

THE ANTITRUST ECONOMICS OF TWO-SIDED MARKETS

By

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ABSTRACT

“Two-sided” markets have two different groups of customers that businesses have to get on board to succeed—there is a “chicken-and-egg” problem that needs to be solved. These industries range from dating clubs (men and women), to video game consoles (game developers and users), to credit cards (cardholders and merchants), and to operating system software (application developers and users). They include some of the most important industries in the economy.

Two-sided firms behave in ways that seem surprising from the vantage point of traditional industries, but in ways that seem like plain common sense once one understands the business problems they must solve. Prices do not and prices cannot follow marginal costs in each side of the market. Price levels, price structures, and investment strategies must optimize output by harvesting the indirect network effects available on both sides. By doing so, businesses in two-sided industries get both sides on board and solve the chicken-and-egg problem. There is no basis for asking regulators or antitrust enforcers to steer clear of these industries or to spend extra effort on them. The antitrust analysis of these industries, however should heed the economic principles that govern pricing and investment decisions in these industries.

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I. INTRODUCTION

Dating clubs—typically bars or cafes—are an innovative way for men and women to meet each other in Japan.¹ At one club, men and women sit on opposite sides of a glass divide. If a man sees a woman he likes, he can ask a waiter to carry a “love note” to her. Dating clubs sell patrons the prospect of making a match. Their business works only if they attract enough members of the opposite sex to their club to make a match likely. Enough men must participate to attract women, and enough women to attract the men. The club must figure out how much to charge men and women so that the club gets the right number and mix of patrons, while at the same time making money since most of these clubs are in business to turn a profit. One bar does this by charging men \$100 for membership, plus \$20 a visit, and letting women in for free.² The bar presumably believes that at equal prices it would attract too many men, or too few women. That pricing structure—one that obtains a disproportionate share of the revenues from the men—seems common, based on an unscientific survey, in singles bars, discotheques and other legitimate businesses around that world that help men and women find companionship.³

¹ Howard W. French, *Osaka Journal: Japanese Date Clubs Take the Muss Out of Mating*, N.Y. TIMES, February 13, 2000.

² *Id.*

³ Here are some examples based on recent (Web-site) visits: C2K, a dance club in Las Vegas, is free for local women while the cover charge is \$10 for out-of-state women and \$15 for men (visited Aug. 15, 2002) <<http://www.lasvegas.com/localmusic/danceclubs.html>>; the Buddha Lounge in Chicago charges \$5-\$15 less to women, depending on the day of the week, than to men (visited Aug. 15, 2002) <<http://centerstage.net/dance/clubs/buddha-lounge.html>>; and on Saturday nights, The Wave Nightclub in Atlantic City lets women in for free while men are assessed a cover charge of \$10 (visited Aug. 15, 2002) http://www.poolspanews.com/2002/011/ac_nightlife.html>. A recently developed online matching service has chosen equal prices—it specializes in matching identical twins. *Twins Seek Twins in Online Matchmaking First*, REUTERS NEWS, Apr. 11, 2002; and Twins Realm website (visited Aug. 15, 2002) <<http://www.twinsrealm.com/>>.

Dating clubs are an example of a “two-sided market.”⁴ In such a market there are two sets of customers who, in effect, need each other. Each type of customer values the service more if the other type of customer also buys the service. Businesses service such markets by acting as “matchmakers.” To do so, they must get both types of customers on board to have a product to sell. Indeed, in such markets the product or service is consumed jointly by two customers and, in a sense, only exists at all if a “transaction” takes place between them.⁵ For example, the “product” created by the dating club is, in the end, a *date* from which both parties expect to benefit, and which occurs only if both of them participate. A fundamental economic characteristic of two-sided markets is the presence of positive externalities from having the other side on board (lots of guys to meet) and the inability of the parties to the transaction to internalize these externalities themselves (only one or a few of the guys get your attention).⁶ Firms profit themselves and society by figuring out ways to internalize these externalities.

⁴ The general economics of two-sided markets are discussed in a seminal paper by Jean-Charles Rochet & Jean Tirole. See Jean-Charles Rochet & Jean Tirole, *Platform Competition in Two-Sided Markets*, FINANCIAL MARKETS GROUP DISCUSSION PAPER #dp0409, (Nov. 26, 2001) <<http://www.idei.asso.fr/Commun/Articles/Tirole/PlatformNov26.pdf>>. See also Bernard Caillaud & Bruno Jullien, *Chicken & Egg: Competing Matchmakers*, CEPR WORKING PAPER #2885 (Apr. 24, 2001), at 5; and Bruno Jullien, *Competing in Network Industries: Divide and Conquer*, IDEI WORKING PAPER, (Jul. 2001). Many of the notions discussed in this article were first introduced in papers that analyzed the payment card industry as a two-sided market. See, e.g., Richard Schmalensee, *Payment Systems and Interchange Fees*, L(2) J. INDUS. ECON. 103 (Jun. 2002); and Jean-Charles Rochet & Jean Tirole, *Cooperation Among Competitors: Some Economics of Payment Card Associations*, CEPR WORKING PAPER #DP2101 (Mar. 1999). This work is based in part on notions that were first recognized in W. F. Baxter, *Bank Interchange of Transactional Paper: Legal and Economic Perspectives*, 23(3) J.L. & ECON. 541 (1983).

⁵ Although we shall see shortly that in many two-sided markets the parties do not even know one another. There is an intermediary who matches them and each only deals with that intermediary.

⁶ A positive externality is something that party A generates for party B but for which party A has no practical way to demand compensation. Planting flowers in your front yard is an example. A negative externality like automobile exhaust fumes causes harm. See Paul Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. STAT. 387-89 (1954). DENNIS W. CARLTON & JEFFREY M. PERLOFF, *MODERN INDUSTRIAL ORGANIZATION* 82-83 (3d ed. 2000).

Many important industries, including some central to what is often called the “new” economy,⁷ are based on business models that are similar to dating clubs. Computer operating systems provide features that software developers can use in writing applications, and a platform on which computer users can run applications that use those features. Both developers and users must use the operating system for it to be a viable product. The PalmOS for handheld devices, Microsoft Windows for the desktop, and Sun Solaris for servers all depend for their success on obtaining application users and application developers. Videogames are similar. People who buy video game consoles, such as the Sony PlayStation, want games to play.⁸ Developers of games want to write for consoles that have many players.⁹ Console manufacturers must attract both developers and users. Payment cards—credit, debit and charge cards—are yet another example.¹⁰ They are used by consumers to make payments and by merchants to take payments. Merchants are more willing to accept cards that are more widely held by shoppers, and shoppers are more willing to carry cards that are accepted by more merchants. Industries that arrange for buyers and sellers to meet each other also are two-sided markets: Internet-based business-to-business exchanges (B2B), apartment rentals, and corporate bond trading are but a few examples. Dating clubs, computer-operating system

⁷ For discussion of the empirical importance of the new economy, see David S. Evans & Richard Schmalensee, *Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries*, in INNOVATION POLICY AND THE ECONOMY VOL. 2 (Adam B. Jaffe *et al.* eds., 2002).

⁸ See, e.g., Chris Morris, *Console Wars: Round Two*, CNN.COM (visited Aug. 7, 2002) <http://money.cnn.com/2002/05/22/technology/e3_consolewards>. Morris states: “Console hardware sales help establish a user base, but it’s ultimately the games that make or break a system.”

⁹ See, e.g., Jim Davis, *Microsoft Woos Game Developers*, CNET.COM (visited Aug. 5, 2002) <<http://news.com.com/2100-1040-237819.html>>. In connection with the launch of Microsoft’s video game console, Davis states: “Microsoft will have to convince people (i.e., developers) that there will be an installed base that makes development efforts worthwhile (...). In other words, there have to be enough potential customers for people to sell games at a profit.”

¹⁰ DAVID S. EVANS & RICHARD SCHMALENSEE, *PAYING WITH PLASTIC: THE DIGITAL REVOLUTION IN BUYING AND BORROWING* 150 (1999).

makers, video-game manufacturers, payment-card systems, and B2B exchanges produce “platforms” that make “matches” between two or more distinct groups of consumers.

A key aspect of the business model for most of these industries involves the optimal pricing structure: the division of revenues between the two sides of the market that gets both sides on board.¹¹ Most computer operating system vendors do not seek significant revenues from software developers, choosing instead to collect mainly from users (Windows) or from the sale of complementary hardware (such as Palm and Sun). Sellers of video game consoles, however, do earn significant revenues from the game developers. Charge-card companies like American Express earn a disproportionate share of their revenue from merchants. And to take an example not discussed above, media sites tend to give readers content for free and collect their revenue from advertisers. The need for a pricing *structure* as well as a pricing *level* distinguishes industries based on a two-sided market from the industries ordinarily studied by economists. In two-sided markets, the product may not exist at all if the business does not get the pricing structure right.¹²

It turns out that most, if not all, industries characterized by network effects—a subject of considerable economic theorizing since the mid 1980s—are two-sided markets.¹³ A network effect arises when the value that one user receives from a product increases with the number of

¹¹ We focus on division of the revenue since many of the costs of providing two-sided markets are joint. For documentation of the assertions in this paragraph, see the discussion of observed business models in Section II and the discussion of the theory of two-sided market pricing strategies in Section III.

¹² The district court in *NaBanco* noted that at an interchange fee (which, as discussed later, is used by the card systems to balance demands on the cardholder and merchant sides) of zero, the Visa system would have likely been substantially less successful. See *National Bancard Corp. (NaBanco) v. VISA U.S.A.*, 596 F. Supp. 1231, 1262 (S.D. Fla. 1984).

¹³ For a discussion of network effects, see generally Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985); Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822 (1986); Chien-fu Chou & Oz Shy, (continued...)

other users of that product. A modern, but already almost quaint example, is the fax machine. You value a fax machine if there are many people to whom you can send faxes and who can send faxes to you. Most network effects arise because the product tends to be two sided. That is clear when there are two distinct types of customers (such as men and women in the dating club example). In other cases the two-sided nature it is subtler. Consider the fax machine. Most people want to both send and receive faxes. There is just one kind of customer who wants to be on a network with other customers. The same is true for telephones, instant messaging, and e-mail services. However, at any given instant, these markets can be divided into senders and receivers and the pricing strategies adopted by businesses in these markets are driven in part by these two kinds of customers.¹⁴

Industries with network effects have been under close examination by U.S. and foreign antitrust enforcement agencies.¹⁵ Several significant cases were brought by these agencies

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Network Effects without Network Externalities, 8 INT'L J. INDUS. ORG. 259 (1990); S.J. Leibowitz & S.E. Margolis, *Network Externality: An Uncommon Tragedy*, 8(2) J. ECON. PERSP. 133 (1994).

¹⁴ See Rochet & Tirole (2001), *supra* note 4, at 36 n.26. For economic models that treat the two-sided nature of communication markets, see Jean-Jacques Laffont *et al.*, *Internet Interconnection and the Off-Net-Cost Pricing Principle*, RAND J. ECON. (forthcoming).

¹⁵ For instance, in his speech Robert Pitofsky, a former FTC Commissioner, noted, "The importance of these industries [high-tech industries] to the economy, and limited antitrust experience and precedent with regard to some uses of intellectual property, suggests that there ought to be careful antitrust attention to be certain that critical economic growth is not compromised by the abuse of private market power." See Robert Pitofsky Speech before the American Bar Association, *Antitrust Analysis in High-Tech Industries: A 19th Century Discipline Addresses 21st Century Problems*, Feb. 25-26, 1999, (visited Aug. 16, 2002) <<http://www.ftc.gov/speeches/pit1.htm>>. Joel Klein, a former Assistant Attorney General of Antitrust Division of the Department of Justice, noted, "Civil non-merger enforcement has become especially important in this era of rapid technological change and the growth of the network industries, and we have also been very active in this area to ensure that antitrust enforcement keeps up with these changes..." See Joel Klein Statement before the Committee of the Judiciary of the United States House of Representatives, Washington D.C., Apr. 12, 2000 (visited Aug. 16, 2002) <<http://www.usdoj.gov/atr/public/testimony/4536.pdf>>. The EC Commissioner for Competition Policy Mario Monti also noted that "competition rules are all the more necessary in the era of the Internet. The Internet is a wonderful enabling technology, which will in principle, increase competition in many markets. Nevertheless, that does not mean that it is immune from competition problems." See Mario Monti Speech, *Competition and Information Technologies*, Sept. 18, 2000 (visited Aug. 16, 2002) <http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=SPEECH/00/315|0|RAPID&lg=EN>.

