An Economist's Guide to
U.S. v. Microsoft

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W hile most antitrust cases proceed in obscurity, the case brought against Microsoft by federal and state antitrust authorities was front-page news. Much of the drama and media hype centered on the struggle between the titan of high technology, personified in Bill Gates, and the titan of government, personified in U.S. Assistant Attorney General Joel Klein. For economists and policymakers, however, the case was about the appropriate role of competition policy in the new economy. Antitrust critics claim that the nineteenth century Sherman Act is ill-suited for the high-technology markets of the twenty-first century. Others argue that the Sherman Act provides a broad constitution for antitrust enforcement that is flexible enough to protect both the interests of consumers and the ability of firms to compete in high-technology markets.

In the *Microsoft* case, the government (by which we mean the U.S. Department of Justice, 19 state attorneys general, and the Attorney General of the District of Columbia that brought the case) asserted that Microsoft engaged in anticompetitive conduct designed to maintain its operating system monopoly to the detriment of consumers. According to the government, antitrust enforcement would rein in the Microsoft monopoly and result in more competition and innovation in the software industry. In its defense, Microsoft contended that the company is a vigorous competitor that benefited consumers by supplying high quality, innovative products. According to Microsoft, antitrust action against it would dampen incentives for competition and slow software innovation.

In this paper, we analyze the central economic issues raised by the Microsoft

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case: the source and strength of Microsoft's market power, the competitive effects of Microsoft's practices, the degree of consumer harm, and proposed remedies.

Early Skirmishes

Microsoft's antitrust woes began in 1990 when the Federal Trade Commission (FTC) launched an investigation of the company. After three years, the FTC's legal staff—but not its economics staff—recommended that the Commission bring a case focusing on Microsoft's licensing practices with personal computer manufacturers. The FTC investigation ended in February 1993 when the Commission deadlocked in a 2–2 vote, with one commissioner recused (Lopatka and Page, 1995, p. 324).

The U.S. Department of Justice continued the investigation of Microsoft's conduct and, on July 15, 1994, brought a complaint alleging that Microsoft used exclusionary and anticompetitive contracts with personal computer manufacturers to maintain an unlawful monopoly of personal computer operating systems. Simultaneous with the filing of the complaint, Microsoft and the Department of Justice entered into a consent decree in which Microsoft agreed to abide by certain restrictions on its licensing arrangements (*United States v. Microsoft Corp.*, 1995–2 Trade Cas. P 71,096 [D.D.C. 1995]).[1] After almost a year of legal wrangling, an appellate court approved the consent decree on June 16, 1995.

Disputes over the scope and interpretation of the decree soon arose. Among other conduct restrictions, the consent decree (Section IV.E) stipulated:

> Microsoft shall not enter into any License Agreement in which the terms of that agreement are expressly or impliedly conditioned upon: (i) the licensing of any other Covered Product, Operating System Software product or other product (provided, however, that this provision in and of itself shall not be construed to prohibit Microsoft from developing integrated products) . . .

The force of this restriction turns on the definitions of what constitute "other" and "integrated" products. Not long after Microsoft and the Department of Justice signed the consent decree, Microsoft began requiring computer manufacturers to license and install Microsoft's Internet Explorer browser as a condition for being able to obtain a license for the Windows 95 operating system. Microsoft argued that the Internet Explorer browser was part of the operating system, not a separate product. The Department of Justice disagreed and sought an injunction against Microsoft.

On December 11, 1997, Judge Thomas Penfield Jackson ordered Microsoft to offer its Windows 95 operating system and Internet Explorer as separate products. Microsoft appealed his ruling. The appeals court reversed Judge Jackson's order,

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[1] See Gilbert (1998) for a discussion of the economic issues in the case.

ruling that Windows 95 and Internet Explorer provided computer users with functionality that did not exist with separate programs and thus passed the "integrated product" provision of the consent decree (*U.S. v. Microsoft*, U.S. Court of Appeals for the District of Columbia Circuit, No. 97-5343, June 23, 1998, at footnote 14). Whatever one thinks of the merits of the two sides' positions following the 1995 consent decree, it is clear that the conduct remedy did not work as the Department of Justice had intended.

The Battle is Joined

On May 18, 1998, the government brought an antitrust case against Microsoft alleging that the company had monopolized the markets for personal computer operating systems and browsers (*U.S. v. Microsoft*, 1998). The government's case against Microsoft rested on allegations that Microsoft compelled computer manufacturers to license and install Internet Explorer, entered into contracts that tended to exclude rivals, and engaged in various forms of predatory conduct.

Microsoft and the government both considered Internet browsers combined with the Java language and server-based applications to be particularly potent sources of potential competition for Windows. In theory, the Java programming language offered a standard to which creators of applications, such as spreadsheet and word processing programs, could write without regard for the underlying operating system. Java did this by providing a "middleware" layer of software between applications programs and the underlying operating system. Netscape was a threat to Microsoft because its Navigator browser was a distribution vehicle for Java that could further its acceptance as a language for application programs that was independent of the underlying operating system. In addition, there was a possibility that Netscape Navigator itself could grow into a substitute for Microsoft Windows or facilitate server-based applications that made minimal use of the desktop operating system. These are the outcomes the government sought to preserve and Bill Gates (1995) feared when he wrote that Netscape threatened to "commoditize the underlying operating system."

The government alleged that Microsoft sought to eliminate the competitive threat posed by Java and Netscape in two ways. The first was to eliminate Netscape's browser as a commercially viable product through an offer of market division and—after that offer was rejected—a combination of predatory and exclusionary actions. The second was to undermine Java as an operating-system-independent platform by promoting a Windows-specific version of Java.

