A Fool's Paradise

The Windows World After a Forced Breakup of Microsoft

Authored by:

Stan J. Liebowitz

Professor of Economics
Management School of the University of Texas at Dallas

Presented by:

Association for Competitive Technology

February 25, 2000

I. Introduction

The debate surrounding the Microsoft antitrust case is focusing more and more on "remedies" that might be imposed on Microsoft. When trying to "remedy" an industry that has contributed so much to U.S. economic growth over the past five years and is characterized by rampant innovation and high customer satisfaction, it is imperative that any regulatory intervention be taken with great care.

Any proponents of dramatic remedies should be held to a high burden of proof that their remedies do more good than harm. At a minimum they should quantify the harm being caused to consumers—in this case, by Microsoft. Second, they must show the intransient nature of the problem at hand, because natural market evolution is always preferable to market intervention, all else being equal. Third, the proponents of a dramatic remedy need show that their proposal would in fact alleviate the harm they identify. Finally, it is imperative that the costs of the cure be less than harm from the disease. When economists venture into the real world to advocate public policy, the stakes increase considerably above our usual ivory tower musings, as must our sense of responsibility for our recommendations.

In the spring of 1999 I conducted a study for the Association for Competitive Technology (ACT) and The ASCII Group in which I examined the costs of forcing a breakup of Windows into three competing operating systems that I will call WinCos. I focused narrowly on the extra costs to developers from having to write new code, support, test, and market multiple versions of their products, a set of costs that I will often lump together under the term porting costs.[1] I concluded that these costs would be at least $30 billion over a three-year period. I did not attempt to quantify the very substantial additional costs to consumers of having to deal with an artificially fragmented standard,

[1] It is important for the reader to understand that even small differences in compatibility can impose significant costs. Software support, for example will require a different database of known problems, different machines to mimic problems encountered by users, and different specialists to answer questions about the two somewhat incompatible operating systems. Testing for problems with the program, which is a large component of development cost, has to be done separately for each operating system. Packaging, instructions, and so forth require duplication and extra cost.

such as re-training, having to choose among and support multiple versions, and the frustrations of file incompatibilities when exchanging information with others

Since the publication of my original study for ACT, two papers taking issue with my estimated porting costs have appeared, one by Dr. Thomas Lenard, and the other by Dr. Robert Levinson, Dr. R. Craig Romaine, and Professor Steven Salop (LRS hereafter).[2] The paper by LRS is almost exclusively about porting costs, and although the Lenard paper is largely about the putative virtues of his particular method of breaking Windows into three competing varieties, the additional porting costs imposed by his remedy on developers is obviously crucial to any cost/benefit analysis of his remedy.

Both of these papers claim that there will be essentially no costs involved with a breakup of Microsoft's operating system into three versions and that there will be only benefits. In order to make the claim that there will be no costs, these papers obviously must dispute my estimates of $30 billion in new costs to software developers, which they do. Both papers, however, fail to provide any counterfactual empirical estimate or examples of their own and merely assume the conclusions that they prefer--that porting costs will be essentially zero.

In an attempt to support their conclusions, these authors make numerous claims that do not withstand scrutiny. The overriding claim, however, is that there will be virtually no porting costs because the various competing versions of Windows will, by necessity, need to remain completely compatible with one another. This claim is flawed in at least two important ways. First, it is inconsistent with the economic literature on compatibility and general common sense. Second, and more importantly, their claims are discredited by the actual behavior of market participants who have been in this position.

In the following I intend to discuss the porting cost issue, explain why the claims of Dr. Lenard and LRS are unrealistic, and further explain the very conservative nature of my earlier estimate.

---

[2] Thomas M. Lenard "Creating Competition in the Market for Operating Systems: A Structural Remedy for Microsoft", Progress and Freedom Foundation, 2000; Robert J. Levinson, R. Craig Romaine, and Steven C. Salop, "The Flawed Fragmentation Critique of Structural Remedies in the Microsoft Case," draft dated 1/20/00. Both of these papers are available at: http://www.utdallas.edu/~liebowit/mic/ .

II. Summary of original study

Before launching into the more fundamental disagreements between my critics and myself regarding the nature and evolution of software markets, it is worthwhile repeating the basic conclusions of my earlier study, and the points of disagreement with my critics.[3]

In my original paper I assumed that three WinCos would be created and would compete with one another. Dr. Lenard and LRS take this as their starting point as well. The reader should note that I took this as my starting point only because this 'remedy' had received considerable attention in the press, not because I believed that the government had proven its case (although I do believe the Judge will rule that the government has prevailed).

With three competing versions of Windows, it seemed natural to assume they would not remain identical to one another, as each flavor of Windows tried to improve its market position. I then estimated the extra costs to developers from having to develop, test, and support their product for three somewhat different versions of Windows.

This estimate was based on asking developers how much extra cost they expected to incur with three versions of Windows, based on their prior experience in porting programs. My instructions were: "I am investigating what the costs of some proposed remedies might be. Do you have any idea how much additional effort is required to port a product to different flavors of an operating system? (Win 3.1 and 95, or various flavors of Unix, say)." [4]

These percentage estimates were then significantly scaled down so that they could be considered a minimum cost estimate and as such be embraced by nonpartisans in the

---

[3] My original paper was "Breaking Windows: Estimating the Cost of Breaking up Microsoft Windows" Association for Competitive Technology and the ASCII Group, April 30, 1999. It can be found on the web at: http://wwwpub.utdallas.edu/~liebowit/msstuff/actreport/actstudy.html

[4] I report the questions asked of the interviewees because LRS imply that I might have biased the results coming from the respondents. On page 24, LRS state: "If Professor Liebowitz' survey respondents were told to assume that significant fragmentation would occur, for example, on the scale of differences between Windows and the Macintosh operating system, then they likely would respond with unrealistically high estimates of porting costs. Professor Liebowitz' paper hints that respondents may have been told to assume just this." If LRS had asked, I would have been happy to alleviate their concern about biased questions.