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during the 1990s and early 2000s and businesses that competed in two-sided markets were at the center of most of these cases: the AOL-Time Warner merger (U.S. and European authorities investigated two-sided markets including Internet portals, magazines, and free television);¹⁶ the credit-card association investigations (Australian and European authorities investigated a two-sided market involving merchants and card users);¹⁷ U.S., European and private antitrust cases against Intel (which competes in a two-sided hardware platform market);¹⁸ the Microsoft cases (U.S. and European authorities investigated two-sided markets involving operating systems and other possible computer platforms);¹⁹ and probes into online broker-dealers (six separate U.S. regulatory investigations and one European investigation looking into anticompetitive behavior in two-sided e-dealer markets).²⁰

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For a discussion of four U.S. antitrust cases during the Clinton Administration that involved network industries, see David S. Evans, *All the Facts That Fit: Square Pegs and Round Holes in U.S. v. Microsoft*, 22 REG. 54, (1999).

¹⁶ See Complaint, FTC Docket #C-3989 (downloaded Jul. 25, 2002) <<http://www.ftc.gov/os/2000/12/aolcomplaint.pdf>>. Other relevant documents may be found at <<http://www.ftc.gov/os/caselist/c3989.htm>> (visited Jul. 25, 2002).

¹⁷ *Commission Plans to Clear Certain Visa Provisions, Challenge Others*, European Commission Press Release IP/00/1164, Oct. 16, 2000 (visited Aug. 14, 2002) <<http://europa.eu.int/comm/competition/antitrust/cases/29373/studies/>>; *Designation of Credit Card Schemes in Australia*, Reserve Bank of Australia Media Release, Apr. 12, 2001 (visited Aug. 20, 2002) <http://www.rba.gov.au/MediaReleases/2001/mr_01_09.html>

¹⁸ See Matt Loney, *EC to Drop Intel Antitrust Investigation*, ZDNET, Feb. 4, 2002 (visited Aug. 20, 2002); <<http://news.zdnet.co.uk/story/0,,t269-s2103680,00.html> James Niccolai>; James Niccolai, *FTC Closes Intel Investigation*, PC WORLD, Sept. 26, 2000; Michael Kanellos, *Court Lifts Injunction in Intel-Integrph Case*, CNET.COM, Nov. 5, 1999 (visited Aug. 20, 2002) <<http://news.com.com/2100-1040-232538.html?legacy=cnet>>.

¹⁹ See *United States v. Microsoft Corp.*, Civil Action No. 98-1232(CKK), Stipulation, Nov. 2, 2001 (downloaded Jul. 25, 2002) <<http://www.usdoj.gov/atr/cases/f9400/9462.htm>>; and *Commission Initiates Additional Proceedings against Microsoft*, European Commission Press Release IP/01/1232, Aug. 30, 2001 (visited Aug. 20, 2001) <http://europa.eu.int/comm/competition/index_en.html>. Other relevant documents may be found at <http://www.usdoj.gov/atr/cases/ms_index.htm> (visited Jul. 25, 2002).

²⁰ See Chris Sanders, *Update 1 – BrokerTec Says Profitable since Q4 of 2001*, REUTERS NEWS, Jun. 6, 2002, in FORBES.COM, (visited Jun. 10, 2002) <<http://www.forbes.com/newswire/2002/06/10/rtr627112.html>>. The article names several online trading companies as being investigated, including the bond trader BrokerTec and currency trader FXall. See also Chris Sanders, *BrokerTec Confirms Probe by US Antitrust Official*, REUTERS NEWS, May 16, 2002; and *Online Trading Draws Greater Scrutiny*, REUTERS NEWS, in CNET.COM, May 17, 2002 (visited Aug. 21, 2001) <<http://news.com.com/2100-1017-916334.html?legacy=cnet&tag=lh>>.

In some cases, the two-sided nature of the market was central to the allegations in the antitrust case. For example, the credit-card investigations involved the pricing structure used to balance the two-sided demand²¹ and the U.S. Microsoft case included the claim that one side of the market (applications) was the source of a barrier to entry.²² In other cases, the two-sided nature of the market provided an important backdrop for understanding the workings of the business. For example, current investigations into online bond and currency exchanges are examining how dealers encourage the use of their trading platforms among buyers and sellers.²³ As another example, the European Commission was concerned that the AOL Time Warner merger would create a dominant platform in a two-sided market. The concern was that the merged company could use its allegedly dominant position in on-line music content: AOL, through its contractual agreements with Bertelsmann, a German media group, and Time Warner would have had a combined share of 30-40 percent of music content in Europe according to the Commission.²⁴ Before approving the merger, the Commission required the companies to take steps to eliminate AOL's contractual links to Bertelsmann, so that the Commission was satisfied that the merged firm "would not have the critical mass in terms of music publishing rights to dominate the market."²⁵ In the late 1980s and early 1990s, Nintendo's videogame

²¹ See Christian Ahlborn *et al.*, *The Problem of Interchange Fee Analysis: Case Without a Cause?* 22(8) EUR. COMPETITION L. REV. 304 (2001).

²² See *United States v. Microsoft Corp.*, 253 F.3d 34, 52 (D.C. Cir. 2001). For other relevant documents see DOJ website (visited Aug. 30, 2002) <http://www.usdoj.gov/atr/cases/ms_index.htm>.

²³ See Chris Sanders, *Analysis—Investigators Sniff Out Online Trading, Again*, REUTERS NEWS, May 16, 2002; and Sanders, *supra* note 20.

²⁴ *Commission Opens Full Investigation into AOL/Time Warner Merger*, European Commission Press Release IP/00/634, Oct. 19, 2000 (visited Aug. 20, 2002) <http://europa.eu.int/comm/competition/index_en.html>. See also EEC Regulation No. 4064/89, Merger Procedure, Art. 8(2) ¶ 46 (Nov. 10, 2000).

²⁵ See EEC Regulation No. 4064/89, Merger Procedure, Art. 8(2) (Nov. 10, 2000); *Commission Gives Conditional Approval to AOL/Time Warner Merger*, European Commission Press Release IP/00/1145, Oct. 11, (continued...)

business was also the subject of FTC and state investigations that looked at Nintendo's licensing practices and the technology it used to restrict unauthorized access to the platform.²⁶

Despite their economic importance, however, two-sided markets have only recently received attention from economists and, with the exception of some recent work on payment cards, have received virtually no attention in the scholarly literature on antitrust.²⁷ This article explains the economics of two-sided markets, considers several important examples, and discusses the implications of this kind of market structure for antitrust analysis.

The remainder of this article is divided into four parts. Part II describes the features of two-sided market industries and explores the business models that firms servicing them tend to adopt. It finds that those firms search for a pricing structure that will solve the well-known chicken-and-egg problem common to firms in two-sided markets. It also shows that firms usually invest resources in developing both sides—sometimes by subsidizing supply on one side of the market and sometimes by producing that supply themselves.²⁸ Part III then delves into the economic reasons behind these business practices. It shows that businesses serving two-sided markets have to set pricing *structures* that balance the demand on the two sides of the market. The combined price charged to those on both sides of the market will have a relationship to the matchmaking firm's marginal costs of making a match. However, the prices charged on a particular side of a market will ordinarily not have a relationship either to the

(...continued)

2000 (visited Aug. 30, 2002)
<http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/00/1145|0|RAPID&lg=EN>.

²⁶ See D. SHEFF, *GAME OVER: HOW NINTENDO ZAPPED AN AMERICAN INDUSTRY, CAPTURED YOUR DOLLARS, AND ENSLAVED YOUR CHILDREN* ch. 12 (1993).

²⁷ See Schmalensee (2002), *supra* note 4; and Rochet & Tirole (1999), *supra* note 4.

²⁸ For a related discussion, see ANNABELLE GAWER & MICHAEL A. CUSUMANO, *PLATFORM LEADERSHIP: HOW INTEL, MICROSOFT, AND CISCO DRIVE INDUSTRY INNOVATION* (2002).

marginal cost of making the match or to costs specific to that side. Indeed, a key feature of these markets is that, because the product jointly benefits two parties, there is no basis for separating benefits or costs.²⁹ It also explains why investment in one side of the market or other, possibly through self-production, is necessary. Part IV discusses the implications of these features of two-sided markets for antitrust analysis. It shows how standard market definition, predatory pricing, vertical restraints, and coordinated effects analyses must be modified to take into account the two-sided nature of these markets. Part V presents brief conclusions.

II. SURVEY OF TWO-SIDED MARKETS

Credit cards, computer operating systems, video games, corporate bond trading, and residential real estate comprise an extraordinarily diverse set of industries. They serve different types of consumers—from adolescent boys to large retailers. Their technologies and business arrangements are quite dissimilar—compare Century 21, Microsoft, and Visa. Yet firms in these industries have adopted similar business models and pricing strategies for solving the problem they have in common—getting and keeping two sides of a market on board. We can see this from considering several different types of two-sided market industries.

Part A examines match-making services similar to the dating club. The residential real-estate industry operates much like a computerized dating service while investment bankers are more like the village matchmakers. Part B considers advertising-supported media. Here the intermediaries match groups of sellers (advertisers) with groups of buyers (consumers). Part C looks at computer operating systems. Here the intermediary provides a platform—the

²⁹ It is well known in economics that the allocation of joint costs is arbitrary. See DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY 255 n.i (1990). See also CARLTON & PERLOFF, *supra* note 6, at app. 3B.

software—in which those who write application software and those who use application software can “meet.” Part D examines video games—a market that is similar to computer operating systems but which has developed a somewhat different business model. Part E considers payment-card systems. The intermediaries—American Express for example—have something in common with the individual match makers (real estate) and the group match makers (media). Individual matches are important—I can use my American Express card to pay for something at a merchant that takes the American Express card. Group matches are important too. American Express delivers a particular class of merchants to a particular class of consumers—and vice versa.

In all these cases we shall see that the intermediary—like the dating club—helps customers complete a “transaction” by providing a “platform.” The transaction occurs when members of both sides get together. Looked at from one side, a transaction is buying a house, watching a television show, buying a software application that runs on a computer, buying a video game that runs on a game console, and using a credit card at a store. The platform is the product (or set of institutional arrangements) upon which this transaction occurs. A free television show is a platform where advertisers meet consumers who may be receptive to their advertisements. A video game console is a place where people who make games can transact with people who play games. A payment-card system is a place where merchants who sell goods can meet customers who want to buy those goods.

The intermediaries succeed in the businesses discussed below by figuring out a pricing structure that internalizes the externalities between the two sides. The residential real estate industry does this by charging potential buyers nothing to look, even though each buyer imposes a cost on the system; and by charging sellers only if a sale results, even though costs

are incurred when a sale does not take place. This pricing structure tends to increase the number of potential buyers and sellers just like the dating club pricing structure tends to increase the number of men and women looking for dates. Software operating system vendors internalize these externalities by reaping most of their revenue from end-users, while video game console manufacturers earn significant revenues from royalties from software game developers.

A. Market Makers—Matching Buyers and Sellers

Real estate agents, apartment finders, merger and acquisition bankers, corporate bond markets, and Internet-based business-to-business exchanges (B2B) match buyers and sellers. Each of these market makers must first solve a chicken-and-egg problem: how to attract buyers without a lineup of established sellers and how to obtain the lineup of sellers without first demonstrating a group of willing buyers. Market makers sometimes solve this coordination problem by collecting a disproportionate share of revenues from one side of the market, perhaps even taking a loss on one side of the market.³⁰

Residential real estate sales in the United States is an example of a market maker that typically charges one side (the seller) while providing free (or low cost) services for the other (the buyer). Most residential property sales result from the services of a real estate agent or broker.³¹ Real estate agents place the property on a common database called a multiple listing

³⁰ Because sometimes both the costs and the product are joint, the concept of “loss” on “one” side of the market is not precise. Here I refer to loss loosely as situations in which one side of the market generates a de minimis (and sometimes zero) share of the revenues and has substantial investments made in it. This will suffice for our purposes.

