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Exclusivity and Tying in *U.S. v. Microsoft*: What We Know, and Don't Know

Michael D. Whinston

U.S. *v. Microsoft* involved the allegation that Microsoft violated the U.S. antitrust laws by engaging in a variety of practices aimed at excluding rivals and potential rivals, most notably the Netscape Corporation's Navigator web browser. The government contended that these efforts were designed to protect Microsoft's Windows monopoly of Intel-compatible operating systems against any devices or software that might lessen the necessity of using Windows.¹ In this article, I discuss an important subset of Microsoft's practices: its use of contracts involving various forms of exclusivity for its web browser Internet Explorer and its attempts at tying the use of Internet Explorer to its Windows operating system.²

Views of economists concerning exclusive contracts and tying arrangements have shifted dramatically in recent decades, from a general hostility to such arrangements, to viewing them as manifestations of healthy competitive processes, to a more mixed and contextual view between these extremes. Here I discuss what the current state of knowledge about exclusive contracts and tying tells us about the issues in the Microsoft case and—equally important—what questions it leaves unanswered.

¹ Franklin Fisher and Richard Schmalensee served as the economic experts for the government and Microsoft, respectively. When I describe the government's or Microsoft's arguments, I am frequently referring to arguments appearing in Fisher's or Schmalensee's testimonies. The most accessible place to find many of these arguments is Evans et al. (2000). In addition, a number of states were involved in the case; their expert was Frederick Warren-Boulton.

² Other issues in the case are discussed in the article by Gilbert and Katz in this symposium.

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I begin by providing a description of Microsoft's use of exclusive contracts and tying. I next provide an overview of the current state of knowledge about these practices. The remainder of the article discusses the case in light of these theories.

Microsoft's Use of Exclusivity and Tying

Microsoft's most visible act was the physical integration of Internet Explorer into Windows. In addition, Microsoft signed a variety of exclusionary contracts involving browser use and promotion with computer manufacturers, Internet access providers (including both Internet service providers and online services such as America Online), Internet content providers, and software vendors. While these contracts rarely required complete exclusivity, they did require preferential treatment for Internet Explorer. Moreover, Microsoft often tied access to Windows to acceptance of these contracts.

Microsoft initially tied Internet Explorer to Windows contractually, by requiring that computer manufacturers who licensed Windows 95 for installation on new computers also install Internet Explorer, and by selling the two products bundled together at retail. Starting in 1996, Microsoft imposed additional requirements on computer manufacturers who licensed Windows: they could not remove the Internet Explorer icon from the Windows desktop; they could not place any icons on the desktop that were larger than the Microsoft icons; and they could not modify the boot sequence or have programs that automatically launch at its conclusion, which could give users an easy way to choose Navigator over Internet Explorer. (These restrictions were loosened somewhat in a January 1998 stipulation with the government.)

Microsoft began the physical integration of Internet Explorer into Windows in August 1996, by integrating some Internet Explorer code into a version of Windows 95. At that time, however, Internet Explorer could be removed with Window's Software Uninstall function. The physical integration of Internet Explorer into Windows 98, introduced in August 1998, eliminated this possibility. There is also some evidence that Microsoft made Windows 98 default to Internet Explorer under certain circumstances (*U.S. v. Microsoft Findings of Fact*, p. 73). It is not clear whether this was a deliberately introduced incompatibility or simply a result of Navigator not performing certain functions, nor whether in reality this incompatibility was very serious.

In addition to the contractual restrictions on computer manufacturers described above, Microsoft also attempted to reward particular computer manufacturers for promoting Internet Explorer over Navigator more explicitly through reduced Windows licensing fees, co-marketing funds, and other payments. Compaq, for example, agreed in February 1997 to "promote Internet Explorer exclusively" for its personal computer products. In 1997 Microsoft also pressured Apple to make Explorer its default browser and to put icons for no other browsers on the

desktops of its Macintosh computers, using in part the threat that it might discontinue its Office product for Macintosh computers.

Microsoft wrote exclusionary contracts, and tied access to Windows upon their acceptance, with 14 of the largest Internet service providers starting in late summer 1996.³ These firms were told that they would be placed in the Windows Internet Connection Wizard—which made it easy for consumers to subscribe to and download access software from Internet service providers—if and only if they agreed to certain restrictions, which included a promise not to offer other browsers to customers nor to offer web links to other browsers. The Internet service provider was allowed to ship another browser if the customer requested it, but Microsoft's contracts required typically that 75–85 percent of all browser shipments be Internet Explorer. The contracts were terminable by either party with short notice, commonly 30 days. The restrictions on distribution of other browsers were relaxed by Microsoft in April 1998 just prior to the trial. However, Microsoft still required that Internet Explorer be the Internet service provider's default browser and that it be promoted at least as prominently as any other browser.⁴

Beginning in March 1996, Microsoft also wrote exclusionary contracts with four online services, and again tied access to Windows upon their acceptance. The most significant was Microsoft's deal with America Online which, together with its subsidiary CompuServe, had 65 percent of the subscribers to the top 80 Internet access providers.⁵ In this case, inclusion in the Windows Online Services Folder, which listed online services whose access software was included in Windows, was conditioned on acceptance of limits on promoting and distributing browsers other than Internet Explorer. Microsoft also offered cash incentives for switching existing customers to Explorer. These contracts appear to have had more binding durations than did the Internet service provider contracts: America Online, for example, was initially bound for a period of approximately two years to its contract. Unlike the restrictions with Internet service providers, Microsoft has not relaxed the restrictions in these contracts.

