.6**
1986	**81.9**	**7.6**	**4.3**		**6.3**
1987	**78.6**	**8.8**	**5.8**		**6.8**
1988	**74.6**	**10.3**	**7.2**		**8.0**
1989	**67.5**	**12.1**	**8.4**	**0.2**	**11.8**
1990	**65.0**	**14.2**	**9.7**	**0.3**	**10.8**
1991	**63.2**	**15.2**	**9.9**	**0.5**	**11.3**
1992	**60.8**	**16.7**	**9.7**	**1.4**	**11.5**
1993	**58.1**	**17.8**	**10.0**	**1.9**	**12.3**
1994	**55.2**	**17.4**	**10.1**	**3.3**	**14.0**
1995	**51.8**	**19.7**	**9.8**	**4.9**	**13.8**
1996	**47.9**	**20.0**	**9.7**	**5.5**	**17.0**
1997	**44.0**	**19.0**	**9.5**	**6.6**	**20.9**
1998	**43.0**	**25.6***	**10.5**	*****	**20.9**

*MCIWorldCom

Source: FCC (1999)

Table 5

Summary of Regression Analyses of Cellular Prices in Top 100 U.S. Cellular Markets, March 1998
(By Number of PCS Operators in an MSA)

Logarithm of Price of:: _	30 MOU	100 MOU	300 MOU	500 MOU	750 MOU	1000 MOU
One or More PCS Operators	-0.067 _(-1.32)	-0.162 (-2.89)*	-0.179 (-2.57)*	-0.182 (-2.93)*	-0.158 (-2.22)*	-0.143 (-1.78)
Two or More PCS Operators	0.070 (1.94)	0.102 (2.54)*	-0.022 (-0.43)	-0.026 (-0.59)	-0.054 (-1.06)	-0.068 (-1.18)
Three PCS Operators	-0.008 (-0.14)	-0.009 (-0.15)	0.055 (0.76)	0.037 (0.59)	0.052 (0.71)	0.092 (1.12)
Adjusted R^2	0.1528	0.1655	0.2007	0.2656	0.2008	0.1875

Notes: t statistics reported in parentheses. MOU = monthly minutes of use. *Value is significantly different from zero at a 95% level of confidence. Regressions also include log (Median Household Income), log (Population Density), log (Travel Time), log (Traffic Density) and dummy variables for the presence of Nextel as explanatory variables.

Source: Crandall and Gertner (1999)