³¹ Approximately 92 percent of the sales analyzed in studies reviewed by Zorn and Larsen were accomplished through brokers. See Thomas S. Zorn & James E. Larsen, *The Incentive Effects of Flat-Fee and Percentage Commissions for Real Estate Brokers*, 14(1) AREUEA J. 24, 27 n.3 (1986).

service (MLS),³² where sellers are able to show their homes to a large audience of buyers, thus potentially increasing the number of offers that they would otherwise receive without the help of a broker.³³ Full service agents typically list the property on a local MLS as part of the overall service package without explicitly charging for the listing.³⁴ Real estate agents then charge the property seller a commission when the property is actually sold.³⁵ The traditional sales commission in the United States is six percent of the property's selling price.³⁶ In contrast, the buyer has access to all of the properties listed and can usually buy a home through an agent

³² Multiple listing services are offered through local non-profit real estate boards or associations. Agents pay a one-time membership plus a monthly flat fee in order to list properties on an MLS. MLS fees are not tied to the number of properties listed and can be viewed as a fixed cost for agents. The only condition dictated by MLS membership is that agents representing sellers split the commission with agents representing buyers—the specific terms of commission-sharing arrangements, as well as the commission itself, are determined by the individual agents. See Metro MLS website (visited Aug. 30, 2002) <<http://www.metromls.com/>>; see also Regional MLS of Minnesota website (visited Aug. 30, 2002) <<http://www.rmls-mn.com/rules.html>>.

³³ See Metro MLS website (visited Aug. 30, 2002) <<http://www.metromls.com/>>. Property owners can always attempt to sell their own homes. A seller will only list with a broker if the broker has lower transaction costs. That is, if the broker can show the home to more potential buyers in a shorter span of time at a lower cost than the seller. James R. Frew & G. Donald Jud, *Who Pays the Real Estate Broker's Commission?* in RESEARCH IN LAW AND ECONOMICS: THE ECONOMICS OF URBAN PROPERTY RIGHTS 177, 178 (Austin J. Jaffe ed. 1987).

³⁴ However, discount real estate brokers (who simply facilitate the transaction without providing advisory services and can have commissions as low as one percent of the selling price) may add an extra 3 percent of the selling price to their fee for listing the property on the MLS. See Robert Erwin, *Are Discount Brokers Too Good to be True?* WALL ST. J. ONLINE (visited Aug. 22, 2002) <<http://homes.wsj.com/columnists/qa/20010914-irwin.html>>. The typical (non-discount) broker or agent's fee will include such services as advising the seller on a reasonable listing price and showing the property to prospective buyers, without charging extra for the MLS listing. *Id.* at 177.

³⁵ The individual agents set commission percentages. While all licensing is conducted through local non-profit real estate boards or associations, implying that each licensed real estate agent is a member of the local board, these boards do not dictate pricing terms to their members. See Regional MLS of Minnesota website (visited Aug. 30, 2002) <<http://www.rmls-mn.com/rules.html>>.

³⁶ Motoko Rich, *Sellers Trade Brokers for Internet Discounters*, WALL ST. J. ONLINE (visited Aug. 2, 2002) <<http://homes.wsj.com/buysell/agentsandbrokers/20001221-rich.html>>; Patrick Barta, *Real Estate Agents Face a Threat from the Web*, WALL ST. J. ONLINE (visited Aug. 2, 2002) <<http://homes.wsj.com/buysell/agentsandbrokers/20020108-barta.html>>; Danielle Reed, *Buyers and Sellers Decide to Go It Alone*, WALL ST. J. ONLINE (visited Aug. 2, 2002) <<http://homes.wsj.com/buysell/agentsandbrokers/20010330-reed.html>>.

without paying that agent.³⁷ Subsidies of this sort get participation from a key side of the market—in this case, the buyer.

Residential real estate agencies have an apparently simple method for pricing—actual sellers pay a fixed percentage of the sales price. But there is a more complex method in the background. Potential buyers and sellers are not charged for access to the MLS. They also are not charged for house showings. Potential sellers pay a commission only if a sale is consummated. The prices to potential buyers and sellers do not bear any obvious relationship to the any costs that are specific to serving each side.

Three points are worth noting. First, potential buyers and sellers of real estate benefit from having someone organize a “bazaar” for them. They all have greater match prospects. Second, potential buyers and sellers have no practical way to internalize externalities from this bazaar. Each seller has benefited from all the buyers who came through his house; and each buyer has benefited from all the houses he has seen. Third, the market intermediary (the real estate agencies and the local associations that provide the MLS) appears to internalize these externalities by adjusting prices between the potential buyer side and the potential seller side. They do not charge buyers or sellers any search fees; and they impose the transaction fee entirely on the seller. Whether they have found the best possible price structure from the standpoint of operating the residential real estate industry efficiently is beyond our purview. Indeed, as we consider different industries, what is interesting is that searching for the “right” price structure is a very important aspect of building a successful business.³⁸

³⁷ That is not true, for example, in France where residential real estate is generally not centrally listed. In the United States, buyers may end up not purchasing a house through a broker, in which case the broker does not even get paid by the seller.

³⁸ Apartment rental agents and location services operate in a somewhat different fashion: typically the rental property owner pays fees to the rental agent in exchange for the agent channeling renters to the property. However,
(continued...)

A similar business model applies to an otherwise very different business. Companies that want to be acquired (sellers) usually retain an investment banker to seek out potential acquirers (buyers). The services of an investment banker with good contacts in key industry segments is important for making matches, especially among firms that are privately held.³⁹ If the firm is purchased, the banker is paid a transaction fee (similar to the commission fee above). Most often, the transaction fee is a portion of the purchase price,⁴⁰ although the investment banker may also set a minimum charge.⁴¹ The seller also typically pays a retainer (an up-front fee) to the banker to cover the cost of researching potential matches based on the

(...continued)

in tight housing markets, such as those in New York City or Boston, the renters are required to pay the real estate broker's commission instead of the landlord. See Courtney Ronan, *Apartment Locaters: How Do They Make Their Money?* Realty Times website, Jun. 30, 1998 (visited Aug. 22, 2002) <http://realtymtimes.com/rtnews/rtcpages/19980630_apptlocator.htm>.

³⁹ See Gabor Garai, *How to Use Intermediaries to Sell Your Business*, in HANDBOOK OF BUSINESS STRATEGY 285, 288 (Pamela Goett ed., 2001).

⁴⁰ One common formula for determining the broker fee in a large transaction is the Lehman formula, or 5-4-3-2-1 formula. Under this arrangement, 5 percent is paid on the first \$1 million of the sale price, 4 percent on the next million, 3 percent on the next million, 2 percent on the next million, and 1 percent on the remaining excess. However, in most small transactions as well as many large transactions, a fixed percentage, equal to approximately 5 to 10 percent of the entire purchase, is generally used instead. See John W. Herz *at al.*, *Broker and Finder Agreements*, in THE MERGERS AND ACQUISITIONS HANDBOOK, 135, 137-8 (Milton L. Rock *et al.* eds., 2d ed. 1994).

⁴¹ For example, the investment banker may set a minimum transaction fee of \$500,000 for a sale price ("consideration") of up to \$10 million, 1.5 percent of consideration for the first \$100 million over the minimum threshold and an additional 1 percent of consideration for amounts over the first \$100 million. For a \$125 million acquisition, then, the fees would break out as follows: \$500,000 minimum + (1.5 percent X \$90 million = \$1,350,000) + (1.0 percent X \$25 million) = \$2,100,000. If the client had paid a retainer of \$50,000, this amount would be applied to the transaction fee, leaving \$2,050,000 due upon deal completion. For a more general discussion, including the varying fee structures in broker-arranged M&A deals, see *id.* at 135-147.

seller's demands.⁴² Potential buyers pay nothing.⁴³ Similar fee structures prevail for other investment banking services, such as leveraged buyouts and private placements.⁴⁴

Some matchmaker markets have not adopted pricing structures that are clearly biased towards buyers or sellers. Consider electronic business-to-business (B2B) exchanges, which bring buyers and sellers together usually over the Internet or through a privately operated network.⁴⁵ B2Bs usually follow either a transaction-fee-only model or a model that includes any combination of registration fees, transaction fees, and listing (or hosting) fees.⁴⁶ Registration fees may be charged to buyers, sellers, or both, and typically involve either a one-time payment or annual fees in exchange for access to the products or services of the B2B⁴⁷—including reduced costs of searching for an audience of buyers/sellers.⁴⁸ Transaction fees are traditionally based on either the monetary value of the transaction (and can be assessed to either buyers or sellers) or on savings realized by the buyer as a result of conducting the transaction

⁴² ANDREW J. SHERMAN, *MERGERS AND ACQUISITIONS FROM A TO Z: STRATEGIC AND PRACTICAL GUIDANCE FOR SMALL- AND MIDDLE-MARKET BUYERS AND SELLERS* 28 (1998).

⁴³ Pricing is rarely this simple. Depending on the relative bargaining power of the two firms, the buyer may end up paying all or some of the transaction fee. *See* Silverstein, *supra* note 40, at 140.

⁴⁴ *See* Shelley Winston, *Producer Price Indexes for Stockbrokers, Dealers, and Investment Banking Companies*, Producer Price Index Program, U.S. Bureau of Labor Statistics (visited Aug. 14, 2002) <<http://www.bea.doc.gov/bea/papers/stockbrokers.pdf>>, at 10.

⁴⁵ *See generally* Steven Kaplan & Mohanbir Sawhney, *E-Hubs: The New B2B Marketplaces*, HARV. BUS. REV. 97 (May-June 2000).

⁴⁶ *Entering the 21st Century: Competition Policy in the World of B2B Electronic Marketplaces, Part 1: Overview of B2B Electronic Marketplaces*, FEDERAL TRADE COMMISSION STAFF REPORT (Oct. 2000) (downloaded Aug. 14, 2002) <<http://www.ftc.gov/os/2000/10/index.htm#26>>, at 14-16.

⁴⁷ *Id.* at 14-16.

⁴⁸ *Entering the 21st Century: Competition Policy in the World of B2B Electronic Marketplaces, Part 2: Efficiencies of B2B Electronic Marketplaces*, FEDERAL TRADE COMMISSION STAFF REPORT (Oct. 2000) (downloaded Aug. 14, 2002) <<http://www.ftc.gov/os/2000/10/index.htm#26>>, at 4-7. In addition, Internet technology makes it possible for buyers and sellers in an electronic B2B marketplace to obtain a great deal of information about the B2B customer base, including number of transactions, transaction volumes, the number of other products the customer viewed before making the transaction, and customer's identity, among other things. *Entering the 21st Century, Part 1, supra* note 46, at 4-5.

through the particular online B2B.⁴⁹ Listing or hosting fees are generally paid by the seller in exchange for permission to market products or services over the online B2B's website; the B2B operates as a "catalog" for the seller to market its products to the B2B's audience.

The B2B's are like the dating clubs. Successful exchanges need many buyers and sellers. The potential buyers and sellers cannot internalize the benefits of having many potential parties to transact with on the other side. However, it does not seem to have been necessary—at least at this point in their development—to bias the pricing structure to one side or the other. The B2Bs seem to be able to get both sides on board without much ingenuity in either pricing or investment.

Many stock-trading systems also function without offering prices that obviously benefit one side over the other. For example, most U.S. stocks trade on auction-style systems, such as the New York Stock Exchange, in which participants offer to buy and sell at posted prices.⁵⁰ As with all exchanges, this only works if there are buyers and sellers looking to trade frequently.⁵¹ Otherwise, an interested buyer may look to trade on the exchange but find no sellers, or vice-versa, within a reasonable timeframe. Such an exchange has little "liquidity" and would have minimal appeal to many buyers or sellers. There is enough interest in buying and selling U.S. stocks to make auction-style exchanges viable.

In contrast to stocks, corporate bonds are infrequently traded and are, at least for now, traded through dealers rather than exchanges.⁵² The lack of liquidity is due to a lack of trading

⁴⁹ *Entering the 21st Century, Part 1*, *supra* note 46, at 14.

⁵⁰ ANTONY SANTOMERO & DAVID BABEL, *FINANCIAL MARKETS, INSTRUMENTS & INSTITUTIONS* 440-441, 445-449 (2d ed. 2001).

⁵¹ *Id.* at 440.

⁵² *Id.* at 439.

activity generally rather than any overall imbalance between buyers and sellers. The corporate bond dealer helps address this liquidity problem by holding an inventory of bonds. It is willing to buy a bond from a customer, and hold it in inventory to be sold later, even if a buyer cannot be located right away.⁵³ The dealer attempts to make money by selling at a higher price than it bought. A dealer also provides liquidity by actively trying to find buyers and sellers for different bonds.⁵⁴ In the language of two-sided markets, the dealer attempts to resolve temporary imbalances between the two sides of the market by either standing in for, or investing efforts to locate, the missing side. In essence, it is willing to provide, or find, the “chicken” or the “egg,” as needed, to ensure the viability of its platform. This is in contrast to other markets we have discussed where there is a need to systematically develop one side of the market. Here, the side that is missing varies from transaction to transaction. Relative prices to buyers and sellers in dealer markets are difficult to assess, in part because prices are not generally publicly reported. There is no obvious bias in favor of buyers or sellers, which is what would be expected given the lack of a need to systematically develop a particular side of the market.

