VERTICAL FORECLOSURE IN BROADBAND ACCESS?

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The merger of AOL and Time Warner involved a vertical combination of the largest Internet content provider and aggregator and a large cable system operator which offers a conduit through which broadband customers can access Internet content at high speeds. We consider the economic incentives of such a firm to engage in two distinct vertical foreclosure strategies: (1) conduit discrimination—insulating its own conduit from competition by limiting rival platform distribution of its affiliated content and services, and (2) content discrimination—insulating its own affiliated content from competition by blocking or degrading the quality of outside content.

1. INTRODUCTION

The recent merger of AOL and Time Warner raises vertical (as well as horizontal) antitrust issues that provide an interesting application of recent theories of vertical foreclosure to the market for residential broadband service. In contrast, the merger of AOL and Time Warner involved a vertical combination of the largest Internet content provider and aggregator

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1 We use the term ‘market’ throughout in the antitrust context—an antitrust product market is defined as the narrowest group of products or services such that when the supply of those goods are controlled by a single firm, that firm could profitably sustain a price increase. See Department of Justice and Federal Trade Commission Horizontal Merger Guidelines, released April 2, 1992, at §1.0 (hereinafter Merger Guidelines).

2 Another related merger—between AT&T and MediaOne—represented a horizontal combination of the two largest broadband service providers. Recognizing the potential anticompetitive vertical impact of such a combination on the provision of broadband content, the Department of Justice (DOJ) required AT&T to divest MediaOne’s interest in one of these Internet Service Providers (ISPs), RoadRunner, as a condition of merger approval, US’s, AT&T Corp. and MediaOne Group, Inc., Competitive Impact Statement, Case No. 100CV00176 (RCL) (May 25, 2000) makes it clear that the merger would ‘lessen competition in the nationwide market for the aggregation, promotion, and distribution of residential broadband content.’

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with one of the largest operators of cable systems that provide a conduit over which Internet content can reach broadband customers at high speeds.³

This paper provides a framework for the analysis of the potential anticompetitive effects of a vertically integrated cable provider on the markets for broadband Internet access and broadband Internet content. While the paper is directed towards an examination of the incentives facing all cable providers, we will frequently use the AOL Time Warner merger as an example. AOL contributes to that merger not only its proprietary content, but also its unique aggregation and presentation of content that allows for easier consumption by end-users. Time Warner, on the other hand, offers the conduit over which AOL’s content can reach residential broadband customers at high speeds. In using the AOL Time Warner, example, we do not attempt to provide an overall evaluation of the AOL Time Warner merger, and in particular, we do not attempt to characterize the potentially significant benefits that are likely to result from the merger.⁴

In the analysis that follows, we seek to ascertain whether and, if so, in what ways a vertically integrated cable firm will find it profitable to discriminate against conduit providers and against content providers. Consumers seeking to purchase broadband Internet service must secure access to many inputs, including: (1) broadband content (e.g., streaming video and audio, movies, video conferencing, interactive games), (2) the aggregation of broadband content and complementary services (e.g., chat rooms, instant messaging) by a broadband portal, (3) connectivity to the Internet supplied by a broadband Internet service provider, and (4) high-speed transport from the home to the ISP supplied by a cable provider, telephone company, or other broadband conduit provider. To simplify the exposition that follows, we will aggregate these four inputs into two distinct antitrust markets. First, we define the downstream market (input 4 above) as broadband transport service—a market served by cable providers, telephone companies, and any other firm that provides consumers transport from the home to an ISP at speeds exceeding 200 kilobits per

³AOL contributes to the merger not only its proprietary content, but also its unique aggregation and presentation of content that allows for easier consumption by end-users. To complement AOL’s upstream input, Time Warner offers the conduit over which such content would reach residential broadband customers at high speeds.

⁴For a discussion of those procompetitive benefits, see FCC Public Interest Statement, in Applications of America Online, Inc. and Time Warner Inc. for Transfers of Control, CS Dkt. No. 00-30 (released Feb. 11, 2000) at III (‘In particular, the combination of the parties’ strengths in providing consumer-friendly Internet services and a rich array of content of all types means that the merged company will be able to bring wholly new interactive services and products to the marketplace more quickly than either could do apart. In addition, the parties expect and intend that this transaction will move the marketplace to resolve the ongoing debate concerning open access on cable broadband systems.’)
second (Kbps). Second, we define the upstream market (inputs 1, 2, and 3 above) as *broadband portal service*—a market served by all firms that create, package, and distribute broadband content and ancillary services, regardless of whether they are ISPs (like AOL)\(^5\) or pure portals (like Yahoo!). We believe that this set of market definitions accurately reflects the functional differences between the services offered by conduit providers and content aggregators.

From these market definitions follow two anticompetitive strategies that a vertically integrated firm, offering both broadband transport and portal services, could in theory profitably pursue. An integrated provider could engage in *conduit discrimination*—insulating its own conduit from competition by limiting its distribution of affiliated content and services over rival platforms. Conduit discrimination could involve a range of anticompetitive strategies, from refusing to distribute an affiliated portal over competing conduits, to making marquee content available only to customers using an affiliated conduit. AOL Time Warner could, for example, curtail its marketing of AOL’s service over digital subscriber lines (‘DSL’) while actively promoting the service over cable. An integrated provider could also engage in *content discrimination*—insulating its own affiliated content from competition by blocking or degrading the quality of outside content. Content discrimination could involve a range of strategies, from blocking outside content entirely, to affording affiliated content preferential caching treatment.\(^6\) A combined AOL Time Warner could, for example, provide preferential caching service to its affiliated CNN-Sports Illustrated site, while providing inferior caching support to Disney’s ESPN site. We have analyzed the potential ability of AOL Time Warner to profitability limit its distribution of affiliated content to DSL and/or other conduit providers, and concluded that absent further conduit related joint ventures, conduit discrimination is less likely to be a significant problem than content discrimination.\(^7\)

The remainder of this paper is organized as follows. Section II reviews the theory of vertical foreclosure. In Section III we ask whether the assumptions necessary to demonstrate anticompetitive harm in the broadband access market are satisfied. Section IV examines the conditions under which a vertically integrated cable company would choose to engage in discrimination against unaffiliated content or conduit providers. Section V concludes with a brief discussion of open access.

