IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

UNITED STATES OF AMERICA, Plaintiff, v. MICROSOFT CORPORATION, Defendant.	Civil Action No. 98-1232 (TPJ)
STATE OF NEW YORK *ex rel.* Attorney General Eliot Spitzer, *et al.,* Plaintiffs, v. MICROSOFT CORPORATION Defendant.	Civil Action No. 98-1233 (TPJ)

REMEDIES BRIEF OF AMICI CURIAE

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Interests of the Amici Curiae

Each of the signatories of this brief is a professional economist with special interest and expertise in the matter now before the Court, namely the design of an appropriate remedy to address Microsoft's antitrust violations. The signatories are filing this submission in their own personal capacities and not on behalf of the institutions with which they are currently affiliated or employed. They are submitting their views because they believe they can assist the Court in fashioning this remedy. None of the signatories has been employed by or retained as consultant for Microsoft, the federal or state governments or any other interested party in this litigation.

Collectively, the signatories to this brief have had extensive experience with various facets of industrial reorganization that we believe are relevant to the Court's remedy determination in this case. We have worked on and studied extensively a wide range of government interventions, including deregulation (in airlines, the financial sector, electricity and telecommunications); structural relief in antitrust cases; privatization (the electric power industry); demonopolization and marketization in formerly state-run economies (including the former Soviet Union and East Germany), and foreign trade cases (including tariff and quota relief and structural adjustment).

Robert E. Litan, currently the Vice President and Director of the Economic Studies Program at the Brookings Institution, was formerly Deputy Assistant Attorney General of the Justice Department's Antitrust Division from September 1993 until March 1995. During his tenure, he helped supervise the first civil antitrust investigation against Microsoft and participated actively in negotiating the consent decree limiting the company's licensing practices, which this Court approved (after remand from the Court of

Appeals) in 1995. He has closely followed the trial and subsequent judicial decisions in this matter and, in his recent research, has concentrated on, among other things, economic and policy issues relating to the rapid development and use of the Internet. Dr. Litan is both an economist and an attorney. During the course of his career as an economist, he has written or edited 20 books and over 100 articles in journals relating to a broad range of economic, regulatory and legal issues.

Roger G. Noll is the Morris M. Doyle Centennial Professor of Public Policy in the Department of Economics at Stanford University. Professor Noll is the author or editor of thirteen books and over 300 articles, focusing on public policies toward business. Among his special areas of expertise are the economics of telecommunications industry and the Internet. He has examined privatization and regulation of telecommunications and electric power firms in many countries around world. He also has served on several boards and committees of the U.S. government, and has been a consultant to the Antitrust Division of the Justice Department, the Federal Trade Commission, and the Federal Communications Commission.

William D. Nordhaus is the A. Whitney Griswold Professor of Economics at Yale University, where he has served on the faculty since 1967. From 1977 to 1979, he was a Member of the U.S. President's Council of Economic Advisers. While at the Council of Economic Advisers, he established and chaired the Regulatory Analysis Review Group, which was charged with analyzing the impacts of major regulations. From 1986 to 1988 he served as the Provost of Yale University. He is the author of many books, among them *Invention, Growth and Welfare*; *Reforming Federal Regulation* (jointly with Robert Litan); and the classic textbook, *Economics*, now in its sixteenth edition (jointly with Paul

Samuelson). His research has dealt with issues of innovation, technological change, deregulation, and demonopolization for Russia and other economies in transition. Dr. Nordhaus was an expert witness for AT&T during the government's antitrust investigation of that company in the late 1970s and early 1980s, specifically on issues relating to the impact of breakup of the company on technological change and innovation. He serves on a number of government panels, including membership on the Congressional Budget Office Panel of Economic Experts, and he is chairman of the Advisory Committee of the Bureau of Economic Analysis. In April 2000 he addressed the First Plenary session of the White House Conference on the New Economy.

Frederic M. Scherer is the Aetna Professor of Public Policy and Corporate Management at the John F. Kennedy School of Government at Harvard University. He is an expert on the economics of industrial organization and antitrust and the author of a leading text in the field, Industrial Market Structure and Economic Performance. During his career, he has authored 19 other books and over 100 articles in professional journals, mainly on subjects related to industrial organization and technological change. He has served as Director of the Federal Trade Commission's Bureau of Economics and economic advisor to the Committee on Government Patent Policy. Dr. Scherer has testified on monopolization and merger issues in several antitrust cases before or involving the Federal Trade Commission and the Department of Justice.

Introduction

Now that it has found Microsoft in violation of the Sherman Act, the Court faces its most important challenge. It must fashion a decree that promises to introduce effective competition in the market that Microsoft has monopolized – Intel-compatible operating

systems – and to restrain Microsoft from projecting its current monopoly into adjacent markets. That monopoly has proved of enormous value to Microsoft: as shown below, in 1999 Microsoft's rate of return was 88 percent on its investments in capital and research and development – *a record of profitability exceeding the average return of other major corporations by a factor of more than thirteen.*

Achieving the required remedy objectives is a heavy responsibility. Too often in the past, the government plaintiffs and the courts have devoted most of their attention to the liability phase of antitrust cases and have tended to breeze through the remedy phase. This case is too important and the stakes for the nation are too high to allow such a course of action to be followed here. The Court has a unique opportunity not only to establish a clear record for appellate review of the remedy, but also to set an important precedent for the way in which remedy determinations are made in future antitrust actions.

In particular, this Court will establish in the process of setting a remedy in this matter the contours of relief in monopolization cases where the defendant's value arises primarily from intangible assets in the form of intellectual property rather than the tangible capital assets characteristic of such prior major monopolization cases as Standard Oil, Alcoa, and AT&T. In essence, this case provides an important test of how antitrust law and remedies should be applied in the "New Economy," where informational capital is the scarce and precious asset and physical assets are relatively minor and hardly unique. We argue that while the valuable assets underlying our economy may be new, the rules of antitrust remain just as valid as when the Sherman Act was first enacted: monopoly power is just as dangerous today when firms holding it have repeatedly demonstrated a willingness and ability to abuse that power. Dissolution of the kind proposed for

Microsoft's operating-system monopoly was both impossible and irrelevant in many earlier major structural cases; dissolution here is the logical extension of physical or regional divestiture for companies based largely on tangible assets to a company whose value is based largely on intellectual and informational assets.

We submit this brief without the benefit of knowing what relief the government plaintiffs will seek. However, our understanding of the relevant legal standard is that this Court has broad discretion in fashioning an appropriate remedy. It need not be limited to the remedies the government plaintiffs may propose. Now that the Court has issued a broad legal Conclusions of Law, it has the authority – indeed the responsibility within the contours of existing law – to impose whatever remedy it finds most appropriate to address the violations it has found, regardless of what the government plaintiffs may propose. *For this reason, we urge the Court, following its scheduled May 24 hearing, to establish procedures (including evidentiary hearings on the risks and benefits of alternative courses of action) for developing a record that will enable the Court to develop a remedy that will provide a reasonable chance for competition to work without the monopolistic distortions outlined in the Court s Findings of Fact and Conclusions of Law.*

The Court has recognized the time-urgency of deciding this matter by suggesting that it may ask for immediate review of its Conclusions of Law and remedy order by the Supreme Court. There is certainly merit to this concept, especially in light of Microsoft's announced plans to extend Windows to the server and Internet access provider markets. *Nonetheless, we believe that, because the underlying remedy issues are so complex, the key concern is the quality of the assessment rather than the speed of the resolution.* Hence, a

careful study and assessment of alternatives should not be sacrificed in the rush to resolve uncertainties surrounding the outcome of this case.

The need for a careful and thorough study of remedies is underlined if the Court contemplates a structural remedy with respect to the monopolized markets. We will argue that conduct and licensing remedies are unlikely to introduce workably competitive conditions into the market monopolized by Windows and that it will be necessary to impose a structural remedy if demonopolization is the goal. At the same time, however, the complexity and potential risks of a structural remedy along with the history of past structural cases underline the need to ensure a careful and thorough study and assessment of alternative approaches before a final remedy is ordered.

Summary of Argument

Three broad categories of remedies are available to Court in this case: (1) a decree constraining Microsoft's future conduct; (2) rules involving licensing or providing access to the Windows source codes; and (3) various forms of structural relief. In addition, the Court might find attractive a remedy that combines one or more of these basic approaches.

First, while a conduct-oriented remedy would be the least disruptive of all of the options in the short run, it is also the least likely to remedy the core problem identified in the Court's Conclusions of Law: the pattern of continuing abuses that have unlawfully maintained Microsoft's monopoly power. A conduct decree would be difficult to enforce, and Microsoft can be expected to take advantage of the "enforcement lag" built into the post-decree process to tilt the market in its favor. Moreover, a conduct order that requires continued judicial supervision of the content of Microsoft's future operating systems would

run a risk of chilling innovation by involving the Courts on an ongoing basis in the design of computer software, against which the D.C. Circuit has already, and in our view correctly, warned.

Second, a licensing remedy for Windows, which might involve publishing the source code, mandatory licensing, or providing open-source versions, would also be relatively easy to accomplish. In principle, these options would allow other companies to compete directly with Microsoft in the various platform markets. In practice, however, because the source code is long, complex, and difficult to adapt, rivals are not likely to be able to compete effectively, even with a license to the source code. At a minimum, outsiders will need to have extensive access to Microsoft's programmers and middle managers. Mandating that Microsoft's employees cooperate in helping its competitors produce a competitive product seems a tall order for any Court to write and enforce.

Third, the relative merits and drawback of structural relief vary substantially depending on its design. One component of any effective structural remedy entails splitting the company into its two main constituent parts: one company holding rights to all of the Windows operating systems or platform products (the "WinCo") and a second company engaged in applications and other enterprises (the "applications company" or "AppCo"). Such a divestiture would be organizationally straightforward, and if it were accompanied by a requirement that the applications company deal with all platform companies (including the new Microsoft OS company) in a non-discriminatory fashion, it would reduce the applications barrier to entry.

The major drawback of a functional breakup is that it leaves the platform monopoly intact. If the Court does not limit the lines of business of this monopoly, it then

runs the risk of having the Windows company leverage its desktop monopoly into adjacent markets. On the other hand, if the court does impose line of business restrictions on the OS company, limiting it either to specific operating-systems markets in which it may currently be engaged, or even more restrictively, to just the Windows 98 and Windows 2000 versions, it runs the risk of chilling innovation. The experience of this district court in administering similar restrictions imposed on AT&T, turning the court into a judicial regulatory agency, should give this Court pause about the wisdom of such an approach.

The present *amici curiae* believe that the most satisfactory approach is the "full divestiture" option. This would combine the functional divestiture – which, in our view, is a minimum remedy requirement – with a "monopoly dissolution." A full divestiture would require Microsoft initially to divest its operating company from the rest of the enterprise. The OS company would then be split into three identical companies, each of which would own and sell Windows products (these being three WinCos). The full divestiture would be the most effective way, in our view, of introducing real competition into the platform market, of reducing the applications barrier to entry, and of reducing or removing Microsoft's ability to project its operating systems monopoly into other markets. We emphasize that the many complex considerations in a full divestiture demonstrate the need for the Court to conduct a thorough inquiry into all of the alternative remedy proposals.

Guiding Remedy Principles

The signatories submit this brief in their roles as professional economists with special expertise in industrial reorganization and innovation.[1] In doing so, we concentrate

[1] Dr. Litan is also an attorney but joins this brief in his capacity as an economist, although his views are informed by his role as a former prosecutor and policy maker in the Justice Department's Antitrust

on the economic implications of various possible remedies that have been widely discussed both during and after the Court's Findings of Fact and Conclusions of Law. Where appropriate, however, we provide citations to legal precedents**.**

We begin by underscoring the need for a careful and independent judicial inquiry into the nature of the appropriate remedy. Indeed, as the Supreme Court has highlighted, the development of an appropriate remedy is "*the most significant phase of the [antitrust] case*." United States v. Glaxo Group Ltd., 410 U.S. 52, 64 (1973) (emphasis added)**.** Fortunately, the Supreme Court also has provided guidance on several occasions for evaluating relief in monopolization cases, announcing that the remedy should terminate the illegal monopoly; prevent practices likely to result in monopolization in the future; and deny to the defendant the fruits of its statutory violation. See, e.g., United States v. United Shoe Machinery Corporation, 391 U.S. 244, 255 (1968). Or, as the Court spoke in United States v. Grinnell Corp., 384 U.S. 563, 577 (1966), relief in a Sherman Act case "*should put an end to the combination* and deprive the defendants of any of the benefits of the illegal conduct*, and break up or render impotent the monopoly power found to be in violation of the Act*." (Emphasis added).[2]

Division, where he was active in supervising a previous investigation of Microsoft and negotiating the 1994 consent decree with the company.

[2] See also United States v. United States Gypsum Co., 340 U.S. 76, 88 (1950) [a decree must "pry open to competition a market that has been closed by defendants' illegal restraints."]; and United States v. E. I. du Pont de Nemours & Co., 366 U.S. 316, 326 (1961).

