Is Microsoft a Monopoly?

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The Microsoft anti-trust trial has pitted the world richest man against the worlds most powerful government in a battle of over, *Microsoft's Windows*, one of the most ubiquitous products in modern society. This backdrop has piqued the interest of the general public, the press and government in the microeconomic theory of monopoly and has been a boon for the field of economics. Although there has been a great deal of commentary and analysis by economists and non-economists covering nearly every aspect of the anti-trust trial, most have followed the adversarial approach of the courts. The purpose of this paper is to address the simplest but perhaps most contentious question of whether or not Microsoft is a monopoly. Using the tools of microeconomic analysis, this paper looks first at whether Microsoft fits the structural definition of a monopoly and then looks at whether Microsoft behaves as would be predicted of a monopolistic firm.

I Structural Characteristics

Although most people have a general understanding of what a monopoly is, to eliminate any ambiguity it is helpful to establish a precise definition of monopoly. A generally accepted definition describes a monopoly as:[1]

I A market composed of a single or dominant firm,
II That sells a good with no close substitutes,
III In a market with barriers to entry.

[1] See for example Stigler (1987), Browning and Zupan (1999), Mankiw (1998), McEachern (2000) or just about any other microeconomic textbook.

To be considered a monopoly, a firm must satisfy all three criteria. It should be noted that even if a firm is determined to be a monopoly it is neither illegal nor pernicious in any sense. It is an economic distinction devoid of any value judgement. Although the term monopoly may elicit visions of price gouging profiteers, this reaction is very much misplaced. Indeed, monopolies are not necessarily harmful to consumer, and in many circumstances they can lead to outcomes more beneficial to consumers than competitive markets.[2] Thus, the distinction of monopoly is not, as many perceive, necessarily damning.

Nevertheless, the purpose of this paper is not to discuss the merits and limitations of monopoly per se, but rather, the purpose of this paper is to objectively determine whether Microsoft fits the structural and behavioral definition of monopoly given above. The paper proceeds with an examination of each component of the above definition and then discusses the ramifications of possessing monopoly power.

II Is the Relevant Market Composed of a Single or Dominant Firm?

Monopoly literally means one seller or firm. However, finding a market composed of a single firm is nearly impossible. Consequently, virtually no firm could be considered a monopoly in the literal sense. A more reasonable definition of a monopoly would include a market dominated by a single firm. For example, the De Beers company of South Africa, which controls 80% of the worlds diamond supply, is often used as a textbook example of a monopoly.[3] OPEC is another example of a cartel that controls a large portion of the worlds oil supply and is

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[2] This would occur in the case natural monopoly in which economies of scale result in a single firm producing at a lower cost than a large number of smaller competitive firms.

[3] More accurately, De Beers is a cartel. However, the purpose of a cartel is to coordinate behavior among firms and act as a monopoly.

therefore considered to wield monopoly power. The first component of the definitions, a market composed of a single or dominant firm, begs two questions: First, what is the relevant market. Second, what constitutes dominance of a market. Obviously, unless the relevant market is very narrowly defined, a monopoly need not be a market composed of a single firm.[4] We can also look to how the courts have defined monopoly.

Most antitrust enforcement today is based on the Sherman Antitrust Act of 1890 which makes "restraint of trade" and "monopolization" illegal, and the Clayton Act of 1914 which delineates specific behavior as illegal which tends to "substantially lessen competition or tend to create a monopoly." Unfortunately, neither the Sherman nor Clayton Acts define monopoly. What the courts have done is look for indications of monopoly. For example, the courts often look at the share of a market a firm holds. This is often referred to as the market share test. An indication of monopoly power is said to exist if a firm's share of the relevant market is more than 70%. If a market is broadly defined, a single firms market share can be substantially reduced. If a market is narrowly defined a single firms market share can be greatly enhanced. Consequently, how the relevant market is defined becomes critical in determining whether or not a firm is a monopoly.

The determination of the relevant market consists to two criteria[5]: The relevant product or output market and the relevant geographic market.[6] The relevant product market includes those

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[4] The criteria used to define the relevant market are explained below.

[5] Miller (1997).

[6] The second component of the relevant market is the geographic market. For products that are sold nationwide, the geographic boundaries of the market encompass the entire United States. If a producer and its competitors sell only in a limited area, the geographic market is

products produced by different firms that have identical attributes. A more applicable definition however would define the relevant market to include products that are not identical but may be used as substitutes for one another. In this interpretation, the second defining characteristic of monopoly becomes important, that of the substitutability among competing goods.

Consider, for example, the 1956 case in which Dupont was judged to hold a monopoly in the cellophane market. Dupont literally controlled 100% of the cellophane market. However, although Dupont controlled 100% of the cellophane market, it controlled only 20% of the "flexible packing materials" market which was defined to include wax paper and aluminum foil. Because wax paper and aluminum foil can be easily substituted for cellophane, the courts determined the relevant market to be the "flexible packing materials" market and ruled that Dupont did not constitute a monopoly in the relevant market.

As would be expected, defining the relevant market has become a central issue in the Microsoft case. If the relevant market is defined, as Microsoft has argued, to be the computer market, then Microsoft's market share is negligible. Narrowing the relevant market to the "software market", would only increase Microsoft's market share to 5% of total dollar sales.[7] However, because the product in question is Microsoft's *Windows*, if, the relevant market is defined as the "operating systems" market, then Microsoft's Windows operating system makes up a much larger share of the market. Yet, even considering only operating systems, there is dissension as to how the market should be defined. If the relevant market is defined as the personal computer operating systems market, then Microsoft is seen as holding between 80% and

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limited to that area. For our concerns, the relevant geographic market is the United States.

[7] Delong 1998.

90% of the market. In the current antitrust case against Microsoft, the court has defined the relevant market to be operating systems for, "single user personal computers with Intel based processors."[8] Given the courts definition, Microsoft's share of the relevant market is approximately 95%. This definition, however, is not without controversy since it excludes Apple computers, which run on Motorola processors and make up approximately 10% of personal computer sales. The courts definition also excludes network systems such as Sun Microsystems which produces large servers that are commonly used as work stations. However, even including Apple, Microsoft is clearly the dominant supplier of operating systems in the personal computer market.

