

**Liberal Rules for a 21st Century
Communications World:
The U.S. Experience with Convergence**

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Abstract

The obsolescence of traditional Postal Telephone and Telegraph (PTT) monopolies has forced liberalization in the telecommunications sector. This transition challenges policy makers with two visions of convergence, however, one implying the emergence of a new monopoly where diverse applications are provided via a single high-capacity network, the other implying the growth of diverse networks that encroach upon rivals. The former generally implies mandatory network sharing regulations; the latter is associated with deregulation. The selection of these distinct policy paths can now be informed by experience. Ironically, U.S. competition in fixed-line phone service succeeded only after the sharing mandates of 1996-2004, designed to facilitate competitive entry, were over-turned by federal courts.. Residential broadband markets yield further data suggesting that deployments accelerate when open access requirements are eliminated. These experiments in liberalization can inform and advance pro-consumer, technology-friendly policies in telecommunications.

1. Convergence and the Transition to Competition

The devolution of the separate telecommunications silos of the 1970s is now a familiar story. As early as 1987, Peter Huber's masterful "Geodesic Network"[1] framed the policy debate as one of adjustment to convergence, removing artificial barriers that kept potentially rival networks quarantined in monopolistic fiefdoms. Even then, a generation ago, the picture on the horizon was coming into focus: local voice access, long distance transport, multi-channel video, and data were not productively supplied under "regulatory apartheid"[2].

What was a "vision" then is a reality today. Liberalization in telecoms has swept the globe; the PTT monopolies of the 1980s are now largely museum exhibits. But the ways in which communications markets have been opened differ across regimes. This can be said to reflect rival assumptions as to the full meaning of the term "convergence."

The "Convergence A" view is that the maturation of communications networks has produced a natural competitive rivalry in the marketplace. What U.S. regulators called the "two wire to the home" policy in the 1980s – one owned by the local telephone carrier, the other by the cable TV operator – spontaneously combusts. Given modern technologies and new business plans, head-to-head network rivalry emerges. The phone wire expands to carry video; the cable wire expands to carry voice. What were two monopolies in distinct product markets merges into a market with overlapping networks battling for market share in either. Integration into broadband richens the rivalry and brings customers "triple play" (voice, video, data) options. The addition of wireless carriers extends the competitive continuum.

In this view of things, the role of the government is to unleash the market, eliminating barriers to naturally rivalrous behavior.¹

In the "Convergence B" framework, existing networks do not expand onto rivals' turf (Perhaps this owes, in part, to the stunting of their initial growth due to economic or regulatory constraints.²) And now the day of the competitive entrant has passed, precisely because the "convergence" implies economies of scale: services that once required their own delivery platform are now efficiently supplied via facilities supplying a vector of services. Rival platforms are now replaced by a communications network with abundant capacity to provide triple plays. Of course, organizing all communications within a single firm has costs as well as benefits; the loss in market rivalry is typically met by regulatory interventions that seek to offset some of these social costs. The resulting markets may be deemed "open," in the sense that non-network application providers utilize the underlying facilities on "reasonable terms and conditions," but basic network infrastructure is supplied on the regulated monopoly model. Convergence B delivers us not to competitive networks but to the PTT model whence we came.

This paper does not undertake the task of global comparison, an important and ongoing element in discerning the optimal policy path.³ It sets its sights on more specific target, describing the policy path in

¹ These include such competitive impediments as local government video franchises that deter telephone carriers from entering cable TV markets. See Hazlett 2007, *Cable TV Franchises as Barriers to Competition*, 12 VIRGINIA JOURNAL OF LAW & TECHNOLOGY 2. It also includes liberalization of spectrum policy, providing more bandwidth for operators to expand services (e.g., into high-speed data) and to adopt innovative technologies. See Hazlett 2008, *Optimal Abolition of FCC Spectrum Allocation*, JOURNAL OF ECONOMIC PERSPECTIVES (Winter).

² In some countries, cable TV networks have been deterred by regulatory barriers. In others, cable TV has not developed throughout the market due to the presence of abundant broadcast TV channels (e.g., Italy) or the relatively high costs of constructions (e.g., the U.K.).

³ For contrasting analyses, see, e.g., OECD 2001, *The Development of Broadband Access in OECD Countries*, Working Party on Telecommunications and Information Services Policies (Paris: Organization for Economic Co-operation and Development; Oct. 29). And National Research Council 2002, *Broadband: Bringing Home the Bits*, Committee on Broadband Last Mile Technology, Computer Science and

the United States where the “A” view has come to dominate – not exactly by strategic vision or formal consensus but by the rough-and-tumble reality of policies tried, failed, and then reformulated.

The short story – and a summary of the paper’s main points – goes like this. The 1996 Telecommunications Act laid out a policy reform on the vision of “Convergence A,” but with a schizophrenic twist: the transition to competitive networks would be managed by a mandatory network sharing regime. This was a temporary expedient to assist the development of new networks, not a long-run “B” view of convergence as leading to dominant platforms with sufficient capacity to efficiently re-monopolize the market.

The transitional regime, however, proved administratively complex and economically disappointing. It encouraged extreme contentiousness in the drafting of network access (wholesale) pricing rules, and deterred network development by both incumbents and entrants. It collapsed in mid-2004, overturned by courts as violating the instructions in the 1996 Act to facilitate the construction of competitive systems. But the demise of regime did not prove a set-back to competition in the marketplace. Inter-modal competition is today supplying the competitive constraints that the network sharing regime, effectively ended just four years ago, could not.

Cable television systems – having made local phone service available to under 15% of U.S. households in 2003, the product of seven years of investment since being awarded the right to supply voice services in the 1996 Act – today pass over 85% of U.S. households. Broadband competition between cable operators and telephone carriers has also accelerated since FCC deregulation of DSL networks in the first quarter of 2003; DSL subscribership was about 60% higher at year-end 2006 than it would have been under the pre-deregulation growth rate. These marked gains in competitiveness are buttressed by trends in wireless phone markets. Yet, by standards used to determine “effective competition” in other communications markets, local phone services are today “effectively competitive” even disregarding mobile telephony as a substitute product. The recent market trends, highly successful in realizing the stated goals of the 1996 Telecommunications Act, appear – at best – unrelated to the “policy-induced” rivalry supported via network sharing mandates. Indeed, the data suggest that the sharing mandates designed to provide “stepping stones” to rivalrous communications networks deterred such deployments.