Beginning with the release of Internet Explorer 4.0 in September 1997, Microsoft also wrote exclusionary contracts with Internet content providers which tied placement in the Windows Channel Bar, which allowed consumers who enabled the Windows Active Desktop to connect more easily to a content provider's website, to making Internet Explorer their preferred browser. This "preferred"

³ The government's complaint attacked only the exclusionary terms of these contracts, not the tying involved. The only contractual ties explicitly attacked by the government were the requirements imposed on computer manufacturers who licensed Windows.

⁴ Microsoft also had agreements with approximately 2500 Internet service providers that gave them access to a special "Internet Explorer Access Kit," which allowed them to brand Internet Explorer, in return for "preferred status" (which was not defined, and apparently not actively enforced) for Internet Explorer. Netscape did not make a similar kit available for Navigator.

⁵ America Online desired to integrate a third-party browser physically into its proprietary software. Part of its deal with Microsoft included Microsoft's technical assistance in accomplishing this task. One advantage that Internet Explorer had over Navigator for this purpose was that Explorer had a compartmentalized design that facilitated this integration.

status involved promotion for Internet Explorer and links for it, not including the same items for other browsers, not paying other browser companies for promotion on the other browser company's website, and developing the Internet content provider's website using certain Microsoft technologies. Some contracts also required the creation of "differentiated" content that would be viewed better with Internet Explorer than with Navigator. These contracts were abandoned beginning in April 1998 both because the Active Desktop proved unpopular and because of pressure prior to the trial. Other than Disney, there is no evidence that any Internet content provider actually developed differentiated content.

Finally, Microsoft also wrote contracts containing exclusivity provisions with some software vendors. For example, in June 1997, Intuit (maker of Quicken) promised not to distribute any other browser with its software. Beginning in fall 1997, Microsoft also wrote dozens of "First Wave" contracts with software vendors in which it conditioned early access to beta releases and other technical information on the software vendor using Internet Explorer as its default browser for any software with a hypertext-based user interface and using Microsoft's "HTML Help," which is accessible only with Internet Explorer, to implement its software's help system.

Theories of Exclusive Contracts and Tying

Views concerning exclusion through contracts with buyers, input suppliers, and producers of complementary goods have undergone dramatic swings. A long-standing concern has been that such contracts can be used by a dominant firm to exclude rivals and reduce competition. Beginning in the 1950s, this view came under a withering attack from authors whose arguments are traceable to the University of Chicago oral tradition associated with Aaron Director (for example, Director and Levi, 1956; Posner, 1976; Bork, 1978). The Chicago school pointed also to a number of procompetitive, or at least competitively neutral, motives for the use of such contracts. More recently, a resurgence of interest in these issues has shown that such practices can indeed be useful tools for excluding rivals. (For a more detailed discussion of the Chicago critique and this more recent work than that provided here, see Bernheim and Whinston, 2000.)

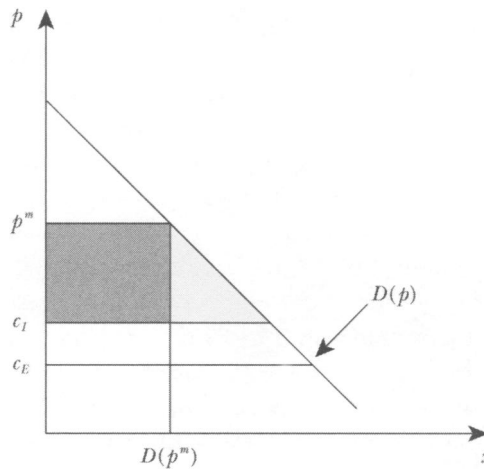
Exclusive Contracts

If a buyer signs an exclusive contract, all other sellers are foreclosed from competing for that buyer's business. (For expositional simplicity, I suppose in what follows that it is a buyer who is subject to the exclusivity provision; similar ideas apply when a seller is so bound.) The Chicago critique of exclusive contracts focuses, however, on whether exclusion through this means can be profitable for the seller.

Suppose that a buyer has the demand function depicted in Figure 1, and that there is an incumbent seller in the market who has a constant marginal cost of c_I .

Figure 1

The Chicago Argument for Why Entry Deterrence Through Exclusive Contracts Is Unprofitable



Suppose also that there is a firm who could potentially enter the market tomorrow with a marginal cost of $c_E < c_I$ by incurring an entry cost of $f > 0$. If the entrant does enter, then the incumbent and entrant compete and the equilibrium outcome involves the entrant winning the buyer's business at a price just below c_I . Suppose that entry under these conditions would be profitable for the entrant.⁶ Should the entrant not enter, however, then the incumbent can instead charge the monopoly price p^m .