Microsoft controversy. The table below reproduces the survey results and the scaled down estimates:

Type of Cost	Average expected cost increase per new version	Scaled down cost increase used in my estimates	Number of respondents
R&D	78%	25%	11
Support	47%	25%	5
Selling costs	7.5%	5%	2

These scaled down estimates are then applied to estimates of the share of R&D, Sales and Marketing, and Technical Support as found in a study conducted by KPMG and the Software Publishers Association. After weighting these cost increases by the component share from the KMPG figures, I conclude that each new version of Windows will raise total costs for software developers by an amount equal to **6.46%** of revenues.

Using estimates from IDC on the size of the market for Windows programs, I concluded that, over a three-year period, the new porting costs would be in the order of $30 billion.

The rest of the paper examines some of the more fundamental disagreements about the direction likely to be taken and how they affect my $30 billion estimate.

III. Will the versions of Windows grow apart?

Dr. Lenard and LRS make two contradictory claims. On the one hand, they claim that the Windows breakup will lead to increasing innovation in the operating system(s), but on the other hand they expect porting costs to be and remain negligible, and consumer confusion and fragmentation to be of zero import.

As an example of the first type of statement listen to Dr. Lenard:[5]

> The lack of competition delays consumer access to a variety of innovations, not only in operating system functionality, but in applications software and hardware as well. This is the case because Microsoft's dominant position allows it to determine the pace of innovation for both applications and computing hardware, both of which need to be compatible with the operating system.6

In his view, when there are three competing versions of Windows we will have a faster pace of change than we have had with a single Microsoft. This view is common among Microsoft critics and also Judge Jackson in his Findings of Fact. Indeed, the lack of OS innovation is the centerpiece of the putative harm caused by Microsoft. Dr. Lenard, for example, uses the word 'innovate'[7] ten times in his text when referring to the lack of innovation in the operating system due to Microsoft's 'monopoly'. For reasons I will expand upon in Section V, his claim of retarded innovation is unsubstantiated.

How is it, then, that Dr. Lenard and LRS could expect a much more rapid pace of operating system change and yet also claim that the competing versions would remain compatible with one another? We are provided with answers, although not very persuasive ones. Listen to each in turn:

> The fears of fragmentation of the Windows standard are unwarranted, because they are inconsistent with the fundamental economics that would characterize the post-breakup operating system market. The three Windows companies would have very strong incentives to retain the pre-existing network externalities.[8]
>
> Because each of the new operating system companies will have powerful competitive reasons to maintain compatibility with the installed base of applications, they will also have incentives to maintain a high degree of compatibility with each other.[9]

---

5 Here is the concluding paragraph of Judge Jackson's findings of fact: "Most harmful of all is the message that Microsoft's actions have conveyed to every enterprise with the potential to innovate…..The ultimate result is that some innovations that would truly benefit consumers never occur for the sole reason that they do not coincide with Microsoft's self-interest."

6 Page 15.

7 Actually, words related to the root "innov"

8 Lenard, page 34.

9 LRS, page 18.

At the stage where porting costs are considered, these papers suddenly downplay innovation in operating systems. LRS tell us that between the competing versions of Windows "[Quality differentiation] would be accomplished by eliminating bugs, increasing speed and reducing susceptibility to crashes, and adding new features and APIs…new features represent small incremental changes to the existing Windows APIs."[10] Dr. Lenard, who was so eager to use the term 'innovation' when criticizing Microsoft's lack of it, also claims "new features would represent incremental additions to the existing Windows APIs." [11]

Small, incremental changes? Where is the outpouring of innovation that the Microsoft critics claim would be released if only the Microsoft monopoly were no longer able to damn up the river of new ideas? In their attempt to convince readers that porting costs are small, LRS relegate the creation of new features and APIs to an afterthought.

A. A reality check

The claim that the competing versions of Windows will produce only incremental improvements to Windows is not just inconsistent with the entire premise of breaking Microsoft up in the first place, but it is also inconsistent with the rate of change that has occurred under the control of the single Microsoft.

It is instructive to examine the additions that Microsoft itself has made to its operating system(s) over time. After all, we are told that Microsoft retarded innovation, so its level of innovation would presumably be a lower bound for the rate of innovation that would occur in a triple-Windows world, at least in the opinions of Lenard and LRS.

Have Microsoft's innovations, or changes to its OS, been of an 'incremental' variety, with only small changes to the number of APIs? The answer is a resounding 'no'.

We can take, for example, the upgrade from Windows 3.1 to Windows 95, which occurred between 1991 and 1995. There were about 3675 elements of the Windows 95 OS that were used by programmers. Of these, several categories would be what are known as APIs, the largest class of which is 'functions', of which there are 2017 in

[10] LRS page 16.

Windows 95.[12] Of these 2017 API functions, 815 were new APIs not found in Windows 3.1 (and an additional 722 were widened to take advantage of the 32 bit operating system). Therefore 40% of the API functions contained within Windows 95 were totally new and less than 25% of the Windows 95 API functions were identical to the Windows 3.1 APIs. The increase in brand new APIs, therefore, was almost 17% per year.[13] Does this sound like the 'small incremental changes' that Dr. Lenard and LRS envision?

