

“Competition and Vertical Integration in the Computing Industry”

by

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Forthcoming in *Competition, Innovation, and the Role of Antitrust in the Digital Marketplace*, Jeffrey A. Eisenach and Thomas M. Lenard (eds.), Kluwer Academic Publishers 1998. Presented at the conference “Competition, Convergence, and the Microsoft Monopoly: The Future of the Digital Marketplace,” organized by the Progress and Freedom Foundation, Washington DC, February 4, 1998.

Key words: computers, network externalities, vertical integration, compatibility, value chains

JEL Classification: L1, D4.

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1. Introduction

In the last few decades, the markets for computer hardware and software have exhibited very fast growth. The computer sector is a very significant sector of the United States economy and a leading export. Moreover, personal computers are reaching into (i) telephony; and (ii) provision of “content” (movies, video, etc.), two other huge sectors.

Recently, public officials have been concerned with the possibility of anti-competitive behavior in the operating systems market for personal computers. In general, from a public policy perspective, it is important to have the following two objectives in mind:

- (i) To preserve and enhance competition;
- (ii) Not to allow anti-competitive practices.

To preserve and enhance competition, one may want to follow a hands-off policy, in which the computer sector is allowed to function without government intervention. On the other hand, government control against anti-competitive practices may require an interventionist policy on the part of the government.

The issue of potential government intervention in the computer sector is colored by at least two factors: (i) the existence of positive feedback effects, commonly called “network externalities;” (ii) very rapid technical change in the sector.

Besides computer hardware and software, rapid technical change characterizes a number of sectors of the US economy, including pharmaceuticals and biotechnology. In

the presence of fast and unpredictable change, government intervention (regulatory or antitrust) is inherently dangerous, since, to a large extent, regulatory and antitrust authorities cannot predict the net effect of their actions.

2. Network Externalities, Compatibility, and Standardization

Network externalities, although common throughout the economy, are significantly more pronounced in telecommunications and computer industries. Network externalities were first observed in the telecommunications network, where clearly the value of the network to a consumer increases with the number of subscribers on it.¹ A good, or a network component, is more valuable when more complementary components are available.

Complementarity between components is crucial in the computer industry. Computers (hardware and software, or, alternatively, operating system and applications software) that are compatible with each other form a “virtual network.” Like other networks, a virtual network exhibits increasing value per unit sold as total sales of compatible goods increase.

Benefits of complementarity can be realized through standardization and interoperability among components. Such a structure is called an “open systems architecture.” A good example is the present Intel/Windows PC structure, where many brands of computers conform to the same technical standards and can share the same operating system. The same computers can also run different operating systems, such as Unix. Once an operating system is functional, users can take advantage of a variety of

applications that are compatible with that operating system, thereby reaping the benefits of complementarity.

Alternatively, benefits of complementarity may be realized through vertical integration – one firm does all, as in the old IBM structure, or in the early Macintosh computers, where all the hardware and software components were made by the same company.

From the point of view of the firm, compatibility and standardization are desirable since a firm can benefit from the externality of the total sales of all compatible firms. On the other hand, compatibility implies more similar products, and therefore more intense competition among the firms that produce compatible products. To avoid the more intense competition, a firm may want to be incompatible with others. In deciding if its products will be compatible with those of others, each firm needs to balance these two opposite strategic incentives.² In the computer hardware and software industry, the problem of choice of compatibility versus incompatibility is significantly more complicated since the cutoff point between compatible components is often chosen by the firms.

Society reaps significant benefits from compatibility and standardization. Social benefits of compatibility and standardization typically exceed private benefits, since society does not lose from the increased competition in each component implied by compatibility, while, as mentioned earlier, firms suffer such losses.

3. Traditional Reasons for Vertical Integration

¹ See Economides (1996).

² For a detailed discussion see Economides and Flyer (1997) and Economides (1996).

A number of other (non-strategic) reasons may tend to drive a firm toward vertical integration:

- (i) Better coordination among components; benefits of joint use of integrated product;
- (ii) Cost savings in joint production;
- (iii) Possibility of a better integrated design;
- (iv) Quicker information flow in a vertically integrated company;
- (v) Assurance of markets for components;
- (vi) Easier vertical expansion to new components – easier incorporation of vertical features.

A number of reasons may tend to drive a firm toward vertical separation (disintegration):

- (i) Increased variety of products;
- (ii) Possibly higher demand for products;
- (iii) Lower capital requirements;
- (iv) Assurance of supply in case of very high demand.

4. Capturing Value in Complementary Component Chains

Besides the non-strategic reasons for vertical integration and the strategic compatibility considerations discussed earlier, there is another crucial reason for vertical integration in the computer industry, and more generally in network industries. As we have discussed earlier, services are created in networks through the combination of various complementary components which can be thought to constitute a chain. For

example, word processing service requires the use of a computer, an operating system, and word-processing 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 in the chain. For example, as explained below, the value that company can extract in the word processing market is dependent on the degree of competition in the hardware market and in the operating systems market.