Before the entrant appears, can the incumbent profitably sign the buyer to an exclusive contract? The Chicago school's answer is "no." The reason is that the buyer will not sign an exclusive contract and commit to buying from a monopoly, unless the incumbent compensates the buyer for its lost consumer surplus, which is equal to the sum of the light and dark shaded areas in Figure 1. But, if it does so, the incumbent incurs a loss equal to the deadweight loss of monopoly pricing (the light shaded area).

Having argued that exclusive contracts cannot be used profitably to monopolize, the Chicago school then sought to explain the use of such contracts as devices that enhance efficiency. The leading efficiency justification is the argument that they can be used to encourage certain noncontractible investments by the buyer and/or seller. For example, without an exclusive contract, a seller may be discouraged from advertising a good sold through a retailer, since the retailer may "free-ride" on these investments, instead selling consumers a cheaper unadvertised good (Marvel, 1982). Similarly, without an exclusive contract, a seller may be

⁶ Formally, c_E must not be too much below c_I for the pricing equilibrium to be as described, while entry is profitable for the entrant if $(c_I - c_E)x(c_I) > f$.

unwilling to train a buyer, knowing that the buyer could use this knowledge in conjunction with purchases from a rival (Masten and Snyder, 1993). Segal and Whinston (2000b) analyze formally for which types of investments exclusive contracts promote efficiency.

The Chicago critique, while very insightful, turns out to be rather special. In recent years, a number of authors have shown how sensible alterations to this Chicago school approach can cause exclusive contracts to be a profitable strategy for excluding rivals. These models share a common feature, which is that some form of externality arises from the exclusive contract on agents who are not parties to the contract—and that this externality makes signing an exclusive contract jointly optimal for the contracting parties.

The first such argument was due to Aghion and Bolton (1987) who showed that a buyer and seller could use exclusionary penalty clauses in their contracts to extract profits out of a potential entrant. If the buyer must pay the incumbent a penalty amount d for each unit purchased from the entrant, then the entrant is forced to set its price at d below the incumbent's price to make a sale. Thus, the penalty enables the buyer and incumbent to extract some of entrant's profit, which they can share through a payment when the contract is signed. At the same time, the penalty reduces the likelihood that the entrant will find it profitable to enter, although it is never optimal to exclude the entrant completely (since no profits would then be extracted).

In a second theory of profitable exclusion, due originally to Rasmusen, Ramseyer, and Wiley (1991; see also Segal and Whinston, 2000a), the focus is on externalities that can arise in settings in which the profitability of entry depends on the contracting decisions of many buyers. Suppose there are three buyers, and that the possible monopoly profit (the dark shaded area in Figure 1) from each buyer equals 9, while the loss in consumer surplus (the total shaded area in Figure 1) is 12. Suppose also that because of entry costs, the entrant needs to serve at least two free buyers for entry to be profitable.⁷ Now, observe that if the incumbent offers two of the buyers a payment of 12 (plus a penny), they will both sign exclusives, and entry will be prevented, allowing the incumbent to monopolize the third buyer for free. The incumbent's profit from this strategy is $3(9) - 2(12) = 3$.⁸ The key point is that each buyer ignores the impact that its decision has on the competitiveness of the market for other buyers. Similar effects could arise with network externalities. In contrast to the Aghion and Bolton (1987) theory, here complete exclusion through simple prohibitions on dealing with rivals can be optimal.

These two theories of exclusionary contracting both assume that the entrant is not present at the contracting stage. In the Microsoft case, Netscape was present; indeed, it was initially the dominant browser. Several papers consider settings in

⁷ Formally, $(c_I - c_E) \times (c_I) < f$ and $2(c_I - c_E) \times (c_I) > f$.

⁸ In fact, the incumbent can often do better than this by approaching buyers sequentially and playing them off against one another. Because each buyer may then be concerned that the monopolist will induce others to sign if it does not, the incumbent can often exclude for free.

which firms compete in trying to reach agreements with buyers (O'Brien and Shaffer, 1997; Bernheim and Whinston, 1998; for a related model, see Hart and Tirole, 1990). Again, the feature that can lead to an exclusive being signed is the presence of externalities that affect parties other than those who are contracting.

As an example, return to Figure 1, but make two changes. First, the entrant is now an existing rival that must pay f to remain active and that can offer to make a payment to the buyer for *not* signing an exclusive with the incumbent. Second, if the incumbent gains an exclusive contract with the buyer, then in some other sphere of competition the incumbent's profits are increased, the rival's profits are reduced, and the incumbent's gain exceeds the rival's loss so that their joint profits in this other sphere increase. For example, if the incumbent gets an exclusive with the buyer, then the rival may become less competitive in future negotiations with other buyers (who would be hurt by the exclusive contract). If these additional joint profits are at least as large as the deadweight loss in Figure 1, then the incumbent will find it worthwhile to pay enough for the exclusive to get the buyer to accept despite the payments offered by the rival and the buyer's loss from being monopolized.⁹

Several further points are worth noting about these models. First, the models focus on contractual terms that explicitly condition on whether the buyer purchases from a rival. In some cases, a contract that is not explicitly exclusionary may nonetheless be *effectively* exclusionary. For example, if the buyer requires exactly 100 units a year, a contract that specifies that the buyer will buy 100 units a year from the incumbent can be equally exclusionary. In general, however, the ability to condition explicitly on purchases from rivals makes profitable exclusion more likely. For example, imagine that the buyer prefers the entrant's product by an amount $\Delta > 0$. If the entrant's marginal cost is less than Δ (as it would be if, for example, marginal cost is close to zero), then absent an exclusivity provision the entrant will still sell to the buyer even after the buyer has committed to buying 100 units from the incumbent, since the buyer will still pay as much as Δ for the entrant's product.