A. Three Analytical Principles For Establishing A Remedy In This Case

Applied to this case, and in light of the Findings of Fact and Conclusions of Law, these principles suggest that the Court should seek to accomplish three objectives in fashioning a remedy:

First, the remedy should within a short period introduce workable competition into the market for Intel-compatible platforms for applications software.

Second, the remedy should reduce the applications barrier to entry as a means of establishing economic conditions most conducive to workable competition for operating systems.

Third, the remedy should reduce the ability of Microsoft to project its current monopoly power into other markets, as a way of preventing new monopolies in those other markets and to inhibit Microsoft from reinforcing its monopoly in operating systems.

Accomplishing these goals is a complex task, not just because of the size of the defendant, but because *any* remedy the Court decides to adopt is likely to have profound economic implications not only in the markets in which Microsoft competes – platforms for personal computers, servers, and the Internet – but for users of these technologies throughout the global economy.

To reorganize a firm of substantial size, whether through conduct or structural means, is a complex undertaking. It requires understanding in depth not only the monopolizing firm but also other firms in the industry, the technology, the evolving legal and contractual structures, the various barriers to entry, and the relation of the various firms to capital and labor markets. While some of these issues have been dealt with in the

liability phase of the case, most have not been analyzed extensively, and the analysis in any event has been conducted in the context of liability rather than relief.

Our review of the relevant literature indicates that the relief phase of antitrust cases is often treated as an afterthought, even in cases as important as monopolization findings under Section 2 of the Sherman Act. For example, Professor Lawrence Sullivan has observed: "Perhaps the best hope is that, hereafter, Courts facing structural remedy issues will get more help than they have customarily received from the Department of Justice. As Judge Wyzanski implied in *United Shoe Machinery*, the government is sometimes extremely casual about remedy."[3] A similar point of view has been voiced by Chief Judge Richard Posner (who attempted to mediate a settlement in this case): "Another reason for the poor record of divestiture as an antitrust remedy is that the government's lawyers tend to lose interest in a case at the relief stage. They derive both personal satisfaction and career advancement from the trial of an antitrust case, but gain neither from the post-trial relief negotiations and proceedings, which they frequently tend to pay scant attention."[4]

In our experience, when similar issues arise outside antitrust, even in situations with far less significant potential economic consequences, agencies charged with making these determinations generally do so only after extensive fact-finding and hearings. Two examples – with which the *amici curiae* have had extensive experience – are the "injury" phase of unfair international trade cases and rulemaking proceedings such as those involving environmental regulations affecting private firms. It is only appropriate,

[3] Lawrence Anthony Sullivan, *Handbook of the Law of Antitrust*, West, 1977, at 146

[4] Richard Posner, *Antitrust: An Economic Perspective,* University of Chicago Press,1978, at 89.

therefore, that the Court adopt a similar procedure in this proceeding, although the approach here could be expedited in light of the urgency and rapid pace of change in the industry. Accordingly, we urge the Court at its May 24 hearing to establish a fact-finding process aimed at resolving the many complex issues we discuss in this brief. We anticipate that such process would require further evidentiary hearings and briefs from the parties and possibly, at the Court's discretion, from knowledgeable outside experts.

Whether or not the Court decides to establish such a process, we believe that the Court should be guided by several key principles in deciding upon a remedy.

B. The Court Has Broad Discretion In Fashioning Antitrust Relief

The Court should recognize that it has broad discretion to fashion relief. It is the Court's job to accomplish the objectives set out by the Supreme Court for addressing the ill effects of monopolization. This simple statement leads to a critical conclusion, however*: the remedy should not be limited to the relief that the government plaintiffs may propose.* The Court's role in fashioning a remedy for *proven antitrust violations* is analogous to but much more extensive than its much more limited role in reviewing proposed antitrust consent decrees.[5]

In particular, if the Court finds that the proposed remedies will not attain the fundamental principles underlying the need for relief, the Court should not be deterred from imposing a different remedy than any the government plaintiffs may offer.

[5] This proceeding differs from that arising from the 1994 consent decree that Microsoft entered into with the Justice Department. In that matter, the D.C. Circuit held that Judge Sporkin exceeded his authority under the Tunney Act, which applies only to consent decrees and not to final judgments, because Judge Sporkin wanted the government to pursue a broader case than the one it actually filed.

C. The Gravity of Microsoft s Offenses, Viewed in Context, Create A Presumption For a Structural Remedy

It is straightforward that the remedy should be proportional to the gravity of the offenses found by the Court, the context in which they have occurred, and the behavior that Microsoft has displayed. The Conclusions of Law makes clear that these offenses were severe, numerous, and committed as part of an overall pattern over an extended period of time.

Microsoft violated the Sherman Act in three significant respects: by unlawfully maintaining its current monopoly in Intel-based PC operating, in violation of Section 2; by attempting to monopolize the market for browsers through this campaign and its attempted market-division with Netscape, also in violation of Section 2; and by unlawfully tying its browser, Internet Explorer, to its Windows operating system. As a result of these acts, this Court concluded that Microsoft had done "violence" to the competitive process (Conclusions of Law at 20) and that its conduct was "predacious" (Conclusions of Law at 21).

These are extremely serious findings, especially the first, and we share the Court's most important conclusion: that Microsoft embarked on a successful *campaign*, consisting of various acts and threats against rivals and customers, designed to protect its platform monopoly. This finding of *monopolization* is among the most serious of all antitrust offenses. It is especially important here because of the context in which Microsoft's campaign took place: in a market characterized by an "applications barriers to entry," which renders it difficult for other platforms for applications software (such as Netscape and Java) to become successful. In effect, the applications barrier to entry tilts the

"scale of competitive fortune" in the company's favor, even in the absence of Microsoft's "oppressive thumb." (Conclusions of Law at 20). For this reason, a remedy that simply removes the thumb cannot undo the damage of Microsoft's prior acts.

Moreover, we believe that, in fashioning any remedy, the Court should consider both Microsoft's preceding and subsequent conduct that is relevant to this case. Microsoft earlier entered into a consent decree, requiring the company to modify various licensing practices, which the Justice Department contended had unlawfully maintained the company's operating system monopoly (then Windows 3.1, the predecessor to Windows 95, and subsequently Windows 98, subjects of this case). Although this Court's ruling that Microsoft had violated this decree by tying its browser and its operating system was overturned by the Court of Appeals, the Court should nonetheless take judicial notice of testimony in this matter suggesting that Microsoft did not take this first consent decree seriously or significantly modify its behavior in response to it**.** This evidence is relevant to the enforceability of any conduct-based remedy that the Court may order now.

Similarly, the Court should take judicial notice of Microsoft's attempt to gain market power – indeed, a monopoly – in the market for personal financial management software through its attempted merger with Intuit. Only after the Justice Department challenged that merger on the ground that it would substantially lessen competition did Microsoft abandon the plan.

Perhaps most significant and daring, while this case was pending, Microsoft mounted a well-publicized campaign to influence the Congress to limit appropriations for the Justice Department's Antitrust Division. The signatories of this brief cannot recall a similar action by a party whose activities had already been subjected to a factual

determination, as was true for Microsoft in this case. In addition, as is discussed below, it is contended that Microsoft is attempting once again to project its desktop OS monopoly into the market for network server operating systems and for programs used by various Internet access devices.

We believe that all these factors taken together create a presumption toward a structural remedy. We are not alone. Professor Areeda, one of the leading antitrust scholars of the 20th century, has observed that the simplest and surest remedy for unlawful monopolization "is the restoration of competition through dissolution or dismemberment of the monopolist into two or more viable competing units." Philip E. Areeda & Herbert Hovenkamp, Antitrust Law, Paragraph 636c, at 56 [rev ed. 1996]. We believe this conclusion is especially apt given its own past behavior and in light of the high barriers to entry into the market that Microsoft has unlawfully monopolized.

D. A Principal Objective Of The Remedy Should Be To Promote Innovation

The central theme running through the Court's Findings of Fact is that Microsoft's acts have chilled innovation and have therefore distorted the evolution of the software market. While history cannot be rewritten and the country has lost several years of workable competition in operating systems, an appropriate remedy can provide future innovation opportunities to current and would-be entrants**.** Adapting the Court's own language, if one object of the remedy is to restore workable competition in the markets in which Microsoft competes, Microsoft's "oppressive thumb" cannot be effectively removed unless the "scales of competitive fortune" are themselves rebalanced.

Microsoft has asserted throughout the trial a different view of its impact on innovation, and indeed, since this Court's verdict was announced, the company has embarked on a major public-relations and television-advertising campaign designed to convince the public that it intends to continue innovating. Nonetheless, Microsoft has argued throughout this proceeding – and can be expected to continue arguing in the remedy phase – that the fast pace of innovation in the entire computer industry renders any stiff sanction by this Court unnecessary. The Windows platform, it has previously claimed, is being or will be successfully challenged by Linux and Java-based programs downloaded from the Internet (which, Microsoft contends, AOL's acquisition of Netscape, working in conjunction with Sun, will accelerate). Furthermore, it is said that the personal computer itself is rapidly becoming less important in the marketplace, especially as various appliances for accessing the Internet – by telephone, in automobiles, at work and at home – assume greater importance in the marketplace, and where, incidentally, Microsoft does not currently enjoy a monopoly.

The Court has already rejected these contentions in its Findings of Fact, which we urge the Court to recognize when fashioning a remedy. While the Court acknowledged (paragraph 408) that the distribution of Internet Explorer with Windows "increased general familiarity with the Internet and reduced the cost to the public of gaining access to it," it also found (at paragraph 409) that the company had "engaged in a concerted series of actions" – ultimately determined to be unlawful – "designed to protect the applications barrier to entry, and hence its monopoly power, from a variety of middleware threats, including Netscape's Web browser and Sun's implementation of Java." This campaign was found to have chilled innovation in both middleware and applications software written to

interface with Java. More broadly, the Court found (paragraph 412) that Microsoft's campaign against rival platforms has discouraged competition *throughout the computer industry*, "deter[ring] investment in technologies and businesses that exhibit the potential to threaten Microsoft."

Microsoft's claims that technological change somehow renders this case moot have also been rejected, and developments since the Court announced its Findings of Fact do not warrant a reversal of these determinations. Despite modest inroads achieved by Linux in the server market, Windows still is shipped with more than 90 percent of Intel-based personal computers. Indeed, Microsoft Chief Executive Steve Ballmer recently admitted that "so far, Linux doesn't have a lot of traction on the client [desktop computer], except in some university environments." (Quoted in The Washington Post, April 19, 2000, at E10).

Indeed, Microsoft is helping to minimize the traction of Linux, exploiting the applications barrier to entry, by declining to develop versions of its best-selling Office products for the Linux systems. This is one of the most powerful examples of how market power and monopoly in both operating systems and in applications reinforce each other. Microsoft's Office software provides a critical core of applications that many desktop users desire when choosing an operating system. Therefore, for Linux to be acceptable to a large number of desktop users, it will need to offer a version of Microsoft's Office. By refusing to develop a Linux version, Microsoft is cutting off the "air supply" to at least one of Linux's lungs and making its entry into the mass consumer market more difficult.

Meanwhile, any claim that the PC itself is rapidly becoming extinct is impossible to square with the fact that roughly 100 million PCs were sold worldwide in 1999

(Microsoft Annual Report, at http://www.microsoft.com/msft/ar99/lts6.htm) and that 30 million PCs were sold in the first quarter of 2000**.** Nor does the contention fit with the fact that Microsoft's sales from Windows platforms represented *an increasing share* of its overall revenues over the 1997-99 period, rising from 41 percent to 43 percent (calculated from Microsoft's 1999 Annual Report).[6]

The prospect that various Net access devices – including so-called thin client or Network computers – will become increasingly popular does not eliminate the need for a significant remedy. For one thing, this Court has also determined in its Findings of Fact (paragraph 23) that "no such information appliance provides all of the features that most consumers have come to rely on in their PC systems," while for various reasons the "day has not yet arrived, nor does it appear imminent" that Network computers will eliminate the need for PCs, which continue to be the workhorses for individuals and business for word processing, data manipulation, storage and computation.

E. The Innovation Defense

Microsoft can be expected to argue against any structural remedy (or presumably any stiff conduct decree) on the grounds that the company allegedly has an impressive record in innovation. We would make two comments in this regard.

[6] Microsoft's latest financial figures for the third quarter of its fiscal year (2000) do not contradict these points. While the growth of income from its core businesses slowed, sales of all versions of Windows still increased by 14 percent over the previous year. Analysts expected a slowdown in Windows revenue growth because Microsoft is now targeting the business market with its Windows 2000 (discussed in greater detail in the text below); businesses often take more time to make what for them are major purchase decisions than consumers. In addition, the company has claimed that the slower recent growth of Windows reflects a slowdown in the growth of purchases of personal computers by corporations, which had been holding back on buying new machines just prior to the turn of the year because of Y2K related fears. See generally, Rebecca Buckman, "Microsoft Revenue Falls Short of Forecast," The Wall Street Journal, April 21, 2000, A3-A4. Notwithstanding Microsoft's claims about the PC market, PC shipments reportedly grew by 17-19 percent in the fourth quarter of 1999 (relative to the same quarter of 1998) according to two other respected industry sources. See John Madden, "PC Shipments Didn't Take Y2K Hit in Q4," PC Week, January 24, 2000.

