THE EMPIRICAL CASE AGAINST ASYMMETRIC REGULATION OF BROADBAND INTERNET ACCESS†

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ABSTRACT

The United States regulates the provision of broadband Internet access service asymmetrically. A cable television system operator is not regulated in its sale of cable modem service. In contrast, an incumbent local exchange carrier ("ILEC") that offers digital subscriber line ("DSL") service faces price regulation as well as the obligation to offer competitors the use of its broadband network on a wholesale (or, "unbundled") basis. The social costs of asymmetric regulation are by now familiar. The Federal Communications Commission ("FCC") could remove its own asymmetric regulation. It could reclassify broadband Internet access as an "information service," which is largely unregulated. Or, it could forbear from regulating ILEC provision of broadband Internet access. A third, and more incremental, approach would be for the FCC to declare ILECs "nondominant" in the provision of advanced services, including broadband Internet access. In this Article, we evaluate the empirical case against asymmetric regulation of broadband Internet access through the lens of the FCC's approach to deciding petitions for nondominance. We use a nested-logit discrete-choice model to produce econometric estimates of the own-price elasticity of demand for DSL service and the cross-price elasticity of demand for cable modem service with respect to DSL service. Our findings suggest that demand for DSL service is price-elastic, that DSL and cable modems are in the same product market, and that DSL providers lack market power. The FCC

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would advance the public interest by ruling that the ILECs are non-dominant in the mass-market broadband services market.

I. INTRODUCTION

The United States has asymmetric regulation of the provision of broadband Internet access service. A cable television system operator is not regulated in its sale of cable modem service. In contrast, an incumbent local exchange carrier ("ILEC") that offers digital subscriber line ("DSL") service faces price regulation as well as the obligation to offer competitors the use of its broadband network on a wholesale (or, "unbundled") basis so that they may offer, in the retail market, DSL services that compete with the ILEC's own retail offering to consumers.

The social costs of asymmetric regulation are by now familiar. Such regulation leads not to deregulation, but to an enduring "managed competition" far more complex to administer than traditional regulation of a monopoly service provider ever was.[1] The alternative to asymmetric regulation is either symmetric regulation or symmetric freedom from regulation.

1. *See, e.g.*, J. GREGORY SIDAK & DANIEL F. SPULBER, DEREGULATORY TAKINGS AND THE REGULATORY CONTRACT: THE COMPETITIVE TRANSFORMATION OF NETWORK INDUSTRIES IN THE UNITED STATES 307-92, 403-26 (Cambridge Univ. Press 1997); DALE E. LEHMAN & DENNIS WEISMAN, THE TELECOMMUNICATIONS ACT OF 1996: THE "COSTS" OF MANAGED COMPETITION (Kluwer Academic Press 2000); ALFRED E. KAHN, WHOM THE GODS WOULD DESTROY, OR HOW NOT TO DEREGULATE (AEI-Brookings Joint Center on Regulatory Reform 2001).

Assuming that the latter alternative is preferred, what actual steps would be taken to abolish asymmetric regulation of ILEC provision of broadband Internet access?

Congress could again amend the Communications Act of 1934.[2] That step, however, would be a daunting one for all the reasons that it took many years for Congress to pass the Telecommunications Act of 1996.[3] Alternatively, the Federal Communications Commission (FCC) could remove asymmetric regulation that the agency itself previously imposed. The FCC could declare that broadband Internet access service is not a "telecommunications service," subject to numerous regulations applicable to ILECs, but rather an "information service," which is free of such regulations. Amid considerable controversy, the FCC invited public comment in February 2002 on such a proposed reclassification.[4] Or the FCC could use its power under section 10 of the Communications Act to forbear from regulating ILEC provision of broadband Internet access.[5]

A third, and more incremental, approach would be for the FCC to declare ILECs "nondominant" in the provision of advanced services, such as broadband Internet access. Nondominant global carriers are exempt from price-cap or rate-of-return regulation, as well as the obligation to file tariffs and to establish the reasonableness of those tariffs through the submission of cost data.[6] Understandably, a dominant carrier will seek to be reclassified as nondominant as soon as market conditions will support such a conclusion by regulators.

Much, if not all, of the economic analysis required to determine whether a carrier is nondominant also would be relevant to the FCC's decision whether to forbear from regulating a particular service or whether to reclassify the service in question as unregulated. Although the FCC did not receive its authority under section 10 to forbear from regulation until

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2. 47 U.S.C. § 1 *et seq*.

3. Pub. L. No. 104-104, 110 Stat. 56 (1996).

4. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities Universal Service Obligations of Broadband Providers Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review—Review of Computer III and ONA Safeguards and Requirements, Notice of Proposed Rulemaking, CC Dkt. No. 02-33, CC Dkts. Nos. 95-20, 98-10 (released Feb. 15, 2002).

5. 47 U.S.C. § 160.

6. Deployment of Wireline Services Offering Advanced Telecommunications Capability, Memorandum Opinion and Order, and Notice of Proposed Rulemaking, CC Dkt Nos. 98-147, 98-11, 98-26, 98-32, 98-78, 98-91, 13 F.C.C. Rcd. 24,011, 24,020 ¶ 19 (1998).

1996, the agency has evaluated petitions for nondominance for a longer time and consequently has distilled a body of law on the subject.

In this Article, therefore, we evaluate the case against asymmetric regulation of broadband Internet access through the lens of the FCC's approach to deciding petitions for nondominance. We examine the economic evidence relevant to whether ILECs are nondominant in the provision of mass-market broadband services, the most familiar of which is DSL service.[7] In Part II of this Article, we review the analytical framework that the FCC has used in previous nondominance proceedings. FCC rules define a dominant carrier as a carrier possessing market power, and a nondominant carrier as a carrier not found to be dominant.[8] The FCC traditionally has considered four factors in determining whether a firm possesses market power: (1) market share and changes therein, (2) demand elasticity, (3) supply elasticity, and (4) cost and size disparity.[9] In addition to considering these four factors, the FCC also has considered whether a firm classified as dominant that lacks market power in the provision of some services could, through discrimination, cross-subsidization, and/or the effectuation of a price squeeze, quickly acquire market power in those services. The FCC has concluded that if a firm does not now have, and could not quickly gain, the ability profitably to raise the price of a service by restricting its output, then it is nondominant in the provision of that service. In Part III, we apply the FCC's nondominance framework to the mass-market broadband services market. We find that all four elements of that test point to the conclusion that an ILEC lacks market power with respect to DSL and other mass-market broadband services. In particular, we use a nested-logit discrete-choice model to produce econometric estimates of the

7. For purposes of this analysis, we use the F.C.C.'s definition of advanced services, as set forth in the *SBC/Ameritech Merger Order*: "wireline telecommunications services, such as ADSL, IDSL, xDSL, Frame Relay, Cell Relay and VPOP-Dial Access Service (an SBC Frame Relay-based service) that rely on packetized technology and have the capability of supporting transmission speeds of at least 56 kilobits per second in both directions." As did the F.C.C., we exclude from this definition: (1) data services that are not primarily based on packetized technology, such as ISDN; (2) x.25-based and x.75-based packet technologies; and (3) circuit switched services. *See* Application of Ameritech Corp, Transferor, and SBC Communications Inc., Transferee, for Consent to Transfer Control of Corporations Holding Commission Licenses and Lines Pursuant to Section 214 and 310(d) of the Communications Act and Parts 5, 22, 24, 25, 63, 90, 95 and 101 of the Commission's Rules, 14 F.C.C. Rcd. 14,712 (1999) App. C., Merger Conditions, at 1 ¶ 2 [hereinafter *SBC/Ameritech Merger Order*].

8. *See* 47 C.F.R. §§ 61.3(o), 61.3(u).

9. Competition in the Interstate Interexchange Marketplace, CC Dkt. No. 90-132, 6 F.C.C. Rcd. 5880, 5882 (1991) [hereinafter *AT&T Streamlining Order*].

own-price elasticity of demand for DSL service and the cross-price elasticity of demand for cable modem service with respect to DSL service. We find that the own-price elasticity of DSL service is high, which suggests that demand for DSL service is price-elastic. Moreover, the cross-price elasticity of demand for cable modem service with respect to a change in the price of DSL service is high as well, which is evidence that DSL and cable modems are in the same product market, and that DSL providers lack market power. Having concluded on the basis of both empirical and qualitative evidence that an ILEC does not now have market power in the provision of DSL service, we explain why an ILEC could not leverage its purported market power in the local exchange market into the mass-market broadband services market.

We conclude that the FCC would advance the public interest by ruling that the ILECs are nondominant in the mass-market broadband services market. Doing so would be an important first step toward the elimination of asymmetric regulation of broadband Internet access service.

II. THE FCC'S FRAMEWORK FOR ANALYZING NONDOMINANCE

The FCC defines a dominant carrier as "a carrier that possesses market power" and a nondominant carrier as "a carrier not found to be dominant (that is, one that does not possess market power)."[10] In the *Fourth Report* in the *Competitive Carrier* proceeding, the FCC defined market power as the "ability to raise and maintain price above the competitive level without driving away so many customers as to make the increase unprofitable."[11] The Commission affirmed this definition in the *Bell Operating Company ("BOC") Classification Order*, concluding that "the BOC interLATA affiliates should be classified as dominant carriers in the provision of in-region, interstate, domestic interLATA services only if the affiliates have the ability to raise prices of those services by restricting their own output."[12] Notably, in affirming this definition, the FCC rejected arguments

10. 47 C.F.R. §§ 61.3(o), 61.3(t).

11. Policy and Rules Concerning Rates for Competitive Common Carrier Services and Facilities Authorizations Therefore, Fourth Report and Order, 95 F.C.C.2d 554, 558 ¶ 7 (1983) (citing William M. Landes & Richard A. Posner, *Market Power in Antitrust Cases*, 94 HARV. L. REV. 937, 945-52 (1981); Valley Liquors, Inc. v. Renfield Importers, Ltd., 678 F.2d 742, 745 (7th Cir. 1982); H&B Equip. Co., Inc. v. Int'l Harvester Co., 577 F.2d 239, 243 (5th Cir. 1978); ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS 65-66 (MIT Press 1988)).