We can also examine the change from Windows NT to Windows 2000.[14] The last complete change in the NT line prior to 2000 was NT 4.0, released in early 1997. If we examine the current Windows 2000 we find that there are 5294 API functions. Of these, 1220 are completely new, 640 came in various NT updates and 230 came in distributions with other products. Again, we find that approximately 40% of the API functions in Windows 2000 were not in the last complete release of Windows NT that is only three years old. This works out to a growth rate in APIs of almost 22% per year.[15]

Clearly, a change of 20% per year in APIs would hardly qualify as the small incremental change suggested by Dr. Lenard and LRS. Dr. Lenard and LRS also suggest that the pace of change will be more rapid after a Microsoft breakup and that changes in the operating system APIs would be minor. Their overall conclusions, based as they are on such faulty and inconsistent assumption, cannot be taken seriously.

B. The virtual impossibility of remaining compatible

An operating system cannot be improved in terms of quality and reliability without changing the code. When OS programmers for the three WinCos start to change the code one might naturally think that the operating systems will diverge from one another and that some level of incompatibility would intrude. This is, after all, hardly a far-fetched idea, given the history of incompatibility between the various flavors of Unix, the

---

[11] Lenard, page 35. See also his footnote 22, which is remarkably similar to LRS's footnote 20.

[12] The major categories in the win95 line are functions, callback functions, macros, messages, constants, interface methods, and structures, with the first three categories normally referred to as APIs.

[13] In the four years approximately 800 new APIs were created, leading to 200 per year. With approximately 1200 APIs in Windows 3.1, that works out to about 17% new APIs each year.

[14] Windows 2000 is much larger than Windows 95, with approximately 11400 elements.

[15] Almost 700 new APIs a year on a base on 3200.

different versions of Windows, and the various distributions of Linux. Dr. Lenard, however, is sanguine in his response:

> "Simply put, consumers want access to a large pool of applications; software developers, in turn, want access to a large pool of consumers. To not maintain compatibility would risk losses with both these groups, which none of the Windows companies would want to do. The costs of switching and the benefits of network effects create powerful incentives for consumers to stay with their existing operating system standard, and for the new operating system companies to retain compatibility with the installed base and each other." P. 34

Unfortunately, Lenard and LRS rely on little more than wishful thinking that betrays a poor understanding both of the history of computer operating systems and the economic consequences of compatibility.

First, it is certainly true that the various flavors of Windows will want to remain compatible with the older versions of Windows, what is called backwards compatibility. I always expected that to be the case and never suggested otherwise.[16] If there were no costs involved in remaining compatible with old versions, all programs and operating systems would always remain compatible with their older versions.[17]

Often, however, new versions are not compatible with older versions. It is not because consumers do not prefer compatibility, because they do. It is not because producers do not prefer compatibility, because they do as well. It is because there are often costs in remaining compatible.

There are a host of examples where firms decided to throw compatibility out the window, so to speak.[18] If a new improvement is compelling but also inconsistent with the

---

[16] LRS claim that I do, and I cannot for the life of me figure out where they got that idea. On page 25 LRS state "Professor Liebowitz instead assumes that the new operating system competitors will opt out of the Windows standard, forcing consumers to jettison their existing investments in applications software and coercing applications developers to rewrite their products."

[17] I discuss this at length in my book with Stephen Margolis Winners, Losers, and Microsoft (Independent Institute 1999) particularly on pages 140-142.

[18] Apple announced several years ago that their new version of the Macintosh operating system was going to be incompatible with the then current Macintosh operating system, although they later rescinded that decision. The Macintosh was of course incompatible with the Apple II operating system, as was the Atari ST with older Ataris and the Amiga with the Commodore operating system. Nintendo and Sega operating systems have all been incompatible with previous versions. The Sony PlayStation II, if it performs as claimed, will be the first videogame system retaining backwards compatibility from one

older system, as sometimes happens, some degree of compatibility will often be given up. Apple gave up compatibility with the Apple II when it created the Macintosh, music-recording companies gave up compatibility with LP records when they moved to CDs, and Windows 2000 is somewhat incompatible with Windows 95/98, a point we come back to later. Some improvements destroy or reduce compatibility.

But this is a minor quibble. I suspect that the new flavors of Windows, for some time at least, will all retain compatibility with the current versions. [Note that there are actually three current versions of Windows—98, 2000 and CE—so that upon breakup we might expect nine versions]. Nevertheless, it is a virtual certainty that the three WinCos will not have their operating systems remain completely compatible with one another, which was the starting point of my prior analysis.

This is for the simple reason that the various versions of Windows will pursue different ideas and different implementations of ideas. Assume that Windows A decides to focus on voice recognition, Windows B works on handwriting recognition, and Windows C works on improving the screen display quality (smoothing fonts and so forth). Assume that all three companies are successful so that many end users will want to take advantage of these advances, and therefore many software developers will incorporate new code calling these APIs. [Of course, each Windows team will usually be working on numerous other advances, not just the single one that I have put forward for the sake of simplicity.]

How can the operating systems from these WinCos, each now with differentiated APIs, remain compatible? LRS suggest that a WinCo might just disclose its APIs to the other two competitors. But this would do little good to the competitors who do not have any expertise in that subject or who were working on different implementations. If, for example, Windows A discloses its APIs for speech recognition, that would do little good for Windows B and Windows C. The APIs are merely calls to components within the operating system, and Windows B and C do not have speech recognition components to put in the OS. Even if Windows B and C were working on their own version of speech

---

generation to the next. Windows 2000 relinquishes the ability to write directly to the hardware, making it impossible for many games to run.

recognition, it is likely that their speech recognition would be somewhat different, with its own set of parameters requiring a different set of APIs.