It is important to note that although the definition of the relevant market and market share or dominance is important, a large market share or market dominance alone is not sufficient for a firm to be considered a monopoly, nor is it illegal. For example, in the 1920 case against U.S. Steel, the courts applied the so called "rule of reason" and determined that although U.S. Steel clearly possessed monopoly power, they controlled nearly 75% of the domestic iron and steal industry, they had not resorted to illegal acts to gain their monopoly position nor did they abuse their monopoly power.[9] Hence, the courts "rule of reason" makes clear that market dominance or "size alone is not an offense" and that not all monopolies are illegal per se. Only those monopolies that resort to illegal acts against competition to gain or maintain monopoly power are illegal.

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[8] U.S. v. Microsoft, *Findings of Fact*.

[9] The rule of reason was first enunciated in the 1911 antitrust cases against Standard Oil and American Tobacco. In the Standard Oil case, the court ruled that Standard Oil's behavior in acquiring its monopoly power was illegal and not that being a monopoly was illegal per se.

It is also important to note at this time that Microsoft is not being charged with being an illegal monopoly. Nor is Microsoft being charged with gaining its market dominance or monopoly power illegally. Microsoft is being charged with abusing it monopoly power.[10] Thus, how Microsoft gained its monopoly position is irrelevant to the question of whether or not Microsoft is a monopoly. Unfortunately, because much of the literature addressing the question as to whether or not Microsoft is a monopoly focuses on how Microsoft acquired its dominance, it may help to address this particular question.[11]

Although there are several explanations as to how Microsoft acquired its dominance in the operating systems market, I will concentrate on three specific explanations: A technical explanation, a strategic explanation and an admittedly simplistic explanation. These explanations are neither collectively exhaustive nor mutually exclusive.

The first deals with several interrelated concepts: Network externalities, first mover advantage and path dependency. It is argued that operating systems exhibit network externalities. Network externalities can be direct and or indirect. A direct network externality occurs if the value of a good increases as more people use the good. Operating systems are said to exhibit direct network externalities because the value of an operating system, measured in terms of compatibility and uniformity with others using the same operating system, increases as more people use a common operating system. For example, the sharing of files generally requires each

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[10] In particular, it is alleged that Microsoft used its monopoly power to artificially construct barriers to entry. The formal charges against Microsoft will be examined more fully later.

[11] A common assertion in defense of Microsoft is they gained their dominance by producing a superior product and thus should not be penalized. This may be so, however, it does not address the question at hand. That is, whether or not Microsoft is a monopoly.

user to use a common or at least compatible operating systems. The more people using a common operating system, the more people with whom I can share files.

In addition a network externality can be indirect if the value of a good X increases as more of a complementary good Y is sold. Likewise, the value of good Y increases the more of good X is sold. As a result, there is an indirect effect on the value of good X through Y referred to as a positive feedback loop. Operating systems are said to exhibit indirect network externalities in that the value of an operating system increases the more software applications are available for that operating system. Similarly, the value of a software application increases the more people have an operating system that runs the application.

As a result of the existence of network externalities, both direct and indirect, consumers will prefer a common operating system that runs a wide variety of applications. Consequently, if an operating systems maker can be the first (i.e., first mover advantage) to reach a "critical mass" of users, consumers will chose that operating system over others thus directing the "path" of consumer demand. One explanation for Microsoft's dominance in the operating systems market is that MS-DOS and subsequently Windows gained first mover advantage in reaching a critical mass of users which then lead to the dominance of Microsoft in the operating systems market.[12] In this case, Microsoft dominance came about through the natural working of a free and competitive market.

A second explanation as to how Microsoft gained it dominance in the operating systems market is not unrelated to the first. In particular, it relates to Apples pricing of its own operating

[12] The theory of network externalities is not without its critics. See for example Liebowitz and Margolis (1999).

system the Mac OS and the tying of its operating system to its hardware. In the early years of personal computers when Apple and IBM were competing for dominance, Apple chose to maintain strict control over the licensing and distribution of its computers and operating systems. IBM, on the other hand, allowed others to copy or "clone" its personal computer configuration which lead to greater competition and lower prices for IBM and IBM compatible systems than for Apple's systems. The lower prices for IBM based systems which used Microsoft's operating system, allowed IBM to reach the critical mass first and hence become the dominant operating system.

A third explanation, again not unrelated to the previous two and one that Microsoft itself would argue, asserts that Microsoft has a dominant position in the operating systems market because MS-DOS and subsequently Windows are simply better than other operating systems. That is, consumers have chosen to use Microsoft operating systems over others because it is a better product at a lower price.

As mentioned above, these are only three explanations out of many that have been posited, and these explanations are not mutually exclusive. In fact, taken together they provide a fairly complete view of how Microsoft may have acquired its dominance in the operating systems market. Note that Microsoft's behavior in all three explanations is entirely benign. In fact, actions by Microsoft played no role in the existence of network externalities in operating systems nor in IBM's choice to allow others to copy its personal computer configuration. Of the three explanations provided, the only action for which Microsoft is responsible, is producing a superior product. An action for which Microsoft should be praised and not the action for which it is prosecuted. One factor that does run through all three explanations is that consumers freely

chose Microsoft's products over competing products. Again, the fact that consumers viewed Microsoft's operating system as superior and freely chose Windows over inferior products is laudable and is the desired result of the workings of a free market. That is, mutually beneficial trade in which both consumers and Microsoft has gained.

The important point to be made by the brief discussion of how Microsoft became a dominant firm is not that consumers freely chose Microsoft. Consumers always freely choose which products to consume. It is consumers who choose diamonds over other possible substitute goods and it is thus consumers who give De Beers its monopoly power. The important point is that just because consumers freely chose Microsoft's products over others does not mean that Microsoft is not a monopoly. Monopoly does not presuppose force upon consumers.

III Are there Substitutes to Microsoft's Windows?