The Assessment of Market Power

A firm's conduct is unlikely to have significant adverse consequences for economic welfare if the firm lacks significant market power. Therefore, the assessment of market power is the initial step in a typical economic antitrust analysis. The

courts commonly assess market power by first defining the relevant market(s) affected by a firm's conduct. A relevant market is a set of products that consumers consider to be reasonably close substitutes for each other (see, for example, U.S. Department of Justice, 1992, sec. 1.11). Once a relevant market has been defined, the assessment of market power moves to the calculation of market share, examination of competitive interactions, determination of the conditions of entry, and analysis of other pertinent structural features of the market. Katz and Shapiro (1999) discuss the assessment of market power in software markets.

The government alleged that Microsoft was a monopolist in the relevant market comprising Intel-compatible personal computer operating systems. The government reasoned that buyers of Intel-compatible personal computers have no substitutes for operating systems designed to work on those systems. Microsoft's share of shipments of Intel-based personal computer operating systems has been 90 percent or more in recent years.

The government also argued that another operating system would be hard-pressed to displace Windows directly. IBM was reported to have spent more than $1 billion to develop, test, and market its OS/2 operating system as an alternative to Windows (Gilbert, 1998). The new operating system was a commercial failure, in part because IBM could not overcome the chicken-and-egg problem that arises from "network effects," whereby the demand for a product increases with the number of other users of the product or with the number of complementary goods and services for that product. Specifically, because of switching costs and consumers' desires for a variety of applications programs, an operating system cannot gain widespread acceptance until it has a large set of available applications. But because of economies of scale and sunk costs in software development, applications programmers do not want to write to an operating system unless there is a large base of users. The government labeled this problem the "applications barrier to entry."

Professor Richard Schmalensee, Microsoft's chief economics expert at trial, countered that competition in the personal computer software market was among "platforms," not operating systems.[2] A platform is a set of software interfaces to which programmers can write applications such as spreadsheets or schedulers. Platforms include operating systems such as the Mac OS, Sun Solaris, and Linux, and various forms of middleware including web server/browser software, Lotus Notes, and Sun's Java, that are intermediate between operating systems and desktop applications. Schmalensee argued that Microsoft faced significant competition from existing and future software platforms, any one of which could emerge as the new standard for desktop computing.

Schmalensee also asserted that in high-technology markets traditional measures of market share provide misleading assessments of the degree of competition. Markets with significant network effects, technological progress, and production economies of scale can exhibit catastrophic entry, whereby one product dominates the market until another product is sufficiently superior that it becomes the new

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[2] Schmalensee's testimony in *U.S. v. Microsoft* on January 13, 1999, available at ⟨http://www.microsoft.com/presspass/trial/schmal/III.asp⟩.

network bandwagon. Rivalry in such markets can take the form of competition to become a dominant firm—competition *for* the market, rather than competition *within* the market. Thus, computer software markets may be characterized by a succession of temporary monopolies (although multiple firms can prosper simultaneously if there is strong product differentiation or cross-supplier product compatibility).

To a large extent the government and Microsoft agreed about the potential for technical change and catastrophic entry in the software industry. However, the government asserted that Microsoft preserved its monopoly by using exclusionary and predatory tactics to block catastrophic entry, while Microsoft claimed that it was just competing in the face of huge forces of change in the industry.

Another argument raised by Schmalensee was that Microsoft did not behave like a firm with monopoly power. Working backward from an estimate of the elasticity of demand for personal computers, he calculated that the monopoly price of Windows should have been at least 16 times the price actually charged (see also Reddy et al., 1999). He attributed the difference to platform competition ignored by the government.

Professor Franklin Fisher was one of the government's expert witnesses and Professor Daniel Rubinfeld was the U.S. Department of Justice's chief economist during most of the trial. They argued that Microsoft's prices were consistent with long-run monopoly pricing once one takes into account factors that encourage Microsoft to restrain its prices, such as the value of growing its installed base, raising demand for complementary products, and discouraging software pirating (Fisher and Rubinfeld, 2000, pp. 13–14).[3] Moreover, they argued that the relatively low price charged to personal computer manufacturers for Windows licenses could represent compensation for Microsoft's onerous contract restrictions.

Fundamentally, the difference between the government's characterization of Microsoft's market power and Microsoft's position is that the government considered Microsoft a monopolist that faced limited potential competition from other platforms, whereas Microsoft saw the market as already invigorated with significant actual platform competition. It appears clear to us that, largely because of network effects and the applications barrier to entry, Microsoft did possess significant market power. Microsoft certainly had the ability to raise prices significantly above marginal costs. Indeed, Microsoft possessed the ability to raise prices significantly above long-run average costs, as suggested by the large multiple of Microsoft's market value to the cost of its asset base.

This conclusion does not prove that Microsoft used its market power to disadvantage consumers. The possession of market power is in itself not objection-

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[3] Fisher and Rubinfeld (2000, p. 13-14) also reject Schmalensee's elasticity calculation as irrelevant to the determination of monopoly power: "Since Microsoft's marginal cost is essentially zero, the short-run profit-maximizing action for the firm is to price at the point where the elasticity of demand that it faces is unity. That is true whether or not Microsoft has market power." While correct, this observation does not refute Schmalensee's point. A profit-maximizing firm responds to its perceived, or firm-specific, demand elasticity. In the presence of competition, which Schmalensee asserts exists, inelastic *market* demand is consistent with elastic *firm-specific* demand, and it is the latter that constrains prices.

able under antitrust policy (for example, U.S. Department of Justice, 1995, sec. 2.2). Indeed, it would not make economic sense to punish a firm that possesses market power solely as a consequence of its having developed a superior product, because doing so would erode the incentives for innovation. We return to the issue of whether Microsoft abused its market power below.