In sum, the U.S. experience offers lessons from policy experiments suggesting that convergence can deliver market outcomes advancing consumer welfare. By an iterative process, the U.S. has discovered much about how to craft, and how not to craft, liberal policies for 21st Century telecoms. This may be of interest to policy makers elsewhere as a case study revealing how the Schumpeterian forces now shaking the communications sector can most effectively be channeled.

2.Fixed Line Telephone Competition: the U.S. Experience

The central economic concern of the 1996 Telecommunications Act was the promotion of competition in local telephone service. This was to be accomplished with a two-pronged policy attack. First, the Act eliminated entry barriers to new entrants in local telecommunications markets.⁴ Previously, state and local franchising laws had created legal prohibitions explicitly or implicitly limited competitive entry. Second, to assist entrants who might emerge, the Act required that incumbent telephone companies:

- (a) interconnect with entrants’ networks⁵
- (b) provide customer connections, at wholesale prices, to new rivals to resell at retail prices⁶
- (c) provide “unbundled” pieces of their network to alternative providers⁷

Telecommunications Board, Division on Engineering and Physical Sciences, National Research Council (Washington, D.C.: National Academy Press).

⁴ 47 U.S.C. §253(a).

⁵ 47 U.S.C. §251(c)(2).

⁶ 47 U.S.C. §251(c)(4).

⁷ 47 U.S.C. §251(c)(3).

The basic interconnection obligation was not controversial. However, the mandates requiring incumbents to share their networks proved highly contentious. In the use of “resale” or “UNEs” (unbundled network elements), rates charged and terms of wholesale access were regulated by state regulatory commissions under guidelines crafted by the Federal Communications Commission. These rules imposed a TELRIC (Total Element Long-Run Incremental Cost) determination of wholesale network access pricing that sought to approximate the costs of a new, efficiently-sized, state-of-the-art network. This tended to under-compensate investors for the risks of technological changes [3], placing zero value on the options extinguished when capital was sunk to create infrastructure[4].

According to later decisions by U.S. courts, the regime tilted decidedly in favor of low access prices and generous terms for competitive entrants leasing incumbents’ networks. This, in turn, was found to bias the “rent v. buy” decisions faced by such entrants, and to depress the incentives of incumbents to fend off emerging rivals by investing in new, upgraded facilities. Federal courts found that this undermined the plainly stated goals of the 1996 Act in promoting the creation of competitive telecommunications networks. Mandates to share existing infrastructure as a “stepping stone” to facilities-based competition [5] were called for in the Act, but this cause-and-effect sequence was undermined by an unbalanced approach that sought only to promote resale of incumbents’ services. As the D.C. Circuit Court of Appeals wrote, in overturning the network sharing rules, the Commission’s “entire argument about expanding competition and investment boils down to the Commission’s expression of its belief that in this area more unbundling is better.”⁸

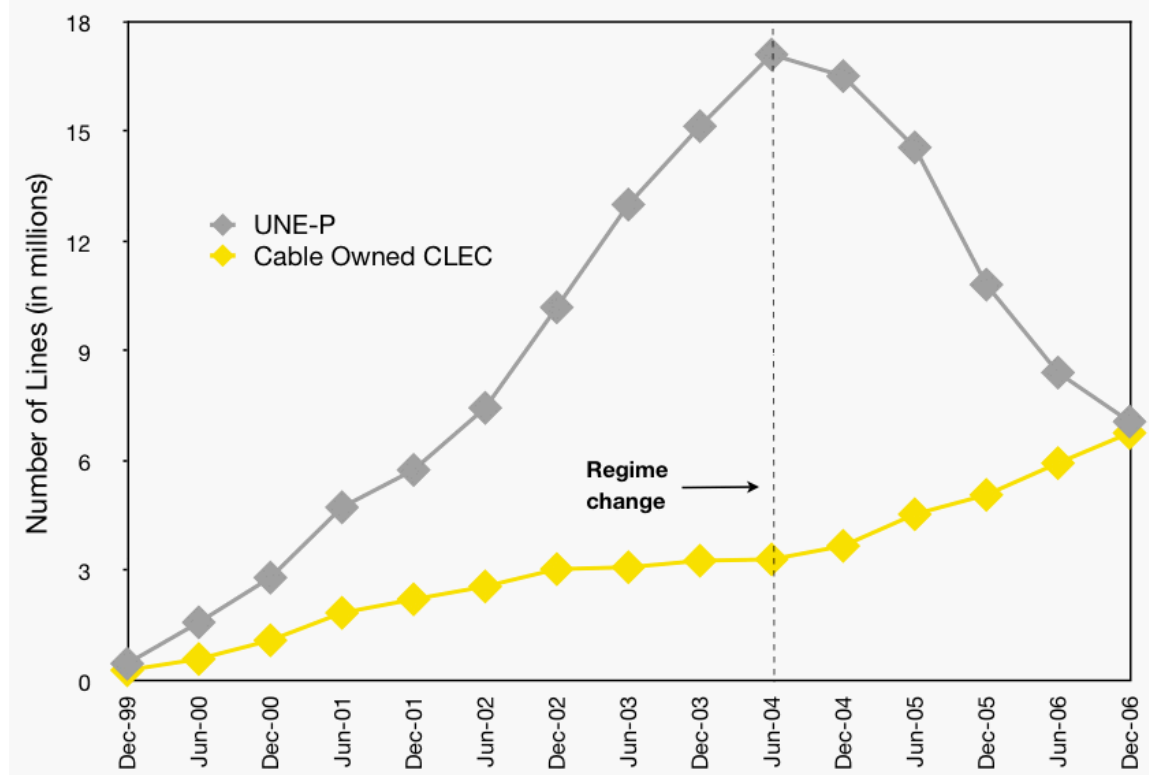
A March 2004 appellate court decision effectively ended this regime⁹ and the two major telephone carriers reselling incumbents resale services, AT&T and MCI, were soon (in 2005) acquired by local exchange carriers, SBC and Verizon. The experiment in “policy-induced competition” [6] was over, and by consensus a failure [7]. There was no stepping stone to facilities-based competition, but a stifling of investment in new network facilities by both entrants and incumbents [5]. While about 32 million lines (out of about 180 million total fixed connections, or about 18% market share) were provided by competitive entrants in June 2004, the resale model appeared to be crowding out entry via “competitor-owned” networks, including (most importantly) those provided by cable TV operators. Unbundled Network Element-Platform (UNE-P) lines¹⁰ grew, on net, from under a million in Dec. 1999 to nearly 16 million in June 2004; cable CLEC lines grew much less (to under 4 million) in June 2004, and had virtually no growth in the 2002-2004 period when UNE-P wholesale rates were declining and UNE-P lines were growing most rapidly. See Fig. 1.