By the late 1990s, a number of firms had started developing auction-style electronic exchanges for trading corporate bonds.⁵⁵ The idea was that advances in technology (many of these exchanges operated over the Internet) might allow buyers and sellers to join a virtual

⁵³ Even on auction-style exchanges, firms known as “specialists” in specific stocks perform a similar role. *Id.* at 443-444.

⁵⁴ In this context, the dealer is also acting partly as a “broker” between buyers and sellers. For more on this, see *Id.* at 437-440.

⁵⁵ *The 1999 Review of Electronic Transaction Systems: eCommerce in the U.S. Fixed Income Market*, THE RESEARCH DEPARTMENT OF THE BOND MARKET ASSOCIATION REPORT (Nov. 1999) (visited Aug. 29, 2002) <http://www.bondmarkets.com/research/ecommerce_survey99.pdf>; see also *The 2001 Review of Electronic Transaction Systems: eCommerce in the U.S. Fixed Income Market*, THE RESEARCH DEPARTMENT OF THE BOND (continued...)

exchange, on which enough buy and sell orders might be posted to generate sufficient liquidity to make the exchange viable. Some participants hoped that such an exchange, if it were successful, might offer better prices than available from dealers.⁵⁶ However, while technological advances might have allowed a larger exchange (with more liquidity) than before, the basic liquidity problem remained difficult to surmount. Customers, which are primarily large institutional investors, complained that electronic exchanges without dealer participation did not solve the liquidity problem.⁵⁷ The other side that this two-sided market needed was the dealer community, which had the liquidity that the institutional investors required. Dealers, of course, had little interest in providing their liquidity to auction-style exchanges that were designed to ultimately replace them, but many corporate bond dealers did develop their own systems. Such electronic exchanges owned or run by dealers, were regarded by some as promising,⁵⁸ although it is unclear whether they would eventually replace dealer markets with auction markets, or simply complement dealer markets.

B. Advertising-Supported Media

In market-maker businesses, the intermediaries (e.g. MLSs in real estate, Lehman Brothers in corporate bonds, CNET in B2Bs help match individual buyers with individual sellers. By contrast, in media markets, the intermediaries (e.g. Time magazine, MTV, CBS, AOL) match a group of buyers with a group of sellers. The sellers in this case are the

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MARKET ASSOCIATION REPORT (Dec. 2001) (visited Aug. 29, 2002)
<<http://www.bondmarkets.com/research/ecommerce/ETSRprt1201.pdf>>.

⁵⁶ See Chuck Epstein, *Electronic Bond Trading Systems Pass Critical Mass*, WALL ST. TECH. ONLINE, Feb. 1, 1999 (visited Aug. 29, 2002) <<http://www.wallstreetandtech.com/story/WST20000619S0015>>.

⁵⁷ *Bonds Get Wired*, THE FORRESTER REPORT (Sep. 2000), at 5.

⁵⁸ *Id.* at 13.

advertisers looking for a platform to pitch their products to a receptive group of readers or viewers. The newspapers, television channels, and Web sites that form media platforms are “audience makers” rather than “market makers.”⁵⁹ That is, advertising-supported media providers are interested in attracting advertisers on one side and subscribers on the other to form an audience for the advertisers.

Like many market makers, most audience makers earn a disproportionate share of their revenues from one side of the market and, like some market makers, may lose money on one side of the market. Newspapers, magazines, and television networks charge advertisers a placement fee dependent on the size or length of the ad and on the circulation or subscriber base of the media platform.⁶⁰ For example, full page ads cost more than quarter page ones and television ads that run during hit shows or special programs, like the Super Bowl, cost considerably more than those that run during non-prime-time slots. For instance, during the 2002 Super Bowl, which ran on FOX and attracted 86.8 million television viewers, the average

⁵⁹ “In a fundamental sense, what advertisers demand, and what the various advertising media outlets supply, are units of audience for advertising messages. Thus advertiser demand for space in the print media and time in the broadcast media is a derived demand stemming from a demand for audience, and is a positive function of the size and quality of audience.” James M. Ferguson, *Daily Newspaper Advertising Rates, Local Media Cross-Ownership, Newspaper Chains, and Media Competition*, 26 J.L. ECON. 635, 637 (1983).

⁶⁰ Newspapers also have different rates for different classes of advertising, such as display versus classified, and different ad types, such as black-and-white versus colored. Fees can also vary depending on the day of the week (Sunday charges may be higher) and time of day (evening edition versus morning edition). A typical newspaper charge is determined by the “milinch,” the column inch per thousand circulation. *Id.* at 653. For television, approximately 70 to 80 percent of network television advertising time is sold prior to the start of the television season, through contracts specifying price and guaranteed minimum rating of the television shows. Ronald Goettler, *Advertising Rates, Audience Composition, and Competition in the Network Television Industry*, CARNEGIE MELLON UNIVERSITY GSIA WORKING PAPER #1999-E28 (Aug. 8, 1999), at 4.

price for a thirty-second commercial was \$1.9 million.⁶¹ In contrast, the average price for a thirty-second commercial on FOX is slightly over \$150,000.⁶²

The fees that media platforms collect from advertisers pay for the content that the media presents to the audience. That is, FOX buys the rights to shows such as *Malcolm in the Middle* with proceeds from advertising, and in exchange, advertisers are allotted a specific amount of time during the show to market to the show's audience (which may include a somewhat specialized demographic group).⁶³ Contracts between the advertiser and television media platform generally include the price paid by the advertiser for commercial time and a minimum rating for the television show that is guaranteed by the media platform.⁶⁴ Advertising prices vary with the television show's audience size, age, and gender make-up.⁶⁵ For example, higher advertising prices are generally associated with a large and primarily homogenous viewing audience, along with a higher proportion of viewers between 35 to 49 years of age.⁶⁶

On the other side, free television viewers pay only an implicit price: the cost of having to watch commercials or waiting for the show to resume. Other platforms, such as newspapers

⁶¹ *TV, Internet and Advertising Trends Surrounding the 2002 Super Bowl*, NIELSON MEDIA RESEARCH (Feb. 19, 2002) (downloaded Aug. 15, 2002) <www.nielsenmedia.com/newsreleases/2002/2002%20Super%20Bowl_WriteUp-POST.doc>.

⁶² *Prime-Time Pricing Survey*, Advertising Age (2002).

⁶³ A recent survey of by the Magazine Publishers of America (MPA) found that 45.1 percent of magazine content consisted of advertisements, while 54.9 percent comprised the editorial content. Providing advertising space generates revenue for the magazine and providing editorial content helps retain a reader base. See *Historical Advertising /Editorial Ratios*, MPA website (visited Aug. 20, 2002) <http://www.magazine.org/resources/fact_sheets/ed2_9_02.html>.

⁶⁴ Television show ratings are measured by Nielson Media Research. Goettler, *supra* note 60, at 4.

⁶⁵ For instance, television shows like *Roseanne* and *Melrose Place* that had desirable viewer demographics (large audience with a high proportion being female and between 18 to 49 years of age) also had substantial gains in ad revenue for each additional million viewers. This is compared with less considerable increases in ad revenue per one million additional viewers for *Hat Squad*, a show with less desirable viewer demographics (audience with a smaller proportion being female compared to *Melrose Place* and a large proportion being 50 years of age and older). *Id.* at 3.

⁶⁶ *Id.* at 16.

and magazines, charge the audience an explicit price. But even here readers are heavily subsidized as advertisers pay the bulk of the costs of obtaining the content that attracts their desired subscriber demographics.⁶⁷

Audience-maker businesses have the basic characteristics of two-sided markets.⁶⁸ Their pricing structure does not have a direct relationship to the marginal cost of providing the media or its content to either side of the market. The economist's usual "marginal revenue equals marginal cost" condition does not help us understand why television viewers pay nothing for watching content that was expensive to create or why many newspapers and magazines are distributed for less than the marginal cost of production and distribution. The audience-makers are helping buyers and sellers internalize externalities. The advertisers benefit more the larger the number of potential buyers they can reach. The potential buyers realize a negative externality from advertising messages—most people would pay to avoid them; the more messages they receive the bigger the externality. These externalities seem to be addressed by a pricing structure in which advertisers pay for the audience, and the audience is paid with content for putting up with the ads. Again, whether this is the most efficient method is beyond the scope here, although its long-term survival in many media suggests that it is. An interesting

⁶⁷ Approximately 80 percent of newspaper revenue comes from advertisers. Lisa George & Joel Waldfogel, *Whom Benefits Whom in Daily Newspaper Markets?* NBER WORKING PAPER #7944 (Oct. 2000), at 11.

⁶⁸ The two-sided nature of advertising is well-understood in the advertising literature. "[M]edia firms, such as newspapers, magazines and commercial television channels, operate simultaneously in two sub-markets. Not only they sell their products to readers, viewers or listeners, they also sell advertising space to firms. Moreover, these markets are generally interrelated on the demand side. For example, the value of placing an ad in a local newspaper depends on the paper's circulation, and the subscribers' valuation of the newspaper is, at least to some extent, affected by the type and amount of advertising." See Jonas Hackner & Sten Nyberg, *Price Competition, Advertising and Media Market Concentration*, STOCKHOLM UNIVERSITY RESEARCH PAPERS IN ECONOMICS #2000:3 (2000), at 1. See also KYLE BAGWELL, ED., *THE ECONOMICS OF ADVERTISING* Pt. VII-VIII (2001). This paper shows that advertising is part of a much broader class of two-sided markets. Also, the theoretical results discussed below do not appear to have been developed in the literature on the economics of advertising.

issue is whether this business model will work for Web portals. Advertisers seem reluctant to pay much for the occasional click while browsers seem reluctant to pay for content.⁶⁹

C. Computer Software

Computer operating systems are two-sided markets comprising applications software developers and people who use the operating system—usually in conjunction with one or more software applications programs. A typical applications program consists of lines of interrelated code that carry out various tasks necessary for accomplishing whatever purpose the software was designed to do—word processing, game playing, or statistical analysis.⁷⁰ Many of the tasks that different kinds of applications must accomplish are similar—drawing dialog boxes on the screen, saving documents, and providing “help” information to users. Therefore, it is possible for the computer industry to reduce the duplication of effort across software developers by having common tasks performed by the operating system rather than each program. This is accomplished by having code in the operating system that accomplishes these tasks and interfaces that enable the software developers to use this code.⁷¹

Of course, the applications software developer can rely on the operating system code only if the user has this operating system running on her computer. She is more likely to have

⁶⁹ “[M]any traditional advertisers have yet to be convinced of the cost effectiveness of spending their marketing budget on the web.” See *Can Dot.Coms Make Money from Advertising?* BBC NEWS, Mar. 8, 2001 (visited Aug. 27, 2002) <<http://news.bbc.co.uk/1/hi/business/1208861.stm>>. Many Internet media companies have already been looking for other sources of income apart from online advertising. For instance, in 1997 Microsoft’s online magazine, Slate, planned to begin asking its readers to pay \$19.95 a year for the magazine they used to receive for free. Eventually, Slate abandoned this idea because it could lock out too many potential readers. See *Slate Clean of Subscription Fees*, CNET.COM, Jan. 10, 1997 (visited Aug. 27, 2002) <<http://news.com.com/2100-1023-261158.html?tag=bplst>>. In general, consumers are reluctant to pay for most information on the Web including Webzines and music. See *Pay for Music Online? No Way!* ZDNET, May 17, 2000 (visited Aug. 27, 2002) <<http://comment.zdnet.co.uk/story/0,,t479-s2113872-p2,00.html>>.

⁷⁰ For definitions, see NetLingo The Internet Dictionary (visited Aug. 21, 2002) <<http://www.netlingo.com/inframes.cfm>>.

⁷¹ *Id.*

this operating system if many applications are available that she wants to use that rely on this operating system. To be successful, then, the operating system vendor has to persuade many applications developers to rely on its operating system in writing software and many software users to install this operating system on their computers. All computer operating systems—from the Palm OS used in handheld devices to Windows and Linux on personal computers to Solaris on servers—must appeal to users and developers.

