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The controversial choice of remedies to cope with the anti-competitive behaviour of Microsoft

François Lévêque

**Working Paper,
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The remedy stage of *USA vs. Microsoft Corporation* has raised three main controversies:

- *Conduct vs. structural remedies*. Certain parties (SIIA, 1999; Salop and Romaine, 1999; Lenard, 2000) asked for structural remedies, such as a break-up, whereas others (Gassée, 1999) called for restrictions on Microsoft behaviour by mandatory rules of conduct. Even among plaintiffs a disensus appeared. The states of Illinois and Ohio voiced doubt about the use of structural reliefs (Ryan and Montgomery, 2000). They proposed to test in a first step whether conduct remedies would alone be sufficient to restore competition.

- *Horizontal divestiture vs. full divestiture*. The Department of Justice proposed that the U.S. District Court break up Microsoft horizontally by separating the operating systems business and applications business. During the remedy hearings, the District Judge, Thomas Penfield Jackson, asked the Assistant Attorney General, Joël Klein, whether an additional separation of Internet browser business would not be also appropriate. He mentioned an *amici curiae* brief (CCIA and SIIA, 2000) as supporting this option. In another *amici curiae* brief (Litan et alii, 2000) submitted to Judge Jackson, a full divestiture including the break-up of the Windows monopoly in three identical parts was recommended.

- *Beneficial vs. harmful effects to consumers of the operating systems/applications separation*. Following the recommendations of the Antitrust Division, the District Court of Columbia ordered the horizontal separation of Microsoft. According to the Antitrust Division, such a divestiture promises to have significant benefits for competition in general and innovation in particular (US DoJ, 2000). Some columnists (Financial Times, April 29 2000) remained more skeptical pointing out that a price increase is likely to result from the replacement of one monopoly by two vertical monopolies.

The paper is aimed at casting light on these controversies in using economic analysis. It is divided into 4 sections, one for each controversy, and a conclusive section. Section 1 argues that the key economic distinction to introduce amongst antitrust remedies is between economic remedies based on incentives and command-and-control remedies rather than between behavioral and structural remedies. Section 2 compares different solutions to break-up Microsoft using the maximising of the consumers' welfare as a yardstick. It points out that the horizontal divestiture dominates the other choices only under a restrictive set of *ad hoc* hypotheses (e.g., the expected costs of Windows' fragmentation is higher than the benefits provided by vertical integration). Section 3 examines to what extent the chosen remedy, that is the horizontal divestiture, is not worse than the evil it is supposed to cure. It establishes that the horizontal divestiture is welfare decreasing for consumers in several plausible circumstances (e.g., the two new entities do not compete to each other).

1. The unsound opposition between conduct and structural remedies

Judge Jackson found that Microsoft violated antitrust law in three ways. In technically tying its browser, Internet Explorer, with its operating system, Windows, Microsoft undertook illegal trade restrictions according to section 1 of the Sherman Act. Moreover, the court found that Microsoft violated section 2 by (i) attempting to monopolise the market for Internet browsers (ii) unlawfully maintaining its monopoly in the market of operating systems for personal computer.

Conduct and structure remedies

Several remedies have been suggested. Examples are listed in Box 1.

Box 1. Different recommended measures to remedy to Microsoft anti-competitive behaviour

- a) A prohibition against tying Microsoft operating systems to each other or to other Microsoft products and services. Such a measure will oblige Microsoft to disbundle Windows and Internet Explorer (Lenard, 2000).
- b) A requirement to port application software, especially Office, to Linux and other operating systems. Today, Office is not compatible with non-Microsoft operating systems but MacOS from Apple.
- c) A ban on adverse actions against computer manufacturers and software developers because they dealt in a product that competes with a Microsoft product (§ 3a and §3d of the plaintiffs' proposed final judgement, US DoJ, April 28).
- d) A requirement to make available the application programming interfaces to competing application software developers. This provision included in the plaintiffs' proposed final judgement (§ 3b) is aimed at enabling developers to make their software run as well with Windows as Microsoft's software does.
- e) A price regulation on Windows. One measure proposed by Varian (1999) consists in compelling Microsoft to distribute its ancient version of Windows at a flat price.
- f) A compulsory licensing of Windows' source code. This licensing can be royalty-free like in the *US vs. General electric* precedent (Litan et alii, 2000) or associated with a compensation (i.e., the source code may be awarded to the highest bidders in a competitive auction).
- g) A requirement to make available an open-source version of some or all versions of Windows operating source codes. In that case, both the source code and derivatives works must be published.
- h) A requirement to establish a compliance committee of Microsoft board of directors, to hire a compliance officer, to maintain certain records and to provide certain information and documents to plaintiffs. This measure is included in the final judgement (§ 4). It is aimed at ensuring compliance with other provisions of the decree.
- i) A break-up separating the operating systems business and the applications business of Microsoft. This remedy is sometimes called the functional divestiture because it divides Microsoft according to its business line. It is also called the horizontal divestiture because that is the way the knife cuts.
- j) A break-up dividing the company into several identical, integrated firms, each with full access to all of Microsoft intellectual property. This remedy is usually named vertical divestiture.

It is common in antitrust literature to divide numerous remedies to anti-competitive behaviour into two large families: conduct remedies and structural remedies. Conduct remedies are those which

prescribe or proscribe certain behaviour. They span the spectrum from a simple prohibitory injunction (« Thou shall not violate the law again ») to a detailed list of permissible and prohibited conduct that governs the firm's business with its affiliate, vendors, competitors and customers. The first three remedies of the list in Box 1 belong to this first family of antitrust policy instruments. The second family groups together so-called structural remedies. They modify a firm's internal or external organisation. An example is when competition authorities request that a firm dispose of certain business units before authorising a merger or an acquisition. Another example is the mandatory setting of Chinese walls to bar exchange of information between employees of different internal departments of the same company. They are required to prevent conflict of interest in audit and consulting global firms whenever they work for competing clients. The last three remedies in the list in Box 1 belong to this second family.