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\(^5\) Other ISPs such as Excite@Home and Terra Lycos offer proprietary content.

\(^6\) Caching technology allows popular Web sites to be stored closer to the end user, possibly at the cable headend, to avoid Internet backbone delays. Some Cisco Systems routers allow cable systems to set higher or lower data speeds for different Web sites. A preferential caching treatment could be used to allow end users to more quickly download affiliated Web content.

\(^7\) Rubinfeld and Singer [2001].

II(i). The Chicago School’s Approach to Vertical Foreclosure

Seen as a form of vertical restraint (a restriction on a company’s buyer or seller relationships with other companies in the chain of distribution), vertical foreclosure can cause competitors to be foreclosed and customers to be harmed.8 Historically, claims of vertical foreclosure as a means of extending a firm’s monopoly power were heavily criticized, and to some extent undermined, by the Chicago School’s ‘one bottleneck monopoly’ theory.9 According to this theory, a vertically integrated firm with monopoly power in the downstream market can charge the monopoly price for the downstream good (perhaps using a non-linear pricing arrangement), thereby extracting all the profits of the upstream producer. As a result, the vertically integrated firm gains nothing from the elimination of its upstream rivals. When the conditions that underlie the one-bottleneck monopoly theory hold, a firm’s refusal to deal with an unaffiliated upstream supplier should not raise antitrust concerns. Carlton has argued, for example, that, under the above assumptions, even when the refusal to deal allows the firm to price discriminate, antitrust or regulatory intervention is necessary.10

II(ii). The Post-Chicago School’s Exceptions

Over the past several decades, numerous authors have discussed and evaluated the conditions that are necessary for vertical foreclosure to generate anticompetitive harm. Ordover, Saloner, and Salop were the first economists to formally model the vertical foreclosure calculus in a game-theoretic context.11 In their model, the refusal to supply inputs by the integrated firm to the rival of its downstream division implies that the remaining upstream supplier will face less competition in serving the foreclosed downstream firm. If the nonaffiliated upstream supplier raises its price to the rival downstream firm, the downstream rival will respond by raising the prices it charges to end-users. Hence, the diminished upstream competition increases the downstream market share of the integrated firm and supports a higher downstream price and increased

8 According to Posner [1976], for example, a vertical restraint can lead to foreclosure when a firm ‘trades a part of its monopoly profits, at least temporarily, for a large market share, by making it unprofitable for other sellers to compete with it.’
9 See, for example, Posner and Easterbrook [1982]; Bork [1993].
10 Carlton [2001].
11 Ordover, Saloner and Salop [1990]; Rasmussen [1991].
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Because the foreclosure equilibrium involves higher prices for all downstream firms without any offsetting efficiency gains, overall social welfare (and, more specifically, consumer welfare) decreases.

Several authors have applied the above framework to analyze vertical foreclosure issues in high-technology industries. For example, Church and Gandal have investigated foreclosure while treating the downstream product as a system composed of hardware (supplied by the downstream provider) and its complementary software (supplied by the upstream provider). In the Church-Gandal framework, the value of the system increases as the variety of the available software grows. Foreclosure involves a decision to make one's software incompatible with rival hardware technologies. Against the backdrop of vertical integration in the cable television industry, Church and Gandal 'expect that conflicts over access to content will arise with the development of the information highway and competition between alternative technologies and vendors.' The authors demonstrate that foreclosure by a single firm, when the other firm does not retaliate in kind because retaliation is not profitable, can occur if either: (1) the hardware products are highly differentiated and the marginal value of software variety is small; or (2) the hardware products are not highly differentiated.

II(iii). More Recent Refinements

In response to the Post-Chicago exceptions, more recent writers have criticized equilibrium foreclosure models for their reliance on inefficiencies

12 Despite the fact that there is some degree of competition at both the upstream and downstream levels, an equilibrium with foreclosure can occur if: (1) the downstream firms' revenues are decreasing in the price of the input (that is, if the price of the final good does not increase as fast as the quantity demand of the final good falls); and, (2) the unintegrated upstream firms do not have sufficient incentive to raise prices to the unintegrated downstream firms (if otherwise, the nonintegrated downstream firms will lose so much share that they will have an incentive to merge with upstream firms).

13 Church and Gandal [2000].

14 Ibid.

15 The authors identify both direct and indirect effects of foreclosure on hardware (downstream) profits: 'The direct effect is the increase in demand from the differential created in software availability for the two hardware systems. The indirect effect is the associated change in hardware pricing. The increase in demand can provide the foreclosing firm with incentives to charge higher prices for its hardware.' After noting that there appears to be little product differentiation among the hardware products, they conclude that 'consent decrees that require integrated 'hardware/software' firms to make software available on a non-discriminatory basis for other hardware technologies might prevent foreclosure that would lead to socially inefficient standardization on one of the platforms.'
in static contracting. In doing so, the authors have refined foreclosure models, while leaving open a specific set of circumstances under which policy intervention is warranted. Below we summarize two such cases in which regulatory intervention to compel open access may be appropriate.