First, the innovation defense – as a variant of the "good trust" gambit[7] – was central to AT&T's arguments during its antitrust case. Yet it was not sufficient to prevent this district Court from ultimately concluding that a breakup was warranted.[8]

Second, while we do not gainsay Microsoft's impressive talents in developing and marketing software, Microsoft's innovations[9] pale beside those of the Bell System. The Bell System's inventions and innovations included fundamental scientific work on the wave nature of matter, the transistor effect, and cosmic background noise (all three of which won Nobel prizes); the laser (with Columbia University scientists); large systems innovations such as microwave transmission, satellite communication, electronic switching, and optical fiber data transmission; and other significant innovations such as the solar cell, magnetic bubble memory, and the UNIX programming language. If the innovation defense was wanting for AT&T, it is hard to see how it would be worth a moment's consideration in the present case.

F. The Court Must Take Account of Microsoft s New Campaign To Extend the Dominance of Windows

[7] Lucile Sheppard Keys, "The Shoe Machinery Case and the Problem of the Good Trust," *Quarterly Journal of Economics*, 68, May 1954, 287-304.

[8] According to Judge Greene's opinion, "Considerable evidence was adduced during the AT&T trial" that the Bell System had an "admirable record…in innovation in the telecommunications industry and, more broadly, in industrial research." In his Tunney Act review, Judge Greene stated, "The Court is of the opinion that there is considerable merit to these contentions. Bell Laboratories has been a positive force both in basic and in applied research, and this research has had a beneficial effect on the nation's economic position in all of its varied aspects." Yet that finding did not lead him to conclude that an "injunctive, non-structural remedy…would be as efficacious as the divestiture of the Operating Companies" in meeting the goals of the remedy. United States v. AT&T, 552 F. Supp. 131, 167 (D.D.C. 1982), aff'd 460 U.S. 1001 (1983).

[9] A list of Microsoft innovations is presented in Richard B. McKenzie's sympathetic depiction, *Trust on Trial*, Persius, Cambridge, Mass., 2000, 137-139 and includes such items as "first pointing device to add a 'wheel' to improve navigation."

Microsoft has made clear – even during the remedy phase of this case – that it fully intends to follow its by-now familiar strategy, of "embracing, extending, and extinguishing" rival middleware threats in an effort to leverage its desktop platform monopoly into dominance of the markets for operating servers and Internet access devices, the two arenas which Microsoft currently does not dominate. Consider the company's well-advertised Windows 2000 project. This new system, developed during the course of the trial, envisions tying business customers – and eventually individual consumers – into an integrated desktop-server platform by limiting functionality of currently competing server platforms. Similarly, the company has announced plans to integrate operating systems for desktops and servers with those for access devices, producing what Bill Gates himself has acknowledged to be "an operating system for the Internet." (Quoted in The New York Times, April 8, 2000, B14).

The market for industrial-strength servers for Web sites and corporate networks is currently hotly contested. Up to now, Microsoft has lagged in this market. Its current strategy is to reconfigure its systems with the release of Windows 2000, a Windows NT upgrade previously named Windows NT 5.0. This system marks the first time Microsoft has unified the operating system kernel and code for both its primary desktop and server operating systems. The effect of this redesign is that in order to gain full functionality of the Windows 2000 desktop and server applications – including MS Office and BackOffice – end users must install Windows 2000 on both their servers and desktop computers. The technological tie-in links various heavily-used applications: media streaming, internet browsing, messaging, and web page creation. Microsoft's Windows 2000 strategy continues the company's historic pattern of using its desktop monopoly to gain a foothold

in adjacent markets and then to vanquish all competition by, among other things, exploiting technological incompatibilities that reinforce its primary desktop platform monopoly and extend that monopoly power into other markets.

In short, it is difficult to take seriously any claim that the new computing technologies threaten Microsoft's core business when the company's future strategy is built around the same concept it used against Netscape: bundling new features into the operating system, exploiting complementarities between its desktop monopoly and adjacent markets, and frustrating the compatibility of rivals' products. As we discuss below, how the Court treats this evolving corporate strategy is perhaps the most critical challenge it faces in fashioning a remedy that enhances innovation that serves interests of consumers. Moreover, Microsoft's strategy of integrating the desktop, server and Internet platforms compels the Court to consider all these environments in any decree it hands down, in whatever form (conduct, licensing or structural relief).

G. The Balance Of Risks Does Not Necessarily Tilt Toward A Conduct Remedy

Normally, the prudent course for policy makers – including courts, which necessarily take on policy making functions when deciding on antitrust remedies – to follow when confronted with rapid technological change is to act cautiously, waiting for significant market failures to emerge and then correcting them incrementally with a scalpel rather than intervening broadly. Otherwise, the risks are great that the "law of unintended consequences" will produce outcomes that are inferior to those market forces may generate.

Such a risk-minimizing strategy would appear, at least at first glance, to support a conduct-oriented decree in this case, where technological change has been at center stage. A structural remedy, in contrast, would seem to represent the riskier course.

Appearances can be deceiving. On closer inspection, several factors point in other direction. The market failure in this case has already occurred, in the form of Microsoft's anti-competitive conduct, which the Court has found thwarted innovation. In addition, through a combination of the applications barrier to entry and Microsoft's campaign to suppress competing platforms, Microsoft has maintained and increased its platform monopoly for *over a decade*, suggesting that however significant technological change in this industry has been, Microsoft's market dominance has been impervious to it.

Microsoft's current campaign to extend its desktop dominance to the server and Network access device markets ironically suggests that a conduct remedy might be even riskier, and more intrusive, than a structural remedy. In particular, if the Court's holding that Microsoft unlawfully tied Internet Explorer to Windows is upheld on appeal, then under any conduct decree, the Court will be faced later with the complicated, job of requiring Microsoft to abandon and undo its plan to integrate the desktop, server and Internet access device platform. At the very least, the Court will need to conduct further evidentiary proceedings to determine whether this plan, too, constitutes unlawful tying under Section 1 of the Sherman Act. By then, of course, it may be too late: the integration will have proceeded sufficiently far that the marketplace already will have been irreparably distorted by an unlawfully generated installed base, just as it arguably may be too late for Netscape's browser to provide effective competition in the platform market for desktop PCs.

A structural remedy that required Microsoft to split its platforms monopoly into at least three separate, but functionally identical companies – the remedy approach we prefer for reasons developed further in this brief – would address the continued evolution of Windows far more easily. The Court could afford to stay such relief, pending a final appellate ruling, confident in the knowledge that if the remedy were upheld, it could be implemented readily without requiring Microsoft to undo the integration plan. Instead, the plan itself would be effectively "cloned" at that the conclusion of the appeals by virtue of the full divestiture, and consumers would then be able to continue to reap the gains from any efficiencies or innovations that have occurred in the meantime. Moreover, such an outcome can occur even if this Court's tying conclusions are not upheld on appeal but the key part of its legal determination is retained: that Microsoft unlawfully pursued a campaign to quash competition in software applications platforms. In such a case, structural relief can and still would be appropriate for the other reasons spelled out in this brief.

In any event, the Court should recognize that the risks that conduct relief will accomplish "too little" are at least as substantial as the risks that structural relief will accomplish "too much." The major risk in a conduct decree is that the monopoly abuses and monopolization will continue, deepen, and broaden in the manner that has occurred in the last decade. A further risk of an ineffective decree is that, to the extent that Microsoft devises new monopolistic tactics in ways that are not explicitly covered by the decree, the Justice Department will be required to mount yet more investigations and trials to cover these new activities. The legal proceedings would drag on for years. Microsoft would once again defeat threats to its competitive position and present future courts with yet another

fait accompli like that posed by the Internet Explorer integration that would be difficult, if not impossible, to reverse.

For all these reasons, the Court should heed the wise counsel of Areeda and Hovenkamp in designing antitrust relief: "any plausible doubts should be resolved against the monopolist." Areeda and Hovenkamp, supra, Paragraph 653c1, at 96.

H. The Court Can Learn From Recent Experience In Other Industries And Related Situations

To the extent that the Court nonetheless still sees a structural remedy as presenting greater risks than a conduct decree, we believe that it can learn from, and be comforted by, the extensive experience that has been gained in other markets that have been deregulated over the past two decades, or where structural antitrust relief has been imposed (notably, in the case of the breakup of AT&T). It was once thought that other "network" industries – airlines, trucking, telecommunications, and electricity – either were subject to natural monopoly (as Microsoft may contend with respect to its operating system) or to market failures that warranted continued government regulation. But deregulation has proved these suppositions to have been largely incorrect. Markets once thought to be natural monopolies have in fact been opened to competition, and the result in each case has been far greater innovation and gains to consumer welfare than were projected by even optimistic observers at the time.[10]

[10] For thorough documentation of this point, see Clifford Winston, "U.S. Industry Adjustment to Economic Deregulation," *Journal of Economic Perspectives*, Vol. 12, No. 2, Spring 1998, pp. 89.

These outcomes were especially noteworthy in the breakup of AT&T, which was not popular at the time it was ordered,[11] and which some observers warned would jeopardize the integrity and reliability of the telephone network. That claim was even more serious than assertions now against any remedy "fragmenting" the Windows platform standard. In fact, critics of the AT&T breakup have been proved wrong at virtually every turn. The breakup now is widely acknowledged to have unleashed powerful forces of competition in long-distance telephone markets; to have induced policy makers to recognize (in the Telecommunications Act of 1996) that not even local telephone service is subject to natural monopoly; and perhaps most important, to have accelerated innovation in telecommunications, especially in the rapid technical development and deployment of fiber optic cable that has facilitated the rapid growth of the Internet. Indeed, having long argued that vertical integration of telephone operations, manufacturing, and research were vital, AT&T more recently has responded to new competition by voluntarily divesting Western Electric and Bell Laboratories to form Lucent Technologies.

In short, the Court should not be swayed by public-opinion polls indicating fear of possible far-reaching remedies. It is better for the Court to rely on the relevant evidence from economic and antitrust history, which indicate that competition unleashes powerful innovative forces when competition is allowed to thrive.

[11] For example, one survey reported in late 1983 indicated that, of those who understood that AT&T was going to be broken up, 41 percent thought that the breakup would make telephone service worse, while only 25 percent thought it would get better (16 percent thought it would remain the same while 18 percent did not express an opinion). Andrew Pollack, "Poll Indicates Confusion on Breakup of A.T.&.T," The New York Times, October 4, 1983, D1.

J. Reliance on Private Damages as a Remedy

Some have suggested that the threat of private damages is a sufficient remedy in the present case. The notion would be that Microsoft is likely to be pecked to death by a flock of private suits lured by the promise of treble damages. This argument for "privatizing" antitrust is defective for a number of reasons. For one thing, it is highly conjectural at this stage to know the outcomes and timing of these private lawsuits. Indeed, the time lags in such litigation are often so long that the monopoly may be able to continue engaging in anticompetitive practices for years.

More fundamentally, the major goal of remedy in a *civil antitrust action brought by the government* is to introduce competition into the monopolized market, not to bankrupt or financially weaken the offender. Additionally, those firms which never got off the ground, along with those whose innovations were stillborn, would never be compensated in private antitrust suits.

Merits and Drawbacks of Alternative Remedies

We now address the major remedies available to the Court. We emphasize that this discussion is only an overview of the principles and one based upon our knowledge about the theory and history of industrial reorganization. As we emphasized in the prior section, before settling on a final remedy, it will be necessary to analyze the alternatives in much greater depth than has been possible in the limited time available to the *amici curiae* in this brief.

In deciding upon a remedy for a Section 2 monopolization violation, it is traditional to separate the choices into three categories, conduct, licensing, and structure. In the case at hand, these would be: (1) *conduct* orders that constrain Microsoft's future

actions; (2) *licensing* remedies that modify the legal and practical rules and obligations concerning the Windows code and contracts, and (3) *structural* remedies, including a functional divestiture which divides Microsoft into separate operating systems and applications companies, and a full divestiture entailing both a functional separation and a dissolution of the operating systems division (the "monopoly dissolution"). In a case involving such widespread and persistent monopolistic abuses, the Court may find it necessary to combine two or more of these basic approaches.

A major lesson of history is to be wary of remedies that treat the symptoms rather than the causes of monopolization. Certain classes of remedies appear relatively simple and safe; these include ordering the offending monopolist to cease and desist from certain actions. Economic theory and the history of antitrust remedies indicate, alas, that conduct remedies do not fundamentally change the incentives and means of the monopolist. Add to this reality the asymmetric knowledge between Courts and defendants, the long enforcement lags, a pattern of continuing monopolizing conduct by Microsoft even to the present day, and one is left with a remedy that is likely to be as effective as giving aspirin to a brain-cancer patient with a violent headache. *The only sure and effective remedy is one which fundamentally changes the incentives and means of the offending monopolist.*

The Court should not be dissuaded from imposing a structural remedy simply because of assertions that structural remedies would be more disruptive to Microsoft, applications software developers, or even to consumers. As for Microsoft, the law is clear: "[antitrust] violators may not reap the benefit of their violations and avoid an undoing of their unlawful project on the pleas of hardship or inconvenience." U.S. v. Crescent Amusement Co. 323 U.S. 173, 189 (1944); International Salt Co. v. U.S. 332 U.S. 392,

400-01 (1947). With respect to software applications developers, it is noteworthy that the Court already has found that Microsoft's deliberate attempts to create incompatibilities in Java software have impaired innovation. Similarly, as to consumers, the Court has found (paragraph 410) that Microsoft has deprived many of a browser-less operating system option and forced them to "content themselves with a PC system that ran slower and provided less available memory than if the newest version of Windows came without browsing software." We will show throughout this section that by addressing the monopoly problem head-on through a structural remedy, the Court not only will be able to prevent Microsoft from inflicting such harms in the future, but also will promote innovation that is the interests of consumers.