The dichotomy between conduct and structure remedies is inherited from Industrial Organization as developed in Scherer' 1973 book « Industrial Market Structure and Economic Performance »¹. Scherer conceptualised how market structure shapes a firm's behaviour and explains economic performances. In changing market structure, structural remedies change a firm's behavior. For instance, in the case of a functional break-up of Microsoft the newly created operating system company would disclose technical information to all software developers, not only to the applications company. It would no longer have any interest in giving a specific advantage to any downstream firm. In contrast, a conduct rule requiring Microsoft to offer an equal access to applications programming interfaces would not modify a firm's interest in engaging in the prohibited conduct. Therefore, the firm is likely to attempt to circumvent the rule. It may invent new forms of conduct that have not been explicitly forbidden. To counter-act such a phenomenon, public authorities have to set more detailed rules. Through time, conduct remedies become based on longer and more complex rules and call for more expertise; this may eventually leads to the creation of a specialised regulatory agency. Because they suppress a firm's interest to behave unlawfully, structural remedies are less costly to enforce.

The enforcement drawback of conduct remedies, in particular the threat of a creeping regulation of the software industry, has been emphasised by proponents of structural reliefs in the case of Microsoft. Using the term of structural remedy as a catch-all category, they also claim that structural remedies are more stringent and more effective. Structural reliefs are said to be more stringent because this characteristic which features divestiture is uncautiously and inappropriately generalised to all other structural remedies (e.g., Chinese walls). They are said to be more effective because divestiture is able to restaure competition and this feature is again extrapolated to all structural remedies. Note that remedies' effectiveness can only be assessed wherever there is an explicit objective. For structural remedies' proponents the considered objective is to kick start the market back to a competitive condition. No remedies can therefore be one hundred per cent effective, except full divestiture and open-source. In contrast, for supporters of Microsoft

such remedies are disproportionate. They consider that remedies are only aimed at impeding past unlawful conduct to repeat, the Court found Microsoft has engaged it. Some conduct remedies would therefore suffice.

The dichotomy between conduct and structural remedies is over-simplifying. Structural remedies are not always especially easy to enforce. This is the case of Chinese walls for information exchange is difficult to observe and therefore to monitor. Moreover, even some forms of divestiture may require significant ex post involvement of administration. The functional break-up is an example. Business lines evolve with changes in technology and demand. Public authorities' involvement is thus necessary to ensure compliance with the maintaining of business lines break-up. On the contrary, some conduct remedies may require a low involvement of administration. For instance, an injunction to publish a price list to remedy to discriminatory pricing is easy to monitor. The dichotomy is also confusing because some remedies as those concerning intellectual property rights are difficult to range into one family or the other².

Incentives remedies

The reason why the dichotomy is confusing is because it entangles two distinct features of policy instruments: the policy approach and the target. The independence of these two features is put in evidence in table 1 with examples of policy instruments used in different areas (environmental policy, tort law, public utilities regulation, etc.) and examples of different Microsoft remedies mentioned in the list in Box 1.

Table 1. Two independent features of policy instruments

Policy approach	Command-and-Control	Providing incentives
Target		
A firm's outputs (e.g., price, quantity, quality)	Cost-plus tariffs, polluting emissions standards <i>Operating System/Internet Explorer Disbundling</i>	Fixed-price tariffs, environmental charges <i>Price Cap on Windows</i>
A firm's organization (e.g., structural antitrust remedies)	Accounting separation <i>Chinese Walls between Windows and Application businesses</i>	Divestiture <i>Microsoft Break-up</i>
Property Rights	Land takings <i>Application Programming Interfaces Disclosure</i>	Patents <i>Varian's Proposal</i>

Whether public policy deals with antitrust, public utilities, pollution abatement or scientific research, a key distinction of instruments is whether they are command-and-control instruments (also called regulatory instruments) or economic instruments (also called market-based

instruments).

Economic instruments incentivise firms to adopt socially desirable behaviour. Whether firms would change their behaviour or not depends on a cost-benefit analysis. For instance, a Pigovian tax on CO₂ emissions will result in pollution abatement whenever the marginal abatement cost is higher than the amount of the charge per unit of emissions. Liability rules are another classical example of economic instruments. They provide incentives to avoid accidents. They leave firms to decide to invest in accident prevention or pay damages when they occur.

Regulatory instruments correspond with another approach of government intervention. Instead of setting incentives, government tells a firm how to behave; it commands and controls their actions. In contrast to market-based instruments, a firm's means to behave against social welfare are constrained but not its incentives.

A second feature of policy instruments relates to their target. Instruments act upon different components of business. They may concern a firm's environment, its outputs, its organisation, its intellectual property rights, and so forth. Historically, economic theory has mainly dealt with regulatory instruments targeting a firm's output, that is price, quantity or quality of products. Classical examples are emission standards in environmental policy, cost-plus pricing in public utilities regulation, quota in agriculture policy, quality standards in consumers policy, etc. It would be wrong to conclude that instruments policy which are targeted on outputs belong to the type of command-and-control. One of the main progresses made by so-called new economics of regulation (Laffont and Tirole, 1993) is merely to have elaborated economic incentives to regulate public utilities (e.g., price cap).

Most antitrust instruments act upon a firm's structure. Mandatory divestiture before the authorisation of mergers and acquisitions is a classical example. In public utilities regulatory reform, structural instruments have also been used (e.g., divestiture of British Rail, accounting separation of the French electricity system operator within EDF).

Similarly to instruments targeted on a firm's outputs and organization, remedies targeted on property rights may belong either to command-and-control or economic incentives approaches. Intellectual property rules provide incentives for innovation and firms would decide to patent their inventions or keep them secret depending on the duration of exclusivity for which they are granted. An example of intellectual property incentives to remedy to Microsoft anti-competitive behaviour is a proposal made by Varian (1999). It consists of requiring Microsoft to license binary versions of its operating system more than X months old (say, 36 months) at a flat price of \$ Y per license (say \$10). X and Y are variables set and fine-tuned by public authorities. In contrast, the disclosure of application programming interfaces to facilitate application software companies to develop complementary product to Windows does not change Microsoft incentives. Its interest

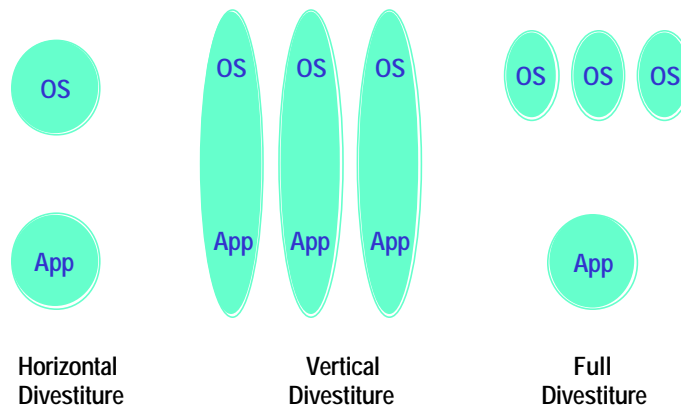
would remain not to comply with the rule in order to give advantage to Microsoft applications product.