Second, the duration of the agreements can matter. In general, agreements of longer duration are more likely to have significant anticompetitive effects. However, short-term exclusives can still have long-run anticompetitive effects if consumer switching costs or other factors lead current market shares to affect future competitiveness.

Third, the above models presumed that a rival who was excluded from a buyer

⁹ The point is easiest to see when the rival earns zero in this other sphere regardless of whether the incumbent gains an exclusive. More generally, in Bernheim and Whinston (1998) anticompetitive exclusives arise if they maximize the joint profits of the parties involved in the contracting process (which may involve exclusion of one of them). An interesting implication of this result is that a merger between the rival and the buyer need not change the market outcome, even if it results in exclusion of the rival. This suggests, for example, that America Online's acquisition of Netscape may not alter any anticompetitive exclusion of Navigator. Fisher and Rubinfeld make a similar point in their contribution to Evans et al. (2000).

could not make up the sales (at the same cost) in other ways. For example, if a firm exclusively contracts with 85 percent of the retailers in a market, but consumers can move freely and costlessly across stores, then a small number of outlets would work just as effectively for the rival as a large number.

Finally, in the models described above, the entrant produces a substitute for the incumbent's product. In the Microsoft case, however, Navigator was a substitute for Internet Explorer, but a complement for Windows. This raises the question of whether exclusion of Navigator is actually worthwhile for Microsoft. This issue has been explicitly discussed in the tying literature, to which we now turn.

Tying

The leverage theory of tying postulated that a firm with monopoly power in one good could use the leverage provided by this good to monopolize a second market. The Chicago school critique of the leverage theory focused again on the question of whether such leveraging could increase the profits of the monopolist. For concreteness, and given the situation in the Microsoft case, I focus here on the case of complementary products. As Posner (1976, p. 173) remarked for this situation: “[A fatal] weakness of the leverage theory is its inability to explain *why* a firm with a monopoly of one product would want to monopolize complementary products as well. It may seem obvious . . . but since the products are by hypothesis used in conjunction with one another . . . it is not obvious at all.”

Consider an example: Imagine that each consumer desires at most one unit of a system composed of one unit of product A and one unit of product B, and has a monetary value of v for such a system. Component A costs c_A to produce, while component B costs c_B . There is a monopolist of component A, while component B is competitively supplied and sold at price equal to marginal cost. Given that consumers must pay c_B for B, absent tying consumers are willing to pay $v - c_B$ for component A. The monopolist can then earn a profit of $v - c_B - c_A$ from selling A alone. Suppose now that the monopolist ties, requiring any buyer of A to buy B also. By doing so, the monopolist becomes the only firm to sell B. But what will the monopolist gain? It can now charge a system price of v , and its profit will once again be exactly $v - c_A - c_B$. Thus, whatever monopoly profit there is to be had is limited to the profit to be earned from the monopoly of A.

This point is more general than this example may suggest: A monopolist can only *benefit* from the presence of more products that are complementary with its monopolized good (and used in fixed proportions with it), even if it reduces sales of the monopolist's own complementary products. For a formal statement of this point, see Whinston (1990, Proposition 3).

If tying cannot be used profitably to extend monopoly power, what explains its use? Physical tying is ubiquitous because it often creates value. Indeed, every production process can be viewed as a process of physically tying inputs together. The reasons for contractual ties are less obvious. Here, the Chicago school pointed to a number of motives. For example, contractual tying can allow a monopolist to practice price discrimination and extract buyer surplus more effectively (Bowman,

1957; Adams and Yellen, 1976). Contractual tying can help also in evading price regulation or cheating on a cartel, since selling a cartelized or regulated product bundled with another product can help hide its true price.

Recent work has shown that the Chicago school arguments regarding tying can break down in certain circumstances. Two features are central to all of these models: 1) the monopolized product is not essential for all uses of the complementary good; and 2) scale economies (or network effects) are present in the complementary good. The first feature provides an incentive for the monopolist of A to exclude rival producers of B since it eliminates the ability to extract all profits through sales of A. The second feature provides the monopolist with the ability to do so, since foreclosure of sales in the complementary market, combined with barriers to entry through scale economies, can keep rival producers of component B out of the market.