LRS also suggest that Windows A might offer both the APIs and the source code to the other two WinCos.[19] What a notion—the focal point of the competition between these companies, the crown jewels if you will, being freely offered to the other firms. Not only does it seem amazingly far-fetched, but it also would create a perverse incentive not to engage in innovative activity.

After all, what is the point of competing in such a utopian paradise? With competitors willing to give away their code to one another, each should try to free ride off the other two and accept the new code without expending any resources of its own on the development of new capabilities.

There are other reasons that these firms will not want to exchange code, which I now discuss.

C. Why the Windows companies will not all want to be compatible with one another

Even if it were possible and costless for the WinCos to remain compatible with one another if they desired, it is well known that there are instances when competitors prefer not to be compatible with each other.

Think back for a moment. Did Lotus make the macros and file structure of 1-2-3 freely available to its competitors? After all, that would have been in the best interest of developers writing macros, as well as Lotus' business customers who might have wanted to purchase some copies of competing products. Of course, Lotus did not do this. Instead it sued another company that had created a perfect imitation of its macros.[20]

Did the Macintosh welcome competitors graphical interfaces that would make it easier for Macintosh developers to port their products to a larger audience? No, instead it sued Digital Research, HP and Microsoft for creating such interfaces.

---

[19] LRS page 12.

Why didn't AOL allow competitors to use its chat standard, since that would be best for its users and allow AOL to take advantage of the maximum network effects? Why didn't Netscape and Microsoft work to ensure compatibility with their extensions to the HTML language so that developers and users would derive maximum benefit?

These firms with a leg up over their competitors acted as almost anyone would have expected them to act. It is well known that firms in an advantageous position often prefer incompatibility. It will often be the case that it is better to have an entire pie to oneself, than to share a slightly larger pie with others.[21] LRS and Lenard fail to mention this possibility.

Firms with a leg up on the field may wish to become incompatible with their competitors to keep the network effects for themselves. In each of the examples given above, the leading company worked to keep the newer firms from the benefits of compatibility, even though that reduced the network effects for the incumbent.

As the WinCo firms compete, some will do better than others and will get a leg up on the field. When that happens any hopes for serious attempts at compatibility go out the window.

D. The hypothesis of operating systems remaining compatible has already been tested by the market—and rejected

Although the above examples are instructive, they are not as instructive as they might be since they are not about competing firms with the same basic operating system. But there are two well-known examples of just that: Unix and Linux.[22]

Have the forces identified by Lenard and LRS, the desire to remain compatible, prevailed as Lenard and LRS would predict? Or have those forces of incompatibility, the

---

[20] Lotus sued Borland over the macros and also sued Paperback Software over copying the look and feel of the product (another form of compatibility discouraged by Lotus).

[21] This result can be found, in harder to understand terms, on page 408 in Tirole (The Theory of Industrial Organization, MIT Press, 1988) where he states: "a weak firm prefers compatibility, whereas a strong firm may or may not prefer compatibility."

[22] One might also include OS/2 and Windows in this category since both were based on the same core (IBM and Microsoft both owned the rights to DOS and the Windows 3.1 source code). Yet they did not attempt to achieve compatibility with one another, as Lenard and LRS suggest they would.

forces neglected by LRS and Lenard, prevailed? Lenard and LRS both know the answer to this question, which is that compatibility is far from the almost perfect level described in their rose-colored world. [23]

The first example is Unix. Unix has several standard settings bodies, although they haven't caused the various flavors of Unix to remain compatible. There are currently dozens of Unix flavors although they all stemmed originally from two major distributions: AT&T and Berkeley. Many attribute the Unix failure to make serious inroads in the desktop market to the massive fragmentation that is found among Unix vendors.

Linux is a version of Unix. Unlike Unix, all versions of Linux use the same 'kernel' or core code, which makes them more compatible than the versions of Unix. Nevertheless, there are various distributions of Linux that differ in the components of Linux offered, certain C libraries used by the OS, and the interface between the user and the kernel. Even with only these minor differences, there are serious concerns that fragmentation might keep Linux from becoming the market success that it might be if it can stay unified.

Here are some news quotes that describe this concern:

- "Sandra Potter, an analyst at Aberdeen Group Inc. said that although many vendor executives know how much damage proprietary implementations did to the Unix

[23] LRS claim in their footnote 16: "Sometimes Unix is cited as an example of what would happen to the personal computer industry if a structural remedy were imposed. However, there are significant differences that make Unix a poor comparison. Windows today has hundreds of millions of users, and tens of thousands of commercial applications written to work only under Windows. A Windows user who switches to an incompatible operating system would all at once lose access to this large network of users, information, and applications, and would have to spend considerable sums to obtain access to an inferior network. As a result, Windows users would be highly resistant to the idea of switching to an incompatible operating system." Network effects, we are to believe, are like a good wine--you have to develop a taste for it before it provides value. LRS also make compatibility a more black/white issue than it is. The competing operating systems will not be completely incompatible, they just will move apart so that developers will have much higher costs getting their software to run on the three versions. LRS also point out that many Windows users are businesses, but this is even more true for Unix, not that it really has any relevance to the compatibility story.

market by killing compatibility among various flavors of Unix, they may still have trouble preventing the same from happening to Linux." [24]

- "VA Research Inc., which sells computers with a choice of four distributions, may have to drop one because testing four is too burdensome, said CEO Larry Augustin." [25]

- "[Caldera CEO Ransom] Love said he's talked to software developers who are reluctant to jump to Linux because they fear it will fragment... Jeff Carr, the founder of Linux PPC, called the Linux standards base — a move to provide common standards for Linux distributions — a crucial and critical movement." [26]