*Market Extension.* Whinston recognized that in the presence of scale economies in the production of the complementary good, the unaffiliated rival would not be completely insulated from the actions of the vertically integrated firm. If the refusal to deal with the unaffiliated rival causes the rival's output to drop below an economically efficient scale, the rival might consider exiting the industry. Assuming that at least some consumers wanted only the service produced by the rival firm, those consumers would suffer harm from reduced competition.

It is important to note that the threat of discrimination against unaffiliated rivals in the face of scale economies formed the underpinnings of the Federal Trade Commission's (FTC) consent decree in the merger of Time Warner and Turner Broadcasting System, Inc. FTC Chairman Robert Pitofsky recognized that there exist 'formidable entry barriers into programming' and that entry into the market for 'marquee' content 'has proven slow and costly.' Moreover, the Commission's majority recognized that a very large audience was required to support the development of new programming, finding that, '[b]ecause of the economies of scale involved, the successful launch of any significant new channel usually requires distribution on [multi-channel video programming distributors] that cover 40 to 60 percent of all subscribers.' Further, the majority concluded that programmers could not support new offerings by relying on technologies or partners other than market leaders, because replicating 'the coverage of these systems by lacing together agreements with the large number of much smaller multichannel video program distributors is costly.

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16 In the static foreclosure models, the advantage of the vertically integrated firm derives from its ability to force unaffiliated downstream providers to face market power in purchasing the upstream good, and the inability of the upstream and downstream unaffiliated firms to write an efficient contract. See Carlton [2001].
17 Whinston [1990].
18 Carlton [2001] reviews the foreclosure literature, using as an example of this case a monopoly resort hotel on an island where hotel workers live. If the resort forced its guests to eat only at the hotel, and if the restaurants outside the resort failed to achieve sufficient sales to remain in operation, then island natives would suffer in their consumption of meals.
20 In re Time Warner Inc., No. C-3709 (issued Feb. 1997) (statement of Chairman Robert Pitofsky and Comm'r Janet D. Steiger and Christine A. Varney). According to the *Merger Guidelines*, there are low barriers to entry if 'entry would be timely, likely, and sufficient in its magnitude, character and scope to deter or counteract the competitive effects of concern.' *Merger Guidelines*, at §3.0.
21 Ibid.
and time consuming. Based on these conclusions, the majority found that the risk of vertical foreclosure in the video programming market was 'both real and substantial.'

**Market Preservation.** As a second motivation for foreclosure, the vertically integrated firm can use its monopoly power over the downstream product to harm future competitors in the downstream market by refusing to buy the upstream product from its rival. By discriminating against rival upstream products, the vertically integrated firm can inefficiently limit the scale of unaffiliated upstream rival, and can prevent a competitor in the downstream market (which relies on the upstream product) from effectively competing against it in the future. This theory is complementary to the earlier vertical foreclosure; in contrast to the goal of extending market power into a complementary market, the dynamic models demonstrate that foreclosure can be motivated by the goal of preserving market power in future periods.

In the following sections we apply the theory of vertical foreclosure to examine the possibility that a vertically integrated firm such as AOL and Time Warner will have an incentive to foreclose content and/or conduits.

### III. Applying Vertical Foreclosure Theory to Broadband Internet Access

We demonstrate below that the necessary assumptions of both the market extension and the market preservation theories appear to be satisfied in the context of the broadband Internet access market. It is important to note that the recent refinements to the Post-Chicago theory have created a more stringent threshold than their predecessors. It is possible, therefore, that certain markets would be considered vulnerable to anticompetitive behavior under the Post-Chicago approach, but free from anticompetitive behavior under the more recent refinements. By showing explicitly that the assumptions associated with the more recent refinements hold, we implicitly support the Post-Chicago assumptions as well.

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22 Ibid.
23 Ibid.
24 Carlton [2001]. Carlton uses as an example a monopolist of operating systems that initially ties applications programs to its systems to prevent new applications programs from developing. According to Carlton, 'In subsequent periods, entry of new operating systems would occur if there existed a stock of independent application programs. But, by assumption, such programs don't exist because Firm 1 prevented their development by foreclosing the initial market to them.
25 For a discussion of the assumptions associated with the Post-Chicago school, see Riordan and Salop [1995].
26 For an application of the Riordan and Salop framework to the broadband Internet access market, see Rubinfeld and Singer [2001].
In our study, the vertically integrated firm with market power in the downstream market is the cable firm, which as of June 2000 had on average 70 percent share of the (downstream) residential broadband access market.\textsuperscript{27} As of March 2001, the ratio of cable modem subscribers to DSL subscribers was 2 to 1 (4.9 million versus 2.4 million),\textsuperscript{28} and first quarter growth in cable subscribers outpaced first quarter growth in DSL subscribers by a factor of 9 (18.01 percent versus 1.97 percent).\textsuperscript{29} We believe that the residential broadband access market is distinct from the narrowband dial-up alternatives.\textsuperscript{30}

Moreover, the extent of vertical integration between the cable conduit (with significant downstream market power) and the upstream broadband portal market is significant:

- As of August 2000, Excite@Home reported two million cable modem subscribers and 32 million cable homes passed.\textsuperscript{31} Excite@Home is owned by AT&T, the largest cable multi-system operator (MSO);
- As of August 2000, RoadRunner had one million cable modem subscribers.\textsuperscript{32} RoadRunner is owned by AOL Time Warner, the second largest cable MSO;
- The merger of AOL and Time Warner combines AOL’s 27.8 million customers with Time Warner’s cable conduit which passes nearly 20 percent of all US homes;\textsuperscript{33}
- With High Speed Access Corporation, Charter Pipeline serves as the broadband ISP to its parent firm Charter Cable;\textsuperscript{34}
- With Excite@Home, Jones ISP serves as the broadband ISP for its parent firm Jones Cable.\textsuperscript{35}

We proceed under the assumption that the market power and vertical integration conditions are satisfied.