Whinston (1990) showed that under a number of plausible circumstances, a commitment to tying through a physical tie involving incompatibility can indeed leverage monopoly power. As an example, suppose that there is some use of B in which A is not required. For example, an operating system monopolist might be a supplier of software—say, a web browser—which some consumers use in conjunction with the monopolist's operating system (a "systems market" in which A is essential), and which other consumers use as a stand-alone product (perhaps in conjunction with some "niche" operating system). Absent tying, the monopolist cannot extract monopoly profits from B in the stand-alone market since there is a rival producer of B. When the monopolist commits to tying, however, the rival producer of B is fully excluded from selling in the systems market. Anticipating this exclusion, this firm may choose to exit the market. If it does so, then although exclusion of the rival's version of B lowers the monopolist's profit in the systems market (for the reasons discussed above), it will raise its profit in the stand-alone market since it can now set a monopoly price for B. The same idea can be applied to investments by a rival other than entry/exit such as research and development, as in Choi (1996).

Carlton and Waldman (2000) provide another example of this phenomenon inspired by the facts of the Microsoft case. They consider a two-period model in which the monopolist's component A is essential in period 1, but the rival has the option of developing a version of A in period 2, rendering the monopolist's component A nonessential in that period. By (incompatibly) physically tying its products, the monopolist commits to depriving the rival of any sales today, which may force the rival out of the market. If so, this will reduce the monopolist's period 1 profit, but may increase its profit in period 2 by more.¹⁰

¹⁰ A different but related theory of exclusion through physical ties is the two-stage entry story, which holds that tying helps exclude rivals because entry into both components simultaneously is more costly than the sum of the costs of entering each market on its own. Indeed, the fact that entry into the component A market must occur in period 2 in the Carlton and Waldman (2000) model can be thought of as representing an extreme version of such a story (in which simultaneous entry in period 1 is

To return briefly to the issue raised at the end of the last subsection, observe that the same logic indicates that exclusion of rival producers of B through other means such as exclusive contracts may also be profitable if (and only if) component A is not essential for all uses of B.

The models above assume that a physical tie involves incompatibility with the rival's version of B. But what if the system is compatible with the rival's product so that, in principle, a buyer can purchase the bundled system from the monopolist and add the rival's version of component B? In this case, just as in the example of a sales contract for 100 units in the previous subsection, the question becomes whether the extra benefit from using the rival's version of B exceeds its marginal cost. When it does, incompatibility or some other factor that makes it infeasible or unattractive to add the rival's version of component B onto the system is necessary for a physical tie to have an exclusionary effect.

Nearly all of the recent literature on the strategic use of tying has focused on the case of a precommitment to tying, which is most compelling for physical ties. The use of contractual ties as exclusionary devices is less well understood. We have seen that a precommitment to tying may be a profitable strategy because it can commit the monopolist to reducing the profits of a rival. Without such a precommitment (or some kind of reputational concern), however, tying will be pursued only if (depending on circumstances) it is the most profitable way to sell component B, to reduce sales of the rival's component B, or to get a firm to accept exclusionary contract terms governing market B. For example, in the case of exclusionary contract terms the question becomes: Why is it more profitable to pay for exclusion through the monopolized component A than through cash?

Although this issue has not received much attention, two examples in which contractual tying helps a monopolist exclude do appear in the literature. Whinston (1990, pp. 849–50) examines a model in which tying turns out, essentially for price discrimination reasons, to be the most profitable way to price when reducing the rival's sales. Carlton and Waldman (2000) look at a model like that described above, except that network externalities in component B imply that the rival cannot make sales in period 2 if it does not make sales in period 1. In such a model, the monopolist wants to price component B cheaply in period 1 to prevent the rival's sales of B in that period. Indeed, in some cases, it may need to set a negative price for B to do so. If a negative price is used, however, two problems arise. First, all real buyers will “buy” the monopolist's version of B, even if they intend to buy the rival's version of B as well. To prevent this behavior, the monopolist's negative price for B can be combined with an exclusivity provision. Second, even individuals who are completely uninterested in use of A and B will choose to “buy” B from the monopolist at a negative price. By selling A and B bundled together, the monop-

infinitely costly). Choi and Stefanadis (2001) develop a version of this story in which there is instead a low likelihood of R&D successes in both components.

olist can solve this problem as well, since only real buyers will be willing to pay for such a (positively priced) bundle.

Microsoft's Motives for its Exclusionary Contracts and Tying

In evaluating whether Microsoft's exclusionary contracts and tying were anti-competitive, one should first ask whether it is reasonable to think that Microsoft used these practices to exclude Netscape. Usually, one would focus on whether Microsoft might profitably monopolize the market for browser software. However, this possibility received almost no attention in the trial. Rather, the government asserted that Microsoft desired to exclude Netscape to prevent entry of new "platforms" that could compete against Windows.

In fact, it is clear from numerous internal e-mails that Microsoft thought that Navigator posed a serious threat to Windows because developers might start writing programs using the application programming interfaces that Netscape included (and planned to include) in Navigator rather than those in Windows. This would, as Microsoft's chairman Bill Gates said in an internal e-mail, "commoditize" the operating system by weakening the "applications barrier to entry," making Windows more easily replaceable.¹¹ An important implication of this possibility of future operating system entry is that it makes Windows nonessential in the sense discussed in the previous section. Thus, as a first step, we see that Microsoft may have had an incentive to exclude a producer of a seemingly complementary product.