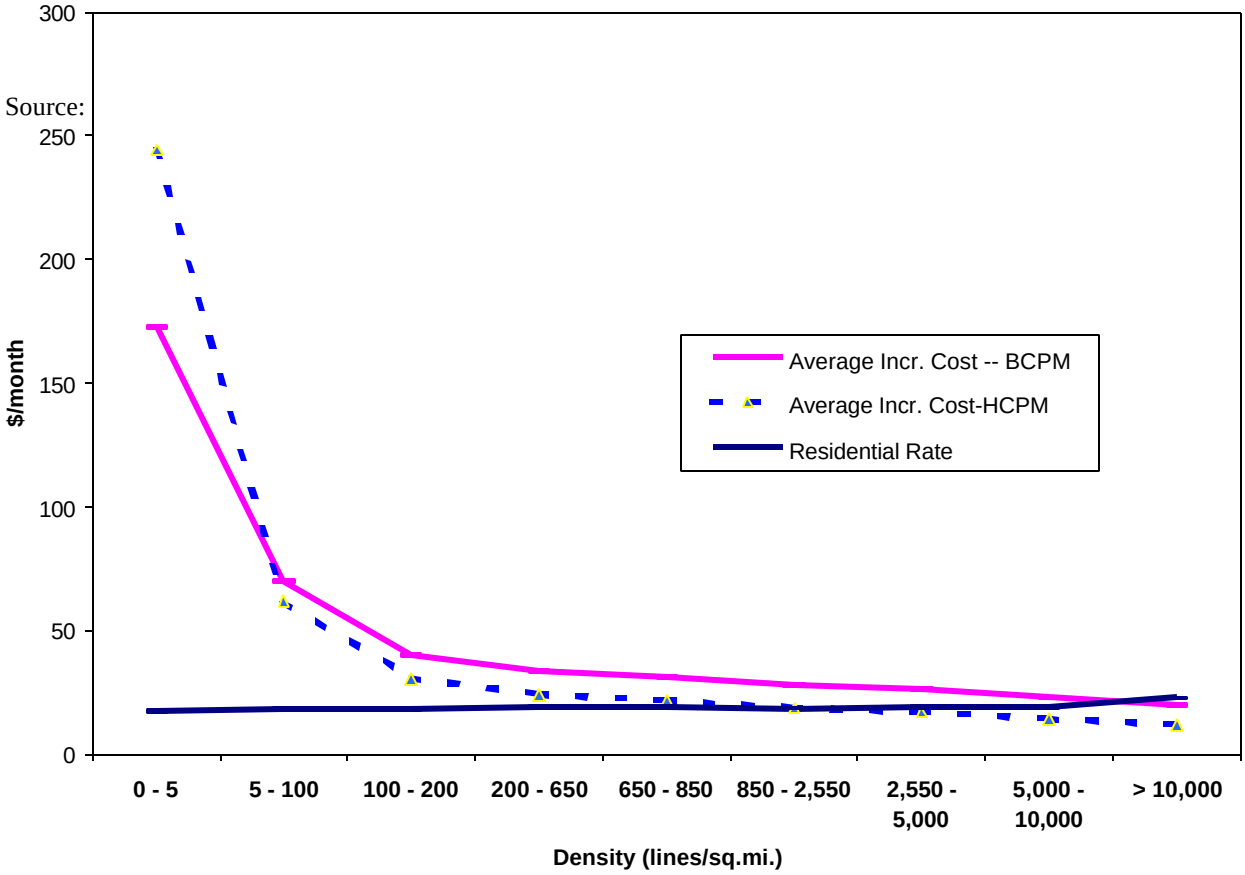
Table 6

Average Household Bills for Most Intensive Users of Wireless, 1997 and 1998

Wireless Spending Percentile	Average 1997 Wireline Bills	Average 1997 Wireless Bills	1997 Ratio Wireless/ Wireline	Average 1998 Wireline Bills	Average 1998 Wireless Bills	1998 Ratio Wireless/ Wireline
70-75	84.73	47.36	0.56	80.85	46.72	0.58
75-80	87.65	53.78	0.61	88.27	53.13	0.60
80-85	92.03	62.81	0.68	90.58	62.18	0.69
85-90	101.60	77.11	0.76	95.54	75.17	0.79
90-95	122.31	100.86	0.82	108.18	98.08	0.91
95-100	133.37	223.63	1.68	123.03	194.22	1.58

Source: PNR

Figure 1
Average U.S. Local Residential Rates vs. Average Incremental Cost



Source:

Source: Robert W. Crandall and Leonard Waverman (2000)