The second part of the definition above posits that a monopoly operates in a market with no close substitutes. The availability of a substitute good, however, is dependant on the definition of the relevant market. Consequently, as with the definition of the relevant market, the availability of a "close" substitute is a term open to a great deal of interpretation. To some extant, there are substitutes for all goods. If there are substitutes for all goods, then the relevant question is how "close" of a substitute one good is for another. Substitutability, however, is determined by consumers. As previously noted, the De Beers company of South Africa is often used as an example of a monopoly because it controls 80% of the worlds diamond supply. However, there are substitutes for diamonds. There is cubic zirconium, an artificial diamond. In fact, most consumers cannot distinguish between a real diamond and a cubic zirconium. For whatever reasons however, consumers choose not to view cubic zirconium as a very good

substitute for diamonds. That is consumers are willing to pay much more for diamonds than for a virtually indistinguishable cubic zirconium. Furthermore, if the relevant market is defined as the precious gems market, then there are also emeralds, rubies, and sapphires. Again however, for whatever the reason, tradition, sentiment or peer pressure consumers do not view these as a close substitute for diamonds. Since it is consumers who choose what is and is not a substitute for a good, it is thus consumers that give firms their monopoly power.

Similarly with operating systems. There are substitutes for Microsoft's *Windows*. For example, *Linux*, *Free BSD*, which runs *Yahoo*, *OS2 Warp* which was developed by IBM, *BeOS*, and others are all substitutes for Windows.[13] However, most consumers do not view *Linux*, *BeOS* or the other fringe operating systems as a "close" substitute to Windows for a variety of reasons. These include the availability of software applications, ease of use, compatibility with other users or simply, as Microsoft would argue, because Windows is "better" than other operating systems. Regardless of the reason, most consumers choose not to view the present alternatives as close substitutes for Windows.

Even including Apples *Mac OS*, the second most widely used personal computer operating system, in the definition of the relevant market, substitutability is not enhanced. Substitutability is defined as the ease with which we can substitute one good for another. Consider the transactions costs associated with switching from Windows to the Mac operating system. First you would have to purchase a whole new computer system i.e., the hardware along

[13] Recall that the court defined the relevant market to be, "single user personal computers with intel based processors." In addition to excluding Apples *Mac operating system*, it excludes other operating systems such as Sun Microsystems, *Solaris*, that also runs on Intel based computers. *Solaris* is not included in the governments definition of the market because it is usually used to run business networks systems.

with the new operating system. This alone would cost somewhere near $1,500. Then you would have to purchase all new versions of your software that runs on the *Mac Operating System*: word processor, spread sheet, games, reference software and any number of a variety of software programs. Depending on how many programs you use, this could cost you thousands of dollars. In addition to the financial cost of switching operating systems, you would have to spend a considerable amount of time learning how to use a new operating system and how to use familiar programs running on a new operating system. That is, of course, assuming you can find versions of all the software applications you normally use that run on the *Mac operating system*. The problem of finding software applications becomes considerably more difficult as you move from the *Mac Operating System* to fringe operating systems such as *Linux* and *BeOS*. It is this dearth of applications available for other operating systems that makes *Windows* unique among operating systems and is one of the central characteristics surrounding much of the Microsoft trial. The existence of both direct and indirect network effects reduce the substitutability of Microsoft's *Windows*.

Again it should be noted that in free markets, consumers determine what is and is not a substitute for a good and in the case of operating systems consumers have made that determination. That is not to say that there will never be a close substitute for *Windows*. Technology moves fast and Microsoft's *Windows* may be displaced by an existing operating system or a future operating system.[14] Then again maybe not. No one knows what will happen in the future, and we should not base our analysis on what may or may not happen in the future. What we can do is analyze the facts as they currently exist.

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[14] Barriers to potential entrants are examined in the next section.

IV Are There Barriers to Entry?

The final and perhaps the most important criteria in meeting the definition of a monopoly is the existence of barriers to entry. Barriers to entry are essential to the perpetuation of a successful monopoly. Microeconomic theory argues that if a firm produces a successful product and is profitable, it will inevitably attract other firms seeking to replicate those profits. If rival firms are allowed to enter the market, profits will only be short lived as competition among the firms will compete away economic profits.[15] Thus for a firm to successfully earn positive economic profits in the long run, barriers to entry must exist. With respect to Microsoft, it is argued that there are three types of barriers to entry to the operating systems market. Two natural barriers to entry and an artificial barrier.

First, it is argued that there are economies of scale in the production of operating systems. That is, the high fixed costs associated with the research, development and marketing of operating systems, result in high per unit costs at low levels of output but a low per unit cost of producing operating systems at high levels of output. Consequently, because Microsoft sells a large number of copies of *Windows*, the per unit and marginal cost of producing each copy is low. The low per unit cost is good for consumers but may pose a problem for rivals. In addition, the high fixed costs can be prohibitive for potential rivals.

As a result of the high fixed costs, in order for a firm to be competitive in terms of price a potential competitor must sell a large number of units to be able to produce at a low per unit cost. This poses two obstacles to a potential entrant: First, a competitor must garner a large amount of