A second important fact is that browsers, like software more generally, are characterized by economies of scale due to large upfront investments and near-zero marginal costs. They are also characterized by network effects in demand, which arise because a good browser must interact well with a number of complementary products like websites and software programs and because producers of these products will work harder to be compatible with more widely used browsers. The presence of economies of scale and network effects is a central feature of models of anticompetitive tying and exclusionary contracts, and it implies that depriving a rival of sales can weaken its future competitiveness.

Given this point, might Microsoft accomplish this goal profitably using exclusionary contracts? It seems so. First, the presence of economies of scale and network effects also implies that parties agreeing to exclusionary contracts, both browser

¹¹ There are two distinct reasons that this could be true. First, in the models discussed in the previous section, a rival producer of component B has a greater incentive to introduce a new superior A than would an independent entrant because, absent entry, the monopolist of A captures some of the profit generated by the presence of the rival's component B. Second, as highlighted in the government's theory, entry is facilitated if independent software producers can write programs to a browser's applications programming interfaces, and if that browser can run on other operating systems. One can formalize this second story by imagining that there is another complementary product C (software) that can be used either in conjunction with the monopolist's component A (Windows) or with a rival's component B (Navigator) and a rival component A (a future operating system entrant).

purchasers and producers of complementary products, might fail to internalize the reduction in competition that their exclusionary contracts cause. Second, the desire to protect its significant profits from Windows would make Microsoft the almost certain winner in its contracting competition with Netscape. Thus, the situation fits well with models in which exclusionary contracts may have externalities on other parties and, in particular, with the last set of models discussed above in which the rival is also active in bidding for contracts.

In contrast, Microsoft's use of tying fits somewhat less well with existing anticompetitive models of tying. Consider Microsoft's integration of Internet Explorer with Windows 98. First, it is unclear whether this really involved a serious precommitment as the theories assume. Indeed, the government made a point of showing that it was easy to remove Internet Explorer from Windows. Second, as we noted, Microsoft seems to have introduced relatively little incompatibility with other browsers. Since marginal cost is essentially zero, bundling could exclude Netscape only if consumers, or computer manufacturers for them, faced other constraints on adding Navigator to their system. Whether this was so was an issue hotly disputed at the trial (see the discussion in the next section).

There is less to say that is very satisfactory about Microsoft's contractual ties. It is true that marginal cost for browsers is close to zero, which may cause Microsoft to want to set a negative price for Internet Explorer as discussed earlier. But Microsoft probably did not need to worry much about making exclusivity payments to firms with no actual interest in browsers, because it was dealing with firms that were clearly serious players in the industry.

On the other side of the equation, are there plausible procompetitive explanations for these practices? Regarding its tying, Microsoft argued that its physical integration of Internet Explorer was no different in nature than its past integration of many other functionalities into Windows (and similar behavior by other software producers) which were done to make a better product. This argument seems plausible. Yet, for software, bundled sales are unnecessary to provide integrated functionality since code for upgraded features can be loaded separately onto a computer. Thus, any efficiency of bundled sales would seem to stem from reductions in consumers' costs of acquiring and adding the features themselves and the software producer's costs of distributing multiple products. Indeed, to the extent the efficiency relates to saving consumer costs, there is some tension between Microsoft's claim that bundling is efficient and its claim, which I discuss below, that consumers can easily add Navigator.

In contrast, Microsoft offered remarkably little in the way of standard procompetitive justifications for its use of exclusionary contracts. Such justification may have been difficult. For example, while Microsoft was referring consumers to Internet access providers (much like the advertising example discussed earlier), there seems to be little that is noncontractible about the referral procedure. Moreover, Microsoft's referral efforts would be improved only by restrictions on promoting Navigator to consumers that *it* referred, and not at all by restrictions on the access provider's other customers.

In this regard, Microsoft's internal e-mails were remarkable in the clarity with which they described Microsoft's aims in utilizing these practices. It is sometimes said that economists should pay little attention to internal documents that talk about "killing" the competition. Microsoft's internal e-mails, however, involved individuals at the highest levels of the company proposing these practices, arguing that their short-run goal was to hobble Netscape, and stating that their longer-run aim was to protect Windows. When high-ranking corporate officers who are very bright and very knowledgeable about the structure of competition in their industry speak with such clarity of their aims, this seems to me to be significant evidence that should not be ignored. While these e-mails are certainly consistent with Microsoft's claim that it developed integrated functionality to offer a more attractive product (motivated by a desire to defeat Netscape), they clearly show that Microsoft thought it could disadvantage Netscape by selling Windows only bundled with Explorer and by employing exclusionary contracts.

The Effects on Netscape

A second step in evaluating Microsoft's practices is to consider whether they were effective at reducing Netscape's ability to compete. There are two reasons why their effect could have been small. First, Microsoft's physical integration of Explorer and exclusionary contracts rarely imposed complete exclusivity. Second, Microsoft's contracts covered only a subset of the possible ways that consumers could get rival browsers. For example, browser use at large corporations, universities, and other institutions—which account for as much as half of all personal computer purchases—was unlikely to be affected much by Microsoft's contractual restrictions. As for other consumers, Microsoft argued that they could easily get Navigator by downloading it over the web, from the many free CD's that Netscape and other firms distributed (over 100 million in 1997), from computer manufacturers who were free to place Navigator on their desktops if their customers desired it, or through its distribution with other computer hardware and software—and that survey evidence (discussed below) indicated that they regularly did so.