Two articles on Linux claims that Red Hat, the market leader (having a leg up, using the earlier vernacular), seems uninterested in Linux standardization. They confirm the points I made in the previous section about incentives to remain incompatible:

> Miller says that application developers ideally want their programs to be able to run on all the different Linux distributions, but that constant change in the C libraries makes it difficult for the developers to keep abreast. If there were a commonly accepted standard, says Miller, there wouldn't be a problem. "I think you'll find agreement on that from most of the hardware vendors and almost all the application developers and the Linux distributions companies," says Miller. "Except that Red Hat is much less hot on the idea. If you are the market leader, then you want to create standards -- that's probably a pretty natural feeling." [27]
>
> Also:
>
> Last year, though, Durham, N.C.- based Red Hat Software, the Linux market leader, released a new set of libraries…. the switch frustrated software developers…"It was painful because we had to do two ports," says Janet Smith, a director of product marketing at Informix… Red Hat CEO Bob Young, a deft marketer with a mischievous grin, shrugs off the ruckus. With the least to gain from a standards body, he downplays

---

24 From "Linux-For-All Faces Obstacles" by David Orenstein, ComputerWorld Online News, 3/15/99 http://www.computerworld.com/home/print.nsf/all/990315960E.

25 "Choice, Not Standards, Drives Linux Users", by David Orenstein, ComputerWorld Online News, Mar 8, 1999 full story at http://www.computerworld.com/home/print.nsf/all/9903089576

26 "Hamstrung by lack of standards? Linux bigwigs talk up desktop and embedded systems — and flag the need to promote standards for the OS," Lisa M. Bowman, ZDNN, CHICAGO, April 20 1999.

27 "Is Red Hat becoming Linux's Microsoft?" Andrew Leonard, Salon Magazine, July 14, 1999. Can be found at: http://www.salon.com/tech/feature/1999/07/14/redhat/index1.html.

> Quinlan's efforts [at standardization] and says the group has made "very little progress" since its formation last August.[28]

It is also the case that Linux vendors have a greater incentive to remain compatible than the WinCos would. Red Hat, for example, can have a big share of a very small pie if it remains the leader in a fractured Linux world. Or it can have a possibly smaller share of a possibly much bigger pie if Linux can remain united and usurps some of Microsoft's share of the desktop. The WinCos already share the big pie, so getting a bigger piece is more important than trying to grow the pie by remaining united. LRS have this point exactly backwards.[29]

To put a finer point on this, the growing fragmentation of Linux demonstrates how unrealistic it is for competing vendors to maintain compatibility, even where they share economic incentives to build the Linux standard. How then could we expect competing Windows vendors to maintain compatibility, when each has the incentive to differentiate and take away customers from its competing versions?

Finally, it is useful to contemplate Windows 2000. Microsoft has, for many years, been trying to bring its NT line and 95 line into general compatibility by matching the APIs. Windows 2000 was supposed to be the successor to Windows 98, although Microsoft officially gave up on that possibility some time ago and now plans to continue the win95/98 line for another iteration or two. Here we have a single firm, not a consortium with conflicted incentives, yet it could not make the various flavors of its operating systems compatible with one another. The reason is that NT was given enhancements to make it much more robust and error free, just the type of thing that LRS and Lenard envision happening in a triple-Windows world. But this innovation proved difficult to make compatible with the Windows 95 code tree. Are we are to believe that vigorous competitors will achieve greater compatibility when they have less incentive to do so?

---

[28] "Standardizing Linux: As the upstart software continues to gain fans, there's an increasing need to keep it from splintering, Unix-style, into a mess of incompatible variations". Alex Lash, The Industry Standard, February 25, 1999. Can be found at:
http://www.thestandard.com/article/display/0,1151,3623,00.html.

[29] On page 22 LRS state: "a major reason why the Windows standard would not become fragmented is the large scale of its installed base."

Microsoft is currently telling non-business users not to upgrade to Windows 2000, due to compatibility problems. If Windows 2000 were owned by a different company than Windows 98, do you think the Windows 2000 company would be telling non-business users to remain with a competitor's product? Clearly, the WinCo with Windows 2000 would trumpet from all quarters the advantages of its operating system, downplaying the incompatibilities. We would have far more confusion and uncertainty in the marketplace as users tried to determine whether they should make the switch that they were being told to make. And we would have many more unhappy users who would find that some of their hardware and software no longer worked. This is a cost of fragmentation that I did not quantify in my earlier study.

IV. Was the original estimate reasonable?

LRS claim, incorrectly, that I assumed that the porting costs from one flavor of Windows to another would be the same as porting from the Macintosh to Windows. From their footnote 28:

> In particular, Professor Liebowitz discusses the importance of porting costs by citing Intuit's costs of supporting and upgrading the Macintosh version of its Quicken financial program. He estimates these as 10% of total revenues. *It is odd that Professor Liebowitz would stress this estimate in his paper*, because he also concedes that this figure "cannot be taken as typical" of the outcome of a structural remedy because "the difference between the Macintosh and Windows will undoubtedly be greater than the differences between the various flavors of Windows, overstating the porting costs. (my italics)

This statement reveals a substantial misreading of my paper. LRS correctly note that I reported that Intuit would forgo approximately 10% of its Quicken revenues if it didn't port Quicken to the Macintosh, and that, holding other factors constant, it is more expensive to port between Windows and Macintosh environments than it will be to port between various flavors of windows.