There is nothing preventing operating system sellers from collecting revenues from both sides of the market. Users can be charged license fees for the software.⁷² Software developers can be charged for information, tools, and other services necessary for accessing the code they want to rely on in their programs.⁷³ In fact, all operating system vendors have chosen to get most of their revenues from the user-side of the market; vendors differ in the extent to which they invest in the applications-side of the market.⁷⁴

Consider Microsoft. It licenses its Windows operating system to computer manufacturers (and also sells some copies at retail and through other channels). This is the

⁷² For instance, Microsoft Corp. charges end-users a \$199 fee for Microsoft Windows XP Home Edition. See Microsoft Corp. website (visited Aug. 21, 2002) <<http://www.microsoft.com/windowsxp/order/>>. Apple's charge for Mac OS 10 X v10.2 is \$129. See Apple website (visited Aug. 21, 2002) <<http://www.apple.com/macosx/>>.

⁷³ For example, Xtras.net supplies certain development tools for .NET at discounted prices. See Xtras website (visited Aug. 21, 2002) <<http://www.xtras.net/>>. Also, companies that make development tools, such as Oracle, Borland, IBM, and Rational Software offer to rent web-based tools to developers. See Wylie Wong, *For Rent: Software Development Tools*, CNET.COM, Jan. 30, 2001 (visited Aug. 21, 2002) <<http://news.com.com/2100-1001-251751.html?legacy=cnet>>.

⁷⁴ For general commentary on the importance of investment in third party software developers, see FM Interview with Linus Torvalds, *What motivates free software developers?* FIRST MONDAY, Mar. 2, 1998 (visited Jul. 31, 2002) <http://www.firstmonday.dk/issues/issue3_3/torvalds/index.html>; Jerry Pournelle, *Jerry's Take on the Microsoft Decision: Wrong!* BYTE.COM, Nov. 8, 1999, (visited Aug. 9, 2002) <<http://www.byte.com/documents/s=200/byt19991108s0001/index.htm>>; and Richard Shim & Sandeep Junnarkar, *Palm Reaches Out to Developers*, CNET.COM, Oct. 23, 2001 (visited Aug. 13, 2002) <<http://news.com.com/2100-1040-274797.html?legacy=cnet>>.

source of most of the considerable revenue that it realizes from Windows.⁷⁵ Microsoft does not charge software developers for information on using the features of the operating system. Developers, in fact, have gotten numerous development tools and considerable support for free from Microsoft, including the free Microsoft Developer Network (MSDN) Web site and free software development kits (SDKs) for Windows.⁷⁶ The company also shares early beta versions of new operating system releases with developers.⁷⁷ The company holds annual development conferences to demonstrate how the Windows programming interfaces are evolving.⁷⁸ It does earn some revenues, however, from developers. It offers five different development packages ranging from \$99 to \$2,799 per individual license.⁷⁹ The packages include varying levels of access to and discounts on technical resources and support, code samples, documentation, development tools, software, and hardware.⁸⁰

Microsoft has also encouraged end-user demand by developing applications programs that run on its operating system. In many cases, Microsoft has done this for the same reason any applications developer does this—to make money from the sales of a successful

⁷⁵ See Microsoft Corp. 10-K (FY2001) (downloaded Aug. 30, 2002) <<http://www.sec.gov/Archives/edgar/data/789019/000103221001501099/0001032210-01-501099.txt>>.

⁷⁶ MSDN website provides online support for developers including technical programming information (sample code, documentation, technical articles, and reference guides), troubleshooting, access to Microsoft MSDN magazine and other information. See Microsoft Corp. website (visited August 30, 2002) <http://msdn.microsoft.com/> >.

⁷⁷ See GAWER & CUSUMANO, *supra* note 28, at 150-51.

⁷⁸ For example, the Windows .NET Server Developer Conference in Seattle, Washington from September 3-6, 2002 was focused on providing various technical content to architects, enterprise developers, ISV developers, and technical decision makers. The cost to register for the entire conference was \$1,295. See Windows .NET Server DevCon, Microsoft Corp. website (visited Aug. 22, 2002) <<http://microsoft.com/misc/external/serverdevcon/>>.

⁷⁹ Discounts are offered on volume licenses and academic licenses orders. See MSDN Subscriptions Pricing, Microsoft Corp. website (visited Aug. 13, 2002) <<http://msdn.microsoft.com/subscriptions/prodinfo/pricing.asp#univ>>.

⁸⁰ See MSDN Subscriptions Level & Feature Overview, Microsoft Corp. website (visited Aug. 13, 2002) <<http://msdn.microsoft.com/subscriptions/prodinfo/levels.asp>>.

application.⁸¹ In other cases, Microsoft has produced applications to encourage users to license its operating system (which in turn encourages other applications developers to write applications). In fact, during the early years of Windows Microsoft had a difficult time persuading other developers to write applications for it. In 1992 there were only 1,438 applications available specifically for Windows compared with 22,328 for DOS and 4,213 for Apple's MacOS.⁸² As Bill Gates puts it, "In 1989, I personally went to all the applications developers and asked them to write applications for Microsoft Windows. They wouldn't do it. So I went to the Microsoft Applications Group, and they didn't have that option."⁸³

Apple, which makes both the Macintosh computer and its operating system MacOS, has followed a similar approach.⁸⁴ Apple provides interfaces (the APIs, or application program interfaces) for its operating system to developers at no charge.⁸⁵ They also provide free SDKs that developers can download from their website.⁸⁶ However, Apple, like Microsoft, does impose some charges for tools that help software developers use the APIs. The Apple Developer Connection (ADC) program provides software and hardware developers access to development tools, software, kits, and reference materials, with membership fees ranging from the \$99 per year Student Program to the \$3,500 per year Premier Program.⁸⁷ Based on various

⁸¹ For example, the current retail price for the 2002 version of Microsoft Word is \$339 (the upgrade from an older version costs \$79.95). See Look Up Prices, Microsoft Corp. website (visited Aug. 21, 2002) <<http://www.microsoft.com/office/howtobuy/pricing.asp>>.

⁸² Software Product Specifications from COMPUTER SELECT CD (Jan. 1992).

⁸³ See Pournelle, *supra* note 74.

⁸⁴ This and the following sentences in this paragraph are based on information available in the developer section of Apple's website (visited Jul. 31, 2002) <<http://developer.apple.com/membership/descriptions.html>>.

⁸⁵ See Development Kit, Apple website (visited Aug. 21, 2002) <<http://developer.apple.com/sdk/>>.

⁸⁶ *Id.*

⁸⁷ See Apple Developer Connection Programs, Apple website (visited Aug. 21, 2002) <<http://developer.apple.com/membership/descriptions.html>>.

membership levels, in addition to development materials and support, members of the ADC may also have access to discounted Apple hardware, discounted technical and business services, and Apple's Worldwide Developers Conference. Like Microsoft, Apple earns relatively little of its revenues from the developer side of the business despite the large costs of writing operating system software code that these developers use.⁸⁸ Apple, however, has been less assiduous at courting developers than Microsoft.⁸⁹

Palm, which is the leader in the market for handheld personal digital assistants (PDAs), currently follows a similar business model although it took a different approach to solve the chicken-and-egg problem in the beginning.⁹⁰ In 1996 Palm introduced the PalmPilot PDA, developed a new operating system to run on it, and also invested in designing application programs.⁹¹ After obtaining critical mass on one side of the market (users), Palm reduced its investments in applications, focused on the hardware and operating system, and began to attract independent developers for applications.⁹² Palm, in effect, solved the chicken-and-egg problem by initially providing its own chicken.⁹³ By supplying one side of the market itself, Palm could

⁸⁸ In 2001, Apple derived 82 percent of its total revenue from sales of Power Macintosh, PowerBook, iMac and iBook to end-users, and 18 percent from third-party developers, services, and sales of iPad, various peripheral products and software. See Apple Computer, Inc. 10-K (FY2001) (visited Aug. 27, 2002) <http://www.corporate-apple.com/ireye/ir_site.zhtml?ticker=aapl&script=800&layout=8>.

⁸⁹ See Pournelle, *supra* note 74.

⁹⁰ See Shim & Junnarkar, *supra* note 74; Media Backgrounder, Palm website (visited Aug. 13, 2002) <<http://www.palm.com/about/pr/background.html>>.

⁹¹ See GAWER & CUSUMANO, *supra* note 28, at 190-91, 194.

⁹² *Id.*

⁹³ Palm's approach was, at least in part, dictated by earlier PDA failures by Apple with the Newton and by Palm with the Zoomer. As Palm cofounder Donna Dubinsky explained, they were determined not to rely on outside developers until they had sold at least a million devices. "We are going to prove it to developers," she stated, "We are not going to ask them to trust us." See D.B. YOFFIE & M. KWAK, *JUDO STRATEGY* Ch. 5 (2001). Gawer and Cusumano argue that a do-everything strategy, while helpful initially, is not a viable long term strategy. "If the product turns out to be successful with customers, specialist firms are likely to jump into the market. Often, they become better at specific tasks (like hardware design or applications design) than firms that try to do everything." See GAWER & CUSUMANO, *supra* note 28, at 249.

focus all of its efforts on attracting end-users. Now, however, it expends considerable effort on wooing software developers by hosting developer forums, providing technical training, and even supplying marketing for complementary software developers.⁹⁴ In September 2000, Palm launched Palm Ventures, a \$50 million venture unit to aid firms developing complementary products.⁹⁵ For individual developers, Palm provides free development kits, product images, limited access to source code, and early access to tools and information.⁹⁶ Palm also offers an advanced plan for a \$495 annual fee, which includes direct technical support, marketing, and quarterly updates on development tools and technology.⁹⁷ In addition, developers can pay to attend brief courses, such as the two-day “Advanced Palm OS Development and Debugging” course for \$1,000.^{98,99}

Palm’s efforts appear to have paid off: in March 2002, Palm boasted that it had nearly 200,000 registered software developers and more than 13,000 software titles already available.¹⁰⁰ Applications range from electronic book-reading with thousands of e-books, to

⁹⁴ See Related Developer Programs, Palm website (visited Aug. 15, 2002) <<http://www.palmos.com/dev/programs/>>.

⁹⁵ *Palm Inc. Launches VC Unit to Aid Complementary Firms*, BOSTON GLOBE, Sep. 7, 2000.

⁹⁶ Shim & Junnarkar, *supra* note 74.

⁹⁷ *Id.*

⁹⁸ See Developer Training, Palm website (visited Aug. 13, 2002) <<http://www.palmos.com/dev/training/instructor/advanced.html>>.

⁹⁹ As another means to encourage independent developers to write applications for Palm OS, Palm licenses its operating system to other hardware manufacturers. For example, Handspring, which makes PDAs that compete with Palm’s, is one of many licensees of the Palm OS. See PalmSource website (visited Aug. 13) <<http://www.palmos.com/licensees/>>. Currently, both Palm and Handspring make the interface specifications for their computing platforms available at no charge to developers. Thus, developers profit from selling Palm- and Handspring-compatible software, and in exchange, Palm and Handspring profit from having a platform that becomes increasingly popular to consumers as more compatible software is developed. See Douglas Lichtman, *Property Rights in Emerging Platform Technologies*, XXIX J. LEGAL STUD. 615, 616 (2000).

¹⁰⁰ See Media Backgrounder, *supra* note 90. In recent years, Palm has faced increasing competition from the Pocket PC platform. See Mark Walser, *The (M)empire Strikes Back*, M COMMERCE TIMES, Jul. 9, 2001 (visited Aug. 29, 2002) <<http://mcommercetimes.com/Technology/147>>.

document-editing programs that work with Microsoft Excel and Word files, to enterprise software tools that let business users fill out forms and check inventories through a wireless connection.¹⁰¹ For consumers, Palm OS powered devices typically start at \$99.¹⁰² But like Microsoft and Apple, Palm earns the preponderance of its revenues from the user-side of the business.¹⁰³

Computer operating system characteristics are similar to those we have seen in our review of other two-sided markets. The business is about the search for the right price structure that will get both sides on board. The price structure is one that is not readily explained by the approach economists apply to one-sided markets. Here one side seems to get extraordinary benefits from the operating systems but pay little for it. Once again there is an externality problem that only an intermediary between the two sides can solve. Users benefit when they have many applications available to run on their computers and when the similar portions of those applications are common. There have no way to pay software developers for the benefits of this coordination. Likewise, developers benefit when they have a larger group of users for their software and when they can avoid duplicating the code used by other packages. They have no way to pay users for the benefits of this coordination. The intermediary can solve the problem—internalize these externalities between the two groups of customers—by adopting a pricing structure that recognizes the mutual benefits. As before, whether the pricing structure

¹⁰¹ See Product Overview, Palm website (visited Aug. 13, 2002) <<http://www.palm.com/about/corporate/productoverview.html>>.

¹⁰² See Developer Training: Class Topics, Palm website (visited Aug. 13, 2002) <<http://www.palmos.com/platform/os5/topten.html>>.