However, in the government's view, the computer manufacturer and Internet access provider channels were by far the most efficient means for distribution and both were effectively foreclosed by Microsoft's actions. The government presented internal Microsoft documents showing the following: that few computer manufacturers were shipping Navigator (the government asserted they only wanted to ship one browser); that over 95 percent of the subscribers to the top 80 Internet access providers were at providers for which Internet Explorer was the default browser and at which 94.1 percent of browser shipments were Internet Explorer; and that Microsoft believed that few consumers download browsers. Microsoft's evident belief that its bundling would provide it with an advantage over Netscape also seems evidence that it believed consumers' perceived costs of adding Navigator to be significant.

Two other sorts of quantitative evidence bearing on this issue were presented at trial. The first concerned the change in Netscape's market share. The government used data from a company called Adknowledge to show that Netscape's market share had declined dramatically during the key time period. Adknowledge tracks browser hits on website advertisements, recording information about the browser used and the user's domain. The Adknowledge data show that Navigator's usage share fell from 77 percent in the first quarter of 1997 to 48 percent in the third quarter of 1998, while Internet Explorer's share rose from 20 percent to 48 percent over the same period (*United States v. Microsoft Findings of Fact*, p. 158).

Microsoft criticized the Adknowledge data and countered with data based on a telephone survey conducted by the Market Decision Corporation (MDC) for Microsoft beginning in March 1996. This survey asked a random sample of respondents who had been online during the last two weeks about their browser use and how they acquired their main browser. The MDC data shows that Navigator's share of main browser usage fell only from 55 percent to 45 percent during this same period (first quarter 1997 to third quarter 1998), while Explorer's rose from 21 percent to 52 percent (*U.S. v. Microsoft, Direct Testimony of Richard L. Schmalensee*, p. 155). The MDC and Adknowledge share estimates are very similar starting in the fourth quarter of 1997, but differ markedly before that, with Adknowledge showing a precipitous fall in Navigator's share in 1997.

A key difference between the two data sources is their treatment of online services such as America Online, which early in the period had their own proprietary browsers. MDC data show Netscape with a 22 percent share of America Online users early in 1997, while Adknowledge shows Netscape with a 70 percent share of these users. This difference is likely due to the different usage patterns of those America Online subscribers who actually visited websites instead of relying solely on America Online's proprietary content. Which figure is more relevant for Navigator's competitive health is not clear. The court took the position that web usage is what matters. More importantly, the court also took the position, for other reasons, that the MDC data should be given no weight.¹²

Although Navigator's share dropped, Navigator's number of users and usage increased dramatically during this time period as interest in the Internet grew. Microsoft argued that what is relevant for software and website developers is the number of users or amount of usage of Navigator, not Navigator's share of them. This argument appears to have much merit, but the court decided that only market share matters, saying that products would be tailored for the most popular browser. This claim ignores, however, the possibility that a software developer or website could invest to make its product work well with *both* browsers.

Hence, one is left to argue that as a result of Microsoft's actions, Navigator's

¹² See *United States v. Microsoft Findings of Fact* (pp. 160–61) and the discussions in Evans et al. (2000, pp. 120–21, 128–29). It is difficult, however, to evaluate the arguments in these sources without access to the underlying survey and data.

use was much lower than it otherwise would have been. This leads to a key question: What level of reduction in Navigator's use would it take to reduce significantly the platform entry threat that Navigator posed? Clearly, we do not know. The only suggestive piece of evidence is that Netscape decided in 1998 not to continue to invest in maintaining a Sun-compliant Java runtime environment.

Evidence that Navigator's share fell does not necessarily imply that it fell because of Microsoft's exclusionary conduct. For example, during the key time period Internet Explorer's quality improved greatly (whether it actually surpassed Navigator was disputed at trial). A second type of quantitative evidence addressed this issue by looking at whether contractual restrictions affected Navigator's use. In two different studies, the government found that the greater the contractual restrictions on an Internet access provider, the greater the reduction in Navigator's share. Microsoft criticized numerous aspects of these studies.¹³ Unfortunately, without having access to the underlying information, it is difficult to evaluate these claims. The court accepted the government's analysis as "appropriate."

Navigator's share has continued to decline since the end of the trial. For example, a University of Illinois engineering website (<http://www.ews.uiuc.edu/bstats>) that tracks browser hits (largely onto the home pages of engineering students) and closely matches Adknowledge statistics as of the third quarter of 1998 shows that Navigator's share was 32.5 percent in December 1999 and 21.6 percent in December 2000. This evidence makes more persuasive the argument that Navigator has been eliminated as a threat for platform entry. But it also calls into question the extent to which Microsoft's exclusionary contracts were responsible for Netscape's decline, since many of these contracts were eliminated or relaxed prior to the trial. Of course, Microsoft's contracts with online services remain in place, as does its bundling of Explorer and Windows.