12. Regulatory Treatment of LEC Provision of Interexchange Services Originating in the LEC's Local Exchange Area and Policy and Rules Concerning the Interstate, Inter-

that a BOC affiliate should be deemed dominant if it could obtain unfair advantages over its competitors by virtue of its association with the BOC. The Commission held that dominant carrier status was designed to address anticompetitive pricing by the affiliate, not anticompetitive practices by the BOC and, therefore, should be imposed only when the affiliate would be able to raise its own prices by restricting its own output.[13] The FCC's dominance analysis is grounded in well-accepted antitrust principles of market power.[14]

The analytical framework currently used by the FCC to assess market power is based on a framework first articulated in 1991, when the FCC streamlined its regulation of certain AT&T business services.[15] In that order, the FCC identified four primary factors to be used in assessing market power: (1) AT&T's market share and changes therein, (2) the extent to which AT&T's competitors had excess supply capacity, (3) the price elasticity of demand of AT&T's services, and (4) the disparity in size, resources, and cost structures between AT&T and other interexchange carriers (IXCs).[16]

The FCC applied this same analytical framework in its 1995 order declaring AT&T nondominant in its provision of domestic interexchange interstate services.[17] The FCC began its analysis by identifying the relevant product and geographic markets for assessing AT&T's market power. It concluded, based on the market definitions used in the *Competitive Carrier* proceeding and notwithstanding arguments that AT&T maintained market power in discrete services, that all interstate, domestic, interexchange services would be considered a single product market.[18] It concluded, further, that there was a single national geographic market for such services. Having so defined the relevant product and geographic market, the FCC concluded, based on the four factors identified above, that AT&T lacked market power in this market. The FCC subsequently applied this

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exchange Marketplace, CC Dkt. No. 96-149, 12 F.C.C. Rcd. 15,756, 15,804 ¶ 85 (1997) [hereinafter *BOC Classification Order*].

13. *Id.* at 15,815 ¶ 103.

14. *See* 2A PHILLIP E. AREEDA, HERBERT HOVENKAMP & JOHN L. SOLOW, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 83-302 (1995); Landes & Posner, *supra* note 11, at 939-52.

15. Competition in the Interstate Interexchange Marketplace, CC Dkt. No. 90-132, 6 F.C.C. Rcd. 5880 (1991) [hereinafter *AT&T Streamlining Order*].

16. *Id.* at 5882 ¶ 10.

17. Motion of AT&T Corp. to be Reclassified as a Nondominant Carrier, 11 F.C.C. Rcd. 3271 (1995) [hereinafter *AT&T Reclassification Order*].

18. *Id.* at 3285-86 ¶¶ 20-22.

same four-part nondominance methodology in both the *AT&T International Nondominance Order*[19] and the *COMSAT Nondominance Order*.[20]

In the *BOC Classification Order*,[21] the FCC revised its approach to defining product and geographic markets and amplified its nondominance analysis to account for firms that could be dominant in the provision of some, but not all, services. With respect to market definition, the Commission adopted the approach taken in the *1992 Merger Guidelines.*[22] Under that approach, a relevant market encompasses any service or group of services for which there are no close demand substitutes.[23] The Commission noted that, under this approach, there could be multiple product markets for domestic, interstate, interexchange services, and that each route that allows a connection from one location to another would be a separate geographic market.[24] Nevertheless, noting that it would be impracticable and inefficient to recognize and analyze every such market, the FCC concluded that it need only do so if there was credible evidence suggesting that there is or could be a lack of competitive performance with respect to a particular service or group of services or in a particular area.[25] Using this approach, the FCC concluded that all domestic, interstate, interexchange services could continue to be treated as a single product market and that a

19. Motion of AT&T Corp. to be Declared Nondominant for International Service, 11 F.C.C. Rcd. 17,963, 17,977 ¶ 36 (1996) [hereinafter *AT&T International Nondominance Order*].

20. COMSAT Corp., Petition Pursuant to Section 10(c) of the Communications Act of 1934, as amended, for Forbearance from Dominant Carrier Regulation and for Reclassification as a Nondominant Carrier, 13 F.C.C. Rcd. 14,083, 14,118-19 ¶ 67 (1998) [hereinafter *COMSAT Nondominance Order*].

21. *BOC Classification Order*, *supra* note 12, at 18,042 ¶ 28.

22. Although under the *Merger Guidelines*, markets are defined primarily based on demand elasticity, the F.C.C. will assume that two services are in the same product market if production substitution among these services is nearly universal—that is, if the suppliers of one service also supply the other service. *See* Application of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communication Corporation to WorldCom, Inc., 13 F.C.C. Rcd. 18,025, 18,041 ¶ 27 & n.66 (1998) (citing *1992 Horizontal Merger Guidelines*, 57 Fed. Reg. at 41,557, § 1.32 n.14) [hereinafter *WorldCom/MCI Order*].

23. *BOC Classification Order*, *supra* note 12, at 18,042 ¶ 29.

24. *Id.* at 18,042 ¶ 30.

25. *SBC/Ameritech Merger Order*, *supra* note 7, at 14,746 ¶ 68 ("As we explained in the *WorldCom/MCI Order*, to define relevant product markets we can identify and aggregate consumers with similar demand patterns"). *See also id.* at 14,747 n.147 ("We can consider, as a whole, groups of point-to-point markets where customers face the same competitive conditions. We therefore treat as a geographic market an area in which all customers in that areas will like face the same competitive alternatives for a product").

BOC's in-region and out-of-region territory be treated as separate geographic markets.

In 1998, the Commission amplified its nondominance analysis in the *BOC Classification Order*. The Commission began its analysis by applying the four-part test first articulated in the *AT&T Streamlining Order* and then applied in subsequent nondominance orders. Because the BOCs were new entrants in the long-distance market, the Commission readily concluded that the BOCs would not have market power in the provision of domestic in-region, interLATA services immediately upon entry into that market. Then, theorizing that this initial lack of market power could simply reflect the BOCs' prior exclusion from the market, the Commission went on to address whether a BOC could leverage market power in local exchange and exchange access services to confer market power on its long-distance affiliate upon entry by the affiliate into the market, or shortly thereafter.

As noted, though, the Commission specifically rejected claims that a BOC long-distance affiliate should be deemed dominant solely on the basis of a finding that it could derive advantages in the market through discrimination, cross-subsidization, or other anticompetitive actions by the ILEC.[26] While acknowledging that such actions could distort the market and result in a misallocation of societal resources, the Commission found that dominant carrier regulation of the affiliate was a poor tool for dealing with those risks.[27] Rather, the Commission found, dominant carrier status would only be appropriate if the advantages conferred by leveraging were so great that, upon entry or soon thereafter, the ILEC's affiliate would be able to raise prices by restricting its own output.[28] We now apply the FCC's four-part test to mass-market broadband services, which include residential customers and small businesses.

III. NONDOMINANCE IN THE MASS-MARKET BROADBAND SERVICES MARKET

Mass-market broadband services are provided by cable providers, telephone companies, direct broadcast satellite ("DBS"), and other firms that provide mass-market consumers packet switched transport at speeds

26. *BOC Classification Order*, *supra* note 12, at 15,873-77 ¶¶ 206-10.
27. *Id.* at 15,877 ¶ 211.
28. *Id.* at 15,834 ¶ 133.

exceeding 56 kilobits per second in both directions.[29] In the following sections, we elaborate on the relevant product and geographic markets.

A. Mass-Market Broadband Services as the Relevant Product Market

We consider now the relevant product market and relevant geographic market in which DSL service competes.

1. The Product Market

Under the 1992 *Merger Guidelines*, used by the FCC to define product markets, a set of services represents a distinct product market if a hypothetical monopoly provider of those services could profitably sustain a nontransient, nontrivial price increase—that is, if the monopolist's profits after the price increase would exceed the monopolist's profits before the price increase.[30] If the price increase caused enough buyers to shift their purchases to a second product to render the increase unprofitable, then the second product should be considered to be part of the same product market.

There is broad consensus that all mass-market broadband services are in the same product market. In fact, the FCC, the Department of Justice,[31] the Federal Trade Commission,[32] and academicians[33] have all previously

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29. *See SBC/Ameritech Merger Order*, *supra* note 7, App. C, Merger Conditions at 1, ¶ 2.

30. 1992 Department of Justice and Federal Trade Commission Horizontal Merger Guidelines, at 20,572 § 1.0 (defining the relevant product market as "a product or group of products such that a hypothetical profit maximizing firm that was the only present and future seller of those products ('monopolist') likely would impose at least a 'small but significant and nontransitory' increase in price").

31. Competitive Impact Statement at 9, United States v. AT&T Corp., Civil No. 00-CV-1176 (D.D.C. filed May 25, 2000) ("A relevant product market affected by [the AT&T/MediaOne] transaction is the market for aggregation, promotion, and distribution of broadband content and services").

32. Complaint at ¶ 21, Am. Online, Inc., File No. 001-0105, Docket No. C-3989 (Dec. 14, 2000) ("The relevant product market in which to assess the effects of the proposed merger is the provision of residential broadband internet access service").