Like antitrust cases of Standard Oil and ATT, a divestiture was ordered to remedy to Microsoft anti-competitive behavior. However, in contrast with oil and telecommunication industries, software and information industries are based on intangible assets in the form of intellectual property rather than physical assets which are easy to divide on a geographical basis or according to business lines. One can regret that the very short time dedicated to remedy hearings in *USA vs. Microsoft Corporation* did not give room to an in-depth discussion on more innovative antitrust remedies, namely economic incentives acting upon intellectual property rights. Considering the growing number of antitrust concerns in the « new economy », an opportunity to reflect on more specific remedies to cope with anti-competitive behaviour in software and information industries has been lost.

2. Which solution of divestitures to choose?

Three main types of divestitures have been discussed³ (CPT, 1999; Levison *et alii*, 2000; SIIA, 1999; Lenard, 2000; Litan *et alii*, 2000). They are represented in figure 1.

Figure 1. How to break-up Microsoft?



The first option has been proposed by the plaintiffs. It consists of dividing the operating systems and applications activities of Microsoft in giving birth to an operating systems company (hereafter, OpCo) and an applications company (hereafter, AppCo). Such a horizontal break-up remains the monopoly on the operating system market intact. The second type of break-up, a vertical divestiture, consists in dividing Microsoft in several identical mini-Microsofts. Each would be endowed with the same intellectual property rights and would have access to equivalent pools of financial assets and skilled personnel. Three mini-Microsoft are considered as the minimal number to expect a significant price and quality competition to take place (Levison *et alii*, 2000). The third type of divestiture, called full divestiture by Litan *et alii* (2000) combines vertical and horizontal divisions. A functional divestiture is associated with the division of the Microsoft operating systems business into three equal-sized firms. It will result in a total of 4 firms: 3 OpCos and 1 AppCo.

What are the key determinants which would make this or that solution of divestiture the most satisfactory one? We propose to compare the three solutions in using the maximising of consumers' welfare as a yardstick.⁴ Each solution incurs a cost to consumers and provide them with a benefit. The conundrum is to select the divestiture which maximises the net gain for consumers, that is the difference between their benefits and their costs as noted in table 2. For instance, horizontal divestiture will be said the most satisfactory solution if it dominates the two

other solutions, that is $B_H - C_H > B_V - C_V$ and $B_H - C_H > B_{HV} - C_{HV}$.

Table 2. Cost and benefits to consumers

Type of divestiture	Benefits to consumers	Costs for consumers
Horizontal	B_H	C_H
Vertical	B_V	C_V
Horizontal and Vertical	B_{HV}	C_{HV}

Benefits to consumers

The benefits for consumers are derived from the restoring of competition because competition is expected to result in a price decrease and a product quality increase. According to basic economics the stronger the competition is, the larger the benefits to consumers are.

(1) $B_V > B_H$ and (2) $B_{HV} > B_H$

Market competition is stronger for vertical divestiture and full divestiture than for horizontal divestiture because the number of companies is higher and there is no longer a monopoly on Windows. Benefits to consumers are higher for both cases.

Is $B_{HV} > B_V$?

The comparison between the benefits of vertical and full divestitures cannot be conclusive. On the one hand, according to the number of firms competition would be stronger in the case of full divestiture. On the other hand, full divestiture leaves a dominant position of Microsoft on desktop suites intact whereas vertical divestiture breaks it⁵.

Costs to consumers

The costs to consumers result from the losses in economies provided by vertical integration and from the fragmentation of Windows and Office standards.

In the case of horizontal divestiture, the operating systems and applications businesses are separated. This separation is costly for consumers if there are synergies in undertaking both activities in the same firm⁶, that is if the development of operating systems software is cheaper (or provide customers with better operating systems) because the company is also involved in the applications software business; or, reciprocally, if the costs of applications are lower (or their

quality higher) because Microsoft also produces operating systems. Unsurprisingly, Microsoft claims that synergies are high and thus that vertical integration is highly beneficial to consumers. For instance, it has advocated during the trial that the tying of Internet Explorer and Windows delivers better performances to users. The loss in the economies of vertical integration, hereafter C_H , is the only cost to consumers that the horizontal divestiture entails.

Full divestiture also incurs the costs C_H to consumers⁷. However, there is now another cost to consider: the costs associated with the fragmentation of Windows. Indeed, the three OpCos may decide to develop their own standards and consumers will therefore be confronted with a decrease in compatibility between products. According to economic theory, a decrease in compatibility leads to three types of costs: switching costs, porting costs and losses of network effects:

Consumers invest time in learning how to use a specific operating system. They incur costs in case of a change (e.g., to drop Windows/PC and adopt Mac OS/Apple). Another switching cost is due to backward incompatibility, that is, when previous personal files cannot be used with the new operating system.

In presence of several incompatible operating systems, extra costs are borne by software developers from having to write new code, support, test and market multiple versions of their products. Liebovitz (1999 and 2000) estimated that each new version of Windows will raise total costs for software developers by an amount equal to 6.5% of revenues. The break-up of Microsoft into 3 OpCos would result in \$ 30 billions of porting costs.

Network effects are due to scale economies in consumption. The basic idea is that a consumer's preference for a product increases with the total number of consumers (i.e., the size of the network). Because consumers are interested in exchanging their files and their experience of user (e.g., their tricks to cope with bugs), the willingness to pay for software increases with the number of users. Another network effect in information technologies takes place between complementary products: a consumer's utility for an operating system depends on the number of compatible applications which may be used. Today, this indirect network effect provides a clear advantage for Windows over other operating systems; for one surveys 70.000 applications in contrast with 12.000 for Mac OS and 900 for BeOS (Schmalensee, 1999). In presence of several incompatible flavours of Windows, both direct and indirect network effects will decrease.