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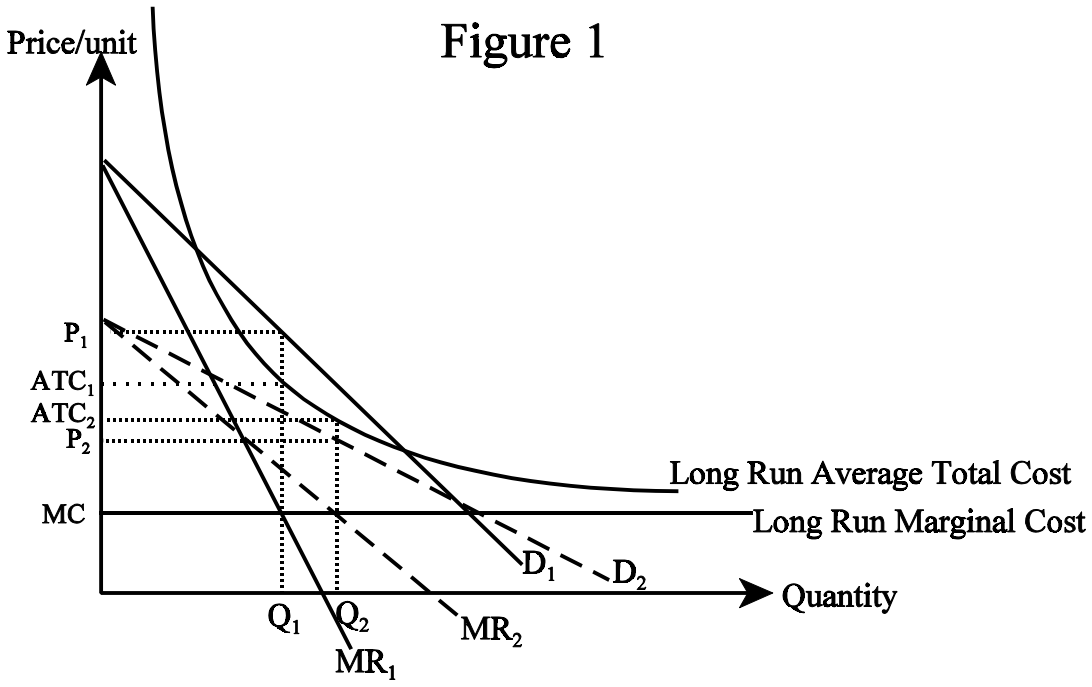
[15] A zero profit long run equilibrium will occur in perfectly competitive markets and imperfectly competitive or differentiated product markets.



the market[16] and second even if the firm is able to acquire a significant market share, the firm still may not earn a profit. In markets that exhibit economies of scale, although it may be profitable for a single firm to serve the entire market, it may be unprofitable for a second firm to enter the market. For example, consider Figure One which shows a situation in which a firms long run average total cost is decreasing as output increases. If this firm is the only firm serving the market, the demand curve, which is the market demand, facing this firm is D_1 and the corresponding marginal revenue curve is MR_1. The profit maximizing monopolist will produce where the marginal cost of production is equal to marginal revenue, which occurs at Q_1. The monopolist then charges the highest price consumers are willing to pay which is shown at the price of P_1. The per unit cost of producing Q_1 units is shown as ATC_1. In this example, the firm makes an economic profit of P_1 - ATC_1 on each unit sold.

[16] The problems associated with gaining a large market share will be examined below.

Now suppose that the positive profits earned by the firm in Figure One entice another firm to enter the market. Assuming the new firm produces a "close" substitute and is able to capture a significant portion of the market, the new firm will take up some of the demand from the existing firm (Firm One) and shift Firm One's demand curve to D_2 with the new corresponding marginal revenue curve of MR_2.[17] Firm One will re-equilibrate to the new demand and marginal revenue functions by producing where the new marginal revenue function equals marginal cost which is now at Q_2. Note that although the existing firm ends up producing more output, the maximum price the firm can charge is now lower at P_2.[18] At a price of P_2, Firm One now incurs an economic loss of P_2- ATC_2 on each unit sold. Under the relatively optimistic assumptions that the entering firm is equally efficient at producing output[19] and that the entering firm captures a significant or even an equal amount of the market, then Figure One can also represent the entering firm. The result, as Figure One shows, of the entry of a second firm is to reduce price to less than the cost of production which results in both firms losing money. Because entry will result in an economic loss, a second firm will be reluctant to enter the market. As a result of economies of scale that occur in the natural production process and not the result of any malevolent action by the existing firm to keep out competitors, the market is not able to profitably sustain more than one firm. Although positive profits of the monopolistic firm will tend to induce entry, competitors will only enter if they can do so profitably. As long as potential

[17] Note also that the existence of a close substitute will also increase the elasticity of the new demand curve D_2.

[18] Competition between the two firms results in a lowers price and an increase in the quantity demanded for both firms.

[19] That is, both firms have identical cost curves.

entrants are sufficiently informed about the market conditions and the costs of production, then firms will not enter if they believe the market cannot support two firms profitably.

In addition to the high fixed costs and the operating losses, the costs of entry are further increased if we consider the costs of exit as well. That is, even if a firm incurs an economic loss after entry into a market, the firm can often recoup some of its fixed costs upon exit by selling off its capital expenditures such as machines and equipment. However, because much of the fixed costs associated with the production and sale of operating systems are unrecoverable or sunk costs, the firms costs of exit and hence entry are increased. In particular, the high fixed costs of research, development and marketing of a new operating system are not recoverable upon exit of the market and subsequently raise the natural barrier that exists with economies of scale.

Furthermore, even if a firm can overcome the high fixed costs and is willing to incur operating losses resulting from economies of scale and the potential loss of non-recoverable fixed costs, there is still the applications barrier to entry. Recall that in order to produce at a low cost, the firm must garner a large part of the market. The applications barrier to entry, perhaps the most significant barrier to entry into the operating systems market, reduces the probability of successfully gaining a large market share.

The applications barrier to entry results from what is referred to as economies of scale in the consumption. Economies of scale in consumption are the result of the aforementioned mentioned network externalities associated with operating systems. Recall that, operating systems exhibit network externalities if the value of an operating system increases as more people use that operating system. By no means are network externalities new. The rail road network, telephone networks, credit card and ATM networks, fax machines, modems and the

internet all exhibit network externalities. That is the value of these goods increases as their use increases. For example, the value of being connected to the internet is low if you are the only one on the internet. However, as more and more people use the internet, the value to internet users increases.[20] It is argued that operating systems exhibit a direct network externality in that as more and more people use a single operating system, consumers benefit the uniformity and compatibility that exists with other users. The existence of a direct network externality poses a barrier to entry to new operating systems because consumers will be reluctant to embrace a new operating system that lacks widespread use and therefore uniformity and compatibility with others.