\textsuperscript{27} High Speed Services for Internet Services—Subscribership as of June 30, 2000, FCC News (released Oct. 31, 2000), at Table 3.
\textsuperscript{28} Failure of Free ISPs Triggers First-Ever Dip, To 68.4 Million Online Users: Cable Modem Boom Continues, As DSL Sign-ups Lag, Telecommunications Reports, April 2001, at 1.
\textsuperscript{29} Ibid.
\textsuperscript{30} For econometric support showing that the pricing of broadband access is not constrained by the pricing of narrowband dial-up Internet, see Hausman, Sidak and Singer [2001].
\textsuperscript{31} AtHome Corp., Excite@Home Surpasses 2 Million Broadband Subscribers (press release), Aug. 23, 2000; AtHome Corp., Excite@Home Reports Second Quarter 2000 Results (press release), July 19, 2000.
\textsuperscript{32} RoadRunner, RoadRunner Hits A Million (press release), Aug. 23, 2000.
\textsuperscript{34} Seventh Annual Report on Competition in Video Markets, CS Dkt. No. 00-132 (released Jan. 8, 2001) at 27.
\textsuperscript{35} Ibid.

III(i).  *Necessary Assumptions for Extension of Market Power*

For vertical foreclosure to be an effective anticompetitive strategy for extending market power under Carlton’s recent approach: (1) there must be scale economies in the production of the complementary good, and (2) there must be some customers who want only the output of the rival firm. It appears that the first condition is satisfied. Most of the production costs of interactive content, like non-interactive programming content, are upfront costs, while the marginal costs (for example, the costs of distribution) are negligible.³⁶ Moreover, a broadband portal aggregates media-rich content that can be viewed by broadband users. Such a portal can either produce its own content or purchase content from independent producers. To achieve success, however, a broadband portal must offer a wide array of content that takes advantage of a high-speed Internet connection; doing so is the only way to attract customers that typically demonstrate a significant degree of loyalty to one portal.³⁷ Given this linkage between access to broadband content and the success of a broadband portal, any impediment to entry in the content market will also inhibit entry into the portal market.

To the extent that the costs of producing marquee broadband content for the next generation of cable television mirror those of producing broadband content for the Internet, any economies of scale would likely translate from one medium to another.³⁸ For example, most of the production costs of broadband Internet content, like cable television content, are upfront costs, while the marginal costs (for example, the costs of distribution) are negligible.³⁹ These up-front costs are very high, particularly for a broadband portal seeking to develop content that can compete with the broadband offerings of CNN.com and other AOL Time Warner marquee content.

The second condition—the existence of a set of consumers who do not perceive unaffiliated broadband content to be a complement to the cable

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³⁷According to McKinsey [2000], anywhere from 50 percent to 75 percent of an Internet site’s sales are from repeat customers. See *Real Battle Is For The Web Revisited*, *Bus. Rev. Weekly*, Oct. 20, 2000. Media Metrix claims that Yahoo!’s portal has the most loyal audience on the Internet, with a 77.5 percent retention rate, the highest among top US domains. Further, Nielsen NetRatings states that Yahoo!’s users consume more and stay longer, with average page views per user at 185 pages (ranked first across all portals) at work and 166 pages (ranked second across all portals) home and work combined. According to Jeff Mallett, Yahoo!’s president and chief operating officer, the ‘loyalty of [its] users is one of [Yahoo!’s] strongest core assets, and their acceptance of the premium services we have rolled out is a key component to our overall strategy.’ See *Yahoo! Reports First Quarter 2001 Financial Results; Company Posts $180.2*, *Business Wire*, Apr. 11, 2001.
³⁸See, e.g., Owen [1999].
³⁹See, e.g., Johnson [1994]. For the effects of scale on media product distribution, see Rosse [1967]; Owen and Wildman [1992].
conduit—appears to be satisfied as well. For the roughly 30 percent of residential broadband access customers who subscribe to DSL, unaffiliated programming from sites such as Disney.com or ESPN.com is not perceived as a complement to the cable conduit. More importantly, for all broadband access subscribers (including cable subscribers) outside of the discriminating firm’s territory, the unaffiliated content is not seen as a complement to the discriminating firm’s cable conduit. If, by denying completely or degrading the quality of broadband content from unaffiliated broadband portals, the cable conduit induces exit in the broadband portal market, then in-region DSL customers and out-of-region broadband customers in general will experience less competition in the supply of broadband content. Hence, a vertically integrated cable firm could potentially extend its market power into the content market—both in-region for DSL customers and out-of-region for all broadband customers—by engaging in content discrimination.