There is no doubt that switching costs, porting costs and network effects losses associated with incompatibility are high for consumers. But will the fragmentation of Windows standard take place if three OpCos are created? Because the issue is very controversial (see box 2) the cost to consumers of Windows fragmentation has therefore to be written as:

pC_{WIN} where p is the probability the fragmentation to occur and C_{WIN} its cost if it does.

Taking into account that full divestiture also entails the loss in economies of vertical integration, the total costs to consumers associated with the full divestiture may be written as follows:

$$(2) C_{HV} = C_H + pC_{WIN} \text{ where } 0 \leq p \leq 1$$

Box 2: The Windows standard: To be fragmented or not to be?

According to Levison *et alii* (2000), the hypothesis of Windows' fragmentation can be rejected. Competition will not lead to incompatibility. « Over time, the competitive [OpCos] might differentiate their products to some extent at the margin, leading some consumers to alter their choices and bear some switching costs. It also might create some minor porting costs for applications developers. However, the costs to [consumers] of this will be minimal ». The argument is that OpCos will begin with totally compatible products and that incentives to maintain compatibility are strong. Indeed, the Windows standard benefits from a huge installed base of compatible applications and software programmes. If a OpCo deviates from the standard, it will be sanctioned by consumers. They will shift to other suppliers in order not to be glued in backward incompatibility problems, not to ensure other switching costs and not to lose network effects. Lenard (2000) has used the same argument and has reached the same conclusion. Litan *et alii* (2000) similarly stressed that there are initially strong incentives to remain compatible. However, the four economists are more cautious as regards the long-term perspective. They also emphasised that divergence in operating systems is not necessarily harmful to consumers. Indeed, fragmentation means product differentiation and, according to consumers' preferences for variety, several standards can pay better off than a single one. In other words, compatibility benefits can be offset by variety losses (i.e., the costs for consumers not to find available products corresponding with their specific needs).

According to Leibowitz (2000) the fragmentation of Windows standard will necessarily occur. Compatibility may provide benefits to consumers but ensuring compatibility is costly for firms. Extra costs in writing additional elements of code or in setting an interface are required to make an improvement consistent with an older or other system. Moreover, compatibility increases competition in price on the market. This is another clear disincentive for firms to maintain compatibility. OpCos may prefer to have an entire pie to oneself, than to share a slightly larger pie with others. The arguments in favor of the fragmentation hypothesis provided by Leibowitz are founded on historical evidence. The discussing of precedents (e.g., Apple, UniX, and even Linux) leads him to conclude that there is a powerful tendency towards fragmentation. Moreover, in examining the additions that Microsoft has made itself to its operating systems over time, Leibowitz estimates the annual rate of change in applications programming interfaces as 20% per year. Assuming that competing OpCos will boost innovation and considering that there would be nine versions at the initial stage of monopoly dissolution (there are actually three current versions of Windows - 98, 2000 and CE) he deduces « a virtual impossibility of remaining compatible »

In the case of vertical divestiture, economies provided by vertical integration remain but there are now two risks of fragmentation: the fragmentation of Windows and the fragmentation of Office. The mini-Microsoft companies may also indeed differentiate their Office suites and decrease backward compatibility and compatibility with each other. Over 100 million copies of Office are in use around the world and about 80% of all the electronic information in most companies is stored in Office documents⁸. Moreover software developers often use Office application programming interfaces for their new applications. As a result, a fragmentation of Office standard would entail high switching costs, porting costs and losses in network effects for consumers. Similarly to the

fragmentation of Windows, the cost to consumers has to be written as:

qC_{OFF} where q is the probability of Office fragmentation and C_{OFF} its costs if it occurs.

The total costs to consumers in the case of vertical divestiture is therefore⁹

(3) $C_V = qC_{\text{OFF}} + p'C_{\text{WIN}}$ where $0 = q = 1$ and $0 = p' = 1$

Comparing horizontal, vertical and full divestitures

According to the above analysis of costs and benefits, the choice of the most satisfactory solution of divestiture depends on (i) the benefits of competition (ii) the expected costs of fragmentation of Windows and Office and (iii) the economies of vertical integration.

In particular, the horizontal divestiture is the best solution if:

$$B_H - C_H > B_{HV} - C_{HV}$$

$$\text{and } B_H - C_H > B_V - C_V$$

or

$$C_{HV} - C_H > B_{HV} - B_H$$

$$\text{and } C_V - C_H > B_V - B_H$$

that is in using (2) and (3)

$$C_H + pC_{\text{WIN}} - C_H > B_{HV} - B_H$$

$$\text{and } qC_{\text{OFF}} + p'C_{\text{WIN}} - C_H > B_V - B_H$$

that is

$$pC_{\text{WIN}} > B_{HV} - B_H$$

$$\text{and } qC_{\text{OFF}} + p'C_{\text{WIN}} > B_V - B_H + C_H$$

To put it in another way, the horizontal divestiture is the best choice if:

a) the cost of Windows fragmentation is higher than the gain in competition provided by full divestiture relatively to horizontal divestiture.

It is the classical dilemma for public authorities confronted with network industries. They may eventually harm consumers if they encourage more competition in order to lower price.

- b) the costs of the fragmentation of Windows and Office is higher than the increase in competition provided by vertical divestiture relatively to horizontal divestiture plus the economies of vertical integration.

Similarly, the conditions for vertical divestiture to be the best solution are:

$$B_V - B_H > qC_{OFF} + p'C_{WIN} - C_H$$

$$\text{and } B_V - B_{HV} > qC_{OFF} + (p' - p)C_{WIN} - C_H$$

This is true in particular if:¹⁰

- a) Economies in vertical integration are higher than the costs of fragmentation of Windows and Office
- b) and competition is stronger in the case of vertical divestiture than full divestiture.