⁸ *United States Telecom Association v. FCC*, 290 F.3d 415. (D.C. Cir. 2002).

⁹ *United States Telecom Association v. FCC*, 359 F.3d 554 (D.C. Cir. 2004). Uncertainty about whether the decision would be appealed to the U.S. Supreme Court delayed a resolution of the policy even after the March 2004 verdict. In June 2004, however, both the FCC and the Bush Administration announced that they had decided not to ask the highest court to overturn the decision and the policy was essentially settled.

¹⁰ UNE-P lines were supplied by incumbent local exchange carriers (ILECs), but sold to retail customers by competitive entrants who paid wholesale prices determined by aggregating costs for each “network element.” This resale model dominated entrants’ choices (a “total service resale,” or TSR, model was also available) because the price was relatively low. TSR wholesale prices (the price paid by the entrant to the incumbent network) were discounted about 20% from retail levels; UNE-P prices were discounted, on average, about 50%. See Hazlett (2006)[5].

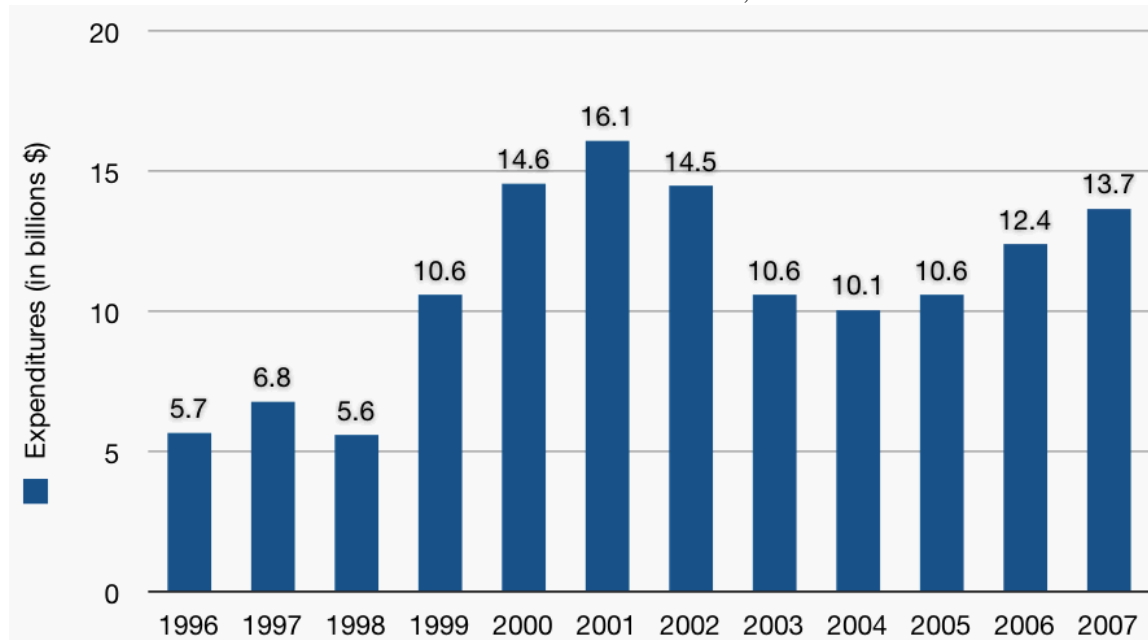
FIG. 1. UNE-P CLEC LINES V. CABLE CLEC LINES



As of the policy regime shift in 2004, the lack of competition in local telephone service was particularly troubling. When the Telecommunications Act passed, more than 95% of U.S. households had access to two wires, and the Act permitted the second of these – owned by a cable TV operator delivering video – to supply telephony. It was known that the costs of upgrading the cable network were relatively modest – \$400-\$900 per household [8]. A U.S. cable operator, Cox, would soon document that high-quality circuit-switched phone service could be overlaid on an existing video network with capital costs of just \$610 per new circuit-switched telephone subscriber[9], with costs falling to \$527 by 2004 (Cox 2004)[10].

Upwards of \$65 billion had been expended by CLECs, largely for marketing resold lines, only to see the policy fail to promote new networks or to sustain the reseller CLECs that had emerged, which largely perished in a wave of bankruptcies [7, p125]. Meanwhile, build-out of a competitive local phone network was relatively inexpensive: at \$610 per new phone customer and twenty-five percent penetration (assumptions used in Cox 2003), the U.S. market could have ‘wired for competition’ via fixed-line cable telephony for just \$15 billion.¹¹ Not only was this a small fraction of what was burned by CLECs that ended in bankruptcy, it was far less than what cable TV operators themselves expended to upgrade systems for digital video, a response to satellite TV competition that drove them to sink approximately \$66.4 billion in network upgrades, 1999-2003. These capital expenditures were more than twice the previous rate. See Fig. 2. The cable industry was an aggressive investor in new technology that enabled delivery of digital video and two-way Internet access at broadband speeds (i.e., cable modem service). But the opportunity to invest incrementally more in telephony was not appealing.

¹¹ This assumes 100 million U.S. households, the approximate size of the market in 1996. In 2007, there were approximately 113 million U.S. households.

FIG. 2. CABLE TV CAPITAL EXPENDITURES, 1996-2007¹²

So, as the unbundling regime was collapsing, cable TV systems were rapidly expanding in scale and scope – but not in cable telephone capacity or subscribership. The U.S. situation has been compared unfavorably with that existing in the U.K. market where, for many years, cable telephony has been a popular service (in the one-half of the national market where cable TV lines pass homes):

The United States provides a less compelling case for the importance of cable television networks in promoting competition in local access. In 2003, cable television firms supplied 2.5 million residential lines, whereas there were 73.783 million basic cable customers and 102.9 million passed homes (Brito & Pereira 2007, p. 298)[11].

Hence, the quandary: with the 1996 Act liberalizing rules such that cable operators were permitted to compete, why so little cable telephony in 2003? Over those seven years, cable operators had elected to roll out telephone service to only about 15% of U.S. households, garnering just 2.5 million subscribers out of over 100 million homes passed by cable (for video service).

That was about to change dramatically, however. Cable telephone subscribership in 20073Q equaled 11.5 million households,¹³ a 350% increase over year-end 2003.¹⁴ In the third quarter of 2007, in fact, cable telephone subscribers grew by 1.14 million, nearly one-half *total net growth 1996-2003*. More importantly, perhaps, is the change in market coverage. By 20073Q, 86% of U.S. households were offered cable telephony, nearly a 500% increase over 2003. While it took seven years to achieve availability in 16 million homes; it then took four years to extend cable telephony service to the next 77 million. See Fig. 3.