III(ii). Necessary Assumptions for Preservation of Market Power

The vertically integrated cable firm might also degrade the broadband features of unaffiliated content providers as a means of preserving its market power in the downstream conduit market in future periods. Here again, we believe that the two critical assumptions are satisfied: (1) there are significant network effects in the consumption of the complementary good, and (2) the unaffiliated provider has the potential to compete directly or indirectly with the vertically integrated firm in the downstream market.

Network economies are particularly strong in the broadband content market because the desirability of a particular variety of broadband content depends on the number of other consumers that view that content (e.g., the utility associated with watching traditional video programming includes the opportunity to discuss recent episodes with friends and colleagues). We expect this same phenomenon to carry over to broadband streaming video.

With respect to the second condition, DSL providers, which compete with cable firms in the downstream market, are critically dependent on the continued development of non-cable-affiliated broadband content. To the extent that content discrimination by the cable firms could drive out unaffiliated content providers, DSL providers would become more dependent on cable firms for the supply of broadband content. Hence, a

\(^{40}\) Stated differently, the DSL subscribers serve the same (unfortunate) role as the island natives in the hotel example. Note that the cable firm can presumably extract a percent of the content margins from its own customers through its pricing of broadband Internet access.

vertically integrated cable firm could undermine the future development of DSL by engaging in content discrimination.

In summary, the necessary conditions for the threat of content discrimination to be taken seriously appear to be satisfied in the context of broadband content. First, there is not another broadband conduit that has a customer base large enough to restore a content provider’s lost revenues from cable customers. DSL has a relatively small share of the broadband residential access market, and the future availability of DSL and alternative broadband conduits remains uncertain. According to a McKinsey study, as of the end of 1999 DSL providers could only address 44 percent of US households. With cable having a market share in August 2000 of roughly 70 percent, it appears that a sufficient number of alternative broadband customers would not likely be available through competing conduits to save content and portal competitors from being foreclosed from systems such as AOL Time Warner.

Second, with economies of scale in the broadband portal market, it is conceivable that a broadband portal would be forced to exit from the market as the result of a foreclosure strategy because it could not achieve minimum viable scale. Because broadband content is subject to significant economies of scale, we believe that a vertically integrated cable firm may not face a significant market check on its ability to discriminate against outside content in the immediate future.

While we believe that the necessary conditions for vertical foreclosure by vertically integrated cable firms may be satisfied with respect to both broadband conduits and broadband content, we find content discrimination to be of particular concern. There is not another broadband conduit with a sufficient customer base to restore a content provider’s lost revenues from cable customers. Moreover, the future availability of alternative broadband conduits appears to be limited. With cable’s share in June 2000 being roughly 70 percent, it appears that a sufficient number of alternative

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41 Satellite-based high-speed Internet service is not currently a close substitute to cable-based Internet access because, unlike cable systems, it provides high-speed connection in only one direction, from the satellite to the user’s computer.

42 McKinsey [2000], p. 27. DSL is sensitive to the distance that transmissions must travel between the home and central office, and in its current form DSL faces a limit of approximately 18,000 feet for the copper segment. However, there is some more recent evidence that DSL deployment might overcome some of these technological impediments. SBC’s DSL initiative, the three-year, $6-billion Project Pronto, uses neighborhood broadband gateways as hubs to extend DSL service beyond the current limit of 18,000 feet. As of March 2001, however, the distance limitations of DSL restricted service to about 60 percent of the population that lives within three miles or so of the provider’s central offices. See Morris Edward, DSL gains on cable modems for broadband Web access, COMM. NEWS, Mar. 31, pp. 94–95.

43 According to the Merger Guidelines, minimum viable scale is the smallest average annual level of sales that the committed entrant must persistently achieve for profitability at premerger prices. Merger Guidelines, at §3.3.

broadband customers would not likely be available through competing conduits to save content and portal competitors foreclosed from vertically integrated cable systems such as AOL Time Warner. In addition, because a broadband portal that cannot achieve minimum viable scale can be forced from the market, a vertically integrated cable firm may not face any significant market check on its ability to discriminate against outside content.

IV. IS FORECLOSURE PROFITABLE?

The forgoing discussion concerned the general market conditions necessary for a vertically integrated cable firm to engage in discrimination against unaffiliated rivals. To complete our analysis, it is important to consider the calculus such a firm might employ to determine whether discrimination was profitable.

IV(i). Content Discrimination

We begin by asking whether a vertically integrated cable company such as AOL Time Warner would have an incentive to block its customers' access to unaffiliated content. This form of discrimination would benefit the company by enhancing the position of its affiliated content providers in the national market by denying unaffiliated content providers critical operating scale and insulating affiliated content providers from competition. Content discrimination would thus allow the company to earn extra revenues from its own portal customers, who would have fewer opportunities to interact with competing outside content.

The cost of content discrimination is the potential loss in revenue from customers that demand the withheld content. To the extent that cable transport providers compete against DSL and other broadband transport providers, the reduction in revenues from lost customers will be greater. Note that content discrimination does not require a complete denial of access to outside content. Less aggressive strategies (for example, providing unequal caching treatment to unaffiliated content providers) may inflict some loss on the downstream transport division, because some customers may still prefer to switch transport providers rather than suffer slower access to outside content. Therefore, a vertically integrated cable company will find it profitable to engage in content discrimination if the gain from additional portal, content and advertising sales offsets the reduction in broadband access revenues resulting from lost broadband subscribers.

44 High Speed Services for Internet Services—Subscribership as of June 30, 2000. FCC News (released Oct. 31, 2000), at Table 3.