The interdependence of value among markets for network components has a number of implications. First, a firm is better off and can extract more value when the complementary markets in which it does not participate are more competitive. Conversely, the more monopolized a market is, the less value remains for the complementary markets. Second, keep in mind that value can be extracted only *once* from the chain of components. If a firm can monopolize one component, and all other complementary component markets are perfectly competitive, this firm gains nothing by attempting to monopolize the complementary component markets. The value of a good or service cannot be extracted more than once, no matter how many components the good is broken into. But, a firm that monopolizes a component has an incentive to enter and compete hard in a market for a complementary component if the complementary component market is *not* perfectly competitive, because by entering such a market, the firm can capture rents that it was losing from its original market. Third, more generally, a firm that participates in a market that is *not* perfectly competitive has a stronger incentive to enter a (not perfectly competitive) market for a complementary component than a firm

that does not participate in any other market. Otherwise put, when complementary component markets are not perfectly competitive, there are strong incentives for the same firms to enter more than one of these markets. Fourth, when a component, say component A, is used together with many other complementary components, say B_1, \dots, B_n , to produce n composite goods of varying market values, competitors in the market for A will tend to enter the markets for the complementary components that, in combination with A, have the highest market value. Fifth, notice that this analysis of entry incentives is done under conditions of full compatibility between the components. Entry in more than one vertically-related market does not pre-suppose or imply incompatibility between the components or exclusion of opponents who do not participate in all component markets.

The entry of Microsoft in the browser market can be seen in the context of competition and multi-market participation in markets for complementary components, and as an application of the ideas above. As long as the market for browsers was competitive and was shared by a number of browsers, and as long as the Internet was a small academic market, Microsoft had no significant business interest in it. When the browser market became dominated by Netscape, and, simultaneously, the Internet market appeared to be significantly larger, Microsoft entered the browser market. Again, there were two reasons for that. First, Netscape had a dominant position in the browser market, thereby taking away from Microsoft's operating system profits to the extent that the operating system was used in conjunction with the browser. Second, as the markets for Internet applications and electronic commerce exploded, the potential loss to Microsoft

from not having a top browser increased significantly. These reasons were sufficient to drive Microsoft to enter the browser market.

Taking the logic of this argument one step further, it makes a lot of sense for Microsoft to enter other complementary markets on the Internet, such as web-hosting, Internet information provision services (such as the ones provided by Yahoo!, Excite, etc.), electronic commerce services, etc. At the same time, it makes sense for Netscape to enter the operating system market, or, at least to enter the market for enhancements of the operating system, and this seemed to be the direction of Netscape before its recent re-organization.

5. Which Vertical Market Structure Benefits Consumers?

We now examine which regime is more competitive and gives bigger benefits to consumers in terms of various factors discussed above. First, no matter which markets firms participate in, consumers and society derive large benefits from compatibility and standardization. In terms of the pace of innovation, economists have reached conflicting results, arguing in a variety of papers that either regime (vertical integration or vertical separation) is better. In terms of quality of services, economists' models again disagree and some find quality is higher in vertical integration, while others argue that quality is higher in vertical separation.

In terms of variety of services, economists agree that variety should be higher under vertical separation. The comparison of prices across regimes is more complicated. On the one hand, prices may be lower under vertical integration if there are no anti-competitive practices because vertical integration eliminates double or triple markups by

the various parties on the product chain. On the other hand, prices may be higher under vertical integration if a dominant firm resorts to anti-competitive practices such as (i) raising rivals' costs; (ii) imposing contracts with certain exclusivity requirements; (iii) imposing some anti-competitive form of price discrimination. We note that a dominant firm may have incentives to engage in anti-competitive practices, such as raising rivals costs.³

6. Regulatory and Antitrust Intervention

In general, antitrust law is not useful or effective (i) in promoting a faster pace of innovation; (ii) in securing higher quality of services; (iii) in securing more variety of service; and (iv) in designing product features and product compatibility. Antitrust law was not designed for these purposes, and should not be used for these objectives, as it is likely to fail miserably. It is also unlikely that antitrust law can be modified or extended so that it deals better with high technology industries, as Senator Hatch suggested this morning in his introductory remarks of this conference.

Antitrust law may be effective in curbing anti-competitive behavior arising out of (i) exclusivity clauses; or (ii) some forms of price discrimination. For these two issues, there is a history of antitrust cases, and there is a significant chance that the courts will decide correctly (i.e., in a way that will maximize consumer and social benefits). Note, however, that this is a *traditional* application of antitrust law, that has little to do with special features of network industries and, in particular, with the computer software industry.

³ See Economides (1997).

Imposition of regulation should be reserved only for the extreme situations where a bottleneck cannot be eliminated or sidestepped through entry. Regulation is very slow to react to technological change – and the computer industry is one of the fastest changing industries. New final and intermediate products are created every day, and a regulatory board would have a very hard time keeping track of them and constantly imposing and re-balancing rates.

In telecommunications, in long distance before the AT&T breakup, and in local services up to now, regulation has been used to keep the pace of price decreases significantly slower than the fast decrease of production costs. During the last two years, local exchange carriers have used their significant influence on State Public Utilities Commissions to derail and thwart the implementation of the Telecommunications Act of 1996 which would have opened the monopolized local exchange markets to competition.

Even in industries with very slow technical change, regulation has been used as an instrument of cartelization and legal monopolization of markets. Take, for example, the regulation of taxicabs in New York City. Regulators did not increase the number of taxicab licenses (“medallions”) for decades, resulting in high profits for the NYC taxicab industry, a skyrocketing price of \$250,000 for a taxicab license, and a significant loss to NYC consumers that exceeds \$2.5 billion per year. Thus, regulation can result in significant social losses rather than benefits.

There is an extra lesson in the NYC taxicab story. Regulation has long term and unpredictable effects. Regulation of taxicabs looked like an excellent idea during the difficult times of World War II. And, who could argue against higher quality and safety standards in taxicabs? But the long run effects of regulation have proved quite different.

In summary, antitrust has a limited scope of applicability in the computer industry, and this scope is in the *traditional* application of antitrust law. I would also caution against regulation of a high technology industry.

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