It is worth recalling, as the Harvard economist and father of innovation theory Joseph Schumpeter taught, that competition is an inherently dissonant process, with the forces of creative destruction simultaneously imposing losses on incumbent technologies and firms while conferring even greater gains upon new firms and to consumers. If fear of the unknown and the costs of competition were always invoked to prevent change, then innovation – which is a paramount benefit of a truly competitive economy, one unfettered by artificial restraints of the kind found in this case – would be stopped dead in its tracks.

Before examining each of the broad remedy options in detail, we urge the Court to recognize that whatever remedy it imposes, one important element necessary to promote workable competition is to encourage the free flow of personnel from Microsoft to potential competitors. This is the analog in the software industry of free agency in major-league sports.

Most observers agree that a successful transfer of a complex technology like the

Windows operating system requires not only publication or licensing of the source code but also the ability of potential competitors to tap into the "human capital" of Microsoft programmers and engineers. While we do not have detailed knowledge about the employment contracts between Microsoft and its employees, we suspect that employees are effectively locked into their employment both by unvested stock options and by restrictions on their ability to work for competitive firms. It will be critical to unlock these employees – to turn them into free agents, so to speak – if a full and unfettered flow of human capital from Microsoft to potential competitors is to occur. This is another example of how antitrust in the new economy will require rethinking the application of the rules, for a substantial fraction of the valuable know-how is contained not only in the source code of Microsoft's software but in the gray matter of Microsoft's employees.

A. A Conduct Remedy

As we have noted earlier, the severity of Microsoft's offenses, especially in the context of the barriers to entry in the market it has monopolized and its own past behavior, merits a broad-ranging response from the Court. If that response takes the form of a decree constraining Microsoft's future conduct, we assume that in light of Microsoft's announced plans to integrate its platforms for desktop PCs, servers and Internet access devices, the scope of the decree would cover, at a minimum, Microsoft's activities related to its current and planned activities in all these environments. Furthermore, we assume that the decree would contain potentially significant fines for violations of its provisions.

1. Elements of a Conduct Remedy

We anticipate that any conduct-oriented decree would contain at least the following elements:

–A ban on all forms of exclusive dealing, whether by contract, threat, or pricing (especially “cliff pricing”, or deep volume discounts triggered when a customer nears or reaches exclusivity);

–A prohibition on attempts by Microsoft to divide markets in the future;

–Non-discrimination provisions (price and non-price) that are designed to have the effect of prohibiting Microsoft from punishing customers, partners, or other parties if they purchase non-Microsoft products;

–Provisions aimed at reducing the applications barrier to entry by requiring Microsoft to make available its application programming interfaces (APIs) to competing operating systems and applications software developers on the same basis and at the same time as it discloses those APIs to its own development staff;

–An order to unbundle Internet Explorer from Windows, as well as a broader prohibition against tying Microsoft operating systems or platforms for software applications to each other and/or to other Microsoft products or services;

–A requirement that Microsoft port its applications software, especially Microsoft Office (which is dominant in its market), to Linux and possibly other operating systems.

–Provisions aimed at ending Microsoft’s ability to “pollute” Java, either by prohibiting the company from developing its own versions of the programming language, or requiring the company to obtain approval from Sun (the developer of Java) in advance before marketing any such future developments.

–In addition, some conduct remedies might include elements of the source code or licensing remedy we discuss later. For example, the decree might require Microsoft to publish the source code of its different operating systems or provide an open-source

version of its operating systems. These provisions might be accompanied by requirements to provide full documentation and free or reasonably priced technical assistance to API users.

2. **Appraisal of a Conduct Decree**

In principle, the combination of above provisions – if complied with and/or effectively enforced – could accomplish to some degree each of the three remedy objectives we set out earlier. Most of the provisions are aimed directly at halting the practices that were found unlawful in the Conclusions of Law. In addition, the provisions relating to timely release of the APIs, a broad anti-tying prohibition, and the requirement that Microsoft port its applications software to competing operating systems also, in principle, would help reduce the applications barrier to entry and prevent Microsoft from monopolizing other markets.

The hazards in a conduct decree are many, however, hence our careful use of the caveats "in principle" and "in theory." However well drafted the decree may be, it is impossible to write language that is at once sufficiently broad (without inherent ambiguities) and specifically detailed to cover all ways in which Microsoft might circumvent the intent of the decree, and to foresee all contingencies that may arise. This impossibility is particularly evident in the complex and rapidly evolving software industry. Indeed, one major implication of the oft-heard view that the pace of change is rapid in this industry is that it will be extremely hard to impose conduct remedies and that structural remedies are more reliable.

Additionally, as we already noted, Microsoft's recent behavior provides little comfort that it will embrace any conduct decree with much enthusiasm and thus abide by

its dictates. Indeed, Microsoft Chief Executive Steve Ballmer recently declared that he did "not think we broke the law in any way, shape or form." (Quoted in The Washington Post, April 19, 2000, at E1). This is hardly the kind of statement that implies a willingness on the part of the company to refrain from exploiting whatever ambiguities a decree will inevitably contain.

Advocates of a conduct remedy can be anticipated to reply that Microsoft can be deterred from violating the decree with appropriately stiff, predetermined sanctions for doing so. That may be true for obvious violations of unmistakably clear provisions, but it is unlikely to apply to provisions that must be broad in their scope and subject to interpretation. Indeed, we had a preview of the potential for ambiguity, end-runs, and litigation in the case of the meaning of the "integrated products" provision of the 1995 consent decree. Whenever any commercially significant ambiguity arises, the Court should expect Microsoft to challenge vigorously an interpretation adverse to its interests. This is of course the company's right, indeed even its duty to shareholders, but the protracted litigation will have the consequence of cementing Microsoft's market power by allowing the company to exploit the inherent "enforcement lag" built into any decree.

Second, certain provisions designed to "fence in" Microsoft from monopolizing other markets may have undesirable side effects. Specifically, we have in mind any provision that would require ongoing supervision of new versions of Microsoft's operating systems to prevent unlawful tying in the future. Such supervision would require this Court – and most likely appellate Courts – to distinguish innovations in operating systems which, on balance, serve the interests of consumers from those that are merely "bolted on" (as the Court found to be the case for Netscape) and aimed at extending Microsoft's monopoly

into an adjacent market. If the decree were structured in a way that required the Court's pre-approval for future operating-system versions, it could chill legitimate innovation. The same result could occur even if the review occurs after-the-fact. Alternatively, if Microsoft continues to behave as aggressively as it has in the past, ex post judicial review of software might be useless if, during the inherent delay, Microsoft is able to distort irreparably the markets in which it competes.

Third, even a one-time unbundling of Windows and Internet Explorer – a seemingly obvious remedy for the tying violations – may not be effective in promoting workable competition in either the platform or browser markets (or, if they are viewed as one, then in the combined market). The reason is that as long as Microsoft continues to own the rights to Internet Explorer it can, and almost certainly would, distribute the browser for free, through the Internet or on disks or CD-ROMs. The Court could do little to stop the company from doing this without setting a minimum price for the browser – a remedy that is difficult to conceive a federal Court imposing not only for practical reasons (what price should be set?) but also because any judicially-imposed lower bound for browser prices almost certainly would make consumers worse off.[12]

Fourth, even a well-drafted decree entails significant enforcement problems, a sample of which are worth listing before addressing their consequences:

–It is easy to anticipate arguments over Microsoft's adherence to any requirement that it simultaneously release its APIs to third parties and to its own applications software developers. Even if Microsoft's applications and operating systems programmers are placed in separate buildings and their e-mails monitored ex post, there is no effective way of

[12] Given its monopoly in operating systems, Microsoft would have no incentive to offset any mandated

preventing these individuals from talking with each other over the telephone or meeting after work.

–While, in theory, it would be desirable to require Microsoft to port its applications software to competing operating systems or platform, the Court will at some point become mired in predictable complaints that the task is more difficult than initially contemplated. Even if the Court sets deadlines, Microsoft can be expected to provide testimony from its managers claiming “unexpected” technical difficulties or that bugs have slowed the company down. It will be difficult for the Court to sort out fact from exaggeration when such disputes arise.

–In order to document non-obvious violations of anti-discrimination or anti-exclusivity provisions, the government plaintiffs will require the cooperation of customers or other parties who can testify to threats Microsoft may have made. Indeed, the government plaintiffs had difficulty during the liability phase of this litigation gaining the cooperation of witnesses willing to testify against a company with whom, because of its monopoly, such parties must deal or lose their position in the marketplace. The most dangerous of all monopolies is one which customers are afraid to criticize. Looking forward, if Microsoft's dominance in platforms continues – that is, if the conduct decree is unable to offset the substantial barriers to entry – then potential witnesses are not likely to testify against the company. They will legitimately conclude that if the government, after investigating and litigating against Microsoft for roughly a decade, cannot dislodge the monopoly, it is better to live with and humor that monopoly than to take the risks of testifying against it.

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charge for the browser by lowering its prices for Windows by an equivalent amount.

In short, any conduct decree, considered against the background of Microsoft's prior behavior, runs substantial risks of at least two sorts. One is that the decree may not be effectively enforced because of difficulties in gaining evidence of decree violations. The other risk is that when disputes do arise, there will be an inherent "enforcement lag" of time required to adjudicate the matter in this Court, as well as to resolve appeals. During this period, which could easily last a year or longer, Microsoft would be able to solidify any market advantages it could gain by virtue of its conduct.

Fifth, this Court found that Microsoft had engaged in a successful campaign of unlawfully maintaining its monopoly in the platform market because it was able to build upon the applications to barrier to entry. Put another way, its unlawful conduct worked only because of the way the market was initially structured. This implies that if the Court is to get to the root of the problem it has found – the unlawful maintenance of the monopoly power – it should address the structure that enabled the monopolization campaign to work in the first instance. That is why we urge the Court to seriously consider a structural remedy.

Sixth and finally, if the Court nonetheless takes a different approach, and imposes a conduct remedy, then we have a suggestion as to how it might avoid some of the administrative problems that arose with Judge Greene's ongoing supervision of the AT&T decree. In particular, we suggest that the Court appoint a magistrate to hear disputes over consent decree violations and that a committee of technical experts assist the magistrate. Such a committee could consist of three individuals, one each appointed by the Court, the Justice Department, and Microsoft. While such an approach would probably reduce the Court's time commitment on a day-to-day basis, it bears a strong resemblance to a new

judicially operated regulatory agency, for which the Courts have little training, inclination, or perhaps even constitutional grounding.

3. **Summary**

In sum, we believe that a conduct remedy inevitably will leave ambiguities and loopholes that will allow Microsoft to continue to exploit its monopoly power through its superior knowledge and its ability to take action before litigation can prevent further faits accomplis. In addition, conduct remedies can be anti-competitive and anti-innovation, while suffering from severe enforcement problems.

Conduct remedies are appropriate when the root problem is conduct. Here, Microsoft's illegal conduct was successful in large part because it had previously acquired a monopoly that was protected by an applications barrier to entry, as the Court has found. *In other words, a monopolistic structure made it possible for a monopolization campaign to work.* To prevent future campaigns of the same sort will require a different sort of remedy, one that directly addresses the structural problem itself

B. **Source Code and Licensing Remedies**

Diverse proposed remedies, some conduct-oriented and others of a structural character, have focused on the source code underlying Microsoft's various operating systems.[13] Proposals include publication of the source codes of the major software, mandatory licensing, and requiring open-source access to major software. These might or

[13] Digital computers work on the basis of what is called object code -- complex arrays of zeroes and ones unintelligible to most if not all people. The object code is created by a program known as a compiler from source code (usually written in some language such as C++), which can be read and understood by experienced programmers. At present, the Windows source code, unlike such "open-source" programs as Linux, Java, and (recently) Navigator, is kept confidential.

might not be accompanied by requirements on documentation and technical assistance. For shorthand, we refer to this class of options as “licensing remedies.”

We have identified and will discuss briefly three licensing remedies. For reasons we have outlined earlier – namely, that Microsoft has announced plans to integrate all of the Windows platforms for desktop PCs, servers, and Internet access devices – we assume for purposes of this analysis that any source code or licensing remedy would cover not just Windows 98, but also various versions of Windows 2000 and Windows CE (or similar platforms for various Internet access devices), and would impose the requirements for provision of codes through some time in the future, perhaps 5 to 10 years.