Whatever level of subscribership is obtained for the competitive entrant in voice service, the presence of the second physical network will itself deliver the benefits of competition. To stem substitution into a rival

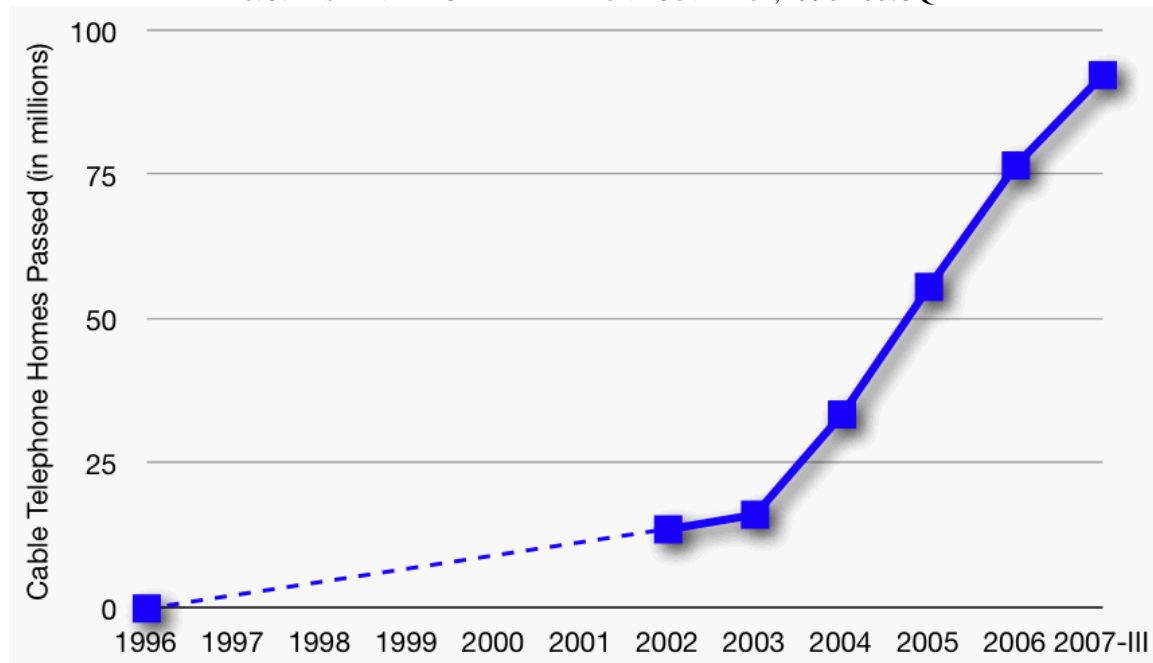
¹² National Cable Telecom. Assoc., www.ncta.com/statistic/statistic/infrastructureexpenditure.aspx.

¹³¹³ Cable telephony subscriber and coverage data are from Leichtman Research. FCC data for 2007 are not yet available.

¹⁴ It should be noted that cable telephone service is largely available to households, as video networks are built-out in residential markets rather than in business districts. Recently, however, cable TV operators have been extending networks into business markets in order to obtain high-speed data and telephony subscribers from enterprise customers.

product, incumbent carriers must lower prices and improve services. If one were to employ the standard established for cable TV (multi-channel video) rivalry by the U.S. Congress in the 1992 Cable Act, an interesting result is achieved. Under that standard, a market is deemed “effectively competitive” (and, hence, deregulated) when a second provider offers service to more than 50% of total households in the market, and serves (through subscriptions) at least 15%. In cable telephony, the first threshold was crossed in 2006 (see Fig. 3), while the latter is surmounted by adding five million non-cable “CLEC owned” subscribers to the 20073Q cable fixed-line total. As of Dec. 31, 2006, the FCC reported 4.4 million non-cable CLEC owned lines;¹⁵ in addition, there are millions of residential VoIP customers who opt out of ILEC voice service via a cable modem subscription.¹⁶ In any event, with cable telephony subscriber additions of over one million households per quarter for cable telephony, the 15% threshold – if not met by year-end 2007, which it likely was – will be easily passed by year-end 2008.

FIG. 3: RESIDENTIAL CABLE TELEPHONY COVERAGE, 1996-20073Q¹⁷



The pattern that emerges, then, is pronounced. Cable telephony grew very slowly after the opening of local telecommunications markets in 1996. Given the new right to build-out video networks to compete in voice services, cable TV operators largely demurred. This was despite massive investments made to upgrade infrastructure, capital expenditures that dwarfed the scale of those needed to deliver local telecommunications access via cable systems.

This suddenly changed, however, in 2004-2007. Cable operators began deploying telephone services at a feverish pace, such that the U.S. is today essentially wired for two competing fixed-line telephone systems. The “two wires to the home” – long in place -- now deliver converged *voice* services. The build-out clearly occurred in two stages: the *sotte voce* phase, 1996-2003; the second a vocal call-out, 2004-2007. Local

¹⁵ FCC, *Local Telephone Competition: Status as of Dec. 31, 2006*, Tables 3 and 5.

¹⁶ The largest stand-alone subscription VoIP service in the U.S. is Vonage, which reported 2.4 million customers in 2007. W. David Gardner, *Embattled Vonage Gets Subscribers To Stick With The Firm*, INFORMATIONWEEK (May 10, 2007); <http://www.informationweek.com/howArticle.jhtml?articleID=199500846>. Most of these are likely to use cable modems for Internet access, given the market share of cable and DSL in residential broadband markets.

¹⁷ Source: Leichtman Research Group, www.leichtmanresearch.com.

fixed line competition, essentially 'left for dead' in 2003, now appears to be a standard part of the telecommunications marketplace. What accounts for the reversal?

Two explanations are available. The first explains the spurt in fixed-line telephony as a product of declining costs of supply, specifically those associated with the maturation of voice-over-Internet (VoIP) technologies. The second attributes cable telephony's recent expansion to policy reforms, specifically the collapse of the network sharing mandates for local voice service.¹⁸

The explanations are not mutually exclusive, and it is asserted here that both factors played important roles. VoIP had long been anticipated as a cost-reduction gift to cable operators seeking to supply voice services, and the 2003-2004 period saw important progress in VoIP applications used in cable and elsewhere. Global VoIP use increased sharply during this recent period.