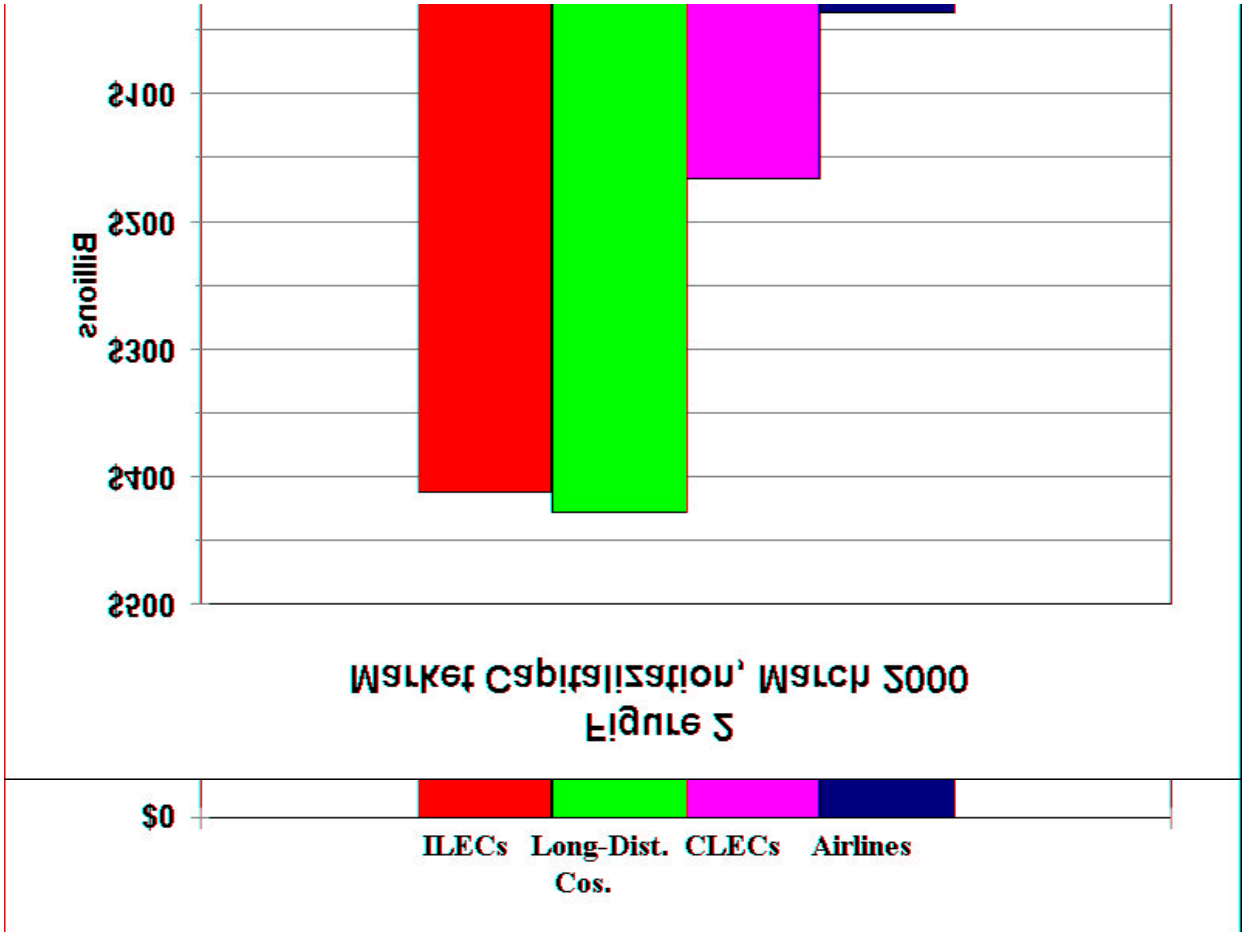
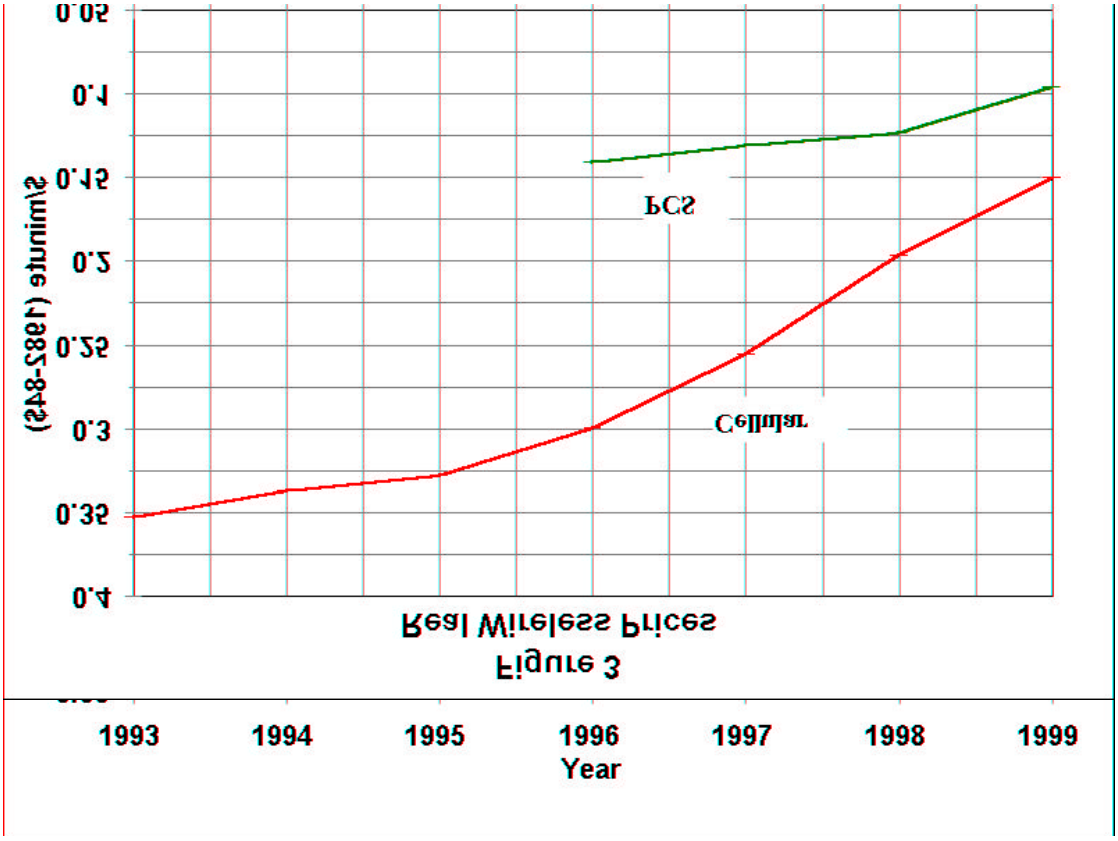