1. Three Licensing Options

The first licensing remedy, which would complement a conduct remedy requiring non-discriminatory publication of all APIs (application program interfaces), would mandate “transparent publication” of the Windows operating systems' source code. This mandate would require publication not only of final code but also of each preliminary or “beta” version along with Microsoft’s internal documentation. With this remedy, individuals writing application programs ported to Windows would be able to study the underlying operating system code structure with which they must interface and thereby could adapt their own programs to utilize the Windows platform more effectively. Under this “publication” remedy, Microsoft would retain its copyright to the published Windows source code and could enjoin others from simply copying its code for their own commercial use.

A second licensing remedy, which would strike more directly at the structural basis of Microsoft's operating-systems monopoly, would be to compel licensing of the various

Windows operating systems source codes to third parties, who could then use all or part of those codes in their own competing software packages. Compulsory licensing of copyrighted computer software has not, to our knowledge, been used as a remedy in an antitrust case. However, compulsory licensing of key blocking patents has been widely used in more than one hundred antitrust orders.[14] In 1953, for example, Judge Forman ordered compulsory royalty-free licensing of incandescent lamp patents when he found that General Electric and its cross-licensees had amassed "an arsenal of a huge body of patents that can easily overwhelm and defeat competition."[15] In 1956, AT&T and IBM were required through consent orders to license the roughly ten thousand U.S. patents they held, including the basic patents that defined a whole new semiconductor industry. In 1975, a Federal Trade Commission monopolization case against the Xerox Corporation was settled with an order that compelled Xerox to license all of its copying machine patents at a royalty rate not exceeding 1.5 percent ad valorem.[16] Many such decrees have required the licensing of patents applied for within five years after the decree was entered along with already-issued patents (and know-how).

A third licensing remedy would require Microsoft to make available an "open-source" version of some or all versions of Windows operating systems source codes. For example, Microsoft might make available open-source versions of Windows 95, 98, NT, and 2000 – perhaps calling them "OpenWind 95," "OpenWind 2000," and so forth.

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[14] U.S. Senate, Report of the Subcommittee on Patents, Trademarks, and Copyrights, "Patents, Trademarks, and Copyrights," 1957, p. 14.

[15] U.S. v. General Electric Co. et al., 115 F. Supp. 835, 844 (1953). See also U.S. v. National Lead Co. et al., 322 U.S. 319, 338 (1947).

[16] In the matter of Xerox Corporation, 86 F.T.C. 364 (1975).

Practice in the open-source world is evolving rapidly, but some key features are that the license may not restrict any party from selling or giving away the software; that the license may not require a royalty or other fee for distribution or sale; that the source code must be published; and that derivative works must be published under open-source rules.

2. Licensing fees

One salient issue concerns the compensation paid to Microsoft for licensed use. Under one proposal, rights to replicate the Windows source code in competing operating systems would be awarded to the three highest bidders in a competitive auction, with the proceeds of the auction going to Microsoft. An alternative system would grant rights to all or parts of the Windows source code to any firm willing to pay a royalty rate on subsequent sales. The royalty rate would be set by some formula; an example would be an ad valorem rate equal to the fraction of Microsoft's 1999 sales devoted to research and development (approximately 15 percent) times the fraction of the Windows source code used in the licensee's derived products. The second proposal would permit licensees to develop operating systems with leaner functionality than Windows or to use parts of the Windows code – such as those affecting key APIs in application programs operating on alternative operating system platforms.

3. Appraisal of the Licensing Options

Each of the major licensing remedies can be viewed as weak structural remedies. They in effect change the ownership of Microsoft’s intellectual property and attempt to lighten the weight of Microsoft's oppressive thumb on the competitive process, but they do not in the short run change the actual market structure or the incentives of the monopolizing firm itself. They are analytically akin to mandatory licensing of patents,

which removes the legal monopoly from the patent, although there are important practical differences, as we will see below. However, because for the most part, Microsoft does not have a legal right to prevent emulation or reverse engineering of its software,[17] the main purpose of licensing remedies is to lower the barrier to entry into the market for operating systems.

The present *amici curiae* are not specialists in computer programming, although some of us have had more than three decades of experience in writing code for various economic and mathematical-programming applications. Based on our experience and discussions with experts, and particularly based upon our experience with technological transfer and the extensive literature on that subject, we would caution the Court that licensing the code or making it available in open-source form lowers the barrier to entry only fractionally. It is not clear whether such a step, by itself, would appreciably increase the likelihood of competition in the market for Intel-compatible platforms. We will demonstrate this as we review three possible concerns with licensing worth considering.

The first objection to compulsory source-code licensing parallels an objection we discuss later concerning monopoly dissolution of Microsoft into multiple companies that would sell competing operating systems: that the different licensees might engage in product differentiation, modifying the competing operating systems in incompatible ways,

[17] The legality of reverse engineering is determined by the intellectual property regime under which the source or engineered product operates. In the case of a product protected by a patent, the use or sale of the reverse-engineered product would be infringement. The law of trade secrets allows reverse engineering of a publicly sold product for any purpose. With respect to copyrights, the law is evolving and lies between patent and trade-secret law. In the case of copyrighted computer programs, the Courts have held that there is a limited right to reverse engineer a work to extract uncopyrightable information from the work, but our understanding is that there is not a universal right to reverse engineer computer programs for any purpose.

reducing or eliminating the advantages of interoperability among the different operating systems, and increasing the costs of porting application programs to the systems.

We discuss this issue at length below in connection with structural relief and do not find it persuasive. We believe that competing vendors of Windows operating systems would find it advantageous to maintain compatibility of most of the APIs their systems expose. Efforts to maintain compatibility might be facilitated through public standards committees, although there would be concerns with requiring Microsoft to conform to a particular set of standards for its APIs or other programming elements because of the potential detrimental impacts of such requirements on innovation.

As with many remedy issues, the questions of the costs, benefits, and likelihood of product differentiation and incompatibility are best explored through well-focused expert testimony. In hearings about alternative remedies, expert testimony could be taken as to why some standards committees have maintained interoperability while others have failed to do so and in eliciting suggestions as to how a standards approach with a high likelihood of success could be fostered.

A second objection to relying on any licensing remedy significantly to open up the operating systems market to competition relates to the code's complexity. It can be argued that an auction or mandatory licensing of Windows source codes *in theory* would enable other companies to compete directly with Microsoft in the various platform markets. However, because the source code is long, complex, and likely to be incompletely documented, outside groups *in practice* might have trouble fully comprehending its structure, implementing it effectively in competing software packages, and supporting the

packages in the future. Consequently, rivals very likely would be unable to compete with Microsoft in the market for platforms even with a license to the source code.

To have a fighting chance at turning the source code into a competitive product, outsiders would need to have extensive access to Microsoft's programmers and middle managers. Again, in principle, the Court could require good-faith documentation and cooperation, a point we address below. An alternative would be for competitors to hire away key personnel from Microsoft, but this would probably lead to a bidding war involving competitive options and cash bonuses against a firm that has $17 billion in cash reserves and immense financial resources. Even then it would be difficult for competitors to identify the appropriate individuals within Microsoft and to make sure they were not hiring the less talented staff.

A third problem with licensing remedies grows out of any requirement that a licensing agreement for a complex technology be imposed when doing so is contrary to the interest of the technology's owner – as would be the case here. Compulsory patent licensing primarily changes property rights. Compulsory licensing of computer code is analogous to ordering someone involuntarily to translate a foreign-language document. For example, suppose that the conduct remedy requires Microsoft to license and facilitate transfer of the source code of some or all of the Windows variants (95, 98, NT, or 2000). Such access is clearly inimical to the commercial interests of Microsoft, and Microsoft is therefore likely to resist a broad interpretation of the requirement, especially in providing adequate documentation for the source code. As anyone who uses modern consumer products knows, the difference between useful and useless products is often the clarity of the accompanying documentation. A poorly written manual is essentially useless. Yet there

is no bright line between adequate and inadequate documentation, just as there is no bright line between good and bad prose.

Another potential conflict would involve the requirement to provide technical assistance to the licensees. To make licensing the source code a commercially viable conduct remedy might require, particularly in the early stages, that Microsoft technicians and programmers provide good-faith assistance to other firms in interpreting and modifying the code. Trying to interpret other people's programs is not unlike trying to decipher encrypted code; it is often impossible without some kind of key, and human code-breakers are the most efficient. If Microsoft provides the necessary technical assistance only begrudgingly, this will impair the ability of other firms to adopt the code. It would be hard to decide whether poor assistance is miscreant or simply incompetent.

A further issue is whether Microsoft should be compensated for the technical assistance it is ordered to provide. If so, how much? Who will set the rates? Will this Court be dragged into adjudicating the reasonableness of the compensation arrangements? The list of such details could go on and on. The key point is that parties can easily differ on the interpretation of a requirement to provide reasonable documentation and technical assistance. No remedy decree can lay out all the contingencies that are likely to arise in the course of resolving all the issues.

Taking these different considerations into account, we believe that the licensing options will lower the barriers to entry into Intel-compatible operating systems. Our judgment, however, is that such remedies, by themselves, are unlikely within a short period of time to introduce workable competition into the market for Intel-compatible operating systems with a reasonable degree of certainty.

At the same time, we recognize in light of the secrecy enveloping Microsoft source code, it is not possible at present for outsiders to judge all of the complex issues involved in a licensing remedy. This reinforces our recommendation that the Court needs an extensive factual inquiry into the many open issues required for developing an appropriate remedy, especially one that entails elements of licensing. Any hearing on the licensing remedy should inquire how extensively the various Windows packages are modularized and documented, whether independent software experts believe the code could be assimilated and utilized commercially by outside organizations, and the extent to which developing a competitive version would require an extensive assistance from Microsoft programmers and code "architects" to implement.

C. Structural Remedies

Structural relief is the third broad category of remedies. As we have noted, there are several reasons for the presumption favoring structural remedies in monopolization cases. If the aim is to "terminate the monopoly", United States v. United Shoe Machinery Corporation, supra, at 255, then the most straightforward solution is to do precisely that: break up the monopoly in some form. This is consistent with the economic view that structural relief goes to the root of the problem, even if the problem is merely conduct that unlawfully maintains the monopoly. Such conduct would not be successful unless the underlying structure of the market in the first instance has been subject to monopoly, even if gained through lawful means. If there are significant reasons why restraining conduct or licensing remedies are not likely to be effective in undoing the terminating the monopoly – reasons which we provided earlier in this section – then the case for some sort of structural remedy is compelling.

As we proceed, it is important to keep in mind the three central goals that a relief should accomplish. First, the remedy should within a short period of time introduce workable competition into the market for Intel-compatible platforms for applications software. Second, the remedy should reduce the applications barrier to entry as a means of establishing the economic conditions that are most conducive to workable competition for operating systems. Third, the remedy should reduce the ability of Microsoft to project its current monopoly power into other markets, as a way of preventing new monopolies in those other markets and of inhibiting Microsoft from reinforcing its monopoly in operating systems. The challenge is to choose a remedy that balances these goals against the potential short-run disruption and risks that necessarily accompany any major structural change (bearing in mind our earlier caveats about the importance of not being unduly distracted by temporary disruptions).

We use the following terms below to describe three different types of structural relief:

– A *functional divestiture* would separate the operating systems from the applications and other parts of the company.[18]

– A *monopoly dissolution* would divide the operating systems company into three equal-sized companies.

– A *full divestiture* combines both a functional divestiture and a monopoly dissolution.

1. Why Substantial and Far-Reaching Structural Changes Are Necessary

Among the Court's Conclusions of Law (at 20), one was particularly critical: "Microsoft mounted a deliberate assault upon entrepreneurial efforts that, left to rise or fall on their own merits, *could well have enabled the introduction of competition into the market for Intel-compatible PC operating systems*." This conclusion indicates that a root-and-branch effort will be needed to change both the incentives and the means by which Microsoft operates. Without fundamental changes in the incentives and the means to monopolize, we expect that Microsoft will continue "trammeling the competitive process through which the computer software industry generally stimulates innovation and conduces to the optimum benefit of consumers." Id.

2. At a Minimum, Structural Relief Should Require Separation of Applications from Operating Systems

Effective structural relief requires more than a mere spinoff of the browser, in our view. At a minimum, the Court should begin by imposing what we have labeled a "functional divestiture".

More precisely, a functional divestiture would split the company into two new firms along functional lines that would track its current divisional structure. For simplicity, we assume here and below that any separation would occur by having "Microsoft" remain as the core company and retaining all rights to applications and other non-platform enterprises (the "applications company" or "AppCo"), but then requiring Microsoft to divest itself of one or more new companies which are the locus of the illegal monopolization. The operating system company (called a "Windows Company" or

[18] The term "functional" is used to rather than the common terms of horizontal or vertical because the

"WinCo") would own the Operating Systems and as such would own rights to all of the Windows platform products (Windows 98, Windows 2000, other computing platforms, such Windows CE, and platforms for various Internet access devices).

The functional separation would need to require that the applications company deal with all platform companies (including the newly spun-off Microsoft OS company) in a non-discriminatory fashion, which implies continuous monitoring. In addition, depending upon the additional remedies imposed upon the newly spun-off Microsoft OS company, it might be necessary to impose line-of-business restrictions upon the OS company.