Cable operators took full advantage of these marketplace trends and shifted from circuit switched to VoIP technologies in the services they offered their customers. White Papers produced by the most aggressive (early) cable entrant into voice, Cox, which was building out cable telephone services since 1997, documented the favorable cost trend. In 2003, Cox found that a circuit-switched cable telephony customer yielded positive net present value and relatively quick pay-back [9]. The company urged other firms to expand into voice, arguing that the circuit-switched option then available was sufficiently profitable as to compensate for the option value in waiting for VoIP.

By 2004, Cox' strategic assessment had changed. It then calculated that VoIP could be provided for just \$267 per voice customer by cable operators, assuming the same penetration profile for a high-quality service that included an independent power supply (i.e., the phone works even when the household's electric power is cut off, as often happens in a storm, e.g.). This, in the Cox analysis, contrasted favorably with a cost for circuit-switched telephony, which was estimated to have fallen to \$527 per voice subscriber. The implication is that the decline in VoIP network costs did encourage cable build-out. Yet, the delays in serving voice markets were purchased at a cost by cable operators; profitable circuit-switched phone services were available to cable operators in the years before the VoIP cost decline, as Cox also strategized.¹⁹ The quick embrace of cable telephony in 2004 begs for further explanation. Incentives created by the creation and elimination of the UNE-P program provide it.

While cable telephony networks were not directly regulated under network sharing mandates, the competitive voice network was. As wholesale rates for ILEC access were politically determined, and sharply declining in the 1999-2003 period, when UNE-P lines rose rapidly, an overhang on cable telephony investment was imposed. The competitive entrant's investment is appropriated, if indirectly, by the same regulatory obligations opposed by incumbent phone carriers.

That appropriation threat was dealt a fatal blow in the federal appellate ruling issued in March 2004, a death that was formally recorded with the Administration's decision not to appeal the verdict to the Supreme Court in June 2004. Within weeks, the major UNE-P carrier (AT&T) announced its withdrawal from the local access markets [7]. The ensuing three years resulted in the national build-out of a fixed-line telephone competitor. Technology and policy reform combined to (finally) produce this fortuitous result.

¹⁸ A third possible explanation is that market conditions improved about 2004, leading cable operators to invest more heavily in an expansion of their product mix. This can be rejected on the evidence that cable operators spent very heavily in the 1999-2003 period to digitize their systems and to expand bandwidth. These investments were undertaken to deliver more video channels and higher cable modem speeds. Cable telephony upgrades were notable by their absence, despite being relatively affordable according to assessments taken by cable operators at the time [9].

¹⁹ Cox (2003)[9] estimated that a cable telephone subscriber would generate \$600 in annual fees (local and long distance revenues) and that 35% of revenues would constitute gross profit. This implies that the average customer would generate \$210 annually, suggesting that a delay of 1.5 years would essentially offset the infrastructure cost advantages reported for VoIP.

3. Broadband Regulation: the U.S. Experience

The U.S. market also provides “convergence” evidence with respect to broadband. Both telephone and cable TV networks pass nearly all U.S. homes, and so residential competition has been facilitated by network upgrades to either – digital subscriber line (DSL) service layered onto traditional phone systems, cable modem services supplied by cable TV operators. Conveniently for policy analysis, distinct regulatory regimes have governed these broadband offerings, and these regimes have changed over time. This allows us to compare and contrast, evaluating how the two approaches to convergence fare; the one stressing policies of mandatory network sharing, and the other focusing on investment incentives for the creation and advancement of separate networks.

3.1 Three Historical Regimes for DSL

3.1.A. Unregulated Cable v. Regulated DSL (until 20031Q)

Cable TV operators began offering cable modem services in 1995 [12] and did so without any obligation to share their network infrastructure with other firms. Attempts to require cable operators to provide “open access” to independent ISPs were unsuccessful.²⁰ A 1999 FCC report concluded that access regulation would risk deterring investment in the rapidly evolving market.²¹ The FCC later concluded that cable modem service should be classified as an interstate information service, and therefore be exempt from common-carrier or open access obligations at both the federal and state/local level. The U.S. Supreme Court upheld the FCC’s determination in June 2005.²²

In contrast to unregulated CM services, telephone company DSL services have historically been subject to various regulatory obligations. When DSL was first offered in the 1990s, incumbent local exchange carriers (ILECs) faced three major types of open access rules. First, telephone companies were required to provide the broadband transmission component of DSL services on a common-carrier basis.²³ Second, telephone companies were mandated to provide the copper loops used to provide DSL service on an unbundled basis.²⁴ Third, the FCC’s so-called line sharing rules required telephone companies to lease just the high-frequency portion of the loop (“HFPL”) used to provide DSL services.²⁵ Regulators then set the price for the HFPL far below the price for an unbundled loop as a whole, substantially reducing Digital Competitive Local Exchange Carrier (dCLEC) costs.²⁶

3.1.B. Cable Unregulated/DSL Partially Deregulated (20031Q-20052Q)

²⁰ The AOL/Time Warner merger, consummated in early 2000, imposed unique third party access obligations. The provisions required the merged firm to offer AOL Broadband only after permitting two independent ISPs to utilize Time Warner Cable infrastructure. The rules did not regulate wholesale prices, nor did they regulate Time Warner’s Road Runner broadband ISP.

²¹ Federal Communications Commission Cable Services Bureau, *Broadband Today*, A Staff Report to William E. Kennard, Chairman, FCC (Oct. 1999); <http://www.fcc.gov/Bureaus/Cable/Reports/broadbandtoday.pdf>.

²² *National Cable & Telecommunications Assn. v. Brand X Internet Services*, 545 U. S. 967 (2005).

²³ Federal Communications Commission, *In the Matter of Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, Report and Order and Notice of Proposed Rulemaking*, CC Docket No. 02-33, pp. 19-20 (Sep. 23, 2005).

²⁴ 47 C.F.R. § 51.319(a)(1).

²⁵ Federal Communications Commission, *In the Matters of Deployment of Wireline Services Offering Advanced Telecommunications Capability and Implementation of Local Competition Provisions of the Telecommunications Act of 1996, Third Report and Order*, CC Docket No. 98-147 (Dec. 9, 1999); http://www.fcc.gov/Bureaus/Common_Carrier/Orders/1999/fcc99355.txt.

²⁶ 47 C.F.R. § 51.319(a)(1)(i). dCLECs are competitive local exchange carriers specializing in data services.

In February 2003, the FCC eliminated DSL line sharing rules.²⁷ As a result, dCLECs would have to pay for the entire local loop in order to supply DSL service to customers over the incumbent carrier's lines, or strike a commercial agreement with the carrier to share a loop. The rationale for the reform was that, with lessened network sharing obligations, telephone carriers would invest more heavily in bringing broadband services to residential customers.