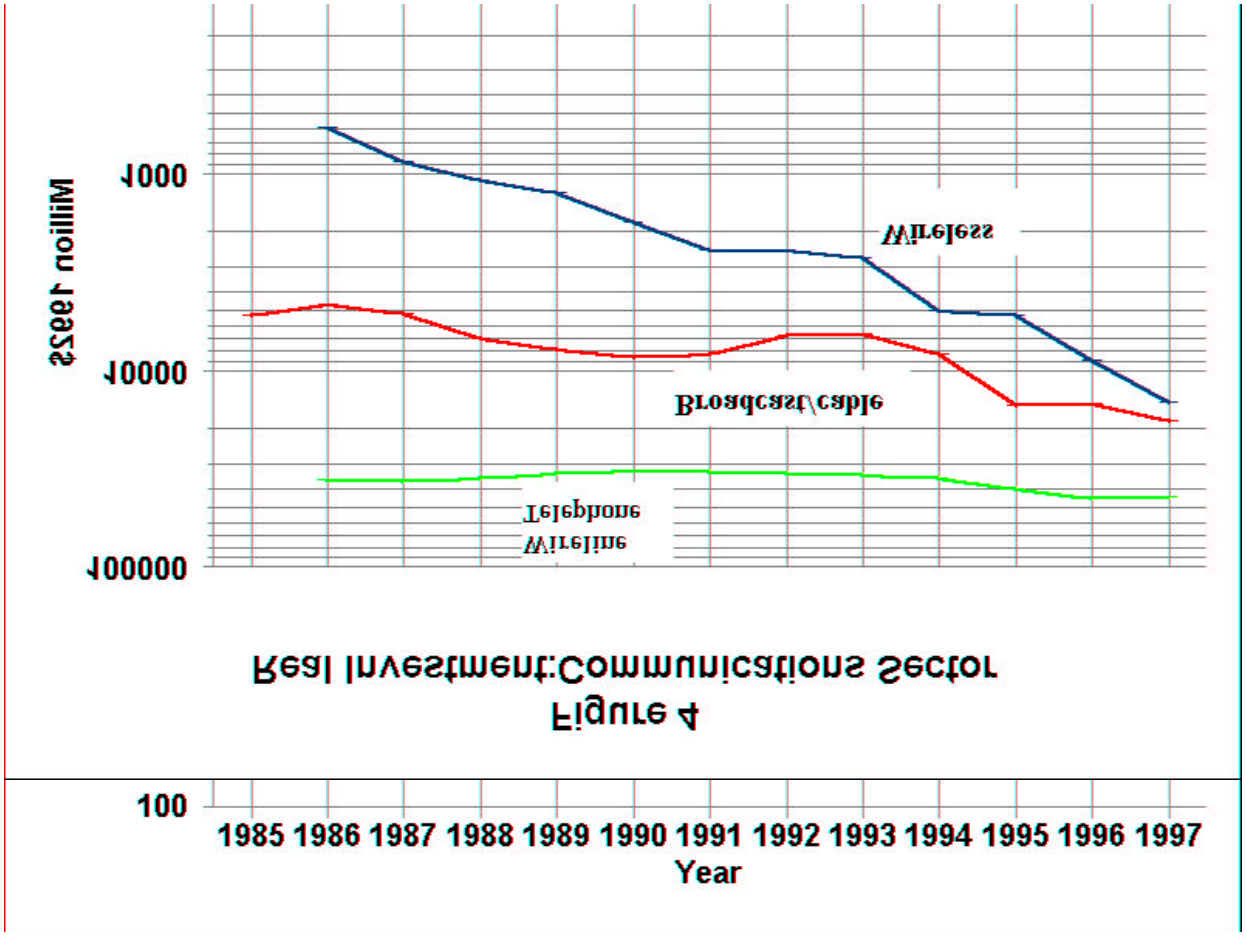