The functional breakup would directly address the second goal of relief – reducing the applications barrier to entry – in an adequate fashion by removing both the incentives and means to raise that entry barrier. For example, we would expect that, unlike the current Microsoft, the new AppCo would be inclined to develop its Office products for alternative operating systems like Linux. In addition, if the new OS company is proscribed from developing new applications (discussed shortly), this remedy would also make a significant contribution to the third relief goal by reducing or removing the OS company's means (but not its incentives) for projecting its OS monopoly into other markets. Nonetheless, Microsoft would still be free to leverage its desktop platform monopoly into other operating systems environments, such as those for servers and Internet access devices, unless the Court prohibited this kind of activity as well (a prohibition that would be difficult to defend because of likely economies of scope in operating systems across these different environments).

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principle of division is separating along programmatic lines.

The greater flaw with a plan that imposes only a functional divestiture, however, is that it leaves the OS monopoly intact. It therefore is unable to address the first goal of relief – introducing workable competition into the market for platforms supporting applications software – which is at the core of why the government plaintiffs brought this case in this first instance and is central to the Court's Conclusions of Law. To remedy this defect, the Court must therefore add to any functional divestiture an extensive set of conduct and licensing remedies, with the weaknesses already discussed, to prevent the OS company from distorting competition in ways similar to those Microsoft has been found previously to have deployed.

In addition, in order to achieve the third relief objective – inhibiting Microsoft from monopolizing other markets – the Court would need to impose line-of-business (LOB) restrictions on the OS company, limiting it either to specific "operating systems" markets in which it may currently be engaged, or even more restrictively, to limit its market just to the Windows 98 and Windows 2000 versions. It might even be necessary to proscribe the OS company from developing competing applications, such as a new version of Internet Explorer, in order to avoid a replay of the Netscape gambit against its sibling applications company. If the Court failed to impose LOB restrictions, then it runs the risk of allowing the Windows company to leverage its market power into dominance of applications (by, among other things, limiting functionality of its OS with new non-Windows applications).

But LOB restrictions also come at a price: not only do they require constant judicial line-drawing – what is and is not an "operating system" ? – but they clearly could stifle innovation. The experience of this district Court in administering the LOB restrictions

imposed on AT&T should give the Court pause about resorting to this approach yet again. Software development is better left to the market, as the D.C. Circuit Court already has opined.

Economic theory suggests a further difficulty with the functional divestiture approach. WinCo would continue to have a monopolistic position in the sale of operating systems while AppCo would have substantial monopoly power in some important "downstream" applications programs (such as Office). When one monopoly sells a product located "upstream" to the product of another monopoly, each may maximize its own profits and set prices higher than would be the case in a competitive market, with correspondingly lower combined profits, than would be the case with an integrated monopoly (such as the present Microsoft). Carried to extremes (which functional divestiture would not reach), the stacking of monopolies vertically can lead to severe restrictions of output, such as those witnessed during the late 18th century, when "robber barons" in Germany each charged monopolistic tolls that together nearly choked off all traffic on the River Rhine.

These various considerations lead us to the view that the Court should seriously examine what we call the full divestiture as the best means for addressing all the remedy goals in this case.

4. Full Divestiture of the Microsoft Monopoly

Given the centrality of achieving the first relief objective – introducing, within a short period of time, workable competition into the market for Intel-compatible operating systems – we believe the Court must contemplate a full divestiture of the Microsoft monopoly. At the same time, however, we recognize the profound challenge the Court confronts in fashioning a remedy that "terminates" Microsoft's operating system

monopoly. For reasons outlined above, there are reasons for being skeptical that either conduct or licensing remedies will, with a reasonable certainty and in the near term, substantially reduce Microsoft's OS monopoly. Moreover, while we believe that the first ("functional") structural remedy will *weaken* the OS monopoly (along with contributing to the two other remedy goals), there is little prospect that the functional structural remedy alone will bring workable competition to the Intel-compatible OS market. It is only the weaknesses of all other remedies that incline us to recommend the court seriously consider the apparently far-reaching proposal of full divestiture of Microsoft.

The full divestiture remedy contains two elements – the functional divestiture described above, combined with a dissolution of the monopoly of the operating systems. Microsoft would divest its OS monopoly and, in turn, that monopoly would be broken into three distinct firms, each of which would at the outset have a full license to all the intellectual property of Microsoft's current OS divisions. The reason for having three competitors is that this is the minimum number of firms that would be required to have workable competition in technological alternatives and pricing, yet not so many as to fragment a market which clearly has substantial economies of scale (we discuss the issue of fragmentation further below).[19] Similar considerations governed the opposition of the Department of Defense and the Department of Justice to the merger of Lockheed-Martin

[19] The experience of having just two competitors in a market, such as the duopoly that used to exist in the wireless telecommunications business before the numbers of licenses were expanded, suggests that having two competitors in a market is not a reliable protection against monopoly. It would require at least three competitors before any significant price and/or quality competition can be expected to take hold. Moreover, particularly because significant barriers to new entrants are likely to exist for some time, having three competitors provides a margin of safety. With but two competitors, if one stumbles and fails, the market would then revert back into a full-blown monopoly.

and Northrop-Grumman, which would have left only two major aerospace systems contractors in many product fields (and was ultimately abandoned by the parties).

Many operational decisions would be required to implement the OS dissolution: we will present a concrete proposal below. The fundamental point is that this division of the monopoly, in conjunction with the functional divestiture discussed above, would completely meet the three remedy goals in the case:

– Full divestiture would create three initially identical companies producing and selling comparable and interoperable Intel-compatible operating systems. In our opinion, *full divestiture would create workable competition in the illegally monopolized market*. A small increase in the relative price or quality by one of the WinCo operating systems (say Windows A v. Windows B) could easily have a substantial impact on its sales. This undoubtedly would stimulate price and quality competition and innovation among the three companies.

– Full divestiture would essentially nullify the applications barrier to entry for the new Windows OS companies. It would not, however, reduce the barrier for new entrants into the OS market. The barrier would be removed for the three OS companies because, at the outset, developers would be able to write programs for all of the WinCos simultaneously. None of the WinCos could hope to exclude the other initially. We see little prospect in the near term, however, of lowering the barriers to entry for other non-successor companies, although technological developments might change that.

– Full divestiture would reduce any of the successor OS companies' ability to project monopoly power into other markets by reducing the monopoly power of the OS companies. For example, as we already noted, there are currently concerns that Microsoft is

using the Windows 2000 system to extend its desktop monopoly to servers. In the post-full-divestiture world, if a single WinCo attempted to develop a system that locked users into a particular and (for users) undesirable linkage of desktop and server software, the users could turn to another WinCo for a different configuration. Similarly, one of the new WinCos might decide to provide a variant of its Windows-compatible operating system that supported primarily Netscape for those users who were attracted to some features of Netscape.

In the sections below, we begin by describing how such a dissolution plan might look. We then will discuss some of the major issues raised by the full divestiture plan.

a. Full divestiture: Operational Details

The model we describe in this section represents only the equivalent of an "artist's sketch."[20] To be fully implemented, it would need to be filled in and modified through extensive analysis by financial, organizational, and industry specialists; additionally, it would require information from those who are familiar with the company's contractual and organizational structure, much of which is not publicly available. Nonetheless, we provide this sketch in an effort to show that there exists a structural approach meeting all of the remedy goals in a more satisfactory fashion than alternative remedies and that it is sufficiently practical to be worthy of serious contemplation. At the same time, we believe that only a careful and thorough review of this and the prominent alternative remedy proposals, through a process we have already suggested, can provide

[20] Our discussion of this model draws heavily on the proposal outlined in Thomas M. Lenard, Creating Competition in the Market for Operating Systems: A Structural Remedy for Microsoft (Washington: The Progress & Freedom Foundation, January 2000).

sufficient supporting detail to assure the Court that this (or indeed any) remedy proposal is best suited to meet the major remedy goals.

We emphasize eight components that make up the full divestiture option:

1. From a legal and financial point of view, the plan would consist first of the functional divestiture as described above. The functional divestiture would keep Microsoft as the core company retaining all applications and force a divestiture of Windows and other operating systems into an Operating Systems (OS) company. The OS company, or WinCo, would then be split up into three identical companies, each having ownership of the intellectual property rights of all Microsoft operating systems (discussed further in step (3) below).

2. The applications company, or AppCo, would retain rights to all major applications, including Office, BackOffice, and Consumer Software. The placement of Internet Explorer (IE) depends upon the details of the divestiture remedy. There is a case for leaving IE with the WinCos only if they are demonopolized. We regard IE as a distinct product or application that is economically bundled but technically integrated. Moving IE to the OS companies would break up what is rapidly becoming a monopoly product, would stimulate competition for browsers, and would prevent the disruption, contractual holdups, need for conduct remedies, and other problems that might arise if IE were placed in the AppCo and therefore retained its significant market power.

3. The WinCos, or operating systems companies, would keep all rights to Microsoft's current operating systems or platforms: Windows 95, 98, 2000, NT, CE, and other systems in the pipeline for Internet access devices and other uses. The current employees and middle management working in Microsoft’s platforms division would be

divided equally among the three WinCos.[21] The contracts between Microsoft and other firms would also be divided equally among the three successor OS firms.

4. Each current shareholder of Microsoft would receive four new shares, one in each of the four companies. Major shareholders would be required to divest their ownership in the shares of the three companies. Each company would have its own non-overlapping management and board of directors. According to the 1999 financial statistics for Microsoft, total operating revenues were $19.7 billion, of which 43 percent came from "Windows platforms," 45 percent from "productivity applications and developers," and 12 percent from "consumer and other." Of the 31,396 employees, 12,090 were in "product research and development."

5. Microsoft currently has substantial cash assets (approximately $17 billion as of June 1999). Division of the cash assets is problematic to the extent that Microsoft's deep pockets have financed its predatory actions. In whatever structure the Court finally decides, therefore, care should be taken to ensure that the vast cash resources of the company are not lodged in an entity that can use them for anticompetitive purposes, such as financing predatory innovation or predatory pricing. One possibility would be to have a substantial part of the reserves set aside for a decade for any private liability damages determinations (with liability split proportionally among the companies according to revenues or some or other reasonable benchmark). In the full divestiture approach, we would favor removing

[21] Division of Microsoft's employees would pose concerns similar to those that arise in trying to promote competition among major-league baseball or football teams. One desideratum is that the three Windows teams be as nearly equal as possible and that each be able to run the operating systems. The second issue is a strategic one: asymmetric information between the current managers and others should not allow current managers to cherry pick the best employees and set them up in one company which will rapidly dominate the new OS market. Without going into detail into proposals, we believe that there are relatively straightforward procedures for meeting both of these objectives by using "cake-cutting" algorithms such as "you divide, I choose."

most of the cash that was not set aside from the AppCo to the new WinCos. This would reduce the financial resources for predatory actions by any lingering monopoly AppCo and facilitate building new campuses and hiring of additional staff by the WinCos. It might also be necessary to use the cash reserves to liquidate employee stock options as a means of promoting inter-firm mobility of labor. To the extent that the cash reserves pose an anticompetitive danger, they should be returned to shareholders either through a substantial forced dividend or as stock buybacks. If the Court refrains from structural measures, it should consider measures to reduce Microsoft's excess cash in any case.

6. In the new structure, the initial market share of each of the new Windows operating systems companies would be around 31-32 percent of the Intel-compatible OS market and less than 30 percent of the market for web browsers. While this structure still qualifies as "extremely concentrated," we believe that such a market structure has in the past and is likely in the future to sustain vigorous competition in the relevant segments of the software industry. The AppCo would continue to have an extremely high market share for several applications, such as Office suites. However, there were no violations concerning applications outside of Internet Explorer in the Conclusions of Law, so there are no liability grounds on which to challenge the monopoly on applications other than Internet Explorer.[22]

7. The intellectual property, employees, non-fungible tangible assets, and management of the current OS division would be licensed or divided into three parts kept as equal as possible (for example, by allocating software teams in a manner similar to the

[22] There is a legal question as to whether the existence of an "applications barrier to entry" is grounds for taking affirmative steps to lower that barrier. We do not rely on such an argument to motivate the

way sports teams solicit players). This would ensure that each WinCo would start on a level playing field relative to the others. It is likely, but not certain, that such a regrouping would allow each WinCo to have a sufficient body of talent and expertise to support an operating system and to support the research necessary for vigorous innovation in developing new and improved operating systems. The distribution of sufficient amounts from Microsoft's cash reserves would allow each of the WinCos to be assured a smooth startup.