In addition to creating substantial market power for Microsoft, the applications barrier to entry was central to the government's theory of why Microsoft took the actions it did with respect to browsers and Java. According to the government, Microsoft had incentives to work hard to protect that barrier by ensuring that other operating systems could not share a common set of applications through middleware. The reason middleware, such as Java or a web browser, is a threat to Microsoft in a way that full operating systems are not is the following. If a user were to adopt an operating system other than Windows, the user would have to forego the large base of Windows applications. Thus, an operating systems entrant either has to offer consumers much lower value or has to incur large sunk costs to develop (or subsidize) a wide range of applications programs before there is a large user base to purchase them. Middleware written on top of Windows would not suffer from this problem. Users could adopt the middleware and still make use of the large number of programs that run on Windows. Hence, middleware that offered useful new features to a wide range of users would have the potential to become widely adopted, which would then make it attractive for applications programmers to write to it. As this happened, new applications would not be associated with a particular operating system, which would reduce the applications barrier to entry for operating systems.

Evans and Schmalensee (2000a, pp. 62–63) argued that the government's claim that there were high barriers to entry but that middleware could overcome them was internally inconsistent. We do not see any inconsistency in the position that middleware was a significant crack in the armor of what would otherwise be a strong applications barrier to entry and that Microsoft attempted to patch that crack.

Hall and Hall (1999, p. 25) argued that if the threat of software piracy or other factors unrelated to the extent of competition drove Microsoft's operating system pricing decisions—as Fisher and Rubinfeld assert—then Microsoft's challenged conduct might have no influence on the equilibrium price. Consequently, Microsoft would not have anticompetitive incentives. This argument, however, ignores the possibility that, absent the challenged conduct, the strength of competition could have grown to limit Microsoft's market power. The existence of significant market power, even if in the short run constrained by factors other than competition, can provide stimulus for Microsoft to engage in conduct intended to protect that market power in the long run.

A Closer Look at Allegedly Harmful Conduct

The government alleged two sets of closely related mechanisms by which Microsoft's practices weakened competition and harmed consumers: exclusionary behavior and several types of predatory behavior.

Exclusionary Behavior

Exclusionary behavior entails denying rivals access to some resource or set of consumers in order to raise the rivals' costs and weaken their ability to compete (for example, Salop and Scheffman, 1987). The government charged that Microsoft used several types of contractual arrangements that tended to exclude competitors (*U.S. v. Microsoft*, 1998, para. 75-102). One set of arrangements was with online and Internet service providers, such as America Online and AT&T Worldnet, in which Microsoft agreed to include a feature in its operating system that made it easy for a user to establish an account with a service provider, but only if the service provider agreed to deny most or all of its subscribers a choice of Internet browser.[4] A second set of agreements was made with personal computer manufacturers, under which the manufacturers could neither remove the Internet Explorer icon nor feature a rival browser more prominently than Internet Explorer. Finally, in a third set of agreements, Microsoft offered Internet content providers preferential, no-cost placement on the Internet Explorer "channel bar" in return for their agreement to promote Internet Explorer as their browser of choice, not to accept compensation for featuring their content on Netscape's browser, or to customize their content so that it was more attractive when accessed using Internet Explorer (*U.S. v. Microsoft*, 2000b).

The traditional "Chicago" view of exclusionary contracts and exclusive dealing arrangements is that they must promote efficiency because the buyers in these transactions would not agree to contracts that made themselves worse off (Bork, 1978, p. 309). There is, however, a fundamental flaw in this argument: a buyer may agree to an exclusive contract without taking into account harm to third parties. A buyer who accounts for only a small fraction of industry purchases has little reason to believe that its individual decisions affect the overall degree of competition in a market. But if a large number of buyers accept inducements to deal exclusively with a single supplier, the overall effect can be to reduce competition to the detriment of consumers (Rasmussen, Ramseyer and Wiley, 1991). This analysis applies with even greater force when a seller with market power can strategically price discriminate and bargain sequentially with buyers (Segal and Whinston, 2000). A related argument holds even with a single buyer if the bargaining takes place before other competitors have arrived. By signing a long-term exclusive dealing agreement with penalty clauses, the buyer and incumbent seller can force an efficient entrant to compensate the buyer for breaking the agreement. In this way, the buyer and incumbent seller can appropriate some of the benefits from entry in the form of higher profits for themselves (Aghion and Bolton, 1987).

In many cases, exclusionary practices that raise rivals' costs will lower economic

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[4] Some authors have argued that America Online wanted an exclusive arrangement to distribute a single browser to its customers and that Microsoft merely won the bidding to supply America Online (for example, Cass and Hylton, 1999). Moreover, Evans and Schmalensee (2000b) claim that America Online is so large that this outcome alone is enough to explain Internet Explorer's dominant market share. Even if these statements are accurate, they still do not explain Microsoft's conduct with respect to other Internet and online service providers.

welfare. However, there are circumstances under which such practices can increase efficiency and consumer welfare. For example, raising an inefficient supplier's costs can increase total surplus by shifting share to more efficient producers (Katz and Shapiro, 1985). And, as discussed below, elimination of a rival may promote innovation in some circumstances. Moreover, exclusive dealing that raises distribution costs for other manufacturers may also support efficient relationship-specific investments by the parties entering into the exclusive contract. The net welfare effects can be positive or negative (Segal and Whinston, 1998; Gilbert, 2000). Given these mixed theoretical predictions about the welfare effects of exclusive dealing, antitrust analysis must focus on the institutional details of the specific practices at issue in a given case to determine their effects.