In addition, operating systems are said to exhibit indirect network externalities. Again, recall that an indirect network externality exists when the value of a primary good increases as more of a complementary good is sold. Likewise, the value of a complementary good increases the more of a primary good is sold. Thus, there is an indirect effect on the value of the primary good through the complementary good referred to as a positive feedback loop. A current example of an indirect network externality is the inter-dependence between DVD's (digital video disks) and the complementary good DVD movie rental stores. The value of a DVD increases with the availability of the complementary good pre-recorded movies on DVD. Also, the value or success of a DVD rental store depends on the number of people who own DVD players. In this case, the demand for movies on DVD depends on the number of DVD players and likewise

[20] There is virtually no value to purchasing access to the internet if you are the only member. However, as more people access the internet, the value measured number to contacts that can be made increases significantly. With n people on the internet, there are n(n-1) potential exchanges among members. However, each new entrant to the network provides a direct externality to all other entrants by adding 2n potential new exchanges.

the demand for DVD players depends on the number and availability of movies on DVD.

Operating systems possess an indirect network externality in that the value of an operating system increases the more that complementary software applications are written for that operating system. Also, the value of a software application increases the more people who use a single operating system that runs the software and by extension the greater the number of potential purchasers of that software.

V The Applications Barriers to Entry a.k.a. " The Chicken and Egg Problem"

Economies of scale in production and economies of scale in consumption, in particular the existence of an indirect network externality, work together to create what is referred to as the applications barriers to entry. The applications barriers to entry is used to explain why there is very little competition for Microsoft's *Windows* and why it is unlikely that competing operating systems will be developed in the near future.[21] The logic behind the applications barrier to entry is as follows: Because of the high fixed costs of developing an operating system, developers of new operating system's need to reach a large number of consumers to recoup costs. In addition, consumers prefer to purchase an operating system for which there are a large number of applications available to run on the operating system. However, because re-writing software to a variety of operating systems is expensive, software vendors will only write applications for operating systems that are used by a large number of people. Since there is no guarantee that a new operating system will be successful, software vendors will be reluctant to write software that will run on a new operating system. Consequently, because few applications will be available for

[21] The applications barrier to entry is also central to the current antitrust trial in that it is alleged that Microsoft's engaged in illegal activity in order to maintain the applications barrier to entry.

a new operating system, demand for a new operating system will be low and thus operating system developers will be reluctant to invest in the development and marketing of new operating systems.

In short, the applications barrier represents a "vicious circle" in which an operating system will only be successful if there are a large number of applications available. A large number of applications will only be written for an operating system that is used by a large number of people. A large number of people will use an operating system only if there are a lot of applications available for it to run. etc., etc., etc.

As noted above, the applications barrier to entry is perhaps the most significant barrier to entry because the dearth of applications results from a reluctance of a large number of independent and varied software applications vendors to write for operating systems other than *Windows*. Consider for example, Apple's *Mac OS*, the second largest personal computer operating system on the market. Although Apple's *Mac OS* has a loyal, albeit small, user base it does not have the same amount of software applications available as Microsoft's *Windows*. The applications barrier becomes even greater for smaller operating systems such as *Linux* and greater yet for a new operating system.

Finally, there is an artificial or government granted barrier to entry. Specifically, Microsoft's copyright to its *Windows* operating system legally restricts others from reproducing its operating system. Government granted patents were designed to reward inventors by giving them the exclusive right to sell their product for twenty years. However, patents are only as valuable as the underlying product they protect and Microsoft's *Windows* has proven to be extremely valuable. Consequently, Microsoft enforces its patent to *Windows* by closely guarding

the underlying source code for the *Windows* operating system. Again, it is important to note that protecting its source code is Microsoft's legal right and is not an action for which Microsoft should be condemned. Microsoft developed a product which consumers find highly valuable and patents are designed to reward developers like Microsoft and many others who invest in the research and development of new products.

To this point, I have described a number of barriers to entry, none of which are unique to the operating systems market. Although none of these barriers are insurmountable, taken together, they pose a significant obstacle to potential competitors of Microsoft's *Windows*. That is, a potential entrant must consider the high fixed costs associated with the research and development of producing a competing operating system, the possible operating losses resulting from entering a market that may not profitably support two firms, the loss of non-recoverable fixed costs resulting from unsuccessful entry, the applications barrier to entry and the copyright laws that protect Microsoft's *Windows*.

Also, it should be noted that although substantial barriers to entry do exist, it does not mean that they are insurmountable nor that they are permanent. A barrier to entry is an "obstacle, obstruction, impediment, hindrance, handicap, difficulty, restriction, limitation, stumbling block, or hurdle,"[22] and is not insuperable. Nor is a barrier forever. Technology can diminish the effectiveness of a monopoly by creating substitutes or by supplanting one monopoly with another that creates a superior product. Thus the issue with respect to barriers to entry is not whether or not they will ever be broken down but rather when they will be overcome. Nowhere in the economic literature are barriers considered absolute and permanent.

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[22] The Random House College Thesaurus.

It is also important to recognize that the barriers to entry enumerated above result from no illegal activity by Microsoft. In fact the applications barriers to entry is a natural barrier resulting from the combined effects of economies of scale in production and the network externality associated with operating system's and is not the result of any action by Microsoft. Thus, Microsoft is not responsible for the existence of the applications barrier to entry. In addition, enforcing its copyright on *Windows* is fully within Microsoft's legal right. Thus, Microsoft is not liable for the existence of barriers to entry into the operating systems market. The relevant point, however, is that there are barriers to entry into the market for operating systems.

To this point, I have addressed the structural characteristics of whether Microsoft is a monopoly. I now turn to the more important question of, if they are a monopoly, "so what?" That is, what are the ramifications of Microsoft being a monopoly?

VI Behavioral Characteristics

Standard textbook microeconomics asserts that a firm with monopoly power will generally attempt to restrict quantity below the competitive level in order to raise price and thus earn positive or above normal economic profits. Recall that in competitive markets, profits may exist in the short run but free entry allows firms compete away excess profits. The questions at hand now become: Does Microsoft restrict output? Does Microsoft charge a price above the competitive level? and Does Microsoft earn positive economic profits? Again, in order to assert that Microsoft is exercising its monopoly power, the answer to these questions must be "yes."