8. Depending upon the exact configuration of the dissolution, there will be a need for some minimum conduct restraints during the near term. These would include prohibitions on recombination among any of the four companies, non-discrimination requirements on licensing unique products, limits or oversight on hiring of employees from the other WinCos, and prohibitions of cross-ownership among the top management. Because the structural relief would remove or reduce the incentives and means for monopolization of operating systems, the full divestiture remedy would minimize the necessary scope and length of legally supervised conduct remedies.

b. Overview of Discussion of the Full Divestiture Plan

Clearly, the full divestiture including a dissolution of the operating system monopoly discussed in the last section represents a far-reaching approach to remedying Microsoft's entrenched illegal monopoly. This section addresses some major issues raised by the proposal. *At the outset, we emphasize that comparisons are potentially misleading because there is a natural tendency to compare the remedy with the status quo, whereas the appropriate comparison is with other remedies.*

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divestiture proposal. However, if such an argument applied, it would strongly reinforce the need for legal

Although, on the surface, the full divestiture plan may appear to be novel, we will describe shortly that it is the logical application of antitrust law to the "new economy" in which value is based on informational assets rather than physical assets. Moreover, we believe that a break with current arrangements comparable to this plan will be necessary to meet the relief goals. Accordingly, the plan is one that in the long run holds the best prospect of terminating the illegal monopoly, increasing the range and quality of software available to consumers at reasonable prices, denying to the defendant the fruits of its illegal activity, ensuring that the defendant has neither the incentive nor the means to maintain or leverage its monopoly in the future – all the while minimizing the burden on the judiciary to maintain a full-time quasi-regulatory vigil to make sure that any demonopolization effort is successful.

Consider first meeting the goals of antitrust relief in this case The major virtue of a full divestiture approach is that it would address each of the three major relief goals. It would introduce effective competition into the market for Intel-compatible operating systems, which is the major offense in the Conclusions of Law. In addition, provided the applications company is subjected to a non-discrimination requirement in dealing with each of the three OS companies (as well as other providers of platforms for applications software), the full divestiture (like the functional breakup) would reduce the severity of the applications barrier to entry. And finally, because it would end the monopoly in operating systems, the full divestiture would effectively preclude Microsoft from extending its current platform monopoly into other markets.

c. Antitrust Remedies in the New Economy

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separation between operating systems and applications.

We are aware that the dissolution of a powerful company into three equally-sized entities may strike some at first reading as a fanciful "ivory tower" construct that lies beyond the pale of reasonable remedies. But this remedy is one that necessarily reflects the evolution of our economy from one based primarily on tangible or natural-resource assets to one based increasingly on informational assets. *In other words, the rules of antitrust have not changed, but they need to be applied in a different fashion to the new-economy firms.*

In several key structural cases of the 20th century,[23] monopolies were based on physical assets, sometimes networks that contained many of the elements of exclusion, tie-ins, network barriers, and network economies that are present in this case. In the AT&T case, for example, MCI was excluded by its inability to connect into AT&T's physical network of local operating companies. AT&T's unique asset was an extensive and expensive network of lines, satellites, regulatory monopolies, and easements that could have been reproduced only if a competitor were willing to spend at least $100 billion on new facilities to reproduce the system. Moreover, the assets could not have been replicated at a cost that was substantially less than that enormous amount. The unique asset could be dismantled, piece-by-piece and region-by-region so to speak, thereby removing the impediments to competition. But it could not have been reproduced through a dissolution without enormous expense.

In the present case, the unique asset is "informational capital" rather than tangible capital. Informational capital like software has a crucial difference from tangible capital in that it is expensive to produce and inexpensive to reproduce. Earlier physical-capital-

[23] We include in this list Standard Oil, American Tobacco, U.S. Steel, Alcoa, and AT&T.

intensive monopolies could be broken up, but they could only be reproduced at extraordinarily high costs. Informational capital in software like the Windows operating systems can be replicated at a cost that is far lower than the costs of developing it. The costs are not zero, because some of the informational capital is embodied in people who have developed or are operating the software, and are therefore necessary for understanding, further developing, and adapting it to new uses. Still, the costs of creating a new and independent operating system are modest relative to their original development costs – a major difference from the industries previously subject to divestiture orders.

The informational nature of Microsoft's assets therefore motivates a completely different approach to structural reform. Once this point is grasped, we see that the monopoly dissolution has important precedents in conduct and licensing remedies even though there are no important precedents in major structural cases. Close relatives of dissolution can be found in remedies which mandate the licensing of patents. In essence, these are cases where demonopolization of intellectual property has occurred by dissolving the grant of exclusive authority to the patent holder and giving other firms open or widespread access to that property.

Here, we believe the far-reaching nature of Microsoft's unlawful monopolization campaign, coupled with the problems entailed in the licensing approach that we have outlined, tilt the scales toward a structural approach instead. This is especially the case given the intangible nature of Microsoft's asset base. *A dissolution of the kind proposed for Microsoft's operating system monopoly was not relevant in many major structural cases in the past, where the value of the firms involved derived from their physical assets. Dissolution is the logical extension of physical or regional divestiture for companies based*

largely on tangible assets to a company whose value is based largely on intellectual and informational assets.

d. The Issue of Fragmentation

One criticism of a plan that would break up Microsoft's OS division is that it would fragment what is the current dominant standard and would lead to incompatible operating systems. We have witnessed the development of two incompatible operating systems between Apple and Intel-Microsoft, and that pattern of divergence might well emerge among future Windows descendants in the future.

Whether market processes necessarily lead to optimal standards is a complex question. Scholars have determined that because of "standards externalities," which are similar to "network externalities," markets often will not provide the optimal degree of standardization. However, there is no hard and fast rule as to whether markets always will provide too little or too much standardization.

A major exception to the tendency for technological convergence is the Apple-Windows incompatibility. But this incompatibility is probably grounded in Apple's determination to protect its hardware from being overwhelmed by the Intel-Windows hegemony (after it was established), not by a desire to maximize software product differentiation. Nonetheless, there is a growing one-way compatibility (from Windows to Apple) through "interpretation" or "bridging" programs, showing the powerful tendency for the non-dominant systems to become compatible with the de facto standard despite strong resistance from the designer.

We suspect that in the present case – marked by strong economies of scale in developing operating systems and powerful network externalities due to consumers' desire

to have operating systems that are able to support large numbers of applications – there is a powerful tendency toward a single OS standard. Therefore, during some reasonable period of time following monopoly dissolution, each of the WinCos would have strong incentives to remain compatible with each other – to maintain common APIs – so that applications software developers will be able to write programs for each operating system with minimum additional porting costs.

At the same time, however, there is a danger that the new structure we are proposing will gravitate toward the current structure. That is, one of the WinCos might innovate so rapidly that it will outstrip the other two companies, producing a new and vastly superior operating system that the other WinCos cannot imitate or reverse engineer, and move to a position of market dominance similar to that of Microsoft today. It is impossible to predict whether or not a new market dominance would occur, but there would be no legal objection to this scenario if the company were to gain market dominance through "superior skill, foresight, and industry." However, if the firm were to gain market dominance through anti-competitive means, this would once again trigger antitrust attention, although new WinCos would be well aware of Microsoft's experience in this litigation, and thus would have at least some incentive to behave differently.

While remonopolization is a concern, it is also clear that the potential for sustained monopoly under the full divestiture proposal is far less than under any alternative remedy. Under the full divestiture remedy, *the market at least begins with a workably competitive structure*. Therefore, compared to the current situation, or to situations with a Microsoft OS monopoly burdened by conduct restraints, as would occur under conduct, licensing, or

partial divestiture proposals, the full divestiture remedy has the best chance of developing a workably competitive market for operating systems.

e. Higher porting costs

A criticism related to the fear of fragmentation is that the full divestiture proposal would entail costs to consumers exceeding the pro-competitive and pro-innovation benefits – primarily because separating Microsoft's OS operation into multiple firms would raise the "porting costs" of developing of applications software.

Along with other major questions, this question deserves further examination in any evidentiary process the Court may establish. However, while we have not examined the empirical evidence in depth, we believe that the favorable impacts on innovation are far more important than possibly increased porting costs. [24]

Moreover, the argument emphasizing high porting costs rests on the assumption that fragmentation will quickly emerge. In the short run, *porting costs will be unaltered* because each of the WinCos will be using the existing APIs. As operating systems evolve over the longer run, each WinCo will have strong economic incentives to retain common APIs, in which case the porting costs remain unchanged. Moreover, in the near term, none of the three WinCos would have sufficient market power over applications developers to be able to impose new proprietary protocols that did not offer significant technical advantages.

[24] Stan Liebowitz, *Breaking Windows: Estimating the Costs of Breaking up Microsoft Windows,* April 30, 1999 estimates that applications producers would face an increase averaging $4.8 billion per year in porting costs over the next three years for each new operating system. We have not examined this number or established its reliability. We note, however, that if these estimates are correct, they would be low relative to final annual expenditures on computers and software, which were $241 billion in 1999 (Bureau of Economic Analysis). An increase in the value to consumers and businesses of computers and software of only 4 percent from improved quality, higher innovation, greater choice, and lower price would offset the estimated higher porting costs for two additional operating systems. We note as well that the rate of technological change and of price decrease in the information sector (computer hardware, computer software, and telecommunications equipment) has been on the order of 10 to 20 percent *per year*, so the

Over the longer run, the porting cost trends depend upon whether operating systems tend to diverge or remain interoperable. *We emphasize, however, that divergence in operating systems is not necessarily harmful to consumers.* What is denigrated as "fragmentation" is more accurately described as "product differentiation," such as occurs in most industries in a progressive market economy, as for example automobiles, VCRs, communications devices, televisions, cameras, most computer software, pharmaceuticals, apparel, breakfast cereals, and even tomatoes.

Indeed, the market for operating systems arguably has provided *insufficient product differentiation* precisely because of Microsoft's monopoly, the applications barrier to entry, and Microsoft's unlawful conduct. The relative paucity of low-end operating systems is one example of insufficient product differentiation. Microsoft's philosophy is akin to that of pre-divestiture AT&T, which held in effect that consumers could have any phone they wanted as long as Western Electric made it and its color was black.

In our view, the Court should view favorably the prospect of competition and innovation that will lead to product differentiation in the market for operating systems. However, the potential for costs to consumers of new technologies is real. New and superior technologies often mean that old investments – in areas such as scythes, horse-drawn carriages, kerosene lamps, typewriters, vinyl records, wooden skis, black-and-white televisions, or 5 ¼ floppy disks – become worthless except as antiques. Yet few are the cases where people yearn for the flickering light of the kerosene lamp, the scratchy sound of their 78-rpm records, or the endless pile of floppy disks. *We should embrace the opportunity for innovation and product differentiation in the market for operating systems*

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impact on innovation is likely to dominate the issue of porting costs.

when the differentiation arises from a competitive process in which each OS company seeks to offer the best operating system for its target category of users.

f. Loss of Value to Shareholders

Another possible concern about the full divestiture remedy is that it will impose potential financial losses on Microsoft's shareholders because it will reduce the value of Microsoft's intellectual property. This is an important question and one worthy of further inquiry.

As of April 26, 2000, the market value of Microsoft shares was $361 billion, which was approximately 3 percent of the market value of all publicly traded U.S. corporations. Insiders owned 26 percent of shares.

Microsoft has enjoyed an extraordinarily high market value for two reasons. First, it has high profits, $7.8 billion after taxes in the last accounting year. Second, it enjoys a high price-earnings (P/E) ratio of around 42, as compared to an average price-earnings ratio of around 30 for the 500 stocks in the comprehensive Standard and Poor 500 index. Microsoft's market value could fall either because its earnings decline or because its P/E ratio (anticipating a decline in future earnings growth) recedes.

The record of stock market performance in major structural cases in the past is somewhat surprising. In two of the most far-reaching structural cases, those involving Standard Oil and AT&T, the market value of the successor companies rose after divestiture. Predicting the impact of a full divestiture on the market value of Microsoft's share is difficult, but one feature here is significantly different from earlier cases. AT&T was a regulated monopolist, and its regulated profit rate was held below free-market levels.

Since divestiture was accompanied by substantial deregulation, it should not be surprising that the profits of the successor firms and their stock values rose post-divestiture.

Microsoft's case is quite the opposite, for it has an astonishing rate of profit on its investments. For comparison purposes, we have shown in an appendix to this brief the rate of return for both Microsoft and for all U.S. nonfinancial corporations. Because Microsoft's primary assets are intangible rather than tangible, we have included in Microsoft's assets intangible investments in research and development (which include primarily software development) along with its property and equipment. For all nonfinancial corporations, the capital stock includes reproducible tangible plant, equipment, and inventories, but excludes research and development. Because research and development is a small fraction of investment for "old economy" firms, the impact of excluding research and development from the aggregate is quite small.

Over the period 1990-98, the post-tax rate of profit of U.S. corporations averaged 6.7 percent per year. Using published numbers from Microsoft's financial statements, we estimate that in 1999 Microsoft's post-tax rate of profit was 88 percent. *In other words, Microsoft's rate of profit on its investments is currently more than thirteen times the average rate of profit of major U.S. corporations.* This is the most impressive economic demonstration of the economic returns to monopoly that we have ever seen in a major antitrust case.[25]

[25] For reasons that escape the present amici curiae, no evidence on the rate of profit appears to have been introduced in the liability phase of the case. There was evidence on profit margins, but these have little bearing on the question of monopoly profits, which refers to a supernormal return on investment above the opportunity cost of funds. The Appendix also discusses why the rate of profit rather than the profit margin is the appropriate measure of monopoly profits.

Four points are relevant to concerns about a substantial decline in the market value of Microsoft's shares. The first question addresses the sources of any potential reduction in Microsoft's profits. In part, Microsoft's extraordinarily high current profit rate may be due to its luck, superior skill, and foresight. But much of its profits undoubtedly arises from its illegally maintained monopoly power. If workable competition succeeds in driving down the profits of the successor companies by a substantial amount because Microsoft is "denied the fruits of its statutory violation," then the decline in value would testify that at least part of Microsoft's extraordinary market value reflects its illegally gained monopoly profits.