Microsoft defended its contracts on the grounds that they were in force when Internet Explorer accounted for only a small share of browser usage and that the contracts enabled Microsoft to build share rapidly to become a more formidable competitor to Netscape.[5] By describing Microsoft as if it consisted only of a fledgling browser striving to compete against established Netscape, this defense sidesteps the fact that Microsoft possessed considerable market power in personal computer operating systems. The question is whether Microsoft used this market power, in combination with exclusionary practices, to hobble a potential competitor to the detriment of consumers.

Moreover, whatever the theoretical arguments about exclusive contracts in general, in this specific case there is little reason to believe that most of these contracts promoted efficiency. Microsoft presented no evidence, and we are unaware of any evidence, that contracts with online and Internet service providers promoted relationship-specific investments.[6] Instead, the main consequence was to disadvantage Netscape and other browser competitors. Microsoft asserted that its requirements that personal computer manufacturers not remove the Internet Explorer icon and not feature a rival browser more prominently than Internet Explorer were justified as promoting a standard Windows "look and feel." However, the government responded that Microsoft's actions belied this claim, because Microsoft permitted personal computer manufacturers to modify the Windows desktop when doing so did not promote a competing browser (*U.S. v. Microsoft*, 1999, Section V.C).

In contrast, Microsoft's contracts with Internet content providers had plausible efficiency benefits. Microsoft offered favorable placement on the Internet Explorer channel bar to Internet content providers who designed their content to favor Internet Explorer. This arrangement might have generated incentives for these

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[5] Direct testimony of Cameron Myhrvold in *U.S. v. Microsoft*, ⟨http://www.microsoft.com/presspass/ trial/mswitness/myhrvold/myhrvold.asp⟩. Myhrvold was a vice-president at Microsoft responsible for business relationships with Internet service providers.

[6] Schmalensee (1999, p. 226) pointed to Microsoft's investment in the Windows feature that made it easy for a user to establish an account with an online or Internet service provider. However, this investment was not specific to any given service provider and thus exclusive arrangements appear unnecessary to support such investment.

firms to make complementary investments with Microsoft. Indeed, Judge Jackson concluded the contracts with Internet content providers were not anticompetitive.

Predatory Conduct

Predatory behavior typically involves an initial stage during which a firm offers a product at an unprofitably low price as a means of driving rivals from the market and facilitating the later exercise of market power. The distinction between exclusionary and predatory practices, while useful for organizing discussion, can be blurred. To the extent that Microsoft sacrificed short-run profits to obtain exclusionary contracts and thus to reduce Netscape's long-run competitive threat, an exclusionary contract can be viewed as a form of predation. Conversely, by denying a rival sales that are necessary to realize increasing returns, predatory behavior can raise the rival's costs and thus look like exclusionary behavior.

Judges, lawyers, and economists have struggled to distinguish conduct that is predatory from that which is vigorously competitive. For example, Areeda and Turner (1975) proposed a rule that predatory conduct occurs if a firm prices below its average variable cost of production. However, such a rule may afford too much latitude for pricing that has predatory effects in industries like software, where average variable costs of production are close to zero. At the same time, the rule may provide too little scope for firms to use low prices as promotional investments, particularly in markets with network effects (for a preliminary analysis, see Farrell and Katz, 1999).

A more general definition of predation, proposed by Ordover and Willig (1981), is any business strategy that is profitable only because of the long-run benefits of eliminating one or more competitors. This definition sensibly captures anticompetitive conduct—including nonprice conduct—that would harm competition yet would not be deemed predatory under the cost-based Areeda-Turner test. However, the meaning of eliminating a competitor may not be a precise concept in a market with network effects (Farrell and Katz, 1999). Moreover, the Ordover-Willig definition should be modified to account for the fact that consumers and efficiency can be harmed when the prey is weakened, even if it is not eliminated.

In a typical predation case, the plaintiff claims that the defendant sacrificed short-run profits from sales of a product to eliminate competition and subsequently raise prices for *that product* in the long run. Here, however, the government asserted that Microsoft sacrificed *browser* profits in the short run primarily to preserve its *operating system* monopoly in the long run.

At first glance, predation against a complementary product might appear puzzling. According to the "one monopoly rent" argument, a monopolist would never engage in predation against a competitively supplied complementary product. To see why, suppose that each customer is willing to pay $100 for a package consisting of products *A* and *B*; in the Microsoft case, think of these as an operating system and a web browser. Suppose that firm *M* is the monopoly supplier of product *A*. In the first case, the complementary product *B* is supplied competitively at a price equal to its marginal cost of, say, $10. As a result, the

monopolist can charge $90 (= $100–$10) for its product *A*. Now, suppose that the monopolist forces consumers to purchase a bundle consisting of *A* and *B*. Consumers still would pay at most $100 for the bundle, the marginal cost of product *B* would still be $10, and the monopolist would earn $90 from selling *A*. In other words, "extending" its monopoly from *A* to both *A* and *B* would not increase the firm's profits.

There are two reasons why the "one monopoly rent" argument does not apply to Microsoft's situation. First, as we discuss below, Netscape Navigator initially was priced significantly above marginal cost and, consequently, Microsoft had incentives to influence competition in the browser market. Second, the "one monopoly rent" argument does not address the fact that predation against complementary product *B* may affect the threat of entry faced by product *A*. Aron and Wildman (1999), Carlton and Waldman (2000), and Whinston (1990) offer models of bundling to deter entry.

The government alleged that Microsoft tried to keep Netscape Navigator from becoming well established as a browser so that it could not evolve into an operating system competitor. The government also alleged that Microsoft wanted to block Navigator as a distribution vehicle for Java, as well as undermine Java directly, because the widespread deployment of Java as a programming language that was independent of the underlying operating system threatened to reduce the applications barrier to entry in operating systems. The government attacked several Microsoft practices as predatory.