VII Does Microsoft Restrict Output?

Microsoft is able to restrict output due to the existence of barriers to entry and the lack of viable alternatives in the operating systems market. Furthermore, Microsoft restricts the output

of *Windows* by maintaining its copyright to *Windows* and closely guarding the technical (i.e., source) code underlying the operating system. This, however, is perfectly legal and within Microsoft's rights as a copyright holder. Copyright laws were intended to reward research, development and innovation by granting the holders of copyrights the monopoly rights to their inventions. In this sense, Microsoft behaves like any other copyright holders.

A common question is, how can Microsoft be restricting output when you can go to any computer store and find copies of *Windows 98* sitting on the shelves? Or how can Microsoft be restricting output when I can go on to the internet and order a copy of *Windows* from any one of a number of sellers? Again, return to the diamond market for clarification. As noted above, the De Beers corporation is used as a textbook example of monopoly in the diamond market. As a monopoly, De Beers closely regulates and restricts the quantity of diamonds on the world market at any one time so as to maintain a profit maximizing price and quantity. Yet, I can go to any jewelry store or I can go on the internet and buy a diamond with little effort. Alternatively, look at OPEC and the market for oil. Recently, OPEC has greatly reduced the quantity of oil supplied to the world oil markets, yet I can go to any corner gas station and purchase gasoline, albeit at a higher price than a year ago. Restricting output does not imply that a shortage will exist. Shortages are generally the result of some type of price controls. A monopolist on the other hand will only restrict output below the perfectly competitive quantity so they can charge a price above the competitive level and thus earn profits above the competitive rate. As was noted above, the intent of patents is to give patent holders a monopoly on their inventions so they can reap the monopoly profits from their invention.

VIII Does Microsoft Raise the Price of its Operating System Above the Competitive Level?

Consider now the pricing of Microsoft's *Windows*. In perfectly competitive industries, price is determined in the market by the interaction of a large number suppliers and demanders. Each firm, lacking price setting power, takes the market price as given. Competitive pressure drives the market price of output to the marginal cost of production. So the question is, does Microsoft charge a price above the marginal cost of production for *Windows* and if so by how much?

It is often argued that the marginal cost of producing an additional unit of *Windows* is close to zero. However, this does not generally include support and other incremental costs associated with selling additional units. Thus we can conclude that the marginal cost of selling additional units is greater than zero. The current retail price of *Windows* is $89.[23] Is $89 above the competitive price? It is often argued that if Microsoft is the dominant firm of the operating systems market with no close substitutes and barriers to entry and if Microsoft restricts output and charges a price above the competitive level then why do they charge so little for *Windows*? That is, $89 per copy of windows does not seem outrageously high. Some have even argued that if Microsoft was a monopoly, they could charge a price as high as $2,000 per copy of *Windows*.[24] There are several explanations for the apparent "low" price of Windows.

To begin with, a monopoly cannot charge "any" price it wants. A monopoly charges the

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[23] The wholesale price to computer manufacturers is approximately $49.

[24] See for example, Reddy, Evans and Nichols, *Why Does Microsoft Charge so Little for Windows?* A copy of which is available on Microsoft's web site.

maximum price consumers are willing to pay for a given quantity. The extent to which a monopoly charges a "high" price is its ability to charge a price above the marginal cost of production. As noted above, if the marginal cost of producing software is relatively low, then even if Microsoft prices above marginal cost this may not result in a price deemed high by consumers.[25]

In addition, it is also argued that a monopolist may choose to sacrifice high short term profits and maximize long term profits by keeping price and thus profits relatively low in order to keep out potential entrants.[26] In the theory of contestable markets, potential entry of firms into markets may result in prices and output close to that of perfectly competitive markets. As long as there is free or costless entry into a market, above normal profit will induce firms to temporarily enter the market in a "hit and run" fashion and compete away profits. Thus, in contestable markets the mere threat of potential competition will force existing firms to behave competitively. It is argued that although Microsoft faces little pressure from actual competitors in the market for operating systems, they do face a threat from potential competitors. Thus, the decision to keep the price of Windows low may deter entry by would be competitors and thus maximize long term profits.[27]

Also, although there may be few legal competitors, Microsoft does faces competition

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[25] For example, if the marginal cost of producing a good is one dollar, doubling marginal cost would only result in a price of two dollars.

[26] See for example, Princeton's William J. Baumol for an elaboration on the theory of contestable markets.

[27] The theory of contestable markets relies on costless entry, which I have argued, does not exist in the operating systems market. However, this does not negate the effect of potential entrants but rather limits their effect.

from illegally pirated software. Prices significantly above marginal cost create an opportunity for arbitragers to produce copies above marginal cost but below Microsoft's retail price. So the black market for Windows may act as a check on Microsoft's pricing policy.

The threat of potential entry, however, depends on how close of a substitute the entering firms product is to the monopolist's product. Consider first the use of a "low" price to deter entry of illegal or pirated copies of *Windows*. It should be noted that piracy is not unique to operating systems nor software in general. Consequently, as with many products, the degree to which an illegal or stolen copy of *Windows* is a "close" substitute for a legal copy of *Windows* is, as always, determined by consumers. Consumers will weigh the costs of obtaining a stolen version of a good with the benefits and determine whether or not the stolen version is a close substitute for the legal version. Again however, this is the same cost benefit decision that consumers face with all alternative products, stolen or otherwise. For example, consider the two alternative sources of heating a home, oil and solar power. Most would agree that solar power is not a "close" substitute for oil, but that it is a substitute nevertheless. However, in the mid and late 1970's when the price of oil rose substantially, the substitutability of solar power for oil increased. That is, at a low price for oil, solar power was not seen as a "close" substitute for oil, but at a high price of oil, solar power became a "closer" substitute. The result of the increase in the price of oil in the mid 1970's was that we saw an increase in the use of solar power.