At last, full divestiture is the best choice if

$$B_{HV} - B_H > pC_{WIN}$$

$$\text{and } B_{HV} - B_V > C_H + C_{WIN} (p - p')C_{WIN} - qC_{OFF}$$

To conclude, the horizontal divestiture, favoured by the antitrust division, as well as the full divestiture, supported by Litan et alii (2000), may be the most satisfactory solution. Whether one is better than the other depends on a set of very restrictive and ad hoc conditions regarding the benefits of competition, the expected costs of fragmentation of Windows and Office, and the economies of vertical integration. In absence of verified hypotheses about the relative size of these variables¹¹, the best solution remains unknown. Moreover, the most satisfactory solution may not be the horizontal, nor the full divestiture but the vertical one which has been ignored by plaintiffs and rejected without consistent arguments by the proponents of full divestiture¹².

3. The pro-competitive effects of the applications and operating systems separation

The District Court of Columbia ruled to horizontally break-up Microsoft into two entities. In the section above we have compared this solution to other possible remedies, assuming they were beneficial for consumers. It is time now to compare it to the *status quo*, that is, to check whether the proposed remedy is not worse than the bad it is supposed to cure¹³. As previously, the point will be discussed in considering only changes in the welfare of consumers. Moreover, emphasis is put on changes in price rather than in the pace of innovation, a criterion for which economists are not well equipped to assess, yet. Two interrelated effects of the break-up are examined: the lowering in entry barriers and the developing of competition between OpCo and AppCo. The latter exerts a key influence on the former. For didactical reasons we will, however, start first with the lowering of entry barriers.

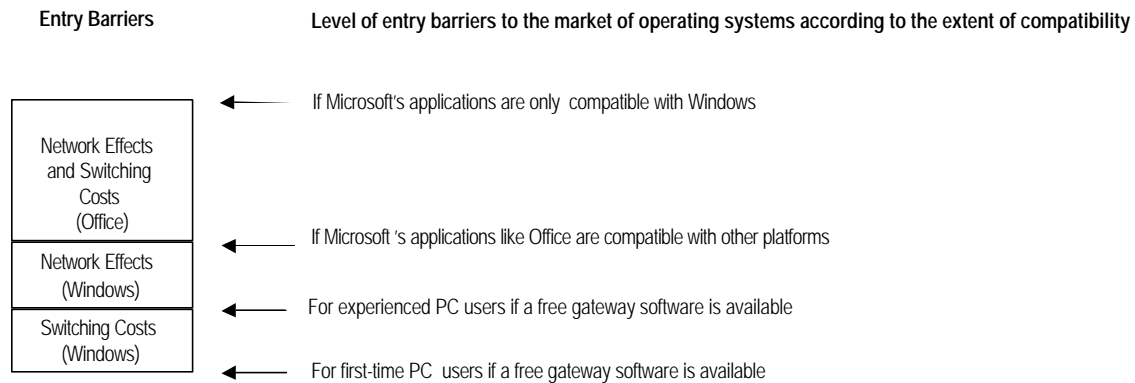
The benefits to consumers of a lowering in entry barriers

Three outcomes of the break-up are discussed below: the elimination of applications barriers, their partial reduction and the emerging of a middleware. Their presentation is preceded by a description of the main entry barriers into the market of operating systems.

The entry barriers into the market of operating systems

As shown in figure 2, a new entrant into the market of operating systems may be confronted by several cumulative barriers associated with switching costs and network externalities¹⁴. They are detailed below in considering different levels of entry depending on the extent of compatibility.

Figure 2. Entry Barriers



a) No barriers

Let's suppose there is a rival operating system that delivers at the same price, the same level of technical performances as Windows. Furthermore, let's assume there is a free software which ensures compatibility between any operating systems and applications (hereafter, a gateway software) the way an electric converter enable travellers to use their electric razor blade in hotel's bathrooms in Japan, US or EU. In such a case, a first-time PC user may indifferently adopt Windows or the rival product. The condition of the entry on the market of new users is to propose a product whose performance is at least as high as that of the product made by the incumbent.

b) Switching costs related to operating systems

If the rival producer wants to enlarge its market to existing PC users, it must offer a product with higher performance than Windows¹⁵. Indeed, only consumers who value this gain in performance for a larger amount than the loss in time to learn how to run the new operating system will buy it. Better performance must compensate switching costs.

c) Network effects related to operating systems

If we relax the hypothesis of the existence of a software gateway ensuring compatibility between platforms and applications, the rival producer of the operating system is now confronted with the indirect network effects that benefit Windows. As mentioned in section 2, more than 70.000 applications are written for Windows; they increase the value of the Microsoft's operating system for consumers. Now the gain in performances that the rival product presents must be high enough to compensate both switching costs and network effects associated with Windows.

d) Applications barriers

Microsoft is vertically integrated into the development of application software. It possesses

applications like those of the Office desktop suite which present the following four features:

- c) they can only operate with Windows,
- d) they ensure a function that every PC users need (a so-called killer application),
- e) they dominate their market,
- f) they exhibit switching costs and network effects.

As an example: Microsoft Word is specific to Windows¹⁶; every PC user needs a word processor; the market share of Word is over than 80%; a change of word processor implies that one must learn to use a new software and raises problems of backward compatibility with ancient files; moreover Word exhibits direct network effects: because consumers are interested in exchanging their files, an individual's willingness to pay increases with the number of total users.

The existence of such applications raises new barriers to entry. Indeed, in adopting a new operating system, the user will loose switching costs and network effects of Windows as before *plus* the switching costs and network effects associated with Office. She would have, for instance, to use a word processor other than Microsoft Word. The user will therefore be confronted with: new learning costs, backward compatibility and difficulties to communicate his files. If we assume that the other word processors which are available in the market have the same technical performance as Word, the entry of a rival producer of operating systems may only take place where the gain to users provided by the better performance of its product combined with the non-Microsoft word processor is higher than the switching costs and network externalities of *both* Windows and the Microsoft application.

In a nutshell, each killer, dominant and Windows specific application that Microsoft owns delivers a supplemental protection to its operating system monopoly. Windows benefits from so-called applications barriers.

On the contrary, if Microsoft's applications are compatible with any operating system, applications barriers disappear. To enter into the market of operating system a rival product must just offer a gain in performances which compensate Windows' switching costs and network effects (see fig. 2).

To conclude this survey on entry barriers it is noteworthy that the key point is not whether applications business and operating systems business are separated but whether applications are compatible or not. The issue is therefore to see how the horizontal break-up will impact incentives to provide compatibility.