Pricing Internet Explorer Below Cost. Microsoft gave Internet Explorer away for free and paid Apple to use its browser. The government argued that Microsoft's actions were predatory because they could be profitable only after taking into account benefits to Microsoft from the elimination of competition (Fisher and Rubinfeld, 2000, p. 20). Microsoft responded that the profitability of its actions did not depend on excluding competition from Netscape. Microsoft claimed that wide distribution of Internet Explorer at a zero price made business sense because it made personal computers more attractive and thus increased the sales of its Windows operating system and other software. Microsoft also said that giving away its browser product for free was a valid business model, one followed by many software companies, because it would generate future revenues. For example, a free browser could help Microsoft establish an Internet portal on which it could sell advertising.

On the surface, Microsoft's position fits the model of Farrell and Katz (2000). In that model, product *A* is monopolized by firm *M* and the market for complementary product *B* is imperfectly competitive. By integrating into the supply of product *B*, firm *M* can engage in a "squeeze," where it sets the quality-adjusted price of its variant of product *B* lower than would a stand-alone supplier. The squeeze can force independent suppliers to charge lower quality-adjusted prices for their variants of product *B* and thus allow firm *M* to earn greater profits from the sale of complementary product *A*. In this model, firm *M* neither extends its monopoly nor acts in a predatory fashion, although independent suppliers could be expected to accuse

it of doing so. Instead, firm *M* lets the most efficient supplier of component *B* make sales, and firm *M* takes its profits by charging higher prices for component *A*.[7]

If Microsoft was concerned with increasing the value of its personal computer platform, however, it should have supported any well-made browser product, without regard to whether the browser was supplied by Microsoft or by a rival. Trial evidence submitted by the government suggested that Microsoft did not want to support a rival browser, no matter how good the product might be, and was mainly concerned with reducing Netscape's Navigator sales. The government hauled out a stack of Microsoft e-mails to argue that Microsoft intended to quash Netscape. The government also showed that Microsoft had carried out studies of the impact on Netscape's revenues of giving Internet Explorer away for free,[8] and a government witness testified that Paul Maritz (a senior Microsoft executive) informed him that Microsoft's Internet strategy was "to cut off Netscape's air supply, . . . by giving away free browsers, Microsoft was going to keep Netscape from getting off the ground."[9]

The government also noted that, if Microsoft's strategy of giving away Internet Explorer for free was based on promoting sales of its software products, that rationale could not explain why Microsoft paid Apple to take its browser. To the extent that Microsoft was motivated by sales of software such as Office for the Macintosh, these concerns would be best served by encouraging Apple to use the best browser. The government also did not accept Microsoft's claims that its browser distribution strategy was profitable because it promoted the sale of web services, such as a portal site.

Tying and Bundling. To the government, the "integration" of Internet Explorer with Windows 95 and later versions of the operating system was little different from the contractual bundling of separate products. The government alleged that Microsoft bundled the operating system and browser as a way to protect its existing operating system monopoly by blocking Netscape Navigator from growing into a platform competitor. The government's main concern was not that Microsoft offered an integrated product that combined Internet Explorer and Windows, but rather that Microsoft refused to offer customers the option of taking Windows without the browser (Fisher and Rubinfeld, 2000, p. 23). Under the government's theory, the bundling was predatory rather than exclusionary. Consumers with Internet Explorer already loaded on their personal computers still could install and make use of Navigator. However, the incremental cost to such customers of using Internet Explorer was zero.

Microsoft responded to the government's bundling charge by contending that

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[7] Although not predatory, a squeeze may lower welfare. It can do so by allowing firm *M* to appropriate the benefits of innovation undertaken by independent suppliers of *B*, thus reducing their incentives to innovate.

[8] These included November 27, 1996, and November 16, 1998, e-mails from A. Nehru detailing Netscape's revenue sources, and a September 23, 1996, e-mail from B. Akerlind stating: "Netscape can no longer make any money on the browser in the OEM [original equipment manufacturer] market."

[9] Trial transcript, *U.S. v. Microsoft*, November 9, 1999 (p.m. session), available at ⟨http://www.microsoft.com/presspass/trial/transcripts/nov98/11-09-pm.asp⟩.

the browser was an integral component of the operating system and that bundling Internet Explorer with the operating system was a product improvement no different from including a file management program with the operating system. Moreover, Microsoft argued, even if the operating system and browser were distinct products, there are plausible efficiency advantages from bundling in the form of lower distribution and transactions costs. Microsoft also noted that other operating system vendors, such as BeOS, Linux, and Sun, bundled browsers with their operating systems.

Polluting the Java Language. Microsoft developed a version of Java that was optimized for Windows and encouraged programmers to write applications for this version. The government alleged that Microsoft tried to "pollute" Java so that it would not become a standardized language that would run equally well on all operating systems. Microsoft's response was that it was merely optimizing Java to exploit the advanced features of Windows, to the benefit of consumers.[10]

According to the government, Microsoft's Java strategy was predatory because Microsoft was incurring unnecessary costs in the short run to undermine the middleware threat posed by a widely deployed programming language that was independent of the underlying operating system. Judge Jackson agreed with the government in finding that Microsoft acted in ways that did not support its efficiency arguments, but were instead intended to undermine the portability of Java. Judge Jackson concluded that: Microsoft designed its Java developer tools to encourage developers to write applications using certain abbreviations that could only be executed properly by Microsoft's version of the Java environment for Windows; Microsoft refused to incorporate as standard components certain Java developments that would enhance portability in the version of Java that it shipped with Internet Explorer 4.0; and Gates pressured Intel not to share its work on a high-performance Java virtual machine with Sun or Netscape or to allow Netscape to include the Intel product with Navigator. In addition, Judge Jackson found that Microsoft pressured software vendors, such as the developer of the RealNetworks multimedia player, to rely on Windows-specific Java technology rather than more portable Java implementations in their products (*U.S. v. Microsoft*, 2000b, Section VI.) Lemley and McGowan (1998) also point out Microsoft's opposition to certifying Java as an international standard.