The same holds true for illegal copies of *Windows* and nearly all goods and services for that matter. At $89 dollars a copy, consumers may not view illegal copies of *Windows* as a close substitute. However, at a significantly higher price, illegal copies may become a closer substitute for legally purchased copies. Therefore, it is safe to say that ceteris paribus, the substitutability

of stolen goods for legally purchased goods increases as the price of the legal good increases.

As I stated above, the substitutability of stolen goods for legally purchased goods increases as the price of the legal good increases. A more general version of this statement is that ceteris paribus, the higher the profits resulting from the sale of a good, the more substitutes it will induce into the market; any market, whether or not barriers exist. Barriers to entry represent the cost of entry by firms. Regardless of how high the cost of entry, if the potential benefits (i.e., profits) of entry outweigh the costs, then firms will attempt to enter. If at a low profit margin, the costs of entry are higher than the benefits, then firms will not enter and there will be a lack of close substitutes. If however, there are high profits, the costs of entry relative to the benefits diminish and entry and the availability of substitutes may occur. Thus, by extension it is safe to say that at a low profits there are substantial barriers to entry and a lack of close substitutes but at a higher profits those barriers are reduced relative to the potential returns.

Another explanation for Microsoft's apparent low price of Windows is the revenue and profits generated from the sale of complementary goods. That is, because Microsoft already dominates the operating systems market further profits can be generated by penetrating the word processing market, the spreadsheet market and the suite market. The current price of Microsoft's *Windows* can be seen as the price that maximizes total profits from the sale of *Windows* and its complementary products Microsoft's *Office, Excel* and *Word*.

To this point of the discussion, the assumption has been that the price of Windows is relatively low. $89 per copy retail and $49 per copy wholesale does not seem inordinately high. Not only is the price of *Windows* seen by some as being low, it has remained constant for the last decade. In fact, it has been argued that because Microsoft has not changed the price it charges for

Windows for at least a decade, if you adjust for inflation and quality the price of *Windows* has actually fallen over time.[28] Even given the reasons provided above, the pricing policy of Microsoft, appears puzzling and inconsistent with the behavior of a firm with monopoly power.

To evaluate the pricing issue more closely, I want to first examine the price of "high tech" goods in general, hardware and software. Consider first the price of the hardware components of a personal computer: random access memory (RAM), video cards, CD-ROM's, processors and monitors. Over the same period that Microsoft has had a dominant position in the operating systems market, the price of hard drives, random access memory (RAM), video cards, CD-ROM's, processors and monitors have all seen significant decreases. The price of *Windows* however has remained the same. In addition to falling prices, the speed of hard drives, random access memory (RAM), video cards, CD-ROMs, and processors has increased. *Windows*, however, over this same time has gotten slower and slower.[29] It could be argued however that hardware and software involve different production processes and thus the above comparison is spurious.

Consider instead the software applications market which would more closely resemble the operating systems market. Microsoft supporters refer to the fact that in markets where Microsoft competes, software prices have fallen. In the word processing market where

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[28] This assumes that the price of Windows 3.1, released in 1990 is approximately the same as Windows 98. OEM prices of Windows 3.1 are not available.

[29] "You have to face the truth: Windows 98 is slower than Windows 95. It demands more system resources, and because of that, your PC's performance will suffer." Quoted from an article on C-NET.COM's web site written by Cormac Foster (2/22/99; updated 1/24/00).

Microsoft's *Word* competes with *WordPerfect* and others, the price of word processors has fallen significantly. Recall however, that over this same period, the price of *Windows* has remained constant.

In the spread sheet market where Microsoft's *Excel* competes with *Lotus* and *Quattro Pro*, the price of spread sheets has fallen significantly. The price of *Windows* has remained constant.

In the personal finance software market, where Microsoft's *Money* competes with *Quicken* and *Managing Your Money*, the price of personal finance software has fallen significantly. The price of Windows has remained constant.[30]

It is abundantly clear that in markets where Microsoft competes, software prices have fallen. However, it is not alleged that Microsoft has a monopoly in the word processing market, the spread sheet market or the personal finance market. It is alleged, that Microsoft has a monopoly in the operating systems market. In the operating systems market, over the same period in which the price of most hardware components and most software applications has fallen, the price of Microsoft's *Windows* has remained constant. The puzzling aspect of Microsoft's pricing policy is that while technological innovation and competition has reduced prices in almost every other market, the price of Microsoft's *Windows* has remained constant or relative to every other product has actually increased.

There are several possible answers to this conundrum. First, you can argue that because the production process of hardware is different than that of software, that you cannot legitimately

[30] For a complete exposition of how software prices have fallen in markets where Microsoft competes, see Liebowitz and Margolis, *Winners, Losers & Microsoft: Competition and Antitrust in High Technology*.

compare the prices of hardware and software products. However, as noted above, the price of most software application have also fallen over the much of the same period. So the question is why has technology and competition had price reducing effects on everything except Microsoft's Windows? Secondly, you can argue that because Microsoft continually upgrades, enhances and improves Windows, that the costs associated with these upgrades, enhancements and improvements have prevented Microsoft from lowering the price of Windows. But again, this raises another question. Hardware and software producers have continually upgraded, enhanced and improved their products, yet prices have continually fallen. So again, why is Microsoft's *Windows* different from all those other products? Finally, you can argue that because Microsoft's *Windows* is the dominant product in the operating systems market, with no close substitutes and protected by barriers to entry, that it does not face the same competitive price reducing pressures that are faced by every other hardware and software producer.

It is important to note that Microsoft is not being accused of "price gouging." Furthermore it is also important to note that all firms that operate in markets with differentiated products have some degree of monopoly power and thus some degree of pricing power. What distinguishes Microsoft, however, is that they operate in a market with no close substitutes and barriers to entry.

IX Does Microsoft Earn Positive Economic Profits?