The elimination of application barriers and its effects on price

Let's imagine now that Microsoft was broken up and let's assume in a first step that AppCo's applications are compatible with all operating systems. As a result, applications barriers no longer exist and entry of rival is facilitated. Then what will happen in terms of price?

If a new competitor enters into the market of operating systems, a price decrease will follow. A classical statement in economics is that the higher the number of producers is, the more intense competition is, and the lower the price results in. Even in absence of effective entry, one may expect that the elimination of applications barriers will induce a price decrease. Firms do not only compete *within* a market. They also compete *for* a market. According to this more dynamic view of competition, lower entry barriers limit the pricing of a single firm on a market. If the price is set too high, there will be incentives to potential competitors to make R&D investments in order to displace the incumbent to take all the market.

It is important to note that the effect of the break-up is very sensitive to the height of applications barriers *relative* to Windows' own barriers. If applications barriers are low, their elimination would have a low impact. The protection of the monopoly is mainly ensured by Windows' own entry barriers. Then the break-up would not result in a significant price decrease. On the contrary, if Windows barriers are low, applications barriers are crucial to protect Microsoft's monopoly in the market of operating systems. Then, in ensuring their elimination the break-up would induce a sensitive to consumers price decrease.

In other terms, the higher the applications barriers relative to Windows' own barriers, the greater the price decrease of operating system is expected to be.

The partial decrease in applications barriers and its price effect

The examined above scenario of the elimination of applications barriers is conditioned by the hypothesis that AppCo makes compatible its applications with other operating systems. That is a strong hypothesis. Indeed, one may expect that AppCo would port its applications to run operating systems other than Windows, say, to port Office to run on Linux, only if the costs to ensure compatibility (i.e., the writing and testing of new lines of programmes) are lower than the benefits provided by new sales.

In other terms, the compatibility of an application to non-Microsoft operating systems would be provided by AppCo if:

$$B_{Ap} - C_{Ap} \geq 0 \quad (4)$$

Where B_{Ap} are the extra sales of software and C_{Ap} the porting cost.

The comparing of compatibility provisions by AppCo and by Microsoft as vertically integrated

company is noteworthy. When it is integrated, the corporation attempts to maximise the total profit of its two business units. As a consequence, compatibility is ensured only if the net gain for the application unit is higher than the loss it entails for the operating system unit:

$$B_{Ap} - C_{Ap} \geq C_{OS} \quad (5)$$

where C_{OS} is the opportunity cost for Windows unit raised by applications' compatibility (e.g., a lower profit owed to a decrease in Windows' market share).

Comparing (4) and (5) illustrates that the proposed break-up will eliminate the incentives of Microsoft to drop profitable opportunities of compatibility that benefits both to consumers and its application business unit in order to protect the Windows operating system market share.

It is important to note that the elimination of these incentives does not imply, however, that the break-up would *always* result in a growing in a number of compatible applications. If $B_{Ap} - C_{Ap} \leq 0$ for all Microsoft's applications, not a single application will be ported to another operating system. In such a case, although Microsoft is broken, applications barriers remain and no price decrease is expected.

On the contrary, if inequation (4) holds for some applications, applications barriers are partially removed and a price decrease will result from the break-up. More precisely, one can state that the higher the AppCo's extra sales B_{Ap} are and the lower the porting costs C_{Ap} are, the greater the price decrease of operating systems will be.

To sum up, the lowering in applications barriers that the break-up entails may be total, partial or nil depending on AppCo's net benefit to ensure the compatibility of its application to other platforms than Windows.

The emergence of a gateway software

We saw above that, as an integrated company, Microsoft has incentives not to port some of its applications to run rival operating systems. Similarly, Microsoft has incentives to impede the development of a gateway software which will ensure full-compatibility between applications and operating systems.

For several authors (Henderson, 2000; Lenard, 2000), including judge Jackson himself (FoF, 1999)¹⁷, the development of such a gateway was merely the threat that Netscape posed to Microsoft and the cause of its aggressive behaviour and anticompetitive actions upon the Internet Browser market. Navigator, Netscape's browser, is viewed as a precursor of an intermediary software (i.e., a middleware) which will make the running of applications neutral vis-à-vis the

operating system. Applications developers would only have had to hook their programmes to the future Navigator to benefit from the interoperability with any underlying operating systems. For other authors, like Liebowitz (2000), the whole idea of Netscape as a gateway software is a fiction.

The technical feasibility to set a gateway software and the ability of AppCo to realise one (or to use its own applications to create a sort of) are quite unclear for the author of the paper. We cannot therefore assess precisely the consequences of the break-up on this point. We can only state that:

- if a gateway software is made, the price of operating systems would be the lowest that may be expected for consumers since no entry barriers would remain¹⁸.
- OpCo has very high incentives to blockade the development of a gateway software since it would suppress a key Windows' entry barrier into the market of operating systems.
- AppCo, as any other software developer, has an interest in the emergence of a gateway software because it will reduce its porting costs. This provides AppCo with incentives to encourage the development of such a software, and possibly to develop one by itself.

The benefits for consumers of competition between OpCo and AppCo

In addition to the lowering of entry barriers, the horizontal break-up is expected by its proponents to give birth to two *competing* companies. Whether OpCo and AppCo will compete with each other is crucial regarding a price change for consumers.

A price increase in absence of competition

The horizontal break-up creates two large companies which dominate their respective markets. As pointed out by Scherer (2000), they may decide not to compete with each other¹⁹.

If each company does not attempt to erode, and to limit the expansion of, the other monopoly, applications barriers on the market of operating system will remain²⁰ and therefore the price will not decrease. In fact, it will increase. The reason is that OpCo and AppCo serve interrelated markets. They sell complementary goods. Complementary goods are products or services that are combined in a system and jointly used by consumers (e.g., a razor blade and a razor; a tape and a tape recorder). The interesting economic feature that such products present is that the decrease in price (or the increase in quality) of one component benefits to the demand for the other component. In more technical terms, it is said that there is a positive *externality in supply*. If two complementary goods are produced by separate vertical monopolies, each will set its price and

quantity independently. Neither takes into account that a lower mark-up would have increased the sales and the profit of the other. By contrast, if complementary goods are both produced by the same firm, the monopoly seeks to maximise the mutual profit of the two businesses and the price of the combined product is lower for consumers. This double margin effect which states that an integrated monopolist reduces the sum of the two prices, relative to the equilibrium prices of independent monopolists, is an old economic theorem. It has been demonstrated by Cournot (1838) in the case of the merger of producers of zinc and copper, raw materials which are used to produce brass. Applying Cournot's theorem to Microsoft, it can be stated that the price of Windows and Office will increase as a result of the separation²¹. Consequently, consumers' welfare will decrease.