Did Microsoft Neutralize the Threat of Navigator/Java Competition?

The trial record offers ample evidence that Microsoft intended to eliminate the middleware threat to Windows posed by the combination of Netscape Navigator and Java. Has Microsoft succeeded in annihilating browser competition? Probably

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[10] For an example of this argument, see testimony of Richard Schmalensee at *U.S. v. Microsoft*, Section III, available at ⟨http://www.microsoft.com/presspass/trial/schmal/III.asp⟩, at para. 149.

not. During the Microsoft trial, America Online purchased Netscape for approximately $4 billion in stock, so that Netscape is now a subsidiary of, and has the backing of, the world's largest online service provider.

Yet by tipping the market in favor of Internet Explorer, Microsoft's conduct undermined the ability of Netscape Navigator to attract software developers to write applications that will run in the Netscape/Java environment. According to Ad-Knowledge, Inc., Internet Explorer's share of monthly browser usage increased from 20 percent in January 1997 to more than 50 percent by August 1998, and other data suggest it has increased since 1998.[11] Judge Jackson concluded that Microsoft's anticompetitive conduct contributed to Netscape's decision not to do the engineering work necessary to continue bundling up-to-date "Java Virtual Machines"—the programs that interpret Java for a particular operating system—that would be compliant with Sun's standards in future versions of Navigator (*U.S. v. Microsoft*, 2000b, at para. 397).

Did Microsoft Harm Consumers?

The courts have long recognized that antitrust policy is concerned with harm to competition, not harm to competitors, because competitors can be casualties of aggressive competition that benefits consumers and/or increases efficiency. Did Microsoft harm consumers in the sense that they would have faced lower prices—adjusted for the quality and variety of the available products—in the absence of Microsoft's challenged conduct?

Assessment of consumer harm from predation is difficult because predation can benefit consumers in the short run while harming them in the long run. For example, consumers were not clearly worse off in the short run as the result of Microsoft's Java development, and some consumers may have been better off because Microsoft's implementation of the Java virtual machine provided advantages for Windows users ("Performance Tests: Compatibility," 1998).

However, what might appear to be an obvious short-term consumer benefit of Microsoft's allegedly predatory behavior—namely, receiving a free copy of Internet Explorer bundled with Windows rather than paying for a browser—might be illusory. The availability of free browsers may have allowed Microsoft to raise (or avoid lowering) the price of Windows. To the extent that Microsoft internalized the benefits

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[11] For movement of browser market shares from 1997 to 1998, see ⟨http://www.usdoj.gov/atr/cases/exhibits/5.pdf⟩. Statmarket claims that Internet Explorer's share of browser usage in June 2000 was more than 86 percent (Scott Clark, "Browser Statistics Look Good for IE," June 27, 2000, ⟨http://www.internetnews.com/wd-news/article/0,,10_403661,00.html⟩). Positive Support Review estimated Internet Explorer's market share at about 76 percent in July 2000, with Netscape at about 15 percent (see ⟨http://www.psrinc.com/MSExplorer.htm⟩). BrowserWatch reported that 58.7 percent of the hits on its website in July 2000 were from Internet surfers using Internet Explorer and 26.1 percent of the hits were from surfers using Netscape Navigator, as reported at ⟨http://browserwatch.internet.com/stats/stats.html⟩.

from free browsers through the Windows price, the short-run consumer benefits from giving away Internet Explorer and bundling it with Windows were limited.

The main thrust of the government's case was that, in the long run, consumers would suffer from reduced competition among both browsers and operating systems. The result could be higher prices in the long run, or a reduction of investment in R&D and product development that reduced or degraded the set of available products.

The need to consider long-run effects of Microsoft's actions raises a number of difficulties. First, there is the matter of predicting what will happen in a market subject to rapid technological change. One cannot be certain that the combination of alternative browsers and a Java programming language that was independent of the underlying programming language would have emerged as a serious platform competitor absent Microsoft's challenged conduct. For example, one obstacle to the widespread acceptance of Java is the additional execution time required to translate the Java code. Clearly, however, Microsoft perceived that such competition was possible.

Second, the link between the degree of competition and the degree of innovation is complex. Certain theoretical arguments support the conclusion that large firm size and high market share are conducive to R&D investment, because a firm in such a market can amortize the fixed costs of the R&D and appropriate most of the R&D's benefits. Catastrophic entry, combined with large investment demands, can necessitate concentrated markets as a means to achieve the returns necessary to motivate large investments that must be recouped over relatively short periods of time before the dawning of the next technological revolution. On the other hand, as Sir John Hicks (1935, p. 8) wrote: "The best of all monopoly profits is a quiet life." There is considerable anecdotal evidence that competitive market structures are more innovative than are protected monopolies, although econometric evidence on the general linkage between concentration and innovation is inconclusive.