33. *See* Jerry A. Hausman, J. Gregory Sidak & Hal J. Singer, *Cable Modems and DSL: Broadband Internet Access for Residential Customers*, 91 AM. ECON. ASS'N PAPERS & PROC. 302 (2001) [hereinafter Hausman, Sidak & Singer, *Cable Modems and DSL*]; Jerry A. Hausman, J. Gregory Sidak & Hal J. Singer, *Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers*, 18 YALE J. ON REG. 129 (2001) [hereinafter Hausman, Sidak & Singer, *Residential Demand for Broadband*].

so concluded.[34] For example, in the *First Advanced Services Report*, the Commission stated in 1999:

> [W]e see the potential for [the consumer broadband] market to accommodate different technologies such as DSL, cable modems, utility fiber to the home, satellite and terrestrial radio. The fact that different companies are using different technologies to bring broadband to residential consumers and that each existing broadband technology has advantages and disadvantages as a means of delivery to millions of customers opens the possibility of intermodal competition, like that between trucks, trains, and planes in transportation.[35]

Likewise, in the *Fixed Wireless Competition Order*, the Commission found this year that "DSL technologies remain the most significant competitors to Internet over cable."[36] In the *AOL/Time Warner Merger Order*, the Commission concluded that mass-market broadband services constitute the relevant product market in determining the effects of the proposed

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34. As explained by Hausman, Sidak, and Singer, broadband access to the Internet represents a discrete product market, separate from the market for narrowband, dial-up Internet access because, among other things, many of the services supported by broadband connections are not available through narrowband connections, and the demand for applications that can be supported only by high-bandwidth connections strongly suggests that the product markets for narrowband and broadband access are distinct. Moreover, empirical research shows that narrowband Internet access prices (including the access charge plus the price of a second telephone line) do not constrain broadband Internet access prices. *See* Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations by Time Warner Inc. and American Online, Inc., Transferors, to AOL Time Warner Inc., Transferee, 16 F.C.C. R. 6547, ¶ 71 (2001) (citing Declaration of Jerry A. Hausman, Attached to the Comments of America Online, Application for Consent to Transfer TCI to AT&T, CS Dkt. No. 98-178, at ¶¶ 4-10; Declaration of Daniel Rubinfeld and J. Gregory Sidak, Attached to the Comments of GTE, Application for Consent to Transfer Control of MediaOne to AT&T, at 8) [hereinafter *AOL/Time Warner Order*]; Hausman, Sidak & Singer, *Cable Modems and* DSL, *supra* note 33; Hausman, Sidak & Singer, *Residential Demand for Broadband*, *supra* note 33.

35. Inquiry Concerning the Deployment of Advanced Telecommunications Capability, Report, 14 F.C.C. R. 2398, 2423-24 (1999). In that same report, the F.C.C. noted that "whether a capability is broadband does not depend on the use of any particular technology or the nature of the provider." *Id.* at 2407.

36. Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, 16 F.C.C. R. 6005, at ¶ 51 (2001). *See also Broadband Today*, F.C.C. Staff Report, at 42 (Oct. 1999) ("as deployment of DSL, satellite, and wireless advances, in large part spurred by rapid cable modem deployment, consumers will have alternative platforms to use for high-speed data access").

merger on the public interest.[37] The Commission also concluded that "[t]he main competitor to cable in the market for residential high-speed Internet services is currently DSL."[38]

The findings of the FCC, the DOJ, the FTC, and academicians that all mass-market broadband services are in the same product market are correct. Absent a quantitative determination of whether two services are part of the same product market, courts have generally included products in the same market if they are "reasonably interchangeable" in their use.[39]

Applying this standard leaves no doubt that all mass-market broadband services, including, most importantly, DSL and cable modem service, are part of the same product market. First, from a functional standpoint, the services are substantially similar. They all are means by which consumers can obtain high-speed access to the Internet. They permit consumers to navigate the web on a far more efficient basis than dial-up Internet access, and they provide consumers with access to a host of features that require high bandwidth, including real-time video programming, on-demand video, customized music and video libraries, real-time radio programming, interactive multi-player gaming, and high-speed telecommuting. According to surveys conducted by ZDNet and the Yankee Group, the high bandwidth common to all broadband services is clearly the principal determinant of consumer decisions to purchase broadband service.[40] Other

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37. *See AOL/Time Warner Order*, *supra* note 34. Although the Commission suggested that its finding that residential high-speed Internet access services constitute a discrete product market might be limited to the specific context in which the issue had been raised, *id.* at n.202, we are not aware of any basis upon which application of the 1992 *Merger Guidelines* could yield different product market definitions in different proceedings. In any event, the Commission has never, formally or informally, deviated from the view that broadband Internet access services constitute a discrete product market. To the contrary, the Commission has in numerous other contexts treated the broadband Internet access market as a discrete product market. *See* note 55, *infra* (presenting market shares for "high-speed services for Internet access").

38. *Id.* at ¶ 65.

39. Brown Shoe Co. v. United States, 370 U.S. 294, 325 (1962); ABA ANTITRUST SECTION, ANTITRUST LAW DEVELOPMENTS 200 (3d ed. 1992).

40. *See, e.g., ZDNet Study Suggests Broadband Adoption Will Be Driven by Increasing Demand for Access to Music, Video, and Games*, PR NEWSWIRE, June 29, 1999 (63 percent of respondents were interested in broadband due to desire to download more audio, video, or game files, while 54 percent were motivated by a desire to enjoy streaming audio or video); JP MORGAN H&Q/MCKINSEY & COMPANY, BROADBAND 2001: A COMPREHENSIVE ANALYSIS OF DEMAND, SUPPLY, ECONOMICS, AND INDUSTRY DYNAMICS IN THE U.S. BROADBAND MARKET, Apr. 2, 2001, at 29 [hereinafter JP MORGAN BROADBAND] (finding that, for most broadband users, the most appealing aspect of the service is its speed); YANKEE GROUP, RESIDENTIAL BROADBAND: CABLE MODEMS AND DSL REACH CRITICAL MASS, Mar. 2001, at 9 [hereinafter YANKEE GROUP BROAD-

common attributes of mass-market broadband services include the fact that they are "always on" and do not require consumers to log on each time they want to use the Internet. In addition, unlike dial-up Internet access, mass-market broadband services do not use the voice frequency of the subscriber's telephone line, thus enabling a subscriber to access the Internet and use his telephone at the same time, without having to purchase a second telephone line. These qualities, as well, are invariably cited by broadband subscribers as significant attributes of the service.[41]

Second, consumers view these services as substitutes for each other. A recent Harris Interactive Consumer TechPoll of more than 69,000 Internet users found that "subscribers saw little difference between DSL and cable modem services."[42] Echoing this conclusion, a survey jointly conducted by the Yankee Group and the Satellite Broadcasting and Communications Association found that nearly half of all of those surveyed who were interested in a broadband connection had no preference as between DSL, cable, or satellite service.[43]

Third, providers of mass-market broadband services perceive themselves as competitors. For example, AT&T promotes its cable modem service to both business and residential customers as a competitor to DSL.[44] According to Comcast's 2001 Form 10-K filing with the Securities and Exchange Commission, Comcast considers DSL to be its most important competitor in the provision of broadband services:

> Numerous companies, including telephone companies, have introduced DSL service and certain telephone companies are seeking to provide high-speed broadband services without regard to present service boundaries and other regulatory restrictions. We are unable to predict the likelihood of success of competing

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BAND] (most commonly cited reason by consumers for interest in broadband service was their desire for a significantly faster connection to the Internet; next most common reason was being able to use their telephone and access the Internet at the same time).

41. JP MORGAN BROADBAND, *supra* 40; United States General Accounting Office, *Characteristics and Choices of Internet Users,* Feb. 2001, p. 25; YANKEE GROUP BROADBAND, *supra* note 40, at 9.

42. *Cable or DSL? Consumers See Little Difference,* Dec. 1, 2000, at www.Cyberatlas.com.

43. YANKEE GROUP BROADBAND, *supra* note 40, at 10.

44. Applications for Consent to Transfer of Licenses and Section 214 Authorizations from MediaOne Group, Inc., Transferor, to AT&T Corp., Transferee, CC Dkt. No. 99-251, AT&T Reply Comments at 80 (filed Sept. 17, 1999) (calling DSL services "the most obvious competitors of broadband cable modem services").

> online services offered by our competitors or what impact these competitive ventures may have on our business and operations.[45]

Similarly, DSL providers mentioned cable modem service as a competitor in the market for broadband services.[46]

Fourth, the different broadband platforms that serve consumers are generally priced similarly enough to support their inclusion in the same product market. Indeed, the prices for cable modem access and DSL access appear to move together. According to ARS Broadband Provider Tracking Service, AT&T charged $39.95 per month for cable modem service from August 2000 through May 2001, raised its prices to $45.95 in June 2001, and raised its prices once in July 2001 to $50.61.[47] In a similar fashion, Verizon charged its DSL customers $39.95 per month from July 2000 through April 2001, and raised its monthly price to $49.95 in May 2001.[48] DirecTV raised the monthly price of its DSL offering in March 2001 from $43.28 to $49.95.[49] The FCC has recognized the similarity in pricing between broadband alternatives.[50]

For all of these reasons, it is clear that mass-market broadband services are "reasonably interchangeable" in use and thus part of a discrete and relevant product market. Indeed, we are unaware of any credible argument to the contrary.[51]

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45. COMCAST CABLE COMMUNICATIONS INC., 2000 SEC FORM 10-K, Mar. 16, 2001, at 6.

46. *See, e.g.*, VERIZON COMMUNICATIONS INC., 2000 SEC FORM 10-K405, Mar. 23, 2001, at 12; BELLSOUTH CORP., 2001 SEC FORM 10-K, Mar. 2, 2001, at 20.

47. Data supplied to SBC Communications by ARS Broadband Provider Tracking Service, Sept. 2001.

48. *Id.*

49. *Id.*

50. *See, e.g.*, Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming, CS Dkt. No. 00-132, 16 F.C.C. Rcd. 6005, ¶ 53 (2001) ("[B]oth cable Internet access providers and DSL operators offer services at around the same price[.]"). In a similar fashion, Hausman, Sidak and Singer analyzed price movements of access technologies to show the broadband services were distinct from narrowband services. *See* Hausman, Sidak & Singer, *Cable Modems and DSL*, *supra* note 33.

51. The fact that DSL or cable modem transport may not be sold directly to the mass market by the transport providers, but rather by ISPs that bundle the transport with their Internet access, is irrelevant to this analysis of the product market. If one can demonstrate that a vertically integrated DSL provider cannot exercise market power in the end-user market, then certainly a vertically disintegrated DSL provider could not exercise market power in the end-user market, or, for that matter, at any stage of the production process. According to Marshall's rules, the elasticity of demand for inputs is directly related to the elasticity of demand for the end product. Applied here, the pricing of transport is constrained by the price-elasticity of demand for DSL service. *See* Jerry A. Hausman & J.