¹⁰³ See Palm, Inc. 10-K (FY2002) (visited Aug. 27, 2002) <http://media.corporate-ir.net/media_files/nsd/palm/reports/fy0210k.pdf>.

the operating system vendors have settled on is the best one for solving this problem is not readily known.

D. Video Games

While similar to operating systems in that they involve hardware and software, video game platforms have an informative history.¹⁰⁴ In the early days of the home video game industry, companies manufacturing game consoles did not face chicken-and-egg problems in a strict sense—consoles were essentially single-game devices, and games were hardwired into the console's circuitry. By definition, the manufacturer of the console was also the manufacturer of the game so there was no need to court independent game developers. Examples of this business model are Atari's Home Pong (1975), and Coleco's Telestar (1976).¹⁰⁵ This was a one-sided market.

With the release of Fairchild's Channel F in 1976 a new business model emerged. Channel F did not hardwire games, but rather played games stored in interchangeable cartridges. Atari expanded on Fairchild's approach with the release of the Video Computer System (VCS) in 1977.¹⁰⁶ Neither Fairchild nor Atari immediately contracted with independent game developers, but these companies did establish the separation of hardware and software in the home video game market.¹⁰⁷ Like Palm in the early days of the PDA industry, video games in the late 1970s solved the chicken-and-egg problem by supplying the chicken.

¹⁰⁴ It should be emphasized that we focus on the history of home video games in the U.S. Some of the platform launches we describe for the U.S. were preceded by releases in Japan.

¹⁰⁵ See S. KENT, *THE ULTIMATE HISTORY OF VIDEO GAMES* Ch.1-8 (2001). The Odyssey, manufactured by Magnavox and introduced in 1972, was the first home video game console. It was the only multi-game console of this early period. While Home Pong played only one game, Odyssey could play twelve. See KENT *supra*, at 80-81.

¹⁰⁶ The Video Computer System was also known as the Atari 2600. *Id.* at xiii.

¹⁰⁷ *Id.* at 94-98.

While still not faced with coordinating both sides of the market, the separation of hardware and software did present console manufacturers with a new business decision: how to price each component. Atari chose to sell the hardware at a relatively low price and earn a larger share of revenue from software sales. “Give away the razors so that you can sell the blades” became an axiom in the industry from this point on.¹⁰⁸ A large library of high-quality games was indispensable for ensuring the success of a home video game console.¹⁰⁹

A new dimension of the business model started taking shape in 1980. In that year some of the Atari programmers defected and founded Activision, the first independent software company in the home video game market.¹¹⁰ The company’s purpose was to create games for the VCS. Activision soon released its first games and was an overnight success. Again like Palm, the VCS game platform reached such a level of success with customers on one side of the market (end-users of games) that it generated demand from customers on the other side (independent game developers). Activision represented a turning point in the video game industry: from this point on console manufacturers entering the market had to attract both gamers and developers to the platform to ensure its success. A two-sided market emerged.

Although it is unclear whether Atari or any other company in the early 1980s charged licensing fees to independent developers, from the mid-1980s onward (and more specifically from the time Nintendo entered the home video game market on), licensing fees from software

¹⁰⁸ *Id.* at 107.

¹⁰⁹ On the significance of game availability for the success of a console, see, among others, Morris, *supra* note 8. See also David Becker, *Who Will Be the King of the Game Consoles*, CNET.COM, Nov. 21, 2000 (visited Aug. 5, 2002) <<http://news.com.com/2100-1040-248875.html>>.

¹¹⁰ Still other Atari programmers left the company to form Imagic. Like Activision, Imagic enjoyed success very quickly. See KENT *supra* note 105, at 192-193, 197.

developers became a major source of revenues for console manufacturers.¹¹¹ In fact, the business model that developed at least from the mid-1980s on was based on selling the console to end-users near or less than its marginal cost of production while relying on revenue from in-house-produced software and from license fees charged to independent developers to recover fixed development costs and earn a profit.¹¹²

Starting in the mid-1980s, Nintendo and its 8-bit Nintendo Entertainment System (NES) displaced Atari as the video game leader. Nintendo was already a big arcade company prior to entering the home segment of the market, and it attracted end-users by converting many popular arcade games into home video games.¹¹³ As far as courting independent developers, Nintendo sought quality over quantity. Nintendo protected the NES with a security chip that locked out unauthorized, unlicensed cartridges. The licensing agreements that it signed with independent developers imposed hefty royalty rates, established that they would only publish five games per year and that those games would be exclusive to the NES for a two-year period.¹¹⁴

By the late 1980s a new competitor, Sega, emerged. Sega's strategy to compete with Nintendo was manifold. In the first place, it beat Nintendo to market with the release of a 16-bit

¹¹¹ See, e.g., *Software Can Raise Platform Values*, Video Games & PC Entertainment Software – Marketers, The Investext Group, Jun. 1, 1998, available in NEXIS. See also Morris, *supra* note 8.

¹¹² See, for example, David Becker, *Revenue from Game Consoles will Plunge, Report Predicts*, CNET.COM, Jul. 31, 2000 (visited Aug. 5, 2002) <<http://techrepublic-cnet.com.com/2100-1040-243841.html?legacy=cnet>>. See also David Becker & Joe Wilcox, *Will Xbox Drain Microsoft?* CNET.COM, Mar. 6, 2001 (visited Aug. 5, 2002) <<http://techrepublic-cnet.com.com/2100-1040-253654.html>>.

¹¹³ See KENT, *supra* note 105, at 278, 296-297, 299-300.

¹¹⁴ *Id.* at 308-309, 351. Nintendo did grant special favors to some of its most successful licensees. It gave a second license to both Konami and Acclaim, two of the top independent game developers for the NES, so that each company would be able to produce 5 additional games per year. *Id.* at 422. On the relationships between Nintendo and its licensees, see also SHEFF, *supra* note 26, at chapter 10.

console that was considerably more powerful than the NES.¹¹⁵ Sega's Genesis was launched in America in 1989, almost two years earlier than Nintendo's 16-bit console, the Super NES.¹¹⁶ Second, in order to attract end-users Sega soon cut the price of the console from \$189 to \$149.¹¹⁷ Third, since Nintendo dominated the arcade translation business, Sega signed contracts with athletes and celebrities in order to create a large library of games based on their names and images.¹¹⁸ Fourth, Sega launched an aggressive marketing campaign to highlight the technological superiority of the Genesis over the NES.¹¹⁹ Finally, even though in general the Sega licensing deals with independent game developers were similar to Nintendo's,¹²⁰ Sega cut deals with some key developers (e.g., Electronic Arts) by offering them special licensing terms.¹²¹ Sega's strategy paid off and it outsold Nintendo in 1991.¹²² Even after Nintendo launched its 16-bit Super NES, Sega remained competitive for some time on the basis of its larger library of game and its faster pace of game publishing.¹²³

¹¹⁵ Sega had unsuccessfully released an 8-bit console, the Master System, in 1986. *See* KENT, *supra* note 105, at 401, 404-405.

¹¹⁶ *Id.* at 404, 431-434.

¹¹⁷ *Id.* at 404, 427, 433.

¹¹⁸ *Id.* at 404-406, 426. Sega did have its own portfolio of arcade games, but Nintendo had exclusivity on some of the most popular arcade products.

¹¹⁹ *Id.* at 426-427.

¹²⁰ *Id.* at 381, 409-410. Independent developers paid Sega between \$10 and \$15 per cartridge on top of the real hardware manufacturing costs. Like Nintendo, Sega created security systems in its consoles to guard against unlicensed publishers. *Id.* at 381-382.

¹²¹ In 1989 Electronic Arts' technicians successfully reverse-engineered both the Nintendo NES and the Sega Genesis. Electronic Arts rejected Sega's licensing terms and decided to go ahead and start publishing their own games on Genesis. Before proceeding, however, they offered Sega the possibility of entering into an agreement with special licensing terms. Sega accepted and granted Electronic Arts a licensing contract with increased flexibility and lower royalty rates. *Id.* at 408-410.

¹²² *Id.* at 434.

¹²³ *Id.* at 447-448.

In 1995 yet another competitor joined the fray: Sony's 32-bit PlayStation. Sony took advantage of a window of opportunity that arose in the mid 1980s. At this time Sega was struggling in an attempt to support several incompatible platforms and Nintendo was starting to develop a 64-bit console (Nintendo 64), which it would not release until 1996.¹²⁴

The Sony model was different from both Sega's and Nintendo's in that Sony made a much stronger effort to attract independent developers. For example, Sony offered excellent development tools to third-party publishers and PlayStation developed a reputation for being very easy to program.¹²⁵ Combined with a liberal \$10 per game licensing fee and Sony's aggressive marketing plans, PlayStation became a very attractive platform for game designers.¹²⁶ By the time it launched in the U.S., about 100 game developing companies had signed agreements with Sony—and more than 300 projects were either planned or underway.¹²⁷ Game developers were now writing similar titles for multiple game platforms (Nintendo, Sega, and Sony).¹²⁸ As far as the end-user side of the market is concerned, Sony attracted consumers by offering a large library of games almost from the beginning and selling the console at a very competitive price.¹²⁹

¹²⁴ *Id.* at ch. 27.

¹²⁵ Sega also launched its 32-bit platform, the Saturn, in 1995, but at launch time this platform had already developed a reputation for being very difficult to program. *Id.* at 509, 516. As a result of Saturn's failure, Sega stopped manufacturing consoles in early 2001. *Next Generation of Gaming: Forecasts and Analysis, 2000-2005*, IDC REPORT #24432 (Apr. 2001), at 26-28.

¹²⁶ Sony's licensing structure was based on a \$10-per-game arrangement that included manufacturing disks, manuals, and packaging. Nintendo's game consoles were based on cartridges, which were much more expensive for game developers than CDs. At the time, it cost more than \$20 to manufacture an 8-megabyte cartridge, but it cost less than \$2 to press a 640-megabyte CD. *Id.* at 511.

¹²⁷ *Id.* at 504.

¹²⁸ *See* The Investext Group, *supra* note 111. *See also* Morris, *supra* note 8.

¹²⁹ *See* KENT, *supra* note 105, at 516-520. Sega's Saturn was launched with a \$399 price tag. Sony's PlayStation was launched at \$299.

Currently, video game business models resemble the operating system approach in that companies entering the market make significant efforts to attract independent game developers. In the process of promoting the Xbox console, for example, Microsoft announced two programs, the Independent Developer Program and the Incubator Program, to encourage smaller developers by providing free software tools and waiving normal pre-publishing requirements.¹³⁰ Furthermore, Microsoft had extensive meetings with developers before the hardware specs for the console were set and incorporated many of their suggestions into the final design.¹³¹ Microsoft also made it easier for developers with PC experience to develop games for the Xbox by relying on DirectX (a collection of APIs that serves as the foundation for most PC games)¹³² in the design of the console.

The video game history illustrates how seemingly similar two-sided markets can arrive at different pricing structures. It is possible that slight differences in technology and demand lead to different pricing structures for internalizing externalities. There is another possibility though. Coming up with the right pricing structure is a difficult problem that requires more information than setting the price of toothpaste. It may take time and experimentation for industries to converge on the optimal structure.

E. Payment Systems

Payment systems—cash, checks, cards, and emerging e-pay systems—are viable only if both buyers and sellers use it. If buyers wanted to use cash but sellers did not want to take cash—a still infrequent but not unheard of situation—then cash would not be a viable system.

¹³⁰ *Microsoft Embraces the Worldwide Independent Video Game Developer Community*, Microsoft PressPass, (visited Aug. 2001, 2002) <<http://www.microsoft.com/presspass/press/2000/Nov00/XPKPR.asp>>.

¹³¹ See Becker, *supra* note 109.

¹³² See Davis, *supra* note 9. See also Becker, *supra* note 109.