What they ***fail*** to report, however, is that I also pointed outtwo reasons that Intuit's porting costs would be less than those faced by firms porting to different versions of Windows. The first was the fact that Intuit had been porting its product between the two environments for many years. Its experience, and the tools it already had in place, imply

lower costs than if it had to begin porting from scratch, as firms porting to new flavors of Windows would have to do. Second, Quicken is a bigger seller than most other products, so its additional fixed costs in developing a product for the Macintosh market can be spread over a larger base than would be the case for many other products. Because these two factors *work in the opposite direction* from the higher costs associated with the more difficult PC-Macintosh port, it is difficult to know whether the 10% figure, which encompasses all three impacts, is too high or too low an estimate of porting costs between different flavors of Windows.

Either way, I do not use the 10% value in my estimates of porting costs, although a reader of LRS's paragraph, quoted above, might be misled to believe otherwise.[30]

The value that I used was provided by experienced software developers based on their encounters with the real world, not some hypothetical construct materializing from the world of pure imagination.

My estimate was crafted in a conservative manner, as described above. And my estimate ignored the extra costs to consumers from having to navigate in an artificially non-standardized world.

V. We feel the pain, but where's the gain? *Why having three Windows will not increase innovation*

Both LRS and Lenard claim that having three competing versions of Windows willincrease the quality of the operating system from what it might have been with a single owner.[31] On the surface, linking the concept of quality improvement with that of competition seems reasonable, but upon inspection the logic makes little or no sense.

[30] LRS are fully aware of this as indicated in their footnote 29 where they repeat the actual value I use, 6.46%, which is, last time I checked, a different number than 10%.

[31] LRS, page 26. On the other hand, they hedge somewhat on page 19 where they say: "Such technological growth within the Windows standard likely would occur at least as rapidly as under the Microsoft monopoly"

Take a hypothetical Microsoft that has 900 employees working on improving its operating system. After the breakup each WinCo gets 300 programmers. We are told that competition between the three will lead to a better outcome.

Assume for the moment that consumers have similar preferences to one another and therefore they will all agree on which operating system is the best and that one will dominate the market.

If greater productivity were achieved by having three competing groups of 300 employees, each group working on competing version of Windows, as suggested by Dr. Lenard and LRS, Microsoft could have internally set them up that way. The three internal divisions would come up with their separate operating systems and Microsoft, perhaps by asking consumers, could determine which one was best.

What Lenard and LRS essentially assume is that 3 groups of 300 will be more productive working for separate firms than they would be working for Microsoft, although they provide no reason why this would be true. They appeal to the reader's general belief that competitors work harder than monopolists, but this implies that that the monopolist is somewhat lazy and not interested in maximizing profits. Does that sound like a description of Microsoft?

The reality is likely to be quite different.

Assume that not all the programmers are equally talented. Perhaps there are programming superstars (who might be given the job of running the project), as there are at other endeavors such as sports, writing, academics, entertainment, politics, and so forth. If one of the WinCos, say WinCo A, gets more of the superstars than the other WinCos, then WinCo A will have a better product than the other two.

Even if WinCo A produces a product almost as good as what the intact Microsoft would have produced, consumers will be worse off.[32] After all, all three WinCos will be claiming that their version is best, as firms are in the habit of doing. Although we have every reason to believe that consumers will eventually pick the better version (so that

[32] Since the original Microsoft had the same 300 programmers, plus 600 others, it is not logical to believe that the WinCo A could produce a product as good as the intact Microsoft.

WinCo A becomes dominant), there will be a period during which some fairly large number of consumers are likely to make the wrong choices and where a certain amount of chaos reigns, as was the case when VHS and Beta were competing with one another.

Many developers are also likely to incur costs in making incorrect decisions about which versions to support, as was the case for OS/2, although developers too will get it right after some time.

And we can be fairly certain that the OS from WinCo A will be inferior to the one that would have been created by the intact Microsoft. This is because Microsoft had all 900 employees to begin with, including all the superstars, and it is reasonable to presume that those other 600 workers were adding some value to the project. If Microsoft was as relentless in its pursuit of profits as its critics always imply, then there is no way that WinCo A could produce an equivalent product.

The result is that additional costs have been imposed for no gain.

After some time, of course, the WinCos might go out and hire new programmers, assume 500 each. However, it will be a long while before the new programmers become as familiar with the ins-and-outs of the millions of lines of source code in Windows as the current programmers. There is also no reason to expect these programmers to be any better than the ones working for Microsoft, which is famous for getting really smart people to work really hard. And if the extra cost of having 2400 programmers (compared to the 900 in the original Microsoft) were more than compensated by the extra value of superior products, why would Microsoft have not chosen to hire that number of programmers to begin with?

The general logic here is quite simple. There is absolutely no reason to believe that the intact Microsoft would produce lower quality operating systems than the three WinCos would. And there are reasons to believe that the opposite would be true, at least until new programmers could come up to speed on these products, which could take several years.

We can change the illustration somewhat and presume that consumers fit into one of two molds—game players and business users, although within each mold consumers

have the same tastes. In this case it makes sense to have two distinct flavors of Windows. Which market is more likely to better meet the needs of these consumers, an integrated Microsoft, or three competing vendors?

Microsoft can assign the better game programmers to the games version, and the better business programmers to the business version, and cleanly separate the two products as much as possible to meet these diverse tastes.