3.1.C. Unregulated Cable/Unregulated DSL (2005Q-present)

In August 2005, the FCC removed the remaining open access regulations for Internet connections bundled with transport. With the Commission determining that DSL fell under Title I of the Communications Act, broadband Internet access became treated as an "information service" exempt from common-carrier regulation.²⁸ This put DSL services on regulatory parity with cable modem service.

3.2. Testing the Policies

Given this policy variation and the existence of rivalry between cable modem (CM) and DSL networks, we can examine how broadband subscribership responds to changes in regulatory obligations. Network sharing rules are tested on the evidence yielded by subscriber choices. Across three broadband regime switches, the theory that convergence requires continued network sharing regulation implies:

- (1) pre-1Q2003: CM unregulated, DSL regulated with "line sharing"
Prediction: *DSL subscribership will exceed CM subscribership.*
- (2) 1Q2003-4Q2006: DSL "line sharing" eliminated 1Q2003
Prediction: *DSL subscriber growth will decline from trend.*
- (3) 3Q2005-4Q2006: DSL classified "information service" 3Q2005
Prediction: *DSL subscriber growth will further decline from trend.*

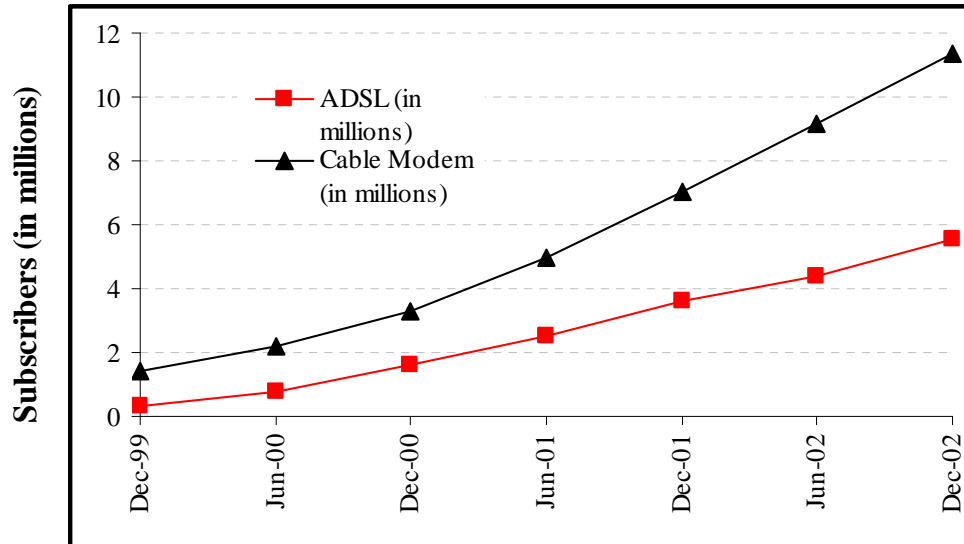
3.2.A. Growth of DSL vs. Cable Modem Prior to 1Q 2003

While DSL and cable modem technologies were developed at roughly the same time, unregulated cable companies expanded the availability and penetration of their services much more quickly than regulated telephone companies. By year-end 1999 cable dominated the emerging residential broadband market: residential and small business DSL lines totaled just 0.29 million, while cable modem subscribers numbered 1.40 million. Cable continued its dominance through year-end 2002, when it served 11.34 million, double the number of DSL lines (5.53 million). See Fig. 4.

²⁷ FCC, *FCC Adopts New Rules for Network Unbundling Obligations Of Incumbent Local Phone Carriers* (Feb. 20, 2003); http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-231344A1.pdf.

²⁸ Federal Communications Commission, *FCC Eliminates Mandated Sharing Requirement on Incumbents' Wireline Broadband Internet Access Services, Decision Places Telephone and Cable On Equal Footing*, Press Release (Aug. 5, 2005); http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260433A1.pdf.

FIG. 4. RESIDENTIAL AND SMALL BUSINESS
ADSL AND CABLE MODEM SUBSCRIBERS, 1999-2002²⁹



These data appear inconsistent with the hypothesis that open access promotes broadband deployment. Moreover, Wall Street analysts have concluded that regulatory factors did play an important causative role in the relatively quick deployment of cable modem services. According to Blake Bath of Lehman Brothers:

The reason that the cable companies really stepped up their investment in 1997 and beyond was they were not regulated, they weren't forced to open up their networks. There were multiple revenue streams that they could address. They could price the services however they wanted.³⁰

Such commentary helps evaluate the link between regulatory events and market outcomes. Investor behavior itself provides further evidence of the link between a cable's favorable regulatory environment and industry growth. Bittlingmayer & Hazlett (2003) found that publicly announced events advancing open access rules³¹ produced negative returns for cable modem providers, but *no positive returns* for the overall Internet Index.³² On the contrary, events defined as setbacks for open access,³³ produced high abnormal returns (returns adjusted for contemporaneous movements in the overall market) for cable modem providers such as Excite@Home, and *positive returns* for the Internet Index. These results suggest

²⁹ Source: FCC, *High Speed Services for Internet Access* (semi-annual report).

³⁰ Quoted in Adam Thierer, *Broadband and the Markets: Perspectives from the Investment Community*, Cato Institute Policy Forum (July 24, 2001), p. 15; <http://www.cato.org/events/transcripts/010724et.pdf>.

³¹ There were 8 open access "victories," which included a ruling by a Portland judge against AT&T, the vote by Broward and Pittsburgh in favor of open access, the FCC avowal to scrutinize the AOL Time Warner merger, and rumors of regulatory action." Table 7 in Bittlingmayer & Hazlett, *The Political Economy of "Open Access,"* 2003 STANFORD TECHNOLOGY LAW REVIEW 4.

³² Returns were calculated for 1-day and 3-day periods surrounding open access event announcements. Reported returns are abnormal, Nasdaq-adjusted.