A payment system is more valuable to sellers if more buyers take the tender and more valuable to buyers if more sellers take the tender. Governments have helped solve the chicken-and-egg problem in the case of money (of the sort that has no intrinsic value) by passing laws that require businesses and people to accept money for discharging debts.¹³³ More interesting from our standpoint are payment mechanisms in which businesses have had to figure out ways to get both sides of the market on board.¹³⁴

Diners Club was the first charge card that many people used to pay at many businesses. It was introduced in 1950.¹³⁵ The card (then a slip of cardboard) was distributed for free to well-off Manhattan residents for the purpose of paying at restaurants. There was no fee. There were also no charges if the cardholder paid within a certain period of time; that meant the cardholders paid nothing for the float they received from the time of their meal to the time they paid. Using its attractive clientele as a lure, Diners Club then persuaded restaurants to accept

¹³³ Until 1971, the gold standard system constrained the amount of money that government could issue to its gold reserves. See Michael D. Bordo, *Gold Standard*, The Concise Encyclopedia of Economics Online (visited Aug. 19, 2002) <<http://www.econlib.org/library/Enc/GoldStandard.html>>. Under this system, paper money could be exchanged for gold, which had intrinsic value. A few years before the gold standard was finally and completely abandoned, Congress passed the Coinage Act of 1965, stating that, “All coins and currencies of the United States...shall be legal-tender for all debts, public and private, public charges, taxes, duties and dues.” See Legal Tender: A Definition, Bureau of Engraving and Printing (visited Aug. 16, 2002) <<http://www.bep.treas.gov/document.cfm/18/110>>. In essence, before officially removing the value from the currency, government passed a law requiring people to accept it for payment of debt. However, this does not mean that merchants are under legal obligation to accept cash for payment. For example, some businesses do not take pennies and certain merchants do not accept cash and only allow credit card transactions. Thus, the laws encourage the use of cash generally but did not specifically mandate merchant acceptance, leaving businesses free to form their own payment guidelines. See FAQs: Currency, U.S. Treasury (visited Aug. 21, 2002) <<http://www.ustreas.gov/education/faq/currency/legal-tender.html>>.

¹³⁴ See generally EVANS & SCHMALENSEE, *supra* note 10.

¹³⁵ *Id.* at 62.

payment with the card, charging the restaurants a cut of the tab—about 7 percent.¹³⁶ In its fourth year of operation, Diners Club added a membership fee of \$34 per year.¹³⁷

This business model has persisted for the last half century for the pure charge card (no credit, pay in full within 30 days). Consider the American Express charge card. In exchange for the rights to accept the American Express card, merchants are typically assessed a fee (known oddly enough as the “merchant discount”) that is about 2.7 percent of the purchase amount on average.¹³⁸ Cardholders pay, on average, a \$34 annual fee for an American Express charge and credit cards.¹³⁹ The cardholders with credit cards that have no annual fees, such as *Blue* and *Optima*, benefit from the float.¹⁴⁰ Overall, excluding finance charge revenue, American Express earned 82 percent of its revenues from the merchant side of the business in 2001.¹⁴¹

The institutions and pricing mechanisms for getting both sides of the market on board are more complicated in the case of “cooperative” card systems.¹⁴² MasterCard and Visa are associations whose members consist of banks that provide payment services to individuals (“issuing”) or merchants (“acquiring”) or both. In the case of individuals, the services include

¹³⁶ *Id.* at 181.

¹³⁷ A \$34 membership fee is reported in 2002 dollars and is equal to \$5 charged by Diners Club in 1954. *See* PETER Z. GROSSMAN, AMERICAN EXPRESS: THE UNOFFICIAL HISTORY OF THE PEOPLE WHO BUILT THE GREAT FINANCIAL EMPIRE 263 (1987).

¹³⁸ *See* American Express Company Annual Report 2001 (visited Aug. 15, 2002), <http://www.onlineproxy.com/amex/2002/ar/pdf/axp_ar_2001.pdf>, at 37.

¹³⁹ *Id.*

¹⁴⁰ The benefit American Express cardholders receive from the float is estimated at approximately \$32. This amount is calculated using average basic card member spending in 2001, a 28-day repayment grace period and the 2001 average 1-year constant maturity Treasury bill interest rate. *Id.*

¹⁴¹ Including finance charge revenue in 2001, American Express earned 62 percent of its revenues from merchants. *Id.*, at 35.

providing a card that can be used to make payment at merchants and that may provide some long-term credit—the issuing bank makes arrangements to pay the merchant and then bills the cardholder and may offer to finance the purchase. In the case of merchants, the services include providing technology for processing card transactions and paying the merchant. Frequently, the issuing and acquiring banks differ. The associations provide coordination: they operate networks and accounting systems that authorize and process transactions and provide the appropriate credits and debits to member accounts.

Getting both sides of the market on board requires that these associations provide members with the proper incentives to service both sides of the market and that there is a pricing structure that provides the proper incentives for individuals and merchants to use the cards. To see why, it is useful to go back to the case of American Express. As a company that both issues cards and acquires from merchants it can devise a pricing structure consisting of a price to cardholders (primarily an annual card fee) and a price to merchants (merchant discount). In contrast, the issuing and acquiring members of an association can only determine their own prices (card fees and interest charges in the case of issuing members and merchant discount and related fees in the case of acquiring members). They cannot determine the relative price of card services to individuals versus merchants; that must be done centrally.

The associations have done this through setting an “interchange fee.” This is a fee that the bank that acquires a card transaction from a merchant charges the bank that issued the card to the individual who made that transaction. Issuing and acquiring banks had to have an

(...continued)

¹⁴² For a short introduction, see David S. Evans, *Payment Card Business: Chickens and Eggs, and Other Conundrums*, MASTERING MANAGEMENT ONLINE (2001), in FIN. TIMES ONLINE (visited Jul. 26, 2002) <http://www.ftmastering.com/mmo/mmo03_2.htm>.

agreement for consummating transactions. Both could take the position that the transaction could not take place without what they brought to the table (and both would be right). It was not practical for the thousands of members to negotiate individual agreements.¹⁴³

The associations could have adopted a rule that said all transactions were exchanged at par—issuing banks had to fully reimburse acquiring banks. However, that in effect amounts to setting an interchange fee equal to zero and adopting a particular pricing structure. Estimates place the average Visa and MasterCard interchange fee in 2001 at 1.53 percent.¹⁴⁴ Acquiring banks usually pass that fee on to the merchant as either an explicit or implicit part of the merchant discount. The resulting pricing structure is one in which the average merchant discount for the card associations is substantially less than the merchant discount charged on similar cards issued by American Express and somewhat more than the merchant discount charged by Discover which is another integrated payment system.¹⁴⁵

Payment cards are a complex match-maker market. The payment systems have a two-stage problem to solve. They have to persuade individuals and merchants to use the same platform—by getting individuals to carry the card brand and merchants to take the card brand. Many consumers do not carry American Express cards and many merchants do not accept those cards. They then need to persuade individuals to use the card to make purchases rather than competing payment devices and they need to persuade merchant to take the card for those purchases rather than steering consumers to other payment devices. Many consumers carry American Express cards but pay with a Visa cards or with cash for numerous transactions.

¹⁴³ Section V reviews the origin of the interchange fee in the Visa association.

¹⁴⁴ THE NILSON REPORT No. 758 (Feb. 2002), at 4.

¹⁴⁵ See *United States v. Visa*, 163 F. Supp. 2d 322, 333 (S.D.N.Y. 2001).

Some merchants take American Express cards but discourage their use when the consumer has a payment alternative that is cheaper for the merchant. In effect, the systems want a lot of people to join the club and to go out on a lot of dates. The pricing structure, and investment strategy, seems to have arisen to solve these two problems: getting people on board and getting those on board together a lot.

Despite these differences with other two-sided markets there are many similarities. The payment systems have two groups of customers. The customers engage in transactions (the use of cards as a means of exchange) on a platform (the card systems). There are externalities—merchants value more cardholders; cardholders value more merchants. And there is a pricing structure that seems to skew prices towards one side—in this case the merchants.

III. ECONOMICS OF TWO-SIDED MARKETS

The preceding section cataloged a variety of business models and strategies employed by companies operating in two-sided markets. In this section, I explore the economic rationale behind the business models we observe in two-sided markets. Part A tries to isolate what makes two-sided markets different. It is true that they tend to have network effects and involve complementary products sold by multiproduct firms. But they have something more that makes the economics of them much different from the well-trodden fields of network economics and multiproduct pricing.

Part B presents a simple economic model of pricing in a two-sided market. It shows that the conditions for optimal product pricing are substantially different from those in the one-sided markets usually analyzed by economists. Neither the usual price equals marginal cost condition found in perfectly competitive markets nor the usual marginal revenue equals marginal cost condition found in imperfectly competitive markets applies. Fundamentally,

simple pricing and cost relationships cannot apply to either side because the transaction that takes place on the platform jointly benefits both parties and often entails joint costs.

Part C examines how the unique economics of two-sided markets affects the business models used by firms in these markets. It examines strategies for getting both sides on board, balancing the competing interests of both sides, and how these strategies are affected by the extent of competition among two-sided firms operating in the same market.

Part D concludes with a brief discussion of how the pricing strategies used in two-sided markets deviate from what a benevolent social planner, trying to maximize social welfare, would like to see. That will set up the discussion for the following section that explores the antitrust analysis of two-sided markets.

A. What Makes Two-Sided Markets Different

The difference between one-sided and two-side markets is subtler than it first appears. To see why, we need to distinguish two-sided markets from those with network effects and those involving complementary products. Network effects and complementarities are important aspects of two-sided markets but do not by themselves distinguish two-sided from one-sided markets.

1. Network Effects

A market has network effects (also known as network externalities or positive-feedback effects) when consumers value a product more the more other consumers use that product. In the case of direct network effects, I value (and therefore have a stronger demand for) the product because you have purchased it as well (therefore we can, for example, communicate

with each other using this technology).¹⁴⁶ In the case of indirect network effects, I value (and therefore have a stronger demand for) the product because your purchase means that the demand for complementary products is higher and the supply of those complementary products will benefit me. Direct and indirect network effects result in purchasing decisions being interdependent over time.

All of the products we discussed in the previous section have indirect network effects. Bond sellers value an exchange system more if more bond buyers participate—they are more likely to consummate a transaction and obtain a more favorable deal. Merchants value a payment system more if more customers have the card. Applications developers value an operating system more if more prospective applications buyers use it. Purchasers of video game consoles value them more if there are more users of these consoles because that will translate into more games. In all these cases, each side values having the other side on board and benefits the more customers there are on the other side.

2. Multiproduct Firms

All of the firms we discussed in the previous section sold what appeared to be multiple products. Residential agencies sell listing services as well as showing services, even though they are not typically priced separately. Magazines sell advertising space and content. Operating system vendors sell application developer tools and operating systems. Payment-card systems sell cardholder and merchant services. Many firms sell multiple products and there is

¹⁴⁶ One can take a communications network and think of there being two sides (senders and receivers) in which case one can also think of the network effects as indirect. What distinguishes two-sided from one-sided markets, and indirect from direct network effects, is whether one can identify distinct groups of users with different preferences. There is an argument that almost all network effects in reality are indirect effects and that almost all network markets are two-sided.

an extensive economic literature on why they do so.¹⁴⁷ On the cost side, there may be economies of scope from having one firm produce multiple products. Automobile manufacturers can use the same production technology for making cars and trucks. American Express can use the same computer system for providing services to cardholders and merchants. On the demand side, there are advantages to pricing complementary products together.

That was first recognized by Cournot in 1838 and now goes by the unhelpful name of “double marginalization.”¹⁴⁸ Suppose there are two complementary products, A and B. Two products are complements if the demand for one is higher the lower the price of the other. Unless there is perfect competition in products A and B, a firm that makes product A can increase its sales if the price of product B is lower (and vice versa for a firm that makes product B). By selling both products a firm can take this pricing interdependency into account; as it turns out, consumers generally benefit as the price of both complementary products will tend to be lower when they are priced jointly than when they are priced separately.¹⁴⁹ Gillette does this selling razors and razor blades. IBM does this by selling mainframes and peripheral devices. Microsoft does this by selling Microsoft Office and Microsoft Windows.

These standard explanations for why firms produce multiple products probably apply to many of the firms discussed in the previous section. But there is a further reason why firms sell

¹⁴⁷ Jeff Rohlfs, *A Theory of Interdependent Demand for a Communications Service*, 5 BELL J. ECON. 16 (1974); WILLIAM J. BAUMOL *ET AL.*, *CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE* (1982); John C. Panzar, *Technological Determinants of Firms and Industry Structure*, in *HANDBOOK OF INDUSTRIAL ORGANIZATION VOL. I 3* (Richard Schmalensee & Robert D. Willig eds., 1989).

¹⁴⁸ AUGUSTIN A. COURNOT, *RESEARCHES INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH*, (Nathaniel T. Bacon trans., Macmillan 1897).