While it is impossible to make definitive statements about the linkage between market structure and innovation in general, competition has stimulated innovation in browsers and operating systems. For example, Evans and Schmalensee (2000a, pp. 45–46) concluded that, by increasing competition in the browser market, "Microsoft's actions speeded innovation in Web-browsing software and left consumers with the choice of two first-rate browsers instead of one." Moreover, Microsoft appears to have accelerated the introduction of DOS 5.0 in response to competition from DR-DOS and to have accelerated the development of Windows in response to competition from Apple and OS/2. Further, the continuing development of Apple's operating system suggests that significant innovation by firms with much smaller sales than Microsoft is feasible.

A third difficulty in assessing the long-run consequences of Microsoft's conduct is that, even if one has found there would be greater competition and more innovation absent Microsoft's actions, as a matter of theory the linkage between innovation and welfare is ambiguous. For example, firms may enter rent-seeking races in which they invest more than the socially efficient amounts in R&D (for a review of the theoretical literature on R&D competition, see Reinganum, 1989). As

an empirical matter, however, private incentives for R&D typically are much lower than the social benefits of the R&D because private firms typically are unable to appropriate all of the benefits that their R&D generates for the economy (Griliches, 1992; Jones and Williams, 1998). Certainly, no evidence of socially excessive R&D investment was presented at trial.

It appears to us that *if* the record in the case had consisted solely of the fact that Microsoft took the actions the government alleged to be predatory—that is, giving Internet Explorer away for free, bundling Internet Explorer with Windows, and creating a non-standard implementation of Java—Microsoft could have made a plausible case that it was engaged in a non-predatory squeeze of Netscape, was improving Java, and its conduct did not harm consumers.

There are, however, two significant problems with this interpretation of the record. First, there is significant evidence that Microsoft took actions for the explicit purpose of harming competition. Economists are often loath to endorse an intent-based approach to evaluating firm behavior because managers often use florid language to describe their actions in memoranda ("kill the competition") and even ill-intended actions may not harm consumers in some cases. We fully agree that caution is warranted in interpreting such evidence. However, when there is a clear economic rationale that certain types of conduct can harm competition and lead to higher prices, and there is evidence that managerial intent was to harm competitors, it can be appropriate to use this evidence to sort harmful from innocent behavior. Of course, one has to be sensitive to the possibility that executives will strategically write memoranda that put soothing spins on their descriptions of firm conduct.

Second, in addition to the allegedly predatory actions, Microsoft undertook a variety of exclusionary tactics that cannot be explained as procompetitive "squeezes" on Netscape. If Microsoft had been trying to maximize its returns on Windows by ensuring that consumers enjoyed maximal benefits from complementary browsers, it would not have worked so hard to make it difficult for consumers to use non-Microsoft browsers. In particular, Microsoft would not have taken measures to discourage consumers from using Netscape's browser.

Judge Jackson concluded that Microsoft's contracts with Internet and online service providers and with computer manufacturers were exclusionary and contributed to a verdict of monopolization. However, he also found that because the contracts did not completely foreclose competition from Netscape and other browsers, the contracts were not illegal in and of themselves. Judge Jackson's finding notwithstanding, imposing costs on competitors can harm consumers even if the competitors are not completely driven from the market. Netscape was forced to pursue other distribution alternatives to compensate for Microsoft's restrictive arrangements, thereby increasing Netscape's costs of distributing its browser to consumers. At least some consumers were harmed because they were unable to obtain their preferred product or they incurred greater costs to do so (for example, time spent downloading the product) as the result of Microsoft's practices. The contracts do not appear to have contributed to efficiencies that would offset these harms. Moreover, in the presence of network effects, a lower current market share

can have negative feedback effects on future sales and thus weaken incentives for product improvements and future competition.

Neither the government nor Microsoft offered numerical projections of welfare effects. Our review of the case suggests the following overall effects. In the short run, Microsoft's allegedly predatory actions of developing a Windows-optimized version of Java, giving Internet Explorer away for free, and bundling Internet Explorer with Windows probably benefited consumers directly. In addition, consumers benefited from the latter two actions because they forced Netscape to make its browser available for free. The short-run consumer gains from a free or bundled browser may have been limited, however, because a zero browser price may have enabled Microsoft to maintain the price of Windows at a higher level than it otherwise would have. In the short run, Microsoft's contracts with personal computer manufacturers and online service providers imposed costs on consumers who preferred the Netscape browser. In the long run, consumers were likely harmed because much of Microsoft's challenged conduct reduced the probability that Netscape/Java would emerge as a platform competitor. The contracts with Internet content providers, however, had potential efficiency benefits.

Remedies

On April 3, 2000, Judge Jackson found Microsoft guilty of violating the Sherman Act (*U.S. v. Microsoft*, 2000c). The government and Microsoft then proposed remedies. Both parties proposed conduct remedies that would constrain certain aspects of Microsoft's behavior, such as the use of exclusive contracts and prohibitions on removing the Internet Explorer icon. The government proposed more extensive conduct remedies than did Microsoft, as well as a structural divestiture of the company into two parts. One part would receive the Windows operating system; the other would receive the applications programs and all other Microsoft lines of business. Both parts would get intellectual property rights to the Internet Explorer browser, but the operating systems company would be limited in its ability to develop, license, or distribute modified or derivative versions of the browser (*U.S. v. Microsoft*, 2000a, sec. 1.c).

From an efficiency perspective, remedies should stop a firm that has engaged in anticompetitive conduct from continuing to do so and should deter that firm and others from engaging in similar anticompetitive conduct in the future. At the same time, remedies should not introduce large administrative costs, deter efficient conduct, or create opportunities for firms to engage in costly strategic behavior.

Judge Jackson found that Microsoft illegally sustained the applications barrier to the entry of operating system competitors. Conduct remedies, such as mandatory unbundling of Internet Explorer from Windows, deal directly with Microsoft's challenged behavior. However, as experience with the earlier consent decree illustrates, conduct remedies can be difficult to enforce and may not be sufficient to deter Microsoft from engaging in other behavior that has similar effects. In addition, conduct remedies may provide a forum for competitors to challenge

Microsoft's business decisions—including those that might benefit consumers—with a potentially chilling effect on innovation.