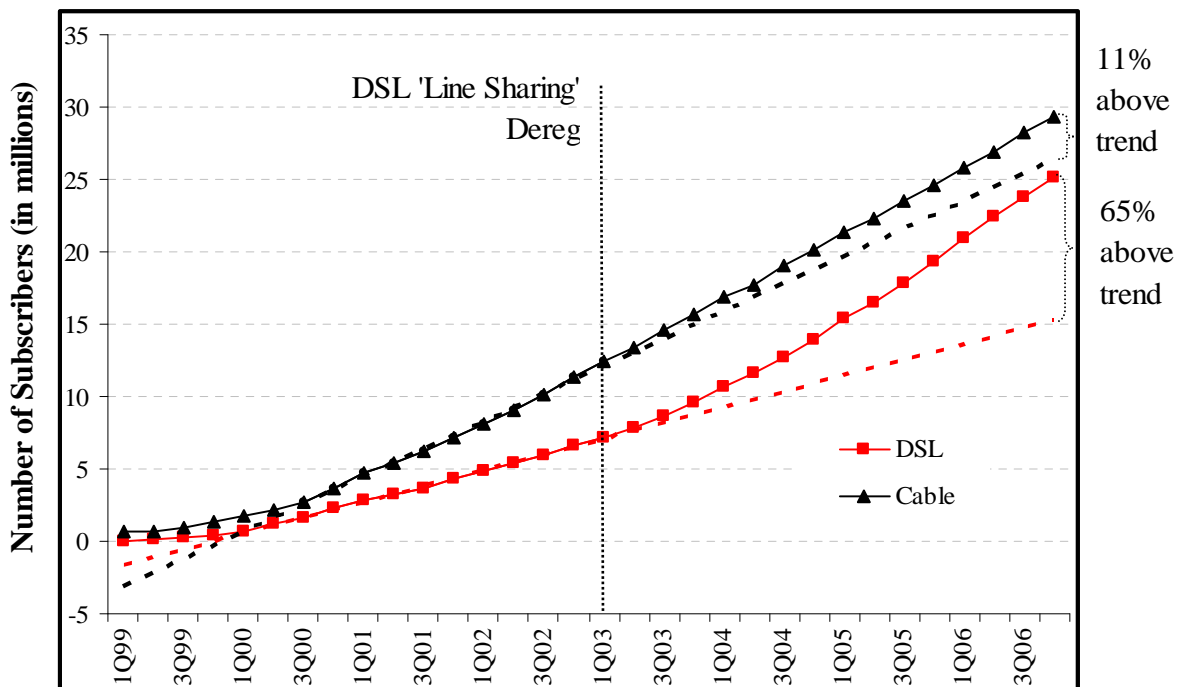
³³ There were 21 "setback" events. "These include announcements of mergers and favorable developments for a variety of mergers, including AT&T's purchase of cable operators TCI and MediaOne. Also included are various rumored deals that never took place, notably linkups of AOL and Excite@Home, and AT&T and Time Warner. Finally, this group of events also includes legal and political setbacks such as a Miami city council ruling in favor of the cable companies and the June 22, 2000 appeals court ruling that struck down Portland, Oregon's local access requirements." Table 6 in Bittlingmayer & Hazlett (2003).

that investors did not expect open access to stimulate innovation and growth in the Internet sector generally, a claim underlying the argument for mandatory network sharing rules.

3.2.B. DSL Growth Before 1Q2003 vs. DSL Growth After 1Q2003

DSL subscribership experienced a sharp increase in trend soon after the FCC’s decision to end line-sharing. During this period, DSL subscribership rose from 6.61 million (year-end 2002) to 25.14 million (4Q 2006). At the same time, cable modem subscriber growth continued at a fairly constant pace, suggesting the increasing DSL growth pattern was due to factors specific to DSL rather than the broadband market generally. See Figure 5. By the fourth quarter of 2006, the *CM-DSL* gap shrank from 5.30 million (27% of the broadband subscribers), the level it reached in the first quarter of 2003, to 4.20 million (just 8% of broadband subscribers). Looking only at CM and DSL, the CM share of broadband was 64% in 1Q2003, with DSL at 36%. By 4Q2006, CM share had fallen to 54%, with DSL rising to 46%.

FIG. 5: DSL & CABLE MODEM SUBSCRIBERS, 1Q1999-4Q2006



By the fourth quarter of 2006, DSL penetration dramatically exceeded the pre-deregulation trend. The level of DSL subscribers in 4Q2006 was 65% higher than projected, linearly extrapolating DSL subscribership observed in the 3Q2000 to 1Q2003 period. Meanwhile, CM subscribers exceeded the same projected trend by 11%.

3.2.C. DSL Growth Before 3Q2005 vs. DSL Growth After 3Q2005

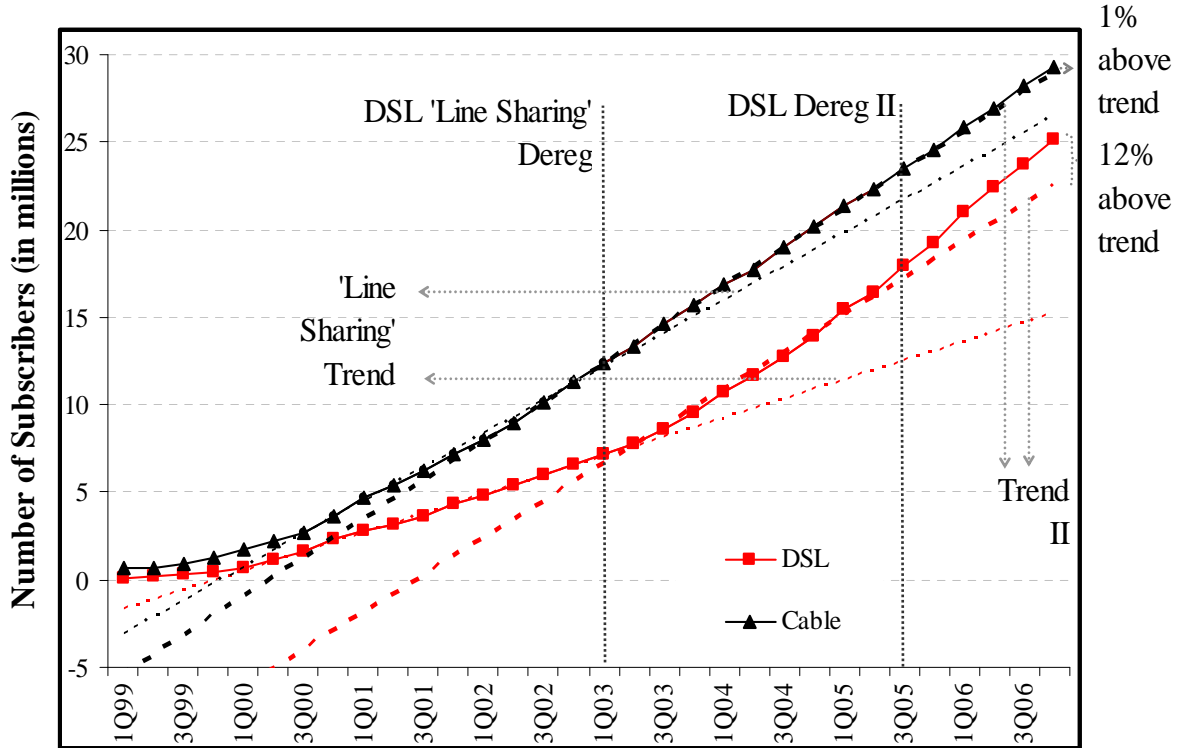
In August 2005, DSL was further deregulated when the Internet access service was declared by the FCC to be an information service under Title I. To gauge retail market reaction, Figure 6 extends Figure 5, projecting broadband subscriber trends as of 2Q2005 and showing actual levels recorded through 4Q2006.