Content discrimination results in lost in-region access sales, but has the potential to increase content and advertising sales across the nation. There are three sources of revenues available to the firm in general: (1) in-region access and content revenues from cable customers; (2) in-region content revenues from non-cable customers; and (3) out-of-region content revenues from all broadband customers. Let \( \Pi_U \) represent the expected monthly revenue per broadband subscriber when the cable company does not engage in content discrimination. Then,

\[
(1) \quad \Pi_U = [kt(p + \rho)] + [k(1 - t)q(o + \rho)] + [(1 - k)(1 - t)q(o + \rho)]
\]

where

\( k \) = the firm’s share of national cable homes (the national ‘footprint’)
\( t \) = the firm’s in-region residential cable-modem broadband access share
\( p \) = the firm’s monthly transport-Internet service price per cable subscriber
\( \rho \) = the firm’s monthly content/advertising revenues per broadband cable subscriber
\( q \) = the firm’s upstream content penetration rate among DSL customers
\( o \) = the firm’s monthly access price for DSL subscribers

Next let \( \Pi_F \) be the expected monthly revenue per broadband subscriber when the vertically integrated cable firm engages in content discrimination, and define \( t_F, q_F, \) and \( \rho_F \) accordingly. We assume that content discrimination affects content and advertising revenues both inside (for non-cable subscribers) and outside of the firm’s footprint (for all subscribers) by inducing exit in the national content market. Then,

\[
(2) \quad \Pi_F = [kt_F(p + \rho_F)] + [k(1 - t_F)q_F(o + \rho_F)] + [(1 - k)(1 - t_F)q(o + \rho)]
\]

We assume that content foreclosure has a direct effect on content profits—an increase in demand from the fact that rival content producers might not achieve minimum viable scale (\( q_F > q \)).\(^{45}\) Assume also that there is an indirect effect—the associated change in content pricing due to the increase in demand for its affiliated content (\( \rho_F > \rho \)).\(^{46}\) Finally, assume that content discrimination might jeopardize in-region broadband trans-

\(^{45}\) The direct effect is a variety effect that depends on the inelasticity of supply of broadband content. Because we focus on conduit discrimination, following Church and Gandal our ‘hardware’ is the broadband portal.

\(^{46}\) It is not clear whether marginal content discrimination such as preferential caching treatment could translate into serious relaxation of a price constraint for affiliated content. More likely, the cable firm’s ability to increase its price of content comes from its ability to deny unaffiliated broadband portals access to its conduit. Through its integrated broadband portals, the cable firm could ensure that affiliated content is downloaded more frequently than unaffiliated content.

port market share by antagonizing cable subscribers who demand the degraded or unavailable content \((t_f < t)\).

For content discrimination to be profitable, \(\Pi_f\) must exceed \(\Pi_U\). The change in profit from engaging in content discrimination is

\[
\Pi_f - \Pi_U = [kt_f(p + \rho)] + [(1 - k)(1 - t)q_f(o + \rho_f)] - [kt(p + \rho)] - [k(1 - t)q(o + \rho)] - [(1 - k)(1 - t)q(o + \rho)]
- q_f(o + \rho_f) - (o + \rho)\]

From (3) it is possible to perform various comparative static exercises that have important policy implications. Suppose, for example, that one is concerned about the relationship between the size of the vertically integrated firm’s footprint and its incentive to engage in content discrimination. To evaluate the effects of footprint size on the profitability of content discrimination, differentiate (3) with respect to \(k\).

\[
d[\Pi_f - \Pi_U]/dk = [(p + \rho)(t_f - t)] + [(1 - t_f)q_f(o + \rho_f)] - [(1 - t)q(o + \rho)] - q_f(o + \rho_f)\]

Note that because \(t_f < t\), the first term in square brackets—the change in in-region revenues among cable subscribers—is negative. Because \(\rho_f > \rho\), \(t_f < t\) and \(q_f > q\), the second term in brackets—the change in in-region revenues among non-cable subscribers—is positive. Finally, because \(\rho_f > \rho\) and \(q_f > q\), the third term in square brackets—the change in out-of-region revenues on all broadband subscribers—is also negative. Whether the vertically integrated provider enjoys gains or losses on in-region cable customers depends on the relative weights of the three terms. Intuitively, the primary motivation for engaging in content discrimination is the gain in content sales outside of the vertically integrated firm’s territory. As the firm’s footprint increases, *ceteris paribus*, the motivation for engaging in content discrimination might weaken.

The analysis presented to this point has omitted several important considerations that could cause content discrimination to be more profitable. First, we have not taken into account the network effects that are likely to be associated with content provision. With network effects, the larger the firm’s customer base, the more likely that content discrimination will cause foreclosed content providers to either exit the market, or negotiate a deal with the vertically integrated firm that gives them carriage in return for a substantial payment. To the extent that foreclosed competitors exit the market, the vertically integrated firm is less likely to lose customers to a
competing conduit because switching conduits will no longer afford customers access to foreclosed content.

Network effects can also affect the decision to discriminate. We note that broadband sites are financed largely by advertising revenue. The demand for advertisements to be placed on broadband sites is derived from the demand of broadband users who wish to access information on that site. By instilling loyalty and raising switching costs, the associated network effects tend to make customer demand for broadband content less price sensitive. Hence, we expect the presence of network effects to shift the demand curve upward, which in turn would make content discrimination even more profitable.

Second, our analysis has focused on the most extreme form of content discrimination—the complete foreclosure of rival content to AOL Time Warner and other cable customers. A strategy of partial foreclosure, one that increased the cost of accessing rival content on its cable systems, has the potential to be substantially more profitable. Indeed, such a strategy, if successful, would have the potential to choke off the supply of rival content generally, and cause customers to shift towards, rather than away from, cable transport as their preferred platform.