Although some have argued that broadband services do not comprise a complete product market,[52] their position has been that the market is *broader* in scope, not that individual broadband Internet services comprise discrete product markets. More specifically, the only debate of which we are aware regarding product market definitions for mass-market broadband services has centered around the question of whether such services are part of a larger market that also includes narrowband Internet access services.

Whether one should include narrowband Internet services in the market is largely academic for present purposes. Even assuming, as some have claimed, that narrowband and broadband Internet access services are part of the same product market, consumers would necessarily have a regulated substitute service (narrowband service) available to them even after the detariffing of an ILEC's broadband service. That regulated alternative would ensure that a substitute service is available at just and reasonable terms, and it would further constrain an ILEC's ability profitably to raise DSL prices to supercompetitive levels. Any such increase would precipitate a migration of customers to alternative broadband platforms, and to narrowband access.

2. The Geographic Market

Like long-distance voice traffic, a broadband connection to the Internet "at its most fundamental level, involves a customer making a connection from one specific location to another specific location."[53] As with a long-distance voice call, customers do not view broadband connections originating in different locations to be close substitutes for each other.[54] In this

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Gregory Sidak, *A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks*, 109 YALE L. J. 417, 475-77 (1999). For an elaborate discussion of Marshall's rules, see P.R.G. LAYARD & A.A. WALTERS, MICROECONOMIC THEORY 259 (McGraw-Hill 1978).

52. *See, e.g.*, Applications for Consent to Transfer of Licenses and Section 214 Authorizations from MediaOne Group, Inc., Transferor, to AT&T Corp., Transferee, CC Docket No. 99-251, AT&T Reply Comments at 71-79 (arguing that high-speed and narrowband Internet access services constitute part of the same market); *AOL/Time Warner Order*, *supra* note 34, ¶¶ 68-74 (noting that MediaOne, AT&T, Time Warner, and AOL have argued, in various proceedings, that narrowband and broadband Internet access services constitute a single product market). Ironically, in the *AT&T-TCI* merger proceeding, AOL argued that broadband access services constituted a separate product market. *See* Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations from Tele-Communications, Inc., Transferor, to AT&T Corp., Transferee, CS Dkt. No. 98-178, Comments of America Online at 16.

53. *See BOC Classification Order*, *supra* note 12, at 15,792-93 ¶ 64.

54. *Id.*

respect, the relevant geographic market for mass-market broadband services is all possible routes that allow for a connection from one particular location to another location (that is, a point-to-point market).[55]

But, as the Commission has properly recognized, assessing market power in each individual point-to-point market would be administratively impractical and unnecessary.[56] There is no credible evidence that there is any particular point-to-point market or group of point-to-point markets in which an ILEC could exercise market power in the provision of DSL services. There are numerous providers of competitive broadband service. There are more than one dozen providers of cable modem service, including, among others, AOL Time Warner, AT&T Broadband, Comcast, and Cox Communications.[57] Moreover, all of the leading providers of cable modem service have upgraded the vast majority of their cable plant so that it is broadband-capable. Indeed, as of June 2001, AOL Time Warner had upgraded nearly 100 percent of its plant and AT&T had upgraded at least 75 percent.[58] Comcast will have upgraded at least 80 percent of its plant by the end of 2001, and Charter Communications as much as 90 percent.[59]

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55. *Id.*

56. *Id.* at 15,794 ¶ 67 ("Unless there is credible evidence suggesting that there is or could be a lack of competition in a particular point-to-point market or group of point-to-point markets, and there is a showing that geographic rate averaging will not sufficiently mitigate the exercise of market power, we will refrain from employing the more burdensome approach of analyzing separate data from each point-to-point market").

57. According to the F.C.C.'s August 9, 2001 report, there at least five providers of cable modem service in each SBC state for which data were released. There were ten providers of cable modem service in California. *See High-Speed Services for Internet Access: Subscribership as of December 31, 2000*, Industry Analysis Division, Common Carrier Bureau, F.C.C., August 2001, at tbl. 5 [hereinafter *CCB Subscribership Analysis*].

58. *See* JP MORGAN BROADBAND, *supra* note 40, tbl.6.

59. MediaWeek, *Smooth Operators Upgrading Cable's Big Seven*, June 14, 2001, downloaded from http://dailynews.yahoo.com/h/bpimw/20010614/ad/_b_hl_smooth_operators_upgrading_cable_s_big_seven_hl_b_1.html on June 20, 2001. JP Morgan and McKinsey provide the following data on cable plant upgrades for the year 2000: AT&T 75 percent; AOL Time Warner 100 percent; Comcast 70 percent; Charter 55 percent; Cox 74 percent; Adelphia 60 percent; and Cablevision 73 percent. For the year 2001 (estimated): AT&T 77 percent; AOL Time Warner 100 percent; Comcast 86 percent; Charter 69 percent; Cox 84 percent; Adelphia 76 percent; Cablevision 95 percent. *See* JP MORGAN BROADBAND, *supra* note 40, at 39 tbl. 6.

All of these data on plant upgrades are national in scope. Regional data are unavailable, but there is no reason to believe that the data would be significantly different for SBC's region. If anything, given SBC's aggressive DSL deployment plans, one would expect the pace of cable plant upgrades to be higher than the national average in the SBC region.

Thus, it is likely that a very large percentage of households in an ILEC's territory have access to cable modem service.

That conclusion is supported by two recent analyst reports. One, issued by the Yankee Group, found that, as of year-end 2001, two thirds of all U.S. households will have access to cable modem service and that, by year-end 2002, 77 percent of U.S. households would have access to cable modem service.[60] Another report, issued jointly by JP Morgan and McKinsey & Co., found even higher addressability: 74 percent of U.S. households at the end of 2000, and an estimated 82 percent at the end of 2001.[61] Finally, the National Cable and Television Association reported in September 2001 that 83 percent of all U.S. households would be upgraded for cable modem service by the end of 2001.[62]

Nationally, fewer than half of all U.S. households have access to DSL service.[63] For example, SBC is currently able to offer DSL service to only 50 percent of its customers.[64] Given that cable penetration in an ILEC's territory is likely to be at least as high as the national average, there are likely to be very few areas in which that ILEC offers DSL service but no cable provider offers cable modem service.[65]

Even if there are a few such nonoverlapping areas, there are alternative broadband platforms in those (and other) areas that compete with an ILEC's DSL service. For example, despite the recent difficulties encountered by many CLECs, they collectively accounted for about 16 percent of the DSL market in December 2000.[66] They can lease unbundled loops or the high-frequency portion of a loop anywhere in an ILEC's territory to provide DSL service. Satellite and fixed wireless broadband services also provide consumers with a broadband alternative. Although wireless technologies still account for a relatively small share of the mass-market broadband services market, they are ubiquitously available and growing rapidly. For example, the Strategis Group predicts that the number of U.S.

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60. YANKEE GROUP BROADBAND, *supra* note 40, at 4.

61. JP MORGAN BROADBAND, *supra* note 40, at 39, tbl.6.

62. Downloaded from National Cable Television Association web site on Sept. 25, 2001 at http://www.ncta.com/industry_overview/indStat.cfm?ind-OverviewID=2.

63. JP MORGAN BROADBAND, *supra* note 40, at 43 chart 25.

64. *See* SBC Communications, Inc., Strong Growth in Data, Wireless and Long Distance Highlights SBC's First-Quarter Results, Press Release, Apr. 23, 2001, *available at* http://www.sbc.com/Investor/Financial/Earning_Info/docs/-1Q_IB_FINAL.pdf.

65. JP MORGAN BROADBAND, *supra* note 40, at 43 chart 25 (as of first quarter of 2000, only 10 percent of residential households were addressable by DSL but not cable modem service).

66. ILECs account for about 84 percent of DSL nationwide. *See* COMM. DAILY, Aug. 14, 2001 at 6 (discussing Telechoice study).

satellite subscribers will grow to more than four million by 2005.[67] It is reasonable to believe that satellite services could reach those (rare) areas that are served by DSL but not served by cable modems. To be sure, upload speeds for satellite broadband service are slow. But as Professors Janusz Ordover and Robert Willig have testified on behalf of AT&T, such concerns are "irrelevant to the vast majority of users who, if they worry about speed at all, are primarily interested in fast download times and do not send significant amounts of information."[68]

Irrespective of whether satellite services experience the explosive growth that some predict, it is reasonable to conclude that providers of those services will fill a market niche, focusing their competitive efforts in any areas in which cable modem and/or DSL services are not available. Indeed, satellite broadband providers are likely to be most successful in areas in which cable service is not available, because it is in those areas that consumers are likely to use DBS service for video, and consumers who already use satellite service are likely to be the most receptive to satellite-based Internet access.

For customers who cannot obtain cable modem access, fixed-wireless service is another option. Frost & Sullivan project that the number of fixed-wireless broadband subscribers will grow from 79,000 at the end of 2000 to over 400,000 at the end of 2001 and to almost one million at the end of 2002.[69] Even if these predictions prove wrong, fixed-wireless services, at a minimum, can be expected to fill any niche in which competition between DSL and cable modem services is less vigorous.

B. Application of the FCC's Framework to the Mass-Market Broadband Services Market

With respect to each of the Commission's criteria, we conclude that ILECs are nondominant in the mass-market broadband services.

1. Market Share

When the FCC declared AT&T to be nondominant in "interstate, domestic, interexchange telecommunications services" in late 1995, AT&T's market share was estimated to be 60 percent.[70] Likewise, AT&T's overall

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67. Dan Miller, *Who You Going to Call for Broadband?*, INDUS. STANDARD, Apr. 30, 2001.

68. Decl. of Janusz A. Ordover and Robert Willig, Applications for Consent to the Transfer of Control of Licenses from MediaOne Group, to AT&T Corp., CC Dkt. No. 99-251 (Sept. 17, 1999).