The market with the three competitors, however, is more difficult to analyze. Each firm could specialize in one version, ceding the other portion of the market to its competitors, or each could produce a product that tried to appeal to everyone.[33] If each tries the latter route, then we have three similar operating systems that each try to appeal to both business users and game players, and we have less than ideal differentiation, a standard theoretical result.[34]

If each firm attempted to specialize we have a bit of a problem – two markets and three specialized versions. If the two best firms attempt to specialize in the same market, then the other market will have a product from the least innovative WinCo, a poor result. If the two best firms specialized in different markets, we have a result that approaches that of a single combined firm, but is still not as good. That is because Microsoft has the luxury of assigning the best game programmers to the game OS and the best business programmers to the business OS. Each WinCo, on the other hand, will assign all of its 300 programmers, some of whom are better at games and others who are better at business, to an operating system that specializes in only games or business. Thus the WinCos cannot take advantage of programmer talents the way that Microsoft can. And, to make matter worse, Dr. Lenard's proposal will forbid programmers transferring from one WinCo to another to achieve a better allocation of programmers.

---

[33] Obviously, there are other possibilities and permutations, such as each firm trying to produce both types of operating system, or some producing two and others producing one. Since my purpose is merely to demonstrate some defects in the LRS and Lenard stories on innovation, we do not need to go through them all.

[34] This is the well-known Hotelling result where firms all produce very similar products because they do not want to cede markets to competitors. The Hotelling model implies that competition produces an inefficiently small amount of variety.

Thus we can expect the operating systems produced by the WinCos to be inferior to that of the intact Microsoft. It is true that they could each hire new programmers to try to compensate for their deficiencies, but since they cannot hire each other's programmers, the only ones with actual Windows experience, this is likely to be an expensive and inadequate solution, at least for a considerable period of time.

VI. Other Issues

A. Will 'forced' fragmentation make consumers better off?

LRS claim in their footnote 22, referring to the extra costs to developers brought about by the breakup, that "it is inappropriate to view the costs of these improvements as inefficient porting costs". The fact is that it is perfectly appropriate to view them that way.

There is an important distinction between the extra developer costs incurred when Windows changed from version 3.1 to 95, and those that I label excessive developer costs, brought about by the forced breakup of Windows. Although changes to the Windows operating system imposed substantial costs for the developers (and to Microsoft in creating the OS and users in making the switch), we know that the overall benefits outweighed these costs because all parties voluntarily adopted these changes to the operating system. In other words, these changes passed the market test. In a market, developers will only port their software if consumers derive sufficient value from them to pay the extra cost. And the operating system producer will only create new versions of the OS if they expect to make money doing so, meaning that consumers are willing to pay an amount greater than the costs.

That is not the case under the triple-Windows scenario, however. In the case of a forced breakup there will be excessive fragmentation and differentiation (assuming that each WinCo doesn't drop any products.[35] It is not the market, reacting to consumer preferences, that decides how many versions of an operating system to provide, but the

government. The fact that it is not a voluntary decision on the part of producers almost guarantees that this differentiation will be inefficient

Microsoft could have created 5, 10, or any number of Windows versions if it had thought it would be profitable to do so. The fact that it didn't indicates that Microsoft didn't believe that the extra revenue from extra versions of Windows would justify the costs.

I think it is a revealing question, at this point, to ask how LRS and Lenard know that 'three' is a good number of competitors. Why not ten, twenty, or a thousand firms? If twenty are too many firms, then how do we know that three are not too many? Where in their arguments would twenty not be better than three? More competition, no extra costs, isn't that the story they are telling?

Dr. Lenard and LRS each implicitly assume that Microsoft doesn't do a good job maximizing its profits.[36] This might be a reasonable assumption for a regulated monopolist, such as AT&T, which was not allowed to keep extra profit earned from being more efficient, but there is no reason to believe it about a non-regulated firm such as Microsoft. Do we really believe that Microsoft was not actively trying to maximize its profits?

If the benefits of new versions, though positive, are less than the costs, then the new versions shouldn't be created. In the case of the forced breakup, we have two extra versions for each Windows line. Three versions of Windows 98, three versions of Windows 2000, three versions of Windows CE. The extra costs to developers of writing for an artificially increased number of Windows are wasteful costs, because they are costs that we must expect to be in excess of the benefits.

---

[35] If WinCo A decided to specialize in Windows 98, WinCo B to specialize in Windows 2000, and WinCo C to specialize in Windows CE, I suspect we would have the Justice Department hauling the WinCos back in court again.

[36] Lenard seems to believe that monopolists are less willing to maximize profits than are competitors. For example he states on page 31: "By contrast, three competing Windows companies would have to become customer-focused very quickly in order to retain and expand their customer base. For example, as a monopolist, Microsoft has little incentive to produce customized versions of its products, because each one increases the costs of support and development." As stated in the text, Microsoft, if it maximizes profits, will not care about costs rising, as long as revenues rise by a greater amount.

B. Competition in these markets

The final line of defense for Dr. Lenard and LRS against the high costs of their remedy is an appeal to the ethos of competition: "The fragmentation argument is ultimately an argument against the premise on which our economic system and the antitrust laws is based, which is that competition best serves the interests of consumers."[37]

This appeal takes an overly narrow view of competition, however, and is a mischaracterization of my concern with fragmentation.

Many software markets have firms with large market shares, but there is competition nevertheless. In the 1980s some might have concluded there was no competition in spreadsheet markets, but there was, as Lotus found out when its market share dropped from over 70% to almost nothing. Software markets tend to be serial monopolies, or successive winner-take-all competitions. A firm gets established as dominant, as WordStar was, and then get replaced by WordPerfect and then Word. There is competition, but also very large market shares.[38]

Operating systems are no different. The best one will likely generate a large market share when it is the leader. That doesn't mean there is no competition. Judge Jackson aside, anyone who doesn't realize that Linux does pose a threat, and that the Macintosh does pose a threat, understands neither competition nor computers.

Competition comes about from the activity of competing. Competition is an action, not a static picture based on the number of participants. A picture of the finish line of a hard fought race where there is but a single figure at the finish line because the others are left behind, still represents competition, whereas a picture of many individuals standing around the finish line afterward does not reflect competition.