IV(ii). Conduit Discrimination

Conduit discrimination—that is, a vertically integrated firm refusing to supply its affiliated content to rival conduits—is costly because the firm will forego revenues from content distribution over foreclosed platforms. There are potentially countervailing benefits, however, because with conduit discrimination, customers will perceive the cable conduit as more valuable, which will increase the demand for the cable conduit. Clearly, a cable broadband provider will engage in conduit discrimination if the gain from additional access revenues from broadband users offsets the loss in content revenues from narrower distribution.

If a cable broadband transport provider controls particular content, but only has a small fraction of the national broadband transport market, that provider would have little incentive to discriminate against rival broadband transport providers outside of its cable footprint. The intuition is straightforward: out-of-franchise conduit discrimination would inflict a loss on the cable provider's content division, while out-of-region cable providers would be the primary beneficiaries of harm done to non-cable competitors. To capture the gains from such discrimination, the vertically integrated cable provider must have a cable footprint in which to

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47 If existing cable customers could not so easily detect their resulting lack of choices, partial discrimination could be done in such a way as to prevent existing cable subscribers from switching to DSL.

distribute its broadband portal service, either through direct ownership or through an arrangement to share the benefits of foreclosure with other cable providers.

While it is theoretically possible to discriminate selectively in the distribution of content, we believe it reasonable to assume that conduit foreclosure results in lost content sales across the nation, whereas increasing conduit sales and higher conduit prices generate revenues only within-region. Currently, DSL remains an open system (which by law must interconnect with rival ISPs) whereas rival cable systems remain closed (that is, a rival cable system would presumably continue to reject AOL as its broadband access provider). Consequently, if a vertically integrated company such as AOL Time Warner were to engage in conduit discrimination, it would also forego its monthly access fee for those DSL customers that would have subscribed to AOL both inside and outside its conduit footprint.

The formal analysis that follows balances the vertically integrated firm’s three economic interests that flow from the three revenue streams. Let \( \Pi_U \) be the expected monthly revenue per broadband subscriber when the cable firm does not engage in conduit discrimination, and let \( \Pi_f \) be the expected monthly revenue per broadband subscriber when the vertically integrated company engages in conduit discrimination. Again, let \( t_f \) equal the in-region broadband access share with input discrimination, and \( p_f \) be the corresponding monthly transport portal service price. We expect conduit discrimination to eliminate all out-of-region transport and content sales, \([1 - k(1 - t)]q(o + \rho)\), as well as in-region content sales to non-cable broadband conduit providers, \([k(1 - t)q(o + \rho)]\). It follows, therefore, that,

\[
\Pi_f = kt_f(p_f + \rho)
\]

As the theory of vertical foreclosure suggests, conduit discrimination will, in general, make it possible for the vertically integrated company to increase both its broadband access share and its access price in region due to its now relatively richer content offering. Conduit foreclosure has both a direct effect on conduit profits, caused by the increase in content demand that results from the differential in content availability over cable modems and DSL \((t_f > t)\); and an indirect effect, caused by the change in access pricing that results from an increase in demand for cable modems \((p_f > p)\).

We can use the recent AOL Time Warner merger to illustrate this methodology. For the AOL-Time Warner merger, we believe that the following are reasonable parameter estimates:

\[
k = \text{share of national cable footprint} = 0.19^{48}
\]

\(^{48}\) This is the percentage of homes passed by TW cable system. Strategis Group [1998], p. 142.
\( t = \text{in-region residential cable-modem broadband access share} = 0.73^{49} \)

\( p = \text{monthly transport-Internet service price per cable subscribers} = \$40.00^{50} \)

\( \rho = \text{monthly content/advertising revenues per broadband cable subscriber} = \$23.10^{51} \)

\( q = \text{residential DSL customer share} = 0.30 \)

\( o = \text{monthly access price for DSL subscribers} = \$21.95^{52} \)

As we pointed out earlier, however, conduit discrimination will lead to a loss in access and content-related revenues out-of-region. For foreclosure to be profitable, in-region revenue increases would have to outweigh these out-of-region losses. Formally, discrimination will be profitable if \( \Pi_F \) is greater than or equal to \( \Pi_U \). Substituting the parameters in (1) and (5) yields \( \Pi_U = \$12.40 \) and \( \Pi_F = 0.19t_p(p_F + \$23.10) \). The necessary condition for discrimination to be profitable becomes:

\[
0.19t_p(p_F + \$23.10) > \$12.40
\]

For example, if \( t_p = 0.73 \) and \( p_F = \$40, \) conduit discrimination for AOL Time Warner would not be profitable. Indeed, given its current limited conduit footprint, significant widespread conduit discrimination by AOL Time Warner outside of its cable franchise territory does not appear likely. We note, however, that our concern with the possibility of conduit discrimination would be significantly increased were the vertically integrated company to selectively implement such a strategy only within its own cable footprint. Then, there would be no lost out-of-region revenues, and discrimination would be substantially more profitable. More generally, the ability to apply a discriminatory strategy that is applied differentially within and without the cable footprint is likely to increase substantially the profitability of conduit discrimination.

Our results are quite sensitive to the size of the cable footprint. Suppose, for example, that AOL Time Warner and AT&T-MediaOne were to enter an agreement that had the effect of pooling their respective cable distribution footprints. Given AT&T's cable footprint of 30 percent (including its MediaOne and TCI properties),\(^{53}\) the combined cable distribution

\(^{49}\) Based on nationwide average of cable modems' share of residential broadband access market. Strategis Group [2000].