In Figure 6, a linear time trend (“Trend I”) was estimated using actual subscriber data through the first quarter of 2003.³⁴ A second linear time trend is calculated using observed subscriber levels during the

³⁴ This estimation used ordinary least squares.

intermediate period, 1Q2003 through 2Q2005. This second trend (“Trend II”) is then projected through the fourth quarter of 2006. According to this simple method, the increase in DSL households that occurs following the Aug. 2005 DSL deregulation amounts to about 12% of total DSL 4Q2006 subscribers. In other words, DSL subscribership again increases from trend in the period following the 2005 deregulation. Despite the short time for post-reform effects to develop (just six quarters, 3Q2005 to 4Q2006, inclusive), there are about 2.63 million *additional* households subscribing to DSL by the end of 2006 than if the trend prior to deregulation (obtaining 1Q2003 to 2Q2005) had continued. CM growth, in contrast, is just one percent above the Trend II prediction at year-end 2006.

FIG. 6: DSL & CM SUBSCRIBERS IN THE U.S., 1Q1999-4Q2006



Notes: The linear 'line sharing' time trend is estimated using data from 3Q2000 to 1Q2003. The linear Trend II is estimated from data between 1Q2003 and 2Q2005. See Fig. 5 for sources and data notes.

3.2.D. Summary

These patterns are analyzed econometrically in Hazlett & Caliskan (2008)[13], which finds that the observed changes in growth rates are statistically significant. Across regimes deployment appears to slow with open access regulation, while increasing with deregulation. These experiments, incorporating market responses on both the demand and supply sides, offer important evidence that convergence among competitive, differentiated, deregulated platforms performs very well relative to convergence managed by network sharing mandates.

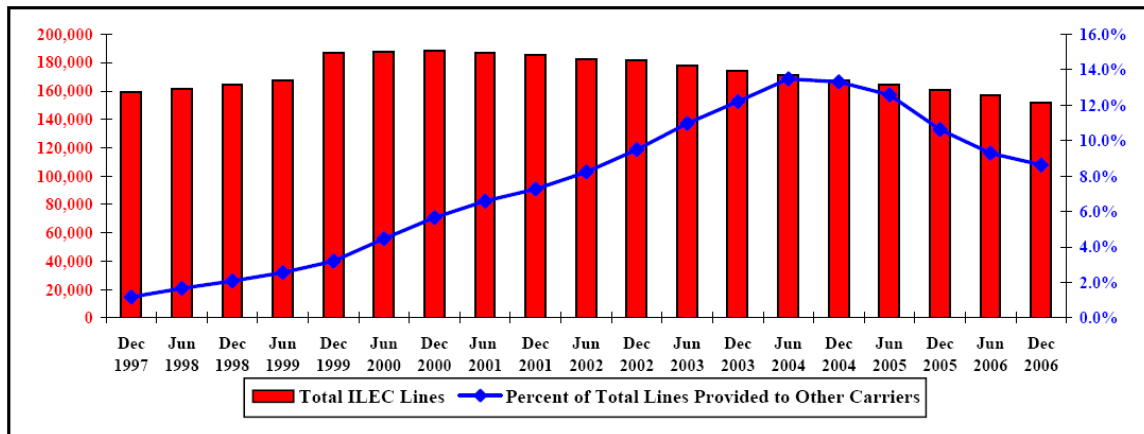
4. Conclusion

The 1996 presumption in the United States was that rival networks, while competitively desirable, were not possible in the short- to medium-term. Instead, incumbent networks would need to host entrants, on regulated terms, allowing such carriers the opportunities to construct new facilities over time. The path

was complicated by the administrative processes required to set wholesale access prices and the natural difficulties in forcing rival firms to cooperate as complementary suppliers [6][14].

The network sharing policy approach, reflecting a Convergence B vision, did manage to produce a substantial amount of network sharing. By June 2004, some 13% of ILEC lines were resold by competitive entrants. See Fig. 7. But the promised stepping stone to facilities-based competition did not materialize. Indeed, when the infrastructure sharing regime was at that point substantially eliminated – having failed, over eight years, to craft legally consistent rules for creating market rivalry – there was a sharp turnaround in local telephone competition. While cable operators had wired only about 15% of U.S. markets (household-adjusted) for telephony in the seven years since the 1996 Telecommunications Act permitted them to do so, the 2004-2007 period ended with over 85% of markets wired for cable telephony. The era of head-to-head fixed-line rivalry had arrived; at best the network sharing policy had been irrelevant, at worst, and most likely, a deterrent to progress.

FIG. 7. ILEC LINES AND PERCENT PROVIDED TO OTHER CARRIERS³⁵



A similar pattern has been seen across regulatory regime changes in U.S. residential broadband markets. Cable modem (CM) service has always been unregulated, while DSL services provided by telephone carriers were traditionally regulated on common carrier rules. CM deployment was initially very aggressive, however, outperforming DSL subscribership by two-to-one in the 1999-2002 period. When “line sharing,” offering low access prices for data CLECs using ILEC facilities, was ended in 1Q2003, DSL deployment gained considerable traction relative to CM subscribership. This trend was furthered following a subsequent 2005 deregulation. By year-end 2006, DSL subscribership was about 25 million households, ten million above the level predicted by the pre-2003 trend established under common carrier rules. Hence, the broadband market offers powerful lessons reinforcing what has been observed in voice telephony.

The local telephone market in the U.S. is today “effectively competitive” by standards used in other communications markets, even without factoring in the most important substitute product: mobile telephone service. It is notable that the greatest progress in this competitive path has been traveled since the collapse of the network sharing regime, once thought to be its facilitator. This is a Convergence A result that should prove valuable in informing policy choices faced by telecommunications regulators everywhere.

³⁵ Federal Communications Commission, *Local Telephone Competition: Status as of Dec. 31, 2006*, Chart 4.

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