If consumers voluntarily choose fragmentation, for the extra value the differentiation provides, that is worthwhile differentiation. On the other hand, if

---

[37] Lenard, page 34.

[38] My 1999 book with Margolis, Winners, Losers, and Microsoft goes through these histories in detail.

consumers have chosen a product, voluntarily, in such numbers that it has an overwhelming market share, then it would be inefficient to force some of them to switch to alternatives just to increase the number of producers. Consumers could have chosen Macintoshes--after all, they have been available for a long time, and have a large and loyal following. Consumers could have chosen Unix based machines, or Linux based machines, or OS/2 based machines. Nevertheless, they didn't.

More to the point, however, is the understanding that there is and was competition in operating systems, and the result of that competition for the moment is for Windows to be used on 90% of desktop computers. This was the result of decentralized individual decisions on the part of millions of consumers. In the name of some abstract notion of competition, however, Dr. Lenard and LRS want to annul these private decisions

VII. Conclusions

I have endeavored in this paper to examine several aspects of the computer market that I did not discuss in detail in my previous study. The $30 billion price tag I calculated in the prior study continues to look very conservative after examining the suggested deficiencies put forward by Dr. Lenard and Drs. Levinson, Romaine, and Salop.

The major issue was whether or not competing versions of Windows would grow apart. To be honest, this question arose prior to my original study but I couldn't imagine that any reasonable person, with all the evidence to support this claim, could seriously question this assumption.

I hope that I have provided sufficient detail about the rate of change in operating systems and the history of incompatibility in operating systems to convince most individuals that my original assumption about incompatibility was correct.

There are numerous other questions that were raised by these two papers. I hope to have answered them in sufficient detail to convince readers that the claims made in these papers are unsound. My experience has been, when discussing this issue with people who have actually done programming, that whether they are pro or anti Microsoft, they agree

that three versions of Windows will be a most unwelcome change to their programming regimen.

On a methodological note, I would suggest that the reader try to determine whether a so-called economic analysis seems consistent with his experience in the real world. Theory is only as good as the assumptions behind it, and it is possible to make some assumptions that clearly are not a part of this universe, and which will lead to conclusions that are also not a part of this universe.

The truly important question of the moment, however, is what to do about Microsoft. For reasons that I can't elaborate upon here, I do not feel the government has made its case. Nevertheless, I believe that the court's probable verdict will call for a "remedy", and it would be a major mistake to compound an error in verdict with an error in remedy.

Consumers are the pawns in a nasty political struggle between competing computer behemoths. I am talking here about Microsoft, Sun, Oracle, IBM, and the other players that readers of this paper are likely to be familiar with. I have identified additional costs to developers from a structural remedy as proposed by various advocates such as Dr. Lenard. These costs are quite enormous. Consumers will undoubtedly pay a large component of these costs, as explained in my earlier study.

I think it is instructive to ask why some of Microsoft's enemies would wish to see these particular remedies brought about. Since these firms generally compete with Windows, they should not want to see a stronger Windows. If they believed what Dr. Lenard claims about his structural remedy, they would find it in their self-interest to oppose such a remedy since they shouldn't want a more vibrant Windows market with better software. They should want a crippled and dysfunctional Windows market, since that would be to their self-advantage. Why should Sun or Oracle (who funded the LRS paper) want to see a more innovative Windows marketplace? They clearly do not, which is why they support this particular remedy. They understand its true draconian impacts.

The unquantifiable costs, those directly imposed upon consumers who will have to bear the uncertainty of choosing the wrong product, or suffer the cost of not being able to

achieve a sufficiently great level of compatibility, I believe will be considerably larger than the costs to developers that I have measured.

The benefits seem virtually nonexistent. Microsoft will no longer get to browbeat some OEMs. Microsoft will not be able to threaten withholding Windows from OEMs. Not-ready-for-prime-time operating systems, such as OS/2, will be able to fail without being able to blame it on a monolithic monopoly. Far-fetched ideas, such as Netscape becoming an operating system, will be able to fail on their own, without being able to blame it on a monopoly. The price of Windows might fall immediately upon breakup, but later versions of Windows may be more expensive.

There are easier and cheaper ways of achieving these benefits. Microsoft could be forced to abide by a price list for Windows with no exceptions. This removes any browbeating of OEMs. It also puts Microsoft into alignment with laws against price discrimination, so I believe it would be in their own best interest to have such a policy. This should not be very difficult to monitor.

There has been talk about revealing APIs to outsiders. I don’t know that this played much of a role in the case, or that it is anything but a myth. But since Microsoft already claims to reveal all the APIs it shouldn’t be too difficult to have Microsoft verify that it actually does so.

If the ultimate resolution of this case calls for remedies, then I suggest a return to the DOJ's original intention to be "surgical" in their removal of anticompetitive behavior. This is about the only way that the government is likely to avoid harming consumers, their putative major concern.

If the government attorneys get too bold and insist on a remedy that excludes the interest of consumers, as this structural remedy does, they may find that they will get more than they bargained for. Yes, they might be able to do-in Microsoft. But this is not Standard Oil in the days where nobody owned a car. Almost everyone uses a computer. If antitrust gets blamed for a very prominent adverse change in the market for computer software—consumers might begin to think of “robber-bureaucrats” the way they once thought of “robber-barons”. If the breakup creates confusion and uncertainty in a market that was doing just fine, if the breakup appears to decelerate innovation, or if the new

operating system giant turns out to be from Japan, antitrust, and its current leading practitioners, will be in the doghouse for many years.