\(^{50}\) At Home Corp., 1999 SEC Form 10-K, p. 6 (Mar. 30, 2000).

\(^{51}\) Ibid. At Home's content and advertising revenues were chosen over AOL's content and advertising revenues because (1) At Home's revenue reflects the revenue streams associated with broadband content and (2) AOL's revenues contain some influence of networks effects owing to its large share of the narrowband residential market.


\(^{53}\) Strategis Group [1998] pp. 140–41 (TCI Communications Inc. had 22 million homes passed and MediaOne had 8.4 million homes passed).
footprint of AOL and AT&T would be approximately 49 percent (k = 0.49). An analysis of the profitability of conduit discrimination shows that AOL Time Warner would earn higher total profits and higher profits per homes passed if the size of its distribution footprint were to increase.\textsuperscript{54}

To see why, note that with conduit discrimination, $t_f > t$ and $p_f > p$. The change in profit from engaging in conduit discrimination is

\begin{equation}
\Pi_f - \Pi_U = kt_f(p_f + \rho) - kt(p + \rho) - (1 - t)q(o + \rho)
\end{equation}

The derivative of the change in profit with respect to the size of the footprint is therefore

\begin{equation}
d[\Pi_f - \Pi_U]/dk = t_f(p_f + \rho) - t(p + \rho),
\end{equation}

which is greater than or equal to zero for all $t_f > t$, $p_f > p$.

V. CONCLUSIONS

In this paper we have not attempted to evaluate fully all of the likely benefits and costs of compelling a vertically integrated firm such as AOL and Time Warner to open its conduit to rival broadband content, or to offer its content to rival conduit providers.\textsuperscript{55} While conduit discrimination is a potential problem, particular as the footprint of the vertically integrated companies grows, our analysis has emphasized the likely profitability of content discrimination.

Our discussion to this point has left implicit the injury that content discrimination will impose on consumers. We believe that the potential harms could be significant, for several reasons. If successful, content discrimination will force consumers to pay more for broadband content (for example, through higher prices for goods sold in ways that rely on broadband advertising), and advertisers will be forced to pay more to reach the vertically integrated firm's captive customer base. Moreover, those cable customers who switch to an alternative conduit will be worse off because they were forced to choose their second-best rather than their first-best broadband alternative.

Finally, retaliation by a DSL provider (or set of DSL providers)—that is, if a DSL provider were to vertically integrate into content by acquiring a large broadband portal and then deny access to all rival content from vertically integrated cable firms—would not likely restore the loss in consumer welfare. In fact, a 'walled gardens' scenario among all vertically

\textsuperscript{54} Total profit is defined as the product of the differential profit per broadband subscriber and the current number of nationwide broadband subscribers (=1,980,000).

\textsuperscript{55} For example, there might be efficiency gains associated with exclusive arrangements for affiliated content.

integrated broadband access providers would force consumers to choose their content at the same time they chose their conduit, which could result in an even greater loss in welfare. More likely, as the analysis of Church and Gandal demonstrates, the DSL provider would not find it profitable to retaliate.

We believe that the FTC was correct in its effort to impose a conduit open-access remedy as a condition for the AOL Time Warner merger. Affording unaffiliated ISPs, such as EarthLink, access to the combined company’s cable modem platform is a significant requirement. Doing so will ensure that AOL Time Warner will promote investment in the broadband portal market by giving new entrants certain access to the merged company’s cable customers, and will limit AOL Time Warner’s ability to engage in both conduit and content discrimination. In addition, AOL Time Warner was required to market and offer AOL’s DSL services to subscribers in Time Warner cable areas where affiliated cable broadband service is available ‘in the same manner and at the same retail pricing as they do in those areas where affiliated cable broadband ISP service is not available.’

Imposing an open access condition on AOL Time Warner undermines its ability to engage in conduit discrimination by ensuring the preservation of a robust broadband portal marketplace. Thus, even if the combined company elects to distribute its service only through cable modems, competing unintegrated portals can still take advantage of cable’s dominant position in the broadband transport market, leaving competing conduit providers with enough content to justify continued investment. Likewise, imposing an open access condition on AOL Time Warner undermines its ability to engage in content discrimination. Even if the merged company elects to block all outside content, unaffiliated portals and content providers can still reach cable customers through a competing ISP. Customers seeking access to foreclosed content will thus not have to switch to some other transport conduit that suffers from a lower rate of market penetration.

\footnote{56 In November 2000, EarthLink and Time Warner reached a revenue-sharing agreement that provided Earthlink access to Time Warner’s cable lines. As part of the agreement, no other unaffiliated Internet provider will be able to offer service on Time Warner’s system before EarthLink, and EarthLink will offer their service on Time Warner’s network at the same time, or before, AOL does. Alec Klein, \textit{Time Warner, EarthLink Reach Deal}, \textit{WASH. Post}, Nov. 21, 2000, p. E1.}

\footnote{57 The FTC imposed other conditions that were unrelated to the anticompetitive conditions raised here. For example, AOL Time Warner are prohibited from interfering with the ability of non-affiliated providers of interactive TV services to interact with interactive signals, triggers or content that AOL Time Warner has agreed to carry. See \textit{FTC Approves AOL/Time Warner Merger with Conditions}, FTC Press Release, Dec. 14, 2000, downloaded at http://www.ftc.gov/opa/2000/12/aol.htm.}
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