As noted above, barriers to entry allow a firm to restrict output, raise price and earn positive economic profits. Consequently, long run above normal economic profits would be indicative of barriers to entry and monopoly power. A common measure of a firms profits is the rate of return on capital. As a measure of normal profits, we can examine the rate of return on

capital for firms operating in the U.S. From 1990-1998, the average return on capital was 6.7% per year for all U.S. firms. Microsoft, on the other hand, earned a rate of return on capital of 88% in 1999 alone. In fact, since 1987 Microsoft has earned a rate of return on capital of over 80% every year and has reached rates above 100%.[31] In the lightening speed of the internet age, a decade would appear to constitute the long run and thus Microsoft's "persistent excess profits provide a good indication of long run [monopoly] power; they show clearly that there is some impediment to [entry by rivals]."[32]

Another argument raised in Microsoft's defense is the contention that because a monopolist does not face competitive pressures, they do not engage in product innovation. Supporters of Microsoft point to Microsoft's 1997 research budget of nearly three billion dollars to show that Microsoft faces vigorous competition and must innovate to stay competitive. Clearly, Microsoft has engaged in rigorous and consistent product development. However, expenditures on research and development are not necessarily an indication of competition. In contrast to the view that only competitive firms engage in research and development others argue that monopolists, like competitive firms are profit maximizers and will engage in innovation and product development if it leads to greater profits. The late Austrian economist Joseph Schumpeter argued that the profits associated with monopoly power provide a source of funds available to monopolistic firms for research and development that competitive firms do not have at their disposal. As evidence of this view is Du Pont, AT&T and IBM all of which are large

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[31] Robert E. Litan, Roger G. Noll, William D. Nordhaus and Frederic Scherer, *Remedies Brief of Amici Curiae,* submitted to judge Jackson April 27, 2000.

[32] Richard Schmalensee, *Comment: Another Look at Market Power*, Harvard Law Review, June 1982.

firms with dominant positions that vigorously engage in research and development. Microsoft can also be added to this list.

X Is Microsoft a Monopoly?

A monopolist will attempt to restrict output and raise price above the competitive level so as to earn positive economic profits. To accomplish this, the monopolist must be the dominant firm in a market without any close substitutes and be protected by barriers to entry. Clearly, Microsoft is the dominant firm in the operating systems industry. Regardless of how Microsoft gained its dominance consumers overwhelmingly choose to use *Windows* over other operating systems.

The degree to which there are "close" substitutes to *Windows* is apparent by its dominance. Because consumers view *Windows* as far superior to other operating systems, those "fringe" operating systems that do exist are not seen as close substitutes to Microsoft's *Windows*. Although producers of rival products invariably believe that their products are superior, it is consumers who decide which products best meet their needs.

Barriers to entry exist in the form of high non-recoverable fixed costs, economies of scale in production, economies of scale in consumption and the enforcement of copyright laws. The fact that these are legal and consistent with profit maximizing behavior does not invalidate their existence. In addition, evidence of barriers can be concluded by the existence of long run economic profits.

Furthermore, I have shown that Microsoft's behavior is consistent with what one would expect from a monopolist. Most would agree that the high technology sector is one of the most competitive segments of the economy and has been characterized by rapid technological

innovation and falling prices. However, because Microsoft's *Windows* is the dominant product in the operating systems market, with no close substitutes and is protected by barriers to entry, Microsoft's *Windows* does not face competitive price reducing pressure and consequently the price of *Windows* has remained unchanged while nearly all other software and hardware products have fallen. Clearly Microsoft has not responded to the presence of any viable competitor. It seems apparent that the evidence presented provides an overwhelming argument to affirm that Microsoft is a monopoly.

XI Have Consumers Been Harmed?

Standard microeconomic theory asserts that consumers are worse off under monopolies because of higher prices, lower quantity and the associated dead weight loss. However, in the case of economies of scale, the standard argument may not hold. On the demand side of the market, economies of scale in consumption mean that consumers prefer a single standard operating system that provides uniformity, compatibility and a wide variety of applications. On the supply side of the market, economies of scale in production mean that a single firm producing a large quantity can produce at a lower per unit cost than smaller firms producing small quantities. Furthermore, when economies of scale in production exists, the market may not profitably support more than one firm, thus producing the competitive level is not sustainable. As a result the welfare cost generally associated monopoly is not applicable.[33]

Also, how much consumers are harmed by monopolistic pricing is difficult to ascertain. Because Microsoft keeps its costs of production secret, it is impossible determine the extent of

[33] This is because production at the competitive level (i.e., at marginal cost) is unprofitable and thus would result in zero output. The choice is then between zero output and the monopolistic output.

the markup above marginal cost, on *Windows*. However, it is clear that Microsoft's *Windows* has not been subjected to the same competitive price reducing pressures that have lowered the prices of most hardware and software products.

In general, consumers benefit from the cost reducing effects that result from economies of scale production and from the uniformity, compatibility and availability of a wide range of software applications that results from economies of scale in consumption. Consumers are, however, made worse off by the pricing power that results from Microsoft's monopoly position in the operating systems market. Because both economies of scale in production and consumption result from free choices and voluntary trade between consumers and Microsoft, it can be assumed that the net effect on consumers is positive.[34]

XII Conclusion

What this paper has done is address one of the most often asked questions in business and economics courses. Is Microsoft a monopoly? In this paper, I have shown that Microsoft looks like a monopoly in that *Windows* is the dominant product in the operating systems market, with no close substitutes and is protected by barriers to entry. I have also shown that Microsoft acts like a monopoly in that Microsoft fiercely protects its underlying source code to *Windows* thus restricting output and allowing Microsoft to remain immune to the competitive price reducing pressures that plague firms in other "hi tech" markets and allows Microsoft to earn long run positive economic profits. So, yes Microsoft is a monopoly. However, Microsoft's *Windows* monopoly results from the voluntary choices and mutually beneficial trade that occurs in the free

[34] There is, however, no question that Microsoft has benefitted from its monopoly position.

market.[35] There remains a number of questions that this paper has not answered. What this paper has not addressed is whether the specific actions for which Microsoft was convicted were in fact anti-competitive and harmful to consumers. These questions along with the legal issues surrounding Microsoft's actions are left to be examined later.

[35] Patent/copyright protection is granted by the government so it could be argued that the *Windows* monopoly, like most monopolies, is the result of government action.