Compared to conduct requirements, structural remedies typically require less regulatory oversight and can be less susceptible to strategic intervention by competitors. But structural remedies may fail if the required structure does not reflect an efficient organization of the industry.

The government's theory was that its proposed structural remedy would invigorate competition by encouraging the applications company to port its software to other operating systems or to develop its own operating system. In either case, Windows would face more vigorous competition. The breakup was also intended to encourage the operating system company to assure interoperability with applications programs from all vendors. More generally, each company would have incentives to encourage competition in the market for the complementary product.

By relying on market forces, the proposed remedy sidesteps the prospect of continuing government oversight of Microsoft. It does not order the applications division to work with other operating systems vendors. It does not seek to define terms like "operating system" and then set up restrictions about what such a system can or cannot include. It does not contain permanent line-of-business restrictions on the Microsoft offspring.[12]

However, the proposed breakup of a huge company would certainly entail substantial direct costs of reorganization. Moreover, the divestiture might well impose indirect costs through its effects on the two companies' abilities and incentives to cooperate, including cooperation in pricing and product development. The concern with respect to pricing is the "double marginalization problem" identified by Cournot (1838). Suppose that every consumer of a personal computer requires one operating system and one application program (for example, a word processor). If the monopoly supplier of the operating system is also the monopoly supplier of the application, it will take foregone application sales into account when analyzing the effects of an increase in the price of the operating system. But if a separate firm sells the application, the operating system monopolist will not count lost application sales as a cost and thus has less incentive to restrain price. A similar logic applies to pricing the application. Hence, this argument suggests that the sum of the operating system and application prices set by an integrated monopolist will be lower than the sum of those prices when set separately by two independent firms each with significant market power.

The separation of suppliers of complementary products can have other nefarious effects. The separate operating system and applications companies might not have incentives to push new products that require commitments from both the operating system and application sides of the business. The introduction of Windows provides a suggestive case study. Microsoft had a strong incentive to design and market applications that took advantage of the Windows graphical user inter-

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[12] Many commenters have drawn comparisons between the proposed breakup of Microsoft and the 1984 breakup of AT&T, but the proposals are actually quite different. The AT&T breakup entailed line-of-business restrictions that kept the courts heavily involved in the workings of the industry.

face, because Microsoft could internalize benefits from the complementarities between Windows and applications. Independent companies, such as Lotus, were slower to make the transition to Windows for their applications than was Microsoft.

It is impossible to predict with confidence how splitting Microsoft in two would actually work and how large any coordination losses would be. The two companies would have incentives to reach agreements to overcome the distortions induced by their separate structure, subject to being allowed to do so by the remedy and antitrust law generally. More broadly, the hope of the government is that divestiture would invigorate competition in both the operating systems and applications markets. If stronger competition occurred, it would reduce the double marginalization problem and could even reduce the total price of software bundles from current levels.

Some have argued for a structural remedy that would create immediate additional competition in the market for personal computer operating systems by breaking Microsoft into an applications company and several competing operating systems companies, often referred to as the "Baby Bills." (The friend-of-the-court submission, *U.S. v. Microsoft*, 2000e, is an example.) Such a proposal offers the benefit of eliminating, or at least greatly reducing, the operating systems market power that was the driving force for anticompetitive conduct. However, this proposal also raises substantial risks of imposing an inefficient market structure because the efficient number of personal computer operating systems companies is unknown. Moreover, the relationship between innovation and market structure is not a simple one. If market forces compelled three Baby Bills to remain compatible with each other, innovation might be limited by the rigidities inherent in a multi-firm effort to preserve standards. Alternatively, a failure among the Baby Bills to cooperate on standards could lead to fragmentation and the loss of network effects. Finally, there are no clear organizational lines along which to cut the operating system company into multiple pieces.

Financial penalties are another potential remedy for unlawful conduct. Except to compensate for harm suffered in its role as a consumer, the government cannot pursue monetary damages in civil litigation. But private parties can do so and have the added incentive of possibly receiving treble damages. While monetary damages have the disadvantage that they do not directly address the conduct at issue, they can serve as a deterrent to future conduct that likely would be found to harm competition. Moreover, monetary damages create neither large administrative costs nor opportunities for strategic behavior (although litigation to obtain such damages can give rise to both).

In any event, Judge Jackson accepted the government's proposed remedies— including the breakup—although he immediately stayed their implementation pending appeals (*U.S. v. Microsoft*, 2000d).

Conclusion

We find ourselves somewhat torn about remedies. Microsoft took actions that appear to have imposed short-run costs on consumers and reduced the long-run

likelihood of platform competition. Thus, we believe that some remedy by the antitrust authorities is appropriate. While the competitive dynamics of the software industry challenge the ability of economic analysis to make precise and certain predictions about competitive effects, the potential welfare effects of business practices in these markets are too important to keep antitrust on the sidelines.

In the light of experience with the earlier consent degree, we are pessimistic that a limited conduct remedy would be effective in this case. Structural remedies, such as the divestiture remedy proposed by the government and accepted by Judge Jackson, may be less subject to gaming, but pose the risk of substantial costs. Ironically, in this case, the most effective remedy may be that the government's victory eases the way for plaintiffs in private antitrust suits to collect monetary damages, which could be sufficient to deter future anticompetitive conduct. Of course, at the time of this writing, the results of those suits—and Microsoft's appeal of Judge Jackson's decision—remain to be seen.

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