The incentives to compete

Services delivered by a desktop computer result from a long chain of complementary products. For instance, the communication of files requires the use of a computer, an operating system, a word-processing software and an e-mail software. The value that a firm can extract from selling any of the components in the chain is dependent not only on the degree of competition in this component market, but also on the competition in each one of the markets for the complementary components (Economides, 1996). In particular, in the case of a bottleneck on the chain, that is a monopoly which produces one of the complementary component, all other markets being competitive, the value for the combined good, or system good, is captured by the bottleneck-holder. Microsoft holds two bottlenecks: Windows and Office. Once separated, each company has interest to be the single monopoly in the chain. OpCo will have incentives to compete with AppCo to get a higher share of the value from the chain and to benefit from a price decrease (or a quality increase) in the complementary market of application software. Similarly, AppCo will have incentives to compete with OpCo to capture more value from the chain and benefits from the externality in supply.

The incentives to compete enlarge to new markets. If a new complementary product with a strong market emerges (as browsers software did), a bottleneck-holder has interest to enter into it and control it (as Microsoft did). If it does not succeed, it will lose part of the value from the chain. The same applies in case of two bottlenecks. Both OpCo's and AppCo's profits are threatened by the monopolisation of market related to another complementary component. Each company will now attempt to control the new market and impede the other to get a new dominant position. In a nutshell, if competition takes place between OpCo and AppCo, the break-up makes leveraging (that is the use of monopoly power to control an adjacent market) unsuccessful.

It is important to notice the derived effect of competition between OpCo and AppCo upon entry barriers as studied in the section above. Competition will provide new incentives to AppCo to make some of its software more cross-platforms. In equation (4) another benefit besides the

increase in AppCo sales may be added: the benefit provided by the weakening of Windows' monopoly. The same applies for incentives related to the development of a gateway software ensuring compatibility between all platforms and applications.

The possible outcomes of competition and their effects on price

Several outcomes may be envisaged if OpCo and AppCo compete with each other.

Firstly, Windows' and Office's monopolies are eroded. Competition prevails at each market of complementary components. It is the best outcome for consumers. The price for the services they used in combining complementary goods is the lowest. The break-up improves a consumer's welfare.

Secondly, a single monopoly remains. For instance, AppCo succeeds in eliminating the Windows' bottleneck but OpCo fails to erode the market power of AppCo. Such outcome is not impossible at all. OpCo may be seen as the new economy equivalent of a public utility whereas AppCo runs a terrific business with a huge installed base. During a two years period, OpCo will be subjected to transitory regulations. They may last, but even if they are dropped, OpCo would remain under the permanent scrutiny of antitrust authorities. By contrast, the applications business of AppCo was not at stake during the antitrust trial. It would have more freedom to behave, including potential anti-competitive actions as price discriminating and products bundling²². Moreover, AppCo benefits from a powerful weapon: the development of compatible applications and gateway software to eliminate Windows' entry barriers. If one wins the battle of competition over the other, the situation for consumers would not be different from today. One monopoly is enough to extract the value from the chain and therefore the price of the services provided by the combination of components would remain the same.

It is not possible for the author of the paper to rank the outcomes mentioned above depending on their likelihood to happen. If it is the same for future companies, OpCo and AppCo might decide not to compete with each other. The separation provides each one incentives to compete but they have to be balanced with the disincentives given by the losses they would incur if competition destroys their monopoly.

To sum up, one may state that:

The break-up creates two large vertical monopolies. OpCo and AppCo may compete or not. If they do, the outcome of the competition process has to be the elimination of the two monopolies for the break-up to be welfare improving for consumers. If one monopoly remains the break-up is not better than the status quo. If OpCo and AppCo do not compete, the remedy is worse than the bad it is supposed to cure.

4. Conclusion

The remedy phase of antitrust trials is commonly underestimated in importance. Government lawyers and judges seem to be more interested in documenting the case and collecting arguments to give evidence on liability than in devising appropriate remedies. As a result, reflections on remedies are used to starting too late, that is after the liability phase instead of at the beginning of the antitrust action, and insufficient efforts and time are dedicated to the remedy phase. The ultimate consequence is that government plaintiffs and the courts cannot predict the net effect of their actions. *USA vs Microsoft Corporation* does not seem to be an exception to this pattern. Too much emphasis has been put on the old-dated question and on the unproductive discussion about behavioral *versus* structural remedies. Not enough attention has been paid on remedies involving intellectual property rights, remedies which are *a priori* more suitable to software industry since informational capital is a key asset in this business. Moreover, there are several restrictive conditions for the proposed remedy to be preferable to other forms of divestitures. In particular, the vertical break-up, that is the creation of three vertically integrated Baby Bills, may be better than the proposed break-up which creates two vertical large dominant monopolies. Last but not least, the proposed remedy may be worse than the bad it is supposed to cure. It may insufficiently lower entry barriers in the operating system and may not provide incentives enough to trigger competition. There are reasonable chances that the break-up will be welfare decreasing for consumers.

“One of the thing I learned when I was chief economist at the Federal Trade Commission is that one should never bring a major antitrust case without having though very carefully the end game. That is to say, what remedies one plans to implement”. This lesson for Michael Scherer (1999) does not seem to have been learnt by all, yet.

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Notes

¹ Scherer acted as a chief economist of the Federal Trade Commission and was involved in several antitrust litigation (e.g., *USA vs. International Business Machine*). He has been very influential on antitrust lawyers and teachers.

² In the SIIA report (1999), compulsory licensing of Windows source code is mentioned as a conduct remedy whereas the establishment of Windows operating system family as open source software is ranged as a structural remedy! According to Litan et alii (2000), all licensing remedies belong to the category of structural remedies.

