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Firms' strategies and network externalities: Empirical evidence from the browser war☆

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Abstract

This paper analyzes adoption decisions of Internet browser software with the focus on firms' strategies and market consequences, and the existence of network externalities. Since the early 1995, Microsoft employed many strategies in order to diminish the popularity of Netscape's Navigator and Communicator. Microsoft's Internet Explorer finally won the war in 1999, but this led to the antitrust lawsuit. Based on the GVU WWW User Survey data in 1997 and 1998, the results from logit models show that network externalities existed in Navigator and Communicator although they were diminishing through time. The success of Internet Explorer was driven by Microsoft's free and bundling strategies, not by the product itself nor by network externalities.

Keywords: Browser; Navigator; Communicator; Internet Explorer; Network externalities; Firm strategy; Predatory pricing; Bundling

1. Introduction

This paper analyzes adoption decisions for Internet browser software based on survey data. There are three purposes with this paper: 1) to characterize possible sources of network externalities and test the existence of network externalities in the browser market, 2) to determine firms' strategies and market consequences to those strategies, and 3) to test the significance of firms' strategies versus network externalities during the browser war.

The topic of network externalities has been studied for almost two decades, but has received more attention recently because many "high tech" products seem to exhibit some kinds of network externalities. A product creates direct[1] network externalities when the utility that an agent derives from consuming the product increases with the number of other agents consuming the same product.

The existence of network externalities in the browser software market may not be as obvious as in other office-related software as in the previously mentioned studies by Gandal (1994, 1995) and Brynjolfsson and Kemerer (1996). Consumers are willing to pay more for office-related software others are using and that is compatible with other software. The main purpose of installing a browser is to surf the World Wide Web (WWW or Web). Compatibility among browsers is not a

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[1] The term "network externalities" or "network effects" used in this paper means *direct* network externalities, as opposed to *indirect* network externalities. A (group of) product(s) exhibits indirect network externalities when the utility is derived directly from consumption of a durable good (hardware) and indirectly from a set of complementary compatible goods (software).

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Table 1
Major browsers release dates

Netscape	Microsoft
Navigator 1.0 — 12/94	Internet Explorer 1.0 — 8/95
Navigator 1.1/1.2 — 6/95	
Navigator 2.0 — 2/96	Internet Explorer 2.0 — 11/95
Navigator 3.0 — 8/96	Internet Explorer 3.0 — 8/96
Communicator 4.0 — 6/97	Internet Explorer 4.0 — 9/97
Communicator 4.5 — 9/98	
Communicator 5.0 — 12/98	Internet Explorer 5.0 — 12/98

Sources: Cusumano and Yoffie (1998), page 233.

source of network externalities since any browser can read the standard text formatting system called Hypertext Markup Language (HTML) and transfer data through the Hypertext Transfer Protocol (HTTP) standard. Network externalities in the browser software come from other sources than the need for compatible interaction with other consumers.

First, a leading browser is the one that users should be familiar with because this browser will be more likely to be available in, or easily accessed at schools, universities, libraries, and workplaces. This is actually Netscape's explicit intention when making its browser "location independent" (Cusumano & Yoffie, 1998).

Second, friends' influences which may be called network spillovers as in Goolsbee and Klenow (1999), is an alternative source of network externalities. A person may decide to use a browser because she wants to use what her friends are currently using, or because she can seek some assistance from her friends regarding how to use that browser, similar to the recommendation of the antiulcer drugs by other patients in Berndt, Pindyck, and Azoulay (1999). Additionally, the general information about a product with a larger network is more easily available (Katz & Shapiro, 1985). When users are kept informed about a particular browser, they may decide to try or even adopt the product.

Third, the most-installed browser may also carry a high quality image such as superior product characteristics or ease of use.[2] The image may not have to be true, it can be just a perception, or so-called bandwagon effects as mentioned by Katz and Shapiro (1985). This high quality image can be forwarded through many channels such as experts' reviews of a software, similar to the advice by physicians about the antiulcer drugs in Berndt et al. (1999).

Fourth, a large installed base of a browser may improve the firm's ability to launch an upgraded version more frequently. Many consumers prefer to use the most updated version. On the other hand, an upgraded version can be thought of as a strategy to attract users because it is a sign of continued innovations and superior technology. Netscape's Navigator and Microsoft's Internet Explorer's releases date of their versions are shown in Table 1.

Though network externalities may not come from compatibility among browsers, different browsers are able to view certain Web sites differently. The browser that can view the most sites and in the optimal format is preferred by users.[3] If this is the case, then network externalities exist in a leading browser due to the fact that Web designers are more likely to develop their sites to support the browser that is, or will be viewed best by most people.[4] In addition, a browser may actually become a new platform by replacing operating system software. A browser can be considered a "middleware" which is a non-operating system software that relies on the interfaces provided by the underlying operating system and simultaneously exposes its own application programming interfaces (APIs) to application developers. When more users are using a particular browser, more independent software vendors (ISVs) will develop more network-centric applications based on this browser's APIs which again causes more users to use that browser.[5]

Not only that the characteristics of the industry play a crucial role during the competition, firms' strategies must also be considered as well. Two important strategies employed by the software industry are bundling and predatory pricing. Bundling of products with inversely related consumer valuations allows firms to sell the bundled product with a higher price. An obvious example would be the software suite which bundle a word processor, a spreadsheet, and a presentation

[2] Barrett and Yang (1999) state that food safety standard may exhibit network externalities because general acceptance of the product is taken as a signal of safety and quality.

[3] For example, a Web page that is created by Microsoft technology such as ActiveX, would best be accessed with Internet Explorer.

[4] Designers may decide to develop a site for more than one browser, but it is estimated that 25% of the total cost of creating a site is for accommodating differences in browsers (Oakes, 1998).

[5] For example, Netscape has been offering its browser for all operating systems. As a result, if an application relies solely on the APIs exposed by Navigator, this application will also run on other operating systems. This multi-platform, or cross-platform strategy actually triggered the browser war in 1995, see Microsoft Trial Finding of Facts (United States of America v. Microsoft Corporation, 1998) for the detailed discussion.