Second, attentive investors were aware of the legal and financial liability and should have adjusted their portfolios to reflect the commercial risks involved.[26] The decline in Microsoft's share price since the Court's Conclusions of Law were announced suggests that this process of price adjustment already is underway.

Third, we do expect that Microsoft's earnings will decline with the monopoly dissolution as a result of the reduction in the value of its intellectual property in operating systems. The decline will come about primarily because the monopoly becomes a "triopoly" and not because other firms appropriate the value of Microsoft's property. In other words, the gainers will be consumers just as the losers up to now were largely consumers. But this loss in profit should not be overstated. To begin with, 57 percent of Microsoft's revenues come from sources other than operating systems. Microsoft's applications division has also been a highly profitable division. We expect that the new OS

[26] Although in this respect investors had little useful guidance from Microsoft, which stated in its second quarter form 10-Q that "Management currently believes that resolving these [legal] matters will not have a material adverse impact on the Company's financial position or its results of operations."

divisions will rapidly begin to produce different products and make a normal return on their investments. But the most important response to this concern is that to the extent that the reduction in value comes from dissolving an illegal monopoly, this is the result of a remedy which is designed to deny to the defendant the fruits of its statutory violation.

Fourth, and most important from a remedial perspective, is that a reduction of Microsoft's monopoly power from increased competition would not only reduce Microsoft's monopoly profits but would also lead to income and economic gains elsewhere in the economy. Moreover, there are strong grounds for believing that the gains elsewhere would more than offset the losses in Microsoft's profits. Consumers and other businesses would gain from lower prices, faster innovation, and greater product variety, and these gains would be larger than the lower earnings that would accrue to Microsoft's owners.

Conclusions

The undersigned *amici curiae* are intervening because we believe that the Microsoft case presents far-reaching issues for the economy and for antitrust law.

A well-designed remedy is of central importance because information technology has provided the cutting edge of the current resurgence in productivity and economic growth in the American economy during the late 1990s. In the last two years, investments in information-processing equipment and software have totaled $760 billion. Growth in these investments has amounted to fully one-quarter of the growth of real gross domestic product for the American economy. Computers are in virtually every American classroom, and more than half of American workers use computers in their jobs. Advances in computation and software are spurring investment and productivity, curbing inflation, increasing real incomes, and boosting our competitiveness in the world economy.

Yet the central processing system of our new economy has a major flaw. The company that produces the dominant operating system for the personal computer has been found guilty of serious economic offenses: it has maintained its monopoly in personal-computer operating systems by illegal anticompetitive means and has attempted to monopolize adjacent markets. As this Court wrote in its Findings of Fact (paragraph 412), Microsoft has demonstrated that "it will use its prodigious market power and immense profits to harm any firm that insists on pursuing initiatives that could intensify competition against one of Microsoft's core products," its conduct "deters investment in technologies and businesses that exhibit the potential to threaten Microsoft. " As a result "some innovations that would truly benefit consumers never occur for the sole reason that they do not coincide with Microsoft's self-interest." We know that Microsoft worked to "cut off the air supply" of its browser rival, but we cannot know how many other firms and innovations were stillborn because of the chilling effect Microsoft's conduct has had on adjacent markets.

How should antitrust law respond to monopolistic abuses in the new economy? Antitrust must recognize the evolution from an economy based on tangible assets to one based on informational assets. The fundamental rules of antitrust need not change, but they need to be modified for new-economy firms. The enduring rule, tested and proven in the crucible of law and economics, is that monopolies are dangerous when they have repeatedly demonstrated a willingness and ability to abuse power – a finding that translates into economics the political dictum that absolute power corrupts absolutely.

The Microsoft monopoly is centralized in a way that earlier monopolies like Standard Oil or AT&T were not. A centralized monopolist such as Microsoft endangers our

economy because it lacks the robustness of decentralized systems and is unaccountable either through the ballot box or the market place. Dispersal of power has been a guiding principle of American political philosophy and economic practice since the founding of our Republic. Senator John Sherman forcefully stated this point in his principal speech supporting the 1890 Sherman Act:

> If the concentrated powers of [a trust] are entrusted to a single man, it is a kingly prerogative, inconsistent with our form of government, and should be subject to the strong resistance of the State and national authorities. If anything is wrong this is wrong. If we will not endure a king as a political power we should not endure a king over the production, transportation, and sale of any of the necessaries of life.

Respectfully submitted,

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April 27, 2000

Appendix on Rate of Return on Investments of Microsoft and Domestic Nonfinancial Corporations

This appendix describes the estimates of the rate of return on investments for Microsoft and for all domestic nonfinancial corporations.

All domestic nonfinancial corporations

The estimates for all domestic nonfinancial corporations come from the Bureau of Economic Analysis (BEA) of the Department of Commerce. ("Note on Rates of Return for Domestic Nonfinancial Corporations, 1960-98," Bureau of Economic Analysis, Washington, June 8, 1999, mimeo.) Table 1 below, drawn from that source, provides the basic results for 1990-98. From this table, we see that the post-tax rate of return for the most recent period for which data are available, 1990-98, was 6.7 percent per year (= 8.7 percent total return minus 2.0 percent for taxes).

Microsoft

For Microsoft, we draw upon its financial statements and calculate the rate of profit on operations for the last full year, fiscal year 1999. Table 2 shows the calculations.

Discussion

The estimates of the rates of return have two conceptual differences that should be noted. First, BEA does not capitalize investments in R&D in its core accounts. Consequently, the profit and capital estimates for all nonfinancial corporations do not include research and development whereas Microsoft's do. Sensitivity analyses using the National Science Foundation's data on industrial R&D indicate that the impact on the overall rate of return of nonfinancial corporations of capitalizing R&D would change the

profit rate only slightly because R&D is a relatively small share of investment for most "old-economy" corporations. Another set of calculations using data for large publicly held firms also finds that capitalization of R&D makes little difference to the average rate of return. Second, the BEA numbers use a replacement cost valuation for capital, whereas Microsoft uses a historical cost of capital for plant and equipment. Because Microsoft's investments are largely computers, we expect that the difference between the two approaches will be small. We have also applied the historical-cost methodology to Microsoft's research and development.

Results

The latest financial data indicate that Microsoft's post-tax rate of return on invested capital and research and development was 88 percent for the fiscal year 1999 (ending June 30, 1999). By comparison, the rate of return on invested capital for all U.S. domestic nonfinancial corporations was 6.7 for the period 1990-98. Therefore, Microsoft's rate of profit was more than thirteen times that of the average of U.S. corporations.

Why Rates of Profit Are Preferable to Profit Margins for Measuring Market Power

The liability phase of the case contained a discussion of profit margins. These are not the appropriate concept for measuring monopoly profits. In competitive markets, the profit rate on investments will tend to the opportunity cost of capital (with appropriate adjustments for differences in risk, inflation, and taxes). If a monopoly earns supernormal profits, that will be seen in its rate of profits.

The profit margin is equal to the rate of profit on investments times the ratio of the investments to sales. The investments-sales ratio is essentially a nuisance parameter that

confuses the calculation and has no particular relationship to the exercise of market or monopoly power.

Therefore, in order to measure whether a monopolist has been successful in earning monopoly profits, the appropriate analytical concept is the rate of return on investments and not the profit margin.

Table 1.--Rate of Return and Income Share, Domestic Nonfinancial Corporations, 1960-98

[Percent]

Year	Rate of return: Property income: Total (1)	Rate of return: Property income: Profits from current production: Total (2)	Rate of return: Property income: Profits from current production: Profits tax liability (3)	Rate of return: Property income: Profits from current production: Profits after tax (4)	Rate of return: Property income: Net interest (5)	Share of domestic income: Property income: Total (6)	Share of domestic income: Property income: Profits from current production (7)	Share of domestic income: Property income: Net interest (8)
1990..	8.0	5.2	1.8	3.4	2.8	17.1	11.1	6.0
1991..	7.5	5.0	1.6	3.4	2.5	16.2	10.8	5.4
1992..	7.3	5.4	1.7	3.7	1.9	15.4	11.4	4.0
1993..	7.7	6.1	1.8	4.2	1.7	16.1	12.7	3.5
1994..	8.9	7.3	2.1	5.1	1.6	18.0	14.8	3.3
1995..	9.3	7.7	2.2	5.5	1.6	18.8	15.5	3.3
1996..	9.8	8.2	2.3	6.0	1.5	19.5	16.5	3.0
1997..	9.9	8.5	2.4	6.1	1.4	19.4	16.7	2.7
1998..	9.6	8.3	2.2	6.0	1.3	18.5	15.9	2.5
Average:								
1990-98..	8.7	6.9	2.0	4.8	1.8	17.7	13.9	3.7

NOTE.--Columns 1-5 are percentages of the net stock of reproducible assets (averages of end-of-year values for adjacent years) valued at current-replacement cost. Columns 6-8 are percentages of domestic income.

Source: Bureau of Economic Analysis.

Table 2. Calculation of Rate of Return on Invested Capital and Research and Development for Microsoft

Fiscal Year Income Statements

in millions, except percent return and tax rates

		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99
1	Revenue	$140	$198	$346	$591	$805	$1,186	$1,847	$2,777	$3,786	$4,714	$6,075	$9,050	$11,936	$15,262	$19,747
2	Operating expenses:															
3	Cost of revenue	30	41	78	158	220	273	410	581	785	1,077	1,346	2,145	2,170	2,460	2,814
4	Research and development	17	21	38	70	110	181	235	352	470	610	860	1,326	1,863	2,601	2,970
5	Acquired in-process technology														296	
6	Sales and marketing	43	57	81	152	205	300	490	758	1,086	1,135	1,564	2,185	2,411	2,828	3,231
7	General and administrative	9	18	22	24	28	39	62	90	119	166	267	316	362	433	689
8	Other expenses	0	0	14	14	10	14	16	11	7	16	16	19	259	230	115
9	Total operating expenses	99	137	233	418	573	807	1,213	1,792	2,467	3,004	4,053	5,991	7,065	8,848	9,819
10	Operating income	41	61	113	173	232	379	634	985	1,319	1,710	2,022	3,059	4,871	6,414	9,928
11	Investment Income	2	5	8	11	19	31	37	56	82	102	191	320	443	703	1,803
12	Noncontinuing items	0	0	0	0	0	0	0	0	0	(90)	(46)	0	0	0	160
13	Income before income taxes	43	66	121	184	251	410	671	1,041	1,401	1,722	2,167	3,379	5,314	7,117	11,891
14	Provision for income taxes	19	27	49	60	80	131	208	333	448	576	714	1,184	1,860	2,627	4,106
15	Net income	24	39	72	124	171	279	463	708	953	1,146	1,453	2,195	3,454	4,490	7,785
16	***Fiscal Year business division revenue***															
17	Windows Platforms													$4,917	$6,279	$8,504
18	Productivity Applications and Developer													5,615	7,041	8,816
19	Consumer and Other													1,404	1,942	2,427
20	Total revenue	$140	$198	$346	$591	$805	$1,186	$1,847	$2,777	$3,786	$4,714	$6,075	$9,050	$11,936	$15,262	$19,747
	Stocks of Capital and R&D	***85***	***89***	***109***	***157***	***236***	***370***	***531***	***777***	***1091***	***1483***	***2046***	***2963***	***4234***	***5988***	***9371***
21	Property and equipment															1611
22	Stock of Research and Development	85	89	109	157	236	370	531	777	1091	1483	2046	2963	4234	5988	7760
23	R&D depreciation	17	17	18	22	31	47	74	106	155	218	297	409	593	847	1198
	Net Income Corrected for R&D															
24	Operating income	41	61	113	173	232	379	634	985	1319	1710	2022	3059	4871	6414	9928
25	Effective tax rate (fraction of income)	0.442	0.409	0.405	0.326	0.319	0.319	0.310	0.320	0.320	0.334	0.329	0.350	0.350	0.369	0.345
26	Operating income after tax	23	36	67	117	158	258	437	670	897	1138	1356	1987	3166	4046	6500
27	Net investment in R&D		4	20	48	79	134	161	246	315	392	563	917	1270	1754	1772
28	Corrected net income including R&D		40	87	165	237	392	599	916	1212	1530	1919	2904	4436	5801	8272

29 Rate of return (as percent of stocks of capital and R&D) ***88%***

Assumptions:

Notes to calculations:
Lines 1 through 20 from Microsoft's financial statements at www.microsoft.com
Line 21 from Microsoft's balance sheet at www.microsoft.com.
Line 22 uses declining balance method with a depreciation rate of 20 percent per year. First year set at 5 times initial R&D.
Line 23 calculates depreciation as the declining balance depreciation rate times previous year's stock of R&D.
Line 24 from line 10 above.
Line 25 equals line 14 divided by line 13.
Line 26 equals line 24 times one minus the effective tax rate.
Line 27 is the net investment in R&D.
Line 28 adds back net investment in R&D into net income.

Source: Microsoft’s financial statements and calculations as described in text of Appendix.