³ The Antitrust Division decision to opt for horizontal divestiture has been preceded by diverse consultations with academics. It has been analysed in a supporting affidavit by two economists from the University of California, Carl Shapiro (2000) and Paul Michael Romer (2000). A few days before the beginning of the remedies hearing, Robert Litan, Vice-President at the Brookings Institution, and three other economists (R. G. Noll, W. D. Nordhaus and F. M. Scherer) urged the Court « to develop a remedy that will provide a reasonable chance for competition to work ». They advocated the full divestiture option as the most satisfactory approach relatively to both functional divestiture and vertical divestiture. Such a preference have been previously argued by other economists, in particular by the antitrust economist, Steven C. Salop from Georgetown University, in a collective working electronic paper (Levinson *et alii*, 2000).

⁴ Such a comparison is restrictive for consumers are not the only group which may benefit or loose from Microsoft divestiture. The changes in welfare for shareholders and for taxpayers (owed to public expenditures in setting and enforcing remedies) would have also been relevant to take into consideration.

⁵ In legal terms, there is no reason to act upon Microsoft Office business for there is no claim nor accusation of abuse of monopoly power on the market of desktop suites.

⁶ Another gain provided to consumers by vertical integration is due to the double margin effects which is explained p 20.

⁷ It is assumed that the costs to consumers related to vertical disintegration are the same for horizontal and full divestitures. This is a simplification because the price effect due to vertical disintegration is not similar when the upstream segment is competitive or monopolistic.

⁸ According to Steve Balmer quoted in Henderson (2000);

⁹ Note that the probability of Windows's fragmentation (p') now differs from the one in the case of full divestiture (p). Indeed, the incentives to ensure compatibility strongly depend on the ownership structure, that is, on how activities are horizontally and vertically integrated.

¹⁰ The conditions can be written as follows: (a) $C_H > qC_{OFF} + p'C_{WIN}$ (b) $B_V > B_{HV}$. Firstly, if (a) holds then $qC_{OFF} + p'C_{WIN} - C_H < 0$; moreover, we know from equation (1) that $B_V > B_H$ and therefore that $B_V - B_H > 0$; because a positive term is always higher than a negative term, one may write that $B_V - B_H > qC_{OFF} + p'C_{WIN} - C_H$. Vertical divestiture therefore dominates horizontal divestiture. Secondly, if $C_H > qC_{OFF} + p'C_{WIN}$ a fortiori $C_H > qC_{OFF} + p'C_{WIN} - pC_{WIN}$ and therefore $0 > qC_{OFF} + (p'-p)C_{WIN} - C_H$; moreover, we know from (b) that $B_V - B_{HV} > 0$. Because a positive term is always higher than a negative one, the inequation $B_V - B_{HV} > qC_{OFF} + (p'-p)C_{WIN} - C_H$ is always verified. Therefore, vertical divestiture also dominates full divestiture.

¹¹ Economic and econometric studies to check the validity of the necessary hypotheses for horizontal divestiture being the best solution have been likely to be carried out by plaintiffs but they are not available.

¹² The undetermination about the best solution to implement which is argued here in considering the welfare of consumers holds if the cost-benefit analysis is enlarged to other interests (e.g., the welfare of stockholders). The use of general welfare as a yardstick instead of the welfare of consumers would have increase the undeterminations not decrease it.

¹³ First doubts have been expressed immediately after Judge Jackson ruling-out. Commentators emphasised that the Court's decision will create two monopolies from one: "Windows is installed on more than 85% of the market and Office is estimated to have a greater than 90% share of the business desktop applications market" (Financial Times, April 29). "Each half of the one time colossus will be a strong titan strong enough to neutralise most competition and co-opt most innovation, just as the original did" (Yahoo!, May 2). "It is possible that they might not compete with each other for the foreseeable future. Instead they might continue to hold the lion's share in their respective markets and cooperate on a technical level" (Financial Times, April 29).

Fears were expressed that AppCo would not write software for other operating systems than Windows (e.g., Linux) and the horizontal break-up would eventually result in a price increase. Meanwhile, of course, the Antitrust Division and its supporting experts claimed that the two companies would compete with each other and that the break-up would make consumers better off: "The two companies will be uniquely positioned to compete vigorously and effectively in both new and existing markets" (Henderson, 2000). "DoJ proposal should drive new alliances and compel innovation, ultimately benefiting the users and buyers of technology" (Klein, Cnet, May 3).

¹⁴ Entry barrier owing to fixed and sunk costs are ignored to simplify the analysis.

¹⁵ Another possibility for the new entrant is to offer its operating system at a lower price than Windows. To simplify only the first possibility (i.e., a better quality of the rival product) to overcome the entry barriers is considered in the remaining of the paper.

¹⁶ MacOS being an exception.

¹⁷ And Bill Gates himself. Netscape introduced Navigator in December 1994. The following May, Bill Gates wrote a memo warning his colleagues at Microsoft that Netscape was “pursuing a multiplatform strategy where they move the key application interface programmes into the client to commoditize the underlying operating system” (FoF §72, 1999).

¹⁸ But sunk and fixed costs.

¹⁹ The reason advanced by Scherer is loyalty. We will see in the remaining of the section that there are good economic reasons too for them not to compete: the possible losses they incur in case of competition.

²⁰ As well as Windows’ incentives to blockade the development of gateway software. If a third party poses a threat to Windows’ market, OpCo as well as Microsoft before will attempt to foreclose or disadvantage it. The only change is that OpCo would have less technical resources to succeed for it would have lost some capabilities in applications software and possibilities to bundle Windows with killer applications.

²¹ Of course when complementary goods are produced in perfectly competitive markets, the double margin effect does not take place since all firms are price-takers and the price of each component is set at marginal cost. A model generalising the Cournot’s complementary monopolies to the case where there are rival producers of components and where the vertical external effect may be outweighed by more horizontal competition is proposed by N. Economides and S. Salop (1992).

²² Ironically, proponents of the horizontal break-up emphasises the economic strength of AppCo (e.g., in Henderson (2000) “The separation will create a large, well-funded and highly profitable applications company) without mentioning the other flip of the coin, that is that AppCo can eliminate OpCo’s monopoly whereas keeping intact its own monopoly against OpCo’s attacks”.