69. FROST & SULLIVAN, NORTH AMERICA BROADBAND WIRELESS ACCESS SERVICES MARKET 2001, at I-2.

70. *AT&T Reclassification Order*, *supra* note 17, at 3305 ¶ 40 & n.173.

share of the international long-distance services market was estimated to be about 60 percent at the time that the FCC declared AT&T to be non-dominant in those services, and in a number of countries, AT&T's market share was significantly higher. Its average market share (weighted by revenues) in 76 select countries was 74 percent, and it faced no competition at all in four countries.[71] In contrast, an ILEC's share of the mass-market broadband services market in its region is about 30 percent—roughly *half* of AT&T's share of the IXC market when the FCC declared AT&T to be nondominant.[72]

We base this estimate of an ILEC's market share on numerous sources. First, the Commission's August 9, 2001 report, *High-Speed Services for Internet Access*, estimates the market share of DSL providers to be between 27.8 percent and 30.6 percent (when counting asymmetric DSL only).[73] The FCC data are largely consistent with data in analyst reports. A survey by Telecommunications Reports International shows that DSL's share of the mass-market broadband services market was 32.4 percent at the end of the first quarter of 2001.[74] In addition, numerous analyst reports show cable modem service to be far outpacing DSL service.[75]

Although the Commission has correctly recognized that, in certain circumstances, market share data are not necessarily a reliable indicator of market power, it did so in the context of a company (AT&T) that had a large, but declining, market share in an industry characterized by high demand and supply elasticities. In that context, the FCC properly recognized that market share is not necessarily indicative of market power.

Although a large market share does not necessarily indicate market power, a low market share usually indicates a lack of market power. That is because firms with low market shares cannot usually affect the price of a product by restricting their output.[76] Courts will almost never conclude

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71. *AT&T International Nondominance Order*, *supra* note 19, at 17,978 ¶ 40.

72. Telecommunications Reports Int'l, *TR's Online Census: Free's Not Always Easy*, May 2001 [hereinafter *TR Census*].

73. *CCB Subscribership Analysis*, *supra* note 57, at tbl.6.

74. *TR Census*, *supra* note 72.

75. *See, e.g.*, YANKEE GROUP BROADBAND, *supra* note 40, at 1 (DSL share of 31 percent); MORGAN STANLEY DEAN WITTER, TELECOM TREND TRACKER, Aug. 17, 2001 at 15 [hereinafter MORGAN STANLEY TELECOM] (DSL share of 39 percent in 2001).

76. *See BOC Classification Order*, *supra* note 12, at 15,802-03 ¶ 83 (the ability to raise prices by restricting one's own output "usually requires a large market share."); *id.* at ¶ 96 ("the fact that each BOC interLATA affiliate initially will have zero market share in the provision of in-region, interstate, domestic, interLATA services suggests that the affiliate will not initially be able to raise price by restricting its output").

that a firm possesses market power if its market share is less than 40 percent.[77]

To be sure, the Commission did not give dispositive weight to the zero market share of the BOC long-distance affiliates in the *BOC Classification Order*. Rather, while recognizing that this market share "suggests that the affiliate will not initially be able to raise prices by restricting output," the Commission deemed it necessary to address whether the BOC might quickly acquire a high market share after entry into the market.[78] That decision, however, was made in the context of a BOC entering a new market for the first time. In contrast, the ILECs have been actively competing for more than two years in the mass-market broadband services market. The Commission need not speculate about whether any particular ILEC, upon entry or soon thereafter, can acquire market power in broadband services. After more than two years of making broadband deployment a top company priority,[79] the ILECs have not come close to acquiring market power.

Indeed, far from acquiring market power, telephone companies have *lost* ground to their cable competitors in the mass-market broadband services market. According to the FCC's August 9, 2001 report, *High Speed Services for Internet Access*, during the year 2000, cable companies added about 2.2 million cable modem lines, while telephone companies added about 1.6 million DSL lines. A Yankee Group report, issued in March 2001, shows an even larger cable modem advantage. According to that report, cable operators added 2.6 million cable modem lines in 2000, while DSL providers added only 1.3 million lines.[80]

2. Demand Elasticities

An analysis of demand elasticities reinforces the conclusion that the ILECs are nondominant in the mass-market broadband services market. In

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77. ABA ANTITRUST SECTION, ANTITRUST LAW DEVELOPMENTS 213-14 (3d ed. 1992); United States v. Aluminum Co. of America, 148 F.2d 416, 424 (2d Cir. 1945) (it is doubtful whether a 60 percent market share would constitute a monopoly, and certainly 33 percent does not); *see also* Landes & Posner, *supra* note 11, at 938, 959.

78. *BOC Classification Order*, *supra* note 12, at 15,811-12 ¶ 96.

79. *See* SBC Launches $6 Billion Initiative to Transform it into America's Largest Single Broadband Provider, Press Release, Oct. 18, 1999, *available at* http://webcast.sbc.com/media/news/release.doc (quoting Edward E. Whitacre, Jr., chairman and chief executive officer of SBC: "We see a rapidly changing marketplace where traditional dial-tone is still a staple service, but where millions of our customers will demand the convenience, productivity, availability and reliability of our broadband service—service which we call '*e*-tone.' With Project Pronto, SBC will lead the nation in speeding the widespread availability and meeting the demand for broadband and emerging broadband-powered services").

80. YANKEE GROUP BROADBAND, *supra* note 40, at 3.

previous nondominance orders, the Commission relied solely on indirect evidence of demand elasticity. For example, in the *AT&T Reclassification Order*, the Commission relied heavily on high churn rates in concluding that long-distance customers had highly price-elastic demand. It also cited its finding in the *AT&T Streamlining Order* that business customers had highly price-elastic demand. This finding was based on evidence that business customers tend to be more sophisticated and knowledgeable purchasers of telecommunications services, are aware of the choices available to them, and have no strong bias towards AT&T versus other interexchange carriers.

Here we present not only the type of indirect evidence of high demand elasticities upon which the Commission has relied in the past, but also direct *quantitative* evidence of the own-price elasticity of demand for mass-market broadband services. That quantitative evidence is derived from a study conducted in 2000 by Professors Paul Rappoport, Don Kridel, Lester Taylor, and Kevin Duffy-Demo. Using Marketing Science survey data for Internet use and TNS Telecoms survey data for broadband access availability and prices, Professors Rappoport, Kridel, Taylor, and Duffy-Demo calculated that the own-price elasticity of demand (the percentage change in demand for every one-percent increase in price) for DSL services is negative 1.462, which implies that for every one-percent increase in the price of DSL service, demand decreases by 1.462 percent.[81] That result suggests that demand for DSL service is, by definition, price-elastic.[82]

Because the study by Professors Rappoport, et al., was based on data from the first quarter of 2000, we have updated it, using nearly the identical econometric model and data from the fourth quarter of 2000 and the first quarter of 2001. In its quarterly survey, TNS Telecoms obtains detailed Internet usage data from approximately 3,500 respondents. Each respondent is asked, among other things, (1) whether DSL and/or cable modem access is available in his or her neighborhood, and (2) whether he or she subscribes to dial-up access or broadband access, and, if so, at what price. Respondents also supply socio-economic information concerning

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81. Paul Rappoport, *et al.*, *Residential Demand for Access to the Internet*, University of Arizona Working Paper, Spring 2001, at Table 10; *see also* Paul Rappoport, *et al.*, *An Econometric Study of the Demand for Access to the Internet*, *in* THE FUTURE OF THE TELECOMMUNICATIONS INDUSTRY: FORECASTING AND DEMAND ANALYSIS (D.G. Loomis & L. D. Taylor eds., Kluwer Academic Publishers 1999).

82. *See, e.g.*, WILLIAM J. BAUMOL & ALAN S. BLINDER, MICROECONOMICS: PRINCIPLES AND POLICY 133 (Dryden Press 7th ed. 1994) (demand is elastic whenever "a rise in the price will decrease total revenue").

their income, race, occupation, and other characteristics that might influence the decision to purchase Internet services.

In the present application, standard regression analysis is not appropriate to estimate the consumer-choice model because the decision to purchase a broadband access technology is a binary (as opposed to continuous) variable. Hence, like Rappoport, *et al.*, we estimated a nested logit model, which allows us to examine the discrete choice across all mass-market broadband alternatives, and the discrete choices within broadband-access alternatives. Details of the model are described in the Appendix. A brief description is provided here.

The model involves two stages in the estimation procedure. In the first stage, we assume that the customer chooses between no Internet access, narrowband Internet access, and broadband Internet access based on the following variables: (1) the customer's income, (2) the customer's gender, (3) the customer's age, and (4) the customer's education. In the second stage, conditional on choosing broadband Internet access, we assume that the customer chooses between cable modem and DSL services based on the price of each service. Before estimating the model, we removed from the dataset any customer who did not have access to both cable modem and DSL services. The output from the regression model appears in the Appendix. Table 1 presents the updated elasticity estimates.

Table 1: Own-Price and Cross-Price Elasticities for DSL Service

Service	Price of DSL	Price of Cable Modem
Choice: DSL	-1.184	0.415
Choice: Cable Modem	0.591	-1.220

As Table 1 shows, the own-price elasticity of DSL is still high (the comparable estimate from Rappoport et al. is -1.462), which suggests that demand for DSL service is price-elastic. Moreover, the cross-price elasticity of demand for cable modem with respect to a change in the price of DSL is high as well: for every 1 percent increase in the price of DSL service, the demand for cable modems rises by 0.591 percent. The comparable elasticity from Rappoport et al. was 0.766 percent. The high cross-price elasticity is further evidence that DSL and cable modems are in the same product market, and that DSL providers do not have market power.

Other evidence underscores that DSL subscribers have highly price-elastic demand. The features that consumers most value from broadband services offerings are not unique to DSL service. As noted above, con-

sumer surveys show that consumers who choose a broadband service do so primarily (1) to increase the speed of ordinary web surfing, (2) to take advantage of applications that require greater bandwidth, (3) to obtain an "always-on" connection, and (4) to free up their telephone line when they are using the Internet. All of these benefits are available not only from DSL, but also from cable modem and other broadband options. Finally, surveys indicate that many consumers who are interested in broadband service are not predisposed towards cable or DSL service. They do not care about what platform they use to obtain broadband service—only that they obtain the features of a broadband connection.[83]

In short, econometric and qualitative evidence indicates that there is price-elasticity of demand for DSL service is high, supporting the conclusion that the ILECs are non-dominant in their provision of DSL services.