Figure 5
Market Capitalization, March 2000
$ billions

Source: www.quote.yahoo (March 14, 2000)



Source: Donaldson, Lufkin and Jenrette, The Global Wireless Communicationsa Industry, Winter 1999-2000.



Source: Cellular Telecommunications Industry Association; FCC; Department of Commerce
Note: Chart to be updated through 1998 when Commerce (BEA) data are published 4/1/2000

Appendix Table 1
Percentage of Lines Resold or Provided as UNE Loops by Large ILECs
June 30, 1999

State – ILEC	Percent Resold	Percent UNE Loops
Alabama – BellSouth	2.0	0.2
Arizona – U S WEST	0.6	0.1
Arkansas—SBC	1.9	0.5
California – GTE	0.9	0.3
California – SBC	1.4	0.6
Colorado - U S WEST	1.1	***
Connecticut -- SNET	2.2	0.1
Delaware -- Bell Atlantic	1.8	0.3
Florida --- GTE	1.4	***
Florida -- BellSouth	1.7	0.2
Georgia -- BellSouth	2.5	0.6
Idaho -- U S WEST	0.1	0
Illinois -- Ameritech	3.0	0.5
Illinois --- GTE	0.1	***
Indiana -- Ameritech	0.8	0.2
Indiana -- GTE	0.2	***
Iowa -- U S WEST	10.9	***
Kansas -- SBC	5.5	***
Kentucky -- BellSouth	2.6	0.1
Louisiana -- BellSouth	3.4	0.1
Maine -- Bell Atlantic	0.7	***
Maryland -- Bell Atlantic	0.7	0.1
Massachusetts -- Bell Atlantic	2.8	0.1
Michigan -- Ameritech	2.4	0.8
Michigan --- GTE	0	0
Minnesota --- U S WEST	4.0	0.3
Mississippi --- Bell South	3.4	0.2
Missouri --- SBC	1.5	0.1
Montana – U S WEST	0.5	0.1
Nevada-- SBC	1.0	1.3

Nebraska --- U S WEST		**0.3**
New Hampshire—Bell Atlantic	**2.5**	**0.1**
New Jersey -- Bell Atlantic	**0.9**	*******
New Mexico -- U S WEST	**0.1**	**0.3**
New York -- Bell Atlantic	**2.1**	**1.2**
North Carolina – BellSouth	**1.5**	**0.3**
North Carolina --- GTE	**0.4**	*******
North Dakota -- U S WEST	**5.9**	**0.2**
Ohio – Ameritech	**2.5**	**0.9**
Ohio --- GTE	*******	**0**
Oklahoma – SBC	**2.4**	**0.1**
Oregon --- GTE	**0.1**	*******
Oregon -- U S WEST	**4.0**	*******
Pennsylvania -- Bell Atlantic	**1.3**	**0.7**
Pennsylvania --- GTE	**0.1**	*******
Rhode Island -- Bell Atlantic	**1.1**	**0.3**
South Carolina – BellSouth	**3.9**	**0.1**
South Dakota -- U S WEST	**6.8**	**0**
Tennessee – BellSouth	**1.3**	**1.0**
Texas --- GTE	**1.0**	**1.0**
Texas – SBC	**3.6**	**0.2**
Utah -- U S WEST	**0.6**	**0.2**
Vermont -- Bell Atlantic	**0.7**	*******
Virginia -- Bell Atlantic	**0.5**	**0.1**
Virginia --- GTE	**0**	*******
Washington --- GTE	**0.1**	*******
Washington -- U S WEST	**1.8**	**0.1**
West Virginia -- Bell Atlantic	*******	**0**
Wisconsin – Ameritech	**1.9**	**0.9**
Wisconsin --- GTE	**0**	**0.3**
Wyoming -- U S WEST	**3.2**	**0**

Source: FCC (1999). *** Less than 0.05%.