The discussion of the last two sections is certainly far from conclusive on the reasons for Netscape's decline. Although such a conclusion is hardly compelling, the evidence considered of market conditions, Microsoft's views of its actions, and data on actual effects is perhaps most consistent with the view that both Microsoft's tying and its exclusive contracts served to reduce Navigator's use and did so, in part, because consumers do indeed perceive significant costs of acquiring and adding software to their computers.

¹³ Results of one of these studies, submitted by Franklin Fisher, can be found in Evans et al. (2000, p. 39). A discussion and critique can be found in *U.S. v. Microsoft, Direct Testimony of Richard L. Schmalensee*. An additional concern is the selection bias that is probably present because of the fact that those Internet access providers who accepted Microsoft's terms would tend to be the ones who most preferred Internet Explorer. It would have been more informative to focus on how Navigator's share changed at an access provider when the provider's contract status changed (in either direction). Also, it would be interesting to compare share changes over time for large businesses and institutions with those for other consumers. As discussed above, the latter group would be more likely to be affected by Microsoft's contractual restrictions if these are effective.

The Effects on Welfare

If we accept that Microsoft's use of exclusionary contracts and tying did affect Netscape's ability to compete, what was the impact on social welfare? In the trial, Microsoft emphasized that the government failed to show any consumer harm from these practices. Indeed, the government essentially took its conclusion that Netscape had been made a less effective competitor as implying a reduction in social welfare. There is a reason for this presumption: such a demonstration would be *very* hard. Indeed, there is no published work that I am aware of that has even tried to estimate the welfare impact of these sorts of practices.

In considering this question, it is useful to separate short-run and long-run effects on social welfare. One short-run effect of Microsoft's exclusionary contracts that may seem immediately apparent is a reduction in choice for consumers who cannot get Netscape with their new computers. However, the appropriate counterfactual is not entirely clear. For example, if Microsoft could not have prohibited computer manufacturers from displaying Navigator with a larger icon, perhaps it would have increased the size of Internet Explorer's icon, or required that more of its own icons be on the desktop so as to effectively exclude Netscape without explicitly excluding it. Indeed, the result could in principle have been that Navigator was equally excluded but in an even less efficient way.

Ambiguities also arise with Microsoft's physical bundling. Suppose that Microsoft had instead offered both a bundled and an unbundled product at a price differential reflecting their (near zero) difference in marginal costs. While all consumers would be weakly better off with this added choice (assuming the bundled price remained unaltered), Microsoft's costs of distribution would have been higher. (If this seems inconsequential, consider the effect of a rule saying that *all* functions of Windows must be available separately.) Moreover, although offering this choice would reduce the exclusion of Navigator in some circumstances, such as when computer manufacturers do not want to ship two browsers, but not in others, such as when consumers find it costly to download or install Navigator.¹⁴

The long-run impact on social welfare is likely to be substantially more important, and even more difficult to measure. First, the welfare impact of any change in the likelihood of entry is not clear. Inefficiencies can sometimes arise in firms' entry decisions, in which case aggregate welfare may be enhanced by the exclusion of rivals (Mankiw and Whinston, 1986). Similarly, if network effects are important, as the government asserted, then entry that causes incompatible standards to exist, even if only for some transition period, might involve substantial welfare

¹⁴ In the latter case, Netscape's disadvantage would be reduced were Microsoft to include Navigator in Windows, but this would impose on Microsoft a duty to deal with rivals, which may be problematic in other respects, as discussed in Carlton (2001).

costs. Indeed, Microsoft at times defended its exclusionary practices with arguments having this flavor (for example, arguments that restrictions were needed to avoid “fragmenting the Windows platform” or to provide the “benefits of standardization”).

A second reason that long-term welfare effects are difficult to gauge is that the software industry is, as Schmalensee (2000) emphasizes, an industry very much in the Schumpeterian mode. A single leader often dominates a category until some significant shift (often due to innovations in hardware) causes a new dominant firm to emerge. The race to become the leader, or to retain that position, induces firms—both leaders and wannabes—to make huge research and development expenditures. A restriction on *Microsoft's* use of exclusionary practices may well enhance other firms' abilities and incentives to invest. However, it is less clear that a restriction on the ability of *all dominant software firms* to use such exclusionary practices will do so. Such a restriction may make entry easier, but the reward to success smaller.

Concluding Thoughts

The literature on exclusive contracts and tying has considerably advanced our knowledge of these practices. Yet, the case of *U.S. v. Microsoft* shows not only the value of this knowledge, but also its considerable current limits.

However, even the current state of knowledge can provide guidance for the law in this area. The court, for example, declared Microsoft's physical tying illegal, but declined to condemn Microsoft's exclusionary contracts, in large part because they did not involve total exclusivity. This decision stands in marked contrast to the conclusions that emerge from the discussion above.

Even though economic analysis may not yield a definitive conclusion given the available evidence in a case, decisions must nevertheless be made. Ideally, decisions in the presence of such uncertainty would rely on knowledge of the typical effects of challenged practices, accumulated from a body of economic research. What is striking about the area of exclusive contracts and tying, however, is how little the current literature tells us about what these effects are likely to be. This state of (non)knowledge is, I think, responsible to a significant degree for the very strong but differing beliefs that economists often have about whether exclusive contracts and tying are likely to have welfare-reducing anticompetitive effects.

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