¹⁴⁹ The classic example of this involves monopoly production of A and B. A merger of two monopolists in these complementary products would result in the merged firm charging lower prices for at least one of the (continued...)

multiple products in two-sided markets. Doing so helps them increase the indirect network effects discussed above. Most firms in one-sided markets do not have to offer product A in order to offer product B. GM could sell cars without trucks and Gillette could sell razor blades without selling razors. Many firms in two-sided markets, however, have to produce multiple products in order to sell any product at all. Diners Club could not have come into existence without providing different services to both cardholders and merchants. Selling operating systems and video game consoles requires firms in these industries to produce products for both users and developers. For others, producing multiple products is important but perhaps not essential. There are companies that specialize in sending advertising messages (direct mail, bill boards) and companies that specialize in just selling content to consumers (the leading German newspaper *Frankfurter Allgemeine Zeitung* has no ads, and *Consumer Reports* declines advertiser support).

B. Profit-Maximizing Pricing in Two-Sided Markets

A market is two-sided if at any point in time there are (a) two distinct groups of customers; (b) the value obtained by one kind of customers increases with the number of the other kind of customers; and (c) an intermediary is necessary for internalizing the externalities created by one group for the other group. Two-sided markets tend to result in businesses that supply both sides of the market, that adopt particular pricing and investment strategies to get both sides of the market on board, and that adopt particular pricing and product strategies to balance the interests of the two sides.¹⁵⁰

(...continued)

products compared to the separate firm. *See generally* Thibaud Verge, *Multiproduct Monopolist and Full-Line Forcing: The Efficiency Argument Revisited*, 12 *ECON. BULL.* 1 (2001).

¹⁵⁰ I discuss what I mean by “balance the interests” below.

A simplified model shows some of the key differences between one-sided and two-sided markets. I do the comparison under the assumption that a monopoly firm is providing the good. Firm S is in a single-sided market and sells q_S . Firm T is in a two-sided market and sells q_T^1 and q_T^2 . I then explore the situation of competing firms.

1. Monopoly Two-Sided Firm

The pricing strategy of a monopoly provider in a one-sided market is well known. Assume that the firm S has a constant cost of production c_S . The monopoly charges price p_S and produces quantity q_S . Profits are: $\pi_S = (p_S - c_S) \times q_S$. To maximize profits the firm should increase q_S to the point where marginal revenue equals marginal cost. At this point the famous Lerner formula applies: percent markup of price over marginal cost should equal one divided by the elasticity of demand: $\frac{p_S - c_S}{p_S} = \frac{1}{\varepsilon}$, where the elasticity of demand is defined as the percentage change in quantity resulting from a one percent change in price (times minus one so it is always positive).¹⁵¹ If it were possible to identify separate groups of consumers with different demand the firm could engage in price discrimination in which case it would charge different prices to these different groups (where each price would be at the level at which the marginal revenue for that group equals marginal cost).

Rochet and Tirole examine the pricing and production strategy of a firm in a two-sided market that is motivated by payment cards but can be easily generalized to many two-sided match-maker markets.¹⁵² They consider the case in which both sides of the market are buying a “transaction” and in which the seller incurs a marginal cost of c_T for consummating that

¹⁵¹ See CARLTON & PERLOFF, *supra* note 6, at 91-92. (The elasticity is sometimes defined without multiplying by minus one.)

transaction. The prices charged to buyers and sellers respectively are two prices, p_T^B and p_T^S . The buyer's demand $D_T^B(p_T^B)$ depends only on the price faced by the buyer and the seller's demand $D_T^S(p_T^S)$ depends only on the price faced by the seller. The demands can be thought of, roughly speaking, as the number of buyers and sellers using the system. The transactions that a seller engages in, and its benefits from those transactions, increase proportionally with the number of buyers on the system. The same holds for an individual buyer.¹⁵³

Total demand equals the product of the two demands: $q_T = D_T^B(p_T^B)D_T^S(p_T^S)$. Thus, if there were 500 sellers and 100 buyers, there would be 50,000 transactions. This assumption mimics the situation in credit cards where the number of card transactions depends on the interactions between those who hold cards and those who take cards. It also captures the situation in which the number of video games that are played depends on the interactions between those who play games on a particular type of video game console and those who make games for that console. The two-sided monopoly's profits are: $\pi_T = (p_T^B + p_T^S - c_T) \times q_T$.

Although this model is special, the results described below are likely to hold generally: the firm has to choose a pricing structure in addition to a pricing level and profit-maximization does not result in the equilibration of marginal revenue and marginal cost in either market taken by itself. The assumption of multiplicative demand between the two sides understates the importance of the indirect network effects. It ignores the fact that the value each side obtains

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¹⁵² See Rochet & Tirole, *supra* note 4.

¹⁵³ Rochet and Tirole assume, for simplicity, that there are no fixed costs of joining the system. If there were fixed costs, a buyer would have to weigh the overall gain from joining, which would depend on the number of sellers, against the fixed costs, so that the number of buyers joining would depend on the number of sellers. As a result, the decision of an individual seller to join the system does not depend on the number of buyers

from the other side increases with the number of customers on the other side. The results below would likely be stronger if this feature were taken into account.¹⁵⁴

A key difference between the one-sided and two-sided firms is that, as Rochet and Tirole show, the two-sided monopolist must choose a pricing level (what total price to charge to buyers and sellers) and a pricing structure (how to divide the total price between buyers and

sellers). The pricing level condition is: $\frac{(p_T^B + p_T^S) - c_T}{(p_T^B + p_T^S)} = \frac{1}{\varepsilon^B + \varepsilon^S}$. This condition is a variant of

the Lerner condition above. Here however, analog of the price term in the one-sided Lerner condition is the sum of the prices to both sides and the analog of the demand elasticity term is the sum of the demand elasticities on both sides.

The optimal pricing structure depends on the following condition where the D' refers to the change in demand with respect to a change in the price on that side of the market:

$(D_T^B)' D_T^S = D_T^B (D_T^S)'$. Consider the left-hand side of this equality. A slight increase in price on

the seller's side will decrease the seller side demand slightly, by $(D_T^B)'$. The impact on total demand (and profits) is the product of the seller side effect times the buyer side demand. The

right hand side is the analogous effect of increasing the buyer side price slightly. In

equilibrium, the effect on profits must be the same from increasing the seller side price versus

the buyer side price. That implies $\frac{p_T^B}{\varepsilon^B} = \frac{p_T^S}{\varepsilon^S}$, where the ε 's are the elasticities of demand for

each side of the market.

¹⁵⁴ The particular model is used because it leads to tractable results that can be used to analyze the welfare consequences of two-sided pricing.

This is very different from the Lerner condition, shown above, in one-sided markets. Moreover, none of the conditions for determining the price level or the price structure in two-sided markets corresponds to marginal revenue equaling marginal cost on either side of the market. In fact, such conditions have no meaning in two-sided markets because there is no way to allocate the increases in revenues from changes in prices to one side or the other. Changes in prices result in more “transactions” from which each side jointly benefits. Nor is there any way to allocate the costs. Often costs are jointly incurred for both parties to a transaction and we have the usual issue that any allocation of cost is arbitrary.¹⁵⁵

To try to understand the pricing structure condition intuitively, consider the following. Suppose, for example, the seller side demand (D_r^S) is five times larger in equilibrium than the buyer side (D_r^B)—say, 500 to 100, with total output of 50,000. Since total demand is the product of the demands on the two sides, a change in the buyer side demand has five times the effect on total demand as the same sized change in seller side demand. If the buyer side decreases by one unit, to 99, then total output falls by 500 units. But if the seller side decreases by one unit, total output falls by only 100 units. At equilibrium, the change in profits coming from a one-cent increase in the seller price must be the same as from the same increase in the buyer price. The monopolist therefore wants to set prices so that the change in buyer side demand from a marginal price change is only 1/5 of the change in seller side demand from a marginal price change because the effect of a buyer side change is multiplied against the much larger demand on the seller side.

¹⁵⁵ See *supra* note 29.

2. Competing Two-Sided Firms

The results are broadly similar when there are competing firms selling to both sides of the market. In practice, consumers in two-sided markets tend to engage in “multihoming”¹⁵⁶—consumers on one or both sides of the market rely on more than one seller of two-sided services. For example, game developers write for several different consoles, merchants accept several different types of credit cards, and home buyers sometimes use several different real-estate agents. Rochet and Tirole consider multihoming under the further assumption—often true in practice—that one side of the market can dictate which two-sided firm must be used in any particular transaction. Payment cardholders usually decide which card to use and computer users usually decide which operating system to use. In this case, competing two-sided firms still must choose a pricing level and a pricing structure. However, the relevant demand elasticities are increased by a factor that reflects the extent to which consumers multihome and therefore have substitutes readily available.

C. Business Models in Two-Sided Markets

Although the economics presented above is simple it helps us understand the rationale for the business models that have been adopted in two-sided markets. Here I consider several issues that occur repeatedly in two-sided markets.

¹⁵⁶ “Multihomed” was originally an Internet term. According to Webopedia, an online technical dictionary, it is “an adjective used to describe a host that is connected to two or more networks or has two or more network addresses. For example, a network server may be connected to a serial line and a LAN or to multiple LANs.” For definition, see Webopedia Online Dictionary (visited Aug. 13, 2002) <<http://www.pcwebopaedia.com/TERM/m/multihomed.html>>. Rochet and Tirole adapt the term to describe two-sided networks where a fraction of end-users on one or more sides connect to multiple platforms. See Rochet & Tirole, *supra* note 4, at 5.

(1) Getting both sides on board. There are many references in the literature on the firms discussed earlier about solving the chicken-and-egg problem.¹⁵⁷ For example, there would be no demand by households for payment cards if they could not use them anywhere and no demand by retailers for payment cards if no one had them. Which comes first—the cardholder or the retailer?¹⁵⁸ Investment and pricing strategies are key to getting both sides on board.

(2) Balancing interests. Even with both sides on board, businesses have to carefully balance their two demands. They always have to consider how changing prices on one side of the market will impact the other side of the market. Businesses sometimes differ over this. For example, in the battle between Microsoft and Netscape over Internet browsers, Microsoft gave away developer kits to Internet portals while Netscape charged for them.¹⁵⁹ Political tensions can also manifest themselves—looking out for their narrow interests customers on each side of the market would like the other side to pay more. This is a familiar problem in the payment-card industry—in Europe a retailers association asked the European Commission to force the card associations to eliminate the interchange fee.¹⁶⁰

(3) Multihoming. Firms sometimes compete to become the dominant two-sided provider. A monopoly provider can emerge if consumers are sufficiently homogeneous (so that one firm can provide them all), the indirect network effects are strong enough, and there are sufficiently large scale economies in production. But even in these circumstances, at the start

¹⁵⁷ See, e.g., GAWER & CUSUMANO, *supra* note 28, at 150-151, 60-61.

¹⁵⁸ See EVANS & SCHMALENSEE, *supra* note 10, at 137-168.

¹⁵⁹ Cameron D. Myhrvold, *Microsoft's Efforts to Create Alliances with ISPs*, Microsoft PressPass, Jan. 6, 1999, (visited Aug. 21, 2002) <http://www.microsoft.com/presspass/trial/mswitness/myhrvold/myhrvold_pt2.asp>.

¹⁶⁰ See *Retail Disappointment as Visa Exempted from EU Competition Rules*, British Retail Consortium Press Release, Jul. 25, 2002 (downloaded Aug. 19, 2002) <<http://www.brc.org.uk/Archive.asp>>; Francesco
(continued...)

of an industry it is common to see several firms in a race to become the dominant firm—they are likely to engage in multihoming strategies. In some cases it is possible that several two-sided firms could co-exist and compete with each other—this has clearly been the case in payment cards where there have been multiple providers for almost half a century. In this case, multihoming has implications for how they compete with each other.

1. Getting Both Sides on Board

An important characteristic of two-sided markets is that the demand on each side vanishes if there is no demand on the other—regardless of what the price is. Men will not go to dating clubs that women do not attend because they cannot get a date. Merchants will not take a payment card if no customer carries it because no transaction will materialize. Computer users will not use an operating system that does not have applications they need to run. Sellers of corporate bonds will not use a trading mechanism that does not have any buyers. In all these cases, the businesses that participate in these industries have to figure out ways to get both sides on board.

One way to do this is to obtain a critical mass of users on one side of the market by giving them the service for free or even paying them to take it. Especially at the entry phase of firms in two-sided markets it is not surprising to see precisely this strategy. Diners Club gave its charge card away to cardholders at first—there was no annual fee and users got the benefit of the float. Netscape gave away its browser to most users to get a critical mass on the computer user side of the market; after Microsoft started giving away its browser to all users

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Gruerrera, *Brussels Set to Let Visa off the Hook*, FIN. TIMES, May 13, 2002; James MacKintosh, *Watchdog