3. Supply Elasticities

A third consideration in determining an ILEC's nondominant status is supply elasticity. In evaluating supply elasticity in its *AT&T Reclassification Order*, the FCC focused on two factors: (1) the capacity of existing competitors to expand supply and (2) low entry barriers for new suppliers.[84] It concluded that AT&T's competitors "can add significant numbers of new customers with their existing capacity and add incrementally to this capacity as new customers . . . . are added to their networks."[85]

The same is clearly true of the ILECs' competitors that provide mass-market broadband service. Those competitors could absorb immediately, and without additional investment, a significant number of an ILEC's DSL subscribers and could eventually absorb an ILEC's entire customer base with little or no additional investment.

First, as discussed above, there are numerous providers of competitive mass-market broadband services throughout each ILEC's region. For example, two-thirds or more of the households in the United States are served by cable facilities that are capable of providing mass-market broadband services. Yet the vast majority of this plant is not being used.

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83. YANKEE GROUP BROADBAND, *supra* note 40, at Ex.12. Among actual broadband users, there is some evidence that customers prefer cable modem service to DSL service. For example, Forrester Research found that cable modem service scored slightly higher than DSL service on each of six separate measures of quality, technical performance, and customer service. *See* FORRESTER RESEARCH, CONSUMER TECHNOLOGY MARKET FOCUS SURVEY, at fig. 1.2 (2000).

84. *AT&T Reclassification Order*, *supra* note 17, at 3303 ¶ 57.

85. *Id.* at 3304 ¶ 60. AT&T had argued that its competitors could immediately absorb 15 percent of AT&T's switched traffic at no additional cost, and two-thirds of its switched traffic within one year at a cost of $660 million. *Id.* at 3303-04 ¶ 59.

Table 2 shows that, as of the end of 2000, 95 percent of U.S. homes that were upgraded for cable modem services and had not subscribed to the service.[86]

Table 2: Excess Capacity in Cable Modem Systems

Year	Households That Are Ready for Cable Modem Service (Millions)	Cable Modem Subscribers (Millions)	Excess Capacity*
1999	48.3	1.47	97.0%
2000	58.6	2.94	95.0%
2001	64.4	4.99	92.3%
2002	70.2	7.27	89.6%
2003	73.2	9.78	86.6%

Source: *Available at* http://www.emarketer.com/analysis/broadband/050800_cable.html.

Note: * Equal to 1 minus the ratio of cable modem subscribers to households that are cable-modem-ready.

This excess capacity indicates that cable operators alone could absorb most of an ILEC's DSL subscribers with only negligible additional dedicated or shared (downstream) investment. For those homes that are not yet cable-modem-ready, it is reasonable to believe that those homes could and would soon be wired, because the incremental cost of readying a home for cable modem service is estimated to be $468 in 2001—a figure that pales in comparison to the expected revenues.[87] With respect to shared investment to alleviate congestion on the cable network,[88] we would expect that this cost, when *averaged* across all new subscribers, would be a much smaller component than the dedicated component.[89] Indeed, the congestion problem does not appear to be specific to any particular access technology.[90] It is therefore reasonable to believe that such costs would not

86. *Available at* http://www.emarketer.com/analysis/broadband/050800cable._html.

87. JP MORGAN BROADBAND, *supra* note 40, at 70.

88. "Because the design of a cable the network is a shared-bandwidth one, the more subscribers accessing the network and transmitting data, the more congestion arises across the entire network." *DSL v. Cable: An Internet Boxing Match*, COMM. NEWS, Feb. 1, 2001, at 63.

89. The detailed cost analyses that we have reviewed make no mention of the shared component when demonstrating the business case for cable modem service.

90. According to *Network Computing*, the real bottleneck exists at the back-end servers providing content, not in the customer's immediate vicinity: "Both DSL and cable can use content-delivery-network techniques, like caching, content replication and multi-

preclude a cable modem provider from accommodating an ILEC's DSL customers. In the terminology of the U.S. Court of Appeals for the D.C. Circuit, an ILEC's competitors would face an attractive investment-to-revenue ratio.[91]

The rapid rate at which other broadband providers are upgrading their networks underscores the fact that the supply of service from the ILECs' competitors is price elastic. Between the end of 2000 and the second quarter of 2002, the percentage of homes passed (by cable television plant) that were cable-modem ready increased from 58 to 86 percent, expanding the availability of cable modem service from 57 million homes to 84 million homes.[92] Equally telling is the rate at which cable modem providers are adding subscribers. Despite a recent slowing of growth, the five largest cable operators added more than 600,000 cable modem subscribers during the second quarter of 2001, according to Warren Communications News' Telecom Research Group.[93]

4. Cost Structure, Size, and Resources

Another set of considerations that the FCC factors into its nondominance analysis is whether the firm at issue has market power by virtue of having greater resources, size, financial strength, and a more favorable cost structure.[94] As the FCC has twice noted, the question is not whether the firm at issue has advantages in the relevant market, but "whether any such advantages are so great to preclude the effective functioning of a competitive market."[95] Indeed, as the FCC recognized, "the competitive process itself is largely about trying to develop one's own advantages, and all firms need not be equal in all respects for this process to work."[96]

With respect to the market for mass-market broadband services, ILECs do not enjoy any advantages over its competitors with respect to size, re-

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cast, to improve performance. Here, neither has the advantage." David Willis, *Cable's Edge*, NETWORK COMPUTING, Aug. 20, 2001, at 35.

91. *See* AT&T Corp. v. F.C.C., 236 F.3d 729, 733 (D.C. Cir. 2001).

92. Information downloaded from NCTA's web site at http://www.ncta.com/industry_overview/indStats.cfm?statID=25. (According to the NCTA, 98.6 million homes were passed by cable television plant in December 2001).

93. *TW Cable Tops AT&T as Biggest High-Speed Provider, Study Shows*, COMM. DAILY, Aug. 17, 2001 at 2.

94. *See AT&T Reclassification Order*, *supra* note 17, at 3309 ¶ 73.

95. *Id.* (citing *First Interexchange Competition Order*, 6 F.C.C.R. at 5891-92). *See also AT&T Streamlining Order*, *supra* note 15, at 5901 n.187, ¶ 60; *COMSAT Nondominance Order*, *supra* note 20, at 14,130-32 ¶¶ 92-93 (agreeing that COMSAT's size and resources gave it significant competitive advantages but forbearing, nevertheless, from dominant carrier regulation of COMSAT).

96. *AT&T Reclassification Order*, *supra* note 17, at 3309 ¶ 73.

sources, financial strength, and cost structure. An ILEC certainly does not have advantages that are "so great [that they] preclude the effective functioning of a competitive market."[97]

The ILECs compete in their provision of mass-market broadband services against, among others, the following multiple system operators (MSOs) with the following market capitalizations: AOL Time Warner ($147.1 billion), AT&T Corp. ($68.2 billion), Comcast Corp. ($33.9 billion), Cox Communications, Inc. ($25.1 billion), and Cablevision Systems Corp. ($7.2 billion).[98] Under no stretch of the imagination could these MSOs be called fledgling competitors that lack the size, resources, or financial stability to compete with an ILEC. Indeed, the rate at which cable operators are upgrading their cable facilities in itself belies any such claim.

Nor does an ILEC enjoy cost advantages vis-à-vis its competitors that effectively preclude competition. To the contrary, an ILEC faces cost *disadvantages* relative to its cable competitors. According to analyst reports, the costs of deploying DSL service exceed the cost of deploying cable modem service. For example, JP Morgan and McKinsey & Company conclude that the average cost per customer of a large ILEC undertaking a massive DSL deployment is currently $86 per month per customer.[99] That cost, they conclude, will decline by 2005 to $38 per month per customer. In contrast, the average, per-customer cost of providing cable modem service is estimated to be $55, declining by 2005 to $30.[100] At no point during the next five years is the average cost of providing DSL service expected to be less than the average cost of providing cable modem service. To the contrary, the costs of cable modem providers are projected to remain substantially lower throughout that period. The conclusion by JP Morgan and McKinsey that cable modem costs are lower than DSL costs is echoed in an August 2001 report issued by the Yankee Group, which predicted: "Cable modem prices are likely to remain cheaper than DSL prices for comparable service levels due mainly to the low service provision costs on the part of MSOs."[101]

In addition to facing the other obstacles, described above, DSL providers face significant technological constraints. DSL cannot reach customers whose copper loops exceed 18,000 feet in length,[102] and the cost of de-

97. *Id*.
98. Downloaded from www.yahoo.com on May 22, 2002.
99. JP MORGAN BROADBAND, *supra* note 40, at Chart 45.
100. *Id.* at chart 46.
101. *See* Drew Robb, *DSL: Don't Tread on Me*, 31 BUS. COMM. REV. 5861, May 1, 2001.
102. *Id.*

ploying service to customers whose loops are routed through digital loop carriers far exceeds the cost of reaching customers with all-copper loops. Although cable operators face their own constraints due to their service architecture, they do not face distance limitations that significantly impair their ability to reach large numbers of customers.

The advantages enjoyed by cable operators are magnified by the asymmetric regulation of DSL and cable modem services. As stated by SBC and BellSouth in their joint comments in the *Cable Open Access* proceeding:

> Telephone companies have to "unbundle" the wireline spectrum that they use for broadband . . . and make it available to all comers at regulated prices. Cable companies do not. Telephone companies must permit their competitors to "collocate" equipment in telephone company premises to make it easier to use that "unbundled" spectrum. Cable companies do not. Telephone companies are almost completely locked-out of the multi-billion dollar (and rapidly expanding) Internet backbone service. Cable companies are not. Telephone companies must offer their retail broadband transmission services to competitors at a federally mandated discount. Cable companies do not. Telephone companies must pay-in to universal service when they provide broadband access. Cable companies do not. And telephone companies have been forced to carve-out their broadband transmission services into a separate affiliate as a condition to gaining regulatory approval of recent mergers. Cable companies have not.[103]

But the disparity between the ILECs and cable operators is not limited to the treatment of their broadband services. The ILECs are highly regulated in their provision of telephone exchange and exchange access service. Cable service, in contrast, is largely deregulated.[104]

In short, no credible argument can be made that an ILEC enjoys advantages in the provision of broadband services, much less that it has advantages that effectively preclude the functioning of that market. The real issue is whether the very opposite is true: Are the advantages enjoyed by cable operators so great as to render them dominant in the provision of mass-market broadband services?

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103. Comments of SBC Communications Inc. and BellSouth Corp., GN Dkt. No. 00-185, at 6-7 (Dec. 1, 2000).

104. *See, e.g.*, ROBERT W. CRANDALL & HAROLD FURCHTGOTT-ROTH, CABLE TV: REGULATION OR COMPETITION?, 4-7 (1996).

C. The Inability to Leverage Market Power from Telephone Exchange or Exchange Access Services into the Mass-Market Broadband Services Market

We have demonstrated above that an ILEC does not now have market power in the mass-market broadband services market. The final component of the FCC's nondominance framework is to address whether an ILEC could nevertheless quickly acquire market power in the mass-market broadband services market by leveraging any market power it might have in the provision of telephone exchange or exchange access services. For purposes of this analysis, the Commission has held that the issue is not whether an ILEC might enjoy certain advantages in the broadband market by virtue of its position in the local exchange market. The issue is not even whether an ILEC might confer advantages on its broadband operations through discrimination and cross-subsidization. Rather, the issue is whether an ILEC could leverage market power in the local exchange market to the point that it *quickly* acquired market power in the mass-market broadband services market. As the FCC explained in the *BOC Classification Order*:

> [I]mproper allocation of costs by a BOC is of concern because such action may allow a BOC to recover costs from subscribers to its regulated services that were incurred by its interLATA affiliate in providing competitive interLATA services. In addition to the direct harm to regulated ratepayers, this practice can distort price signals in those markets and may, under certain circumstances, give the affiliate an unfair advantage over its competitors . . . . For purposes of determining whether the BOC interLATA affiliates should be classified as dominant, however, we must consider only whether the BOCs could improperly allocate costs to such an extent that it would give the BOC interLATA affiliates, upon entry or soon thereafter, the ability to raise prices by restricting their own output.[105]

The Commission's conclusion that dominant carrier regulation of a service is appropriate only if the BOC could quickly acquire market power in that service is sound. As the Commission noted, "our dominant carrier regulations are generally designed to prevent a carrier from raising prices by restricting its output . . . . We agree with the DOJ that applying dominant carrier regulation to an affiliate in a downstream market would be 'at best a clumsy tool for controlling vertical leveraging of market power by the

105. *BOC Classification Order*, *supra* note 12, at 15,815 ¶ 103.

parent, if the parent can be directly regulated instead.'"[106] Moreover, as the Commission noted, "regulations associated with dominant carrier classification can . . . have undesirable effects on competition."[107] Thus the Commission does not impose dominant carrier status on an entity or service unless the firm at issue can control price in the market by restricting its output of that service. The FCC does not impose dominant carrier status simply to ensure what some call "a level playing field."

It is inconceivable that any showing of leveraging could be made. As noted above, cable operators enjoy significant advantages in the mass-market broadband services market. To quickly acquire market power, an ILEC would not only have to overcome these advantages, but also would have to establish its own overwhelming advantages. Considering that the services in which an ILEC is ostensibly dominant—local exchange and exchange access services—are highly regulated, that outcome is most unlikely.

Of course, the FCC need not speculate on this point. If, soon after entering the mass-market broadband services market, an ILEC could have acquired monopoly power in that market, it presumably would have done so. Yet the ILECs' collective market share continues to be dwarfed by their cable competitors' share. Those facts show that an ILEC cannot use its position in the local exchange market to obtain dominance in the mass-market broadband services market.

In any event, an ILEC could not, even as a theoretical matter, quickly acquire market power in the mass-market broadband services market by leveraging any market power that it might retain in the local exchange market. In its past orders, the Commission has recognized three ways in which such leveraging could occur: cross-subsidization, discrimination, and the effectuation of a price squeeze. We address each below in the context of the relevant product market.

In the *BOC Classification Order*, the Commission held that BOC long-distance affiliates could obtain the ability, through cross-subsidization, to raise prices by restricting their own output only "if a BOC's improper allocation enabled a BOC interLATA affiliate to set retail interLATA prices at predatory levels (i.e., below the costs incurred to provide those services), drive out its interLATA competitors, and then raise and sustain retail interLATA prices significantly above competitive levels."[108] Thus the issue here is whether, through cross-subsidization, an ILEC could set DSL

106. *Id.* at 15,804 ¶ 85, 15,808 ¶¶ 85, 91 (quoting DOJ Reply, Aug. 30, 1996, at 27).
107. *Id.* at 15,808 ¶ 90.
108. *Id.* at 15,815 ¶ 103.

prices at predatory levels, drive its broadband competitors out of the market, and then raise and sustain its prices significantly above competitive levels.

Even in the unlikely event that an ILEC could drive a cable operator into bankruptcy, the bandwidth capacity of that carrier would remain intact, ready for another firm to use (after a liquidation sale) and immediately undercut an ILEC's noncompetitive prices. If an ILEC were to attempt predatory pricing in the broadband market, it could not expect to recoup its investment in sales made below incremental cost. The FCC has expressly embraced this economic reasoning when it concluded that predation is implausible with respect to either long-distance fiber-optic networks[109] or spectrum.[110] The argument applies with equal force to the fixed broadband infrastructure of a cable operator.

Clearly such cross-subsidization is not possible. The ILECs have, until quite recently, been treated as nondominant providers of DSL services, and their prices for DSL Internet access services—far from being predatory—are *higher* than prevailing prices for cable modem service, as are their costs.[111] Moreover, an ILEC could not possibly finance a predatory pricing strategy through cross-subsidization. An ILEC's basic local exchange rates are subject to rigorous price regulation, including price ceilings, in each of its states. Thus, an ILEC has no ability to raise basic local exchange prices to finance below-cost DSL prices. Similarly, an ILEC's switched-access prices are capped, as a result of the *CALLS* proceeding, at 0.55 cents per minute and its special-access rates are constrained by price cap regulation in all areas that do not exhibit sufficient competition to

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109. *See* Implementation of the Non-Accounting Safeguards of Sections 271 and 272 of the Communications Act of 1934, as Amended; and Regulatory Treatment of LEC Provision of Interexchange Services Originating in the LEC's Local Exchange Area, Notice of Proposed Rulemaking, 11 F.C.C.R. 18,877, 18,943 ¶ 137 (1996) (citing Daniel F. Spulber, *Deregulating Telecommunications*, 12 YALE J. ON REG. 25, 60 (1995)). *See also* SIDAK & SPULBER, *supra* note 1, at 93-94 (making same argument).

110. *See* Applications of Voicestream Wireless Corp., Powertel, Inc., Transferors, and Deutsche Telekom AG, Transferee, for Consent to Transfer Control of Licenses and Authorizations Pursuant to Sections 214 and 310(d) of the Communications Act and Petition for Declaratory Ruling Pursuant to Section 310 of the Communications Act and Powertel, Inc., Transferor, and Voicestream Wireless Corp., Transferee, for Consent to Transfer Control of Licenses and Authorizations Pursuant to Sections 214 and 310(d) of the Communications Act, etc., Memorandum Opinion and Order, 16 F.C.C.R. 9779, ¶ 90 (2001).

111. Those higher prices are a product both of the higher costs of DSL deployment and the Commission's asymmetric regulatory requirements, which further raise an ILEC's cost of providing DSL service.

qualify for pricing flexibility.[112] Given these regulatory requirements, an ILEC has no ability to finance below-cost DSL prices with price increases in telephone exchange or exchange access services.

In the *BOC Classification Order*, the Commission expressed concern that a BOC could "discriminate against unaffiliated interLATA carriers, such as through poorer quality interconnection arrangements or unnecessary delays in satisfying its competitors' requests to connect to the BOC's network."[113] The Commission nevertheless concluded that a BOC could not discriminate "to such an extent that [its] affiliate would gain the ability to raise prices by restricting its own output upon entry or shortly thereafter."[114]

In this case, similar concerns about discrimination are misplaced. Unlike the long-distance market in 1996, the mass-market broadband services market is characterized by significant intermodal competition. Cable companies and wireless providers, in particular, are in no way dependent upon an ILEC's services or facilities in their provision of broadband services. Thus an ILEC has no ability to discriminate against these entities. For that reason alone, it could not possibly acquire market power through discrimination.

In the *BOC Classification Order*, the Commission held that "the entry of a BOC's affiliate into the provision of in-region, interstate, domestic, interLATA services might give the BOC an incentive to raise its price for access services . . . to disadvantage its affiliate's rivals, increase its affiliate's market share, and increase the profits of the BOC overall."[115] It concluded nonetheless that "price cap regulation of the BOCs access service sufficiently constrains a BOC's ability to raise access prices to such an extent that the BOC affiliate would gain, upon entry or soon thereafter, the ability to raise prices of interLATA services above competitive levels by restricting its own output of those services."[116]

As with discrimination, the price squeeze concerns addressed in the *BOC Classification Order* are inapt in the present context. Because an ILEC's largest competitors in the mass-market broadband services market do not rely on ILEC facilities, an ILEC has no means of raising its rivals' costs to acquire market power in that market. Moreover, those competitors

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112. Access Charge Reform; Price Cap Performance Review for Local Exchange Carriers; Low-Volume Long Distance Users; Federal-State Joint Board on Universal Service, 15 F.C.C.R. 12,962, 13,029 ¶ 162 (2000).

113. *BOC Classification Order*, *supra* note 12, at 15,821 ¶ 111.

114. *Id.* at 15,822 ¶111.

115. *Id.* at 15,829 ¶ 125.

116. *Id.* at 15,829-30 ¶ 126.

that do rely on ILEC facilities—DLECs that purchase unbundled loops—are able to lease those facilities at TELRIC rates, not allegedly inflated access rates. Thus, there is no basis upon which the Commission could conclude that an ILEC could acquire market power in their provision of mass-market broadband services by effecting a price squeeze.

D. Summation

FCC precedent and generally accepted economic and antitrust principles indicate that mass-market broadband service constitutes a relevant product market. The relevant geographic market is a point-to-point market but, as a practical matter, FCC precedent would treat the geographic market as an ILEC's entire service region.

Each of the four considerations in the FCC's nondominance framework indicate that ILECs lack market power in the mass-market broadband services market. With respect to market share, an ILEC's share of the consumer broadband market within its serving area is, on average, between 28 percent (according to the FCC) and 38 percent (according to Morgan Stanley Telecom) of the broadband services market nationwide. As the FCC and the courts have recognized, evidence of low market share is by itself strong evidence that a carrier lacks market power. In this case, it is evidence that ILECs lack market power in the provision of DSL and other mass-market broadband services.

The empirical evidence on demand elasticity is further proof that ILECs lack market power in the provision of DSL services. The own-price elasticity of demand for DSL is very high (between -1.2 and -1.5). We corroborate our demand elasticity analysis with other evidence, including survey data showing that consumers who use broadband services have no strong predisposition to DSL or cable modem service and are likely to choose the platform that offers the best combination of service and price. The FCC has relied heavily on such data in its prior analyses of demand elasticity in cases where market power was at issue.

The evidence on the supply elasticity of an ILEC's mass-market broadband competitors, as well as the evidence on an ILEC's relative resources, also indicate nondominance. An ILEC competes against numerous mass-market broadband competitors in its region, and an ILEC's cable modem competitors alone have sufficient capacity to absorb a significant number, if not all, of an ILEC's existing DSL subscribers. Moreover, an ILEC's competitors could readily expand their capacity to absorb additional customers.

An ILEC does not possess cost or size advantages that give it market power in its provision of DSL services. To the contrary, an ILEC com-

petes against some of the nation's largest companies. Additionally, unlike the ILECs, these companies are deregulated not only in their provision of mass-market broadband services but also in other services (such as multi-channel video programming distribution services) in which they likely have market power.

Finally, an ILEC could not leverage its purported market power in the local exchange market into the mass-market broadband services market. The theory that an ILEC would engage in discrimination or predatory pricing against unaffiliated rivals is not credible.

IV. CONCLUSION

There is no economic justification for regulating the ILECs' mass-market broadband services. Mandatory tariffing is unnecessary to protect DSL customers from unreasonable prices or lack of attractive content, because competition from cable operators and other broadband access providers compels an ILEC to maximize consumer choice and to price its service at competitive levels. Empirical and qualitative evidence support the conclusion that ILECs lack market power in the mass-market broadband services market and are therefore nondominant. The FCC would advance the public interest by embracing such a conclusion and thereafter forbearing from further regulation of ILECs' mass-market broadband services and facilities.

V. APPENDIX: OUTPUT FOR NESTED LOGIT MODEL

We estimate a consumer's probability of choosing a type of Internet access using a two-stage nested logit model. The four end choices are no Internet, dial-up Internet service, cable modem, or DSL. In the first stage of the nested logit, the consumer chooses whether to have no Internet access, narrowband access, or broadband access. No Internet access is the base category relative to which the other two branches are estimated. The independent variables that determine the first-stage choice are education dummies, income dummies, and age. If the consumer chooses broadband access, the consumer then chooses in the second stage between DSL and cable modem. The independent variable that determines the second choice is price.

We use TNS Telecoms survey data of households from the fourth quarter of 2000 and the first quarter of 2001. We restrict our sample to households who reply that they have access to both DSL and cable modem service—7,561 of 62,846 households responded that they had access to both DSL and cable modem service and 16,604 had access to either DSL

or cable modem service at the time of the survey. We also exclude from the sample observations with survey weights equal to zero.

We calculate price information for Internet service using the bill-harvesting portion of the sample, a survey in which only a fraction of the sample participates. Even for consumers who are in the bill-harvesting sample, the price of Internet service is available only for the chosen alternative for each consumer. We impute missing data for dial-up prices using geographic matching within the sample. We impute missing data for DSL and cable modem service using the typical price charged by an ILEC (for DSL) and incumbent cable provider (for cable modem service) in the geographic area where the consumer is located. These prices were obtained from the companies' web sites and news reports about price changes. The average price for dial-up was $19.25, for cable modem $41.80, and for DSL $43.08 in the sample for the fourth quarter of 2000 and first quarter of 2001.

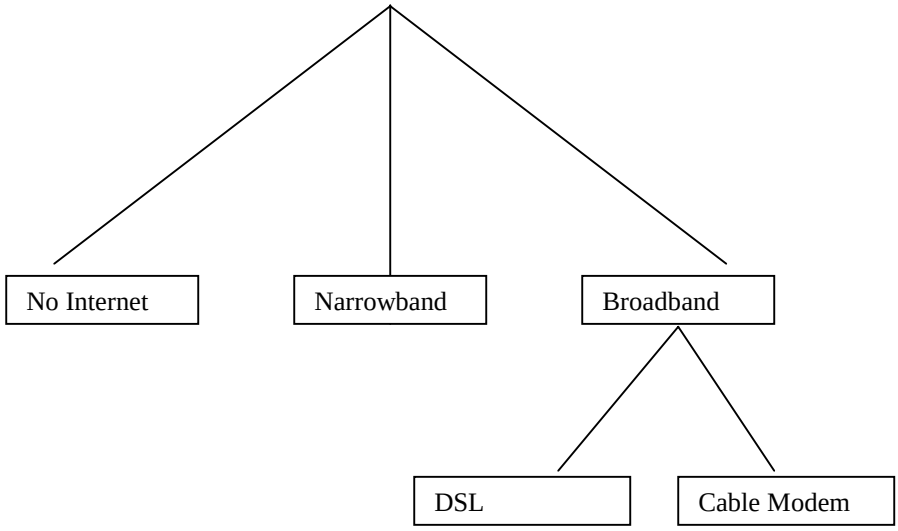
Table A1 presents the means of the independent variables used in the first stage of the nested logit model. In certain cases, the higher categories of the income and education variables were dropped, because they were not identified.

Table A1: Explanatory Variables in the Nested Logit Model

Variable	Mean	Standard Error
Income less than $15,000	0.0746	0.26
Income between $15,000 and $25,000	0.0946	0.29
Income between $25,000 and $35,000	0.1230	0.33
Education less than high school	0.0497	0.22
High school education	0.2404	0.43
Some college education	0.2626	0.44
Age	40.0000	11.58

We used the nested logit routine in the LIMDEP (Version 7) program to estimate the nested logit model and calculate the own-price and cross-price elasticities of demand for Internet access choices. LIMDEP requires the user to specify the tree structure for the model as well as the utility functions for each alternative at each stage. The nested logit routine can then formulate the likelihood function and estimate the nested logit model using maximum likelihood. Figure A1 shows the tree structure, and is followed by the utility functions that we specified. Table A2 presents the coefficient estimates.

Figure A1: Tree Structure for the Nested Logit Model



The utility functions for the nested logit model were as follows:

[1] U (DSL) = α1 +β*price-DSL
[2] U (Cable) = α2 +β*price-Cable
[3] U (Dial-up) = α3 +β*price-Dial-up
[4] U (No Internet) = β*price-No Internet = 0
[5] U (Broadband) = *b1**income1 + *b2* *income2 + *b3**income3 + *c1* *educ1+ *c2* educ2+ ***c3*** *educ3+ *d* *age
[6] U (Narrowband) = e1*income1 +e2*income2 + e3 *income3 + f1*educ1 + f2 *educ2 + f3 *educ3 + g *age

where **U( )** are the utility functions for the relevant services; **price** reflects the price for each service; the three **income** variables are dummy variables reflecting different levels of household income; the three educ variables are dummy variables reflecting the level of education of the head of household; and **age** is the age of the head of household.

Table A2: Estimated Coefficients from the Nested Logit Model

P (Y = BROADBAND)

Variable	Coefficient	Standard Error	T-Statistic	P-Value
Income less than $15,000	-1.4977	0.1680	-8.9170	0.0000
Income between $15,000 and $25,000	-1.1317	0.1443	-7.8440	0.0000
Income between $25,000 and $35,000	-0.9080	0.1265	-7.1790	0.0000
Education less than high school	-1.3247	0.2067	-6.4100	0.0000
High school education	-1.0906	0.1074	-10.1500	0.0000
Some college education	-0.3665	0.0995	-3.6830	0.0002
Age	-0.0245	0.0036	-6.7910	0.0000

P (Y = NARROWBAND)

Variable	Coefficient	Standard Error	T-Statistic	P-Value
Income less than $15,000	-1.3159	0.1021	-12.8870	0.0000
Income between $15,000 and $25,000	-0.7672	0.0914	-8.3930	0.0000
Income between $25,000 and $35,000	-0.6039	0.0859	-7.0260	0.0000
Education less than high school	-0.7729	0.1255	-6.1600	0.0000
High school education	-0.5869	0.0751	-7.8170	0.0000
Some college education	-0.1504	0.0784	-1.9170	0.0552
Age	-0.0197	0.0025	-7.7950	0.0000

P (TYPE OF INTERNET ACCESS)

Variable	Coefficient	Standard Error	T-Statistic	P-Value
Price	-0.0284	0.0069	-4.1140	0.0000
DSL	0.0972	0.2996	0.3240	0.7456
Cable modem	0.4374	0.2899	1.5090	0.1314
Dialup	1.7474	0.1358	12.8700	0.0000

The estimates indicate that income below $35,000 and lack of a college degree significantly decreases a consumer's propensity to choose a broadband access technology. Households that are headed by an older person are less likely to choose a broadband access technology. Finally, increases in the price of the Internet access technology—regardless of the type—significantly decreases the consumer's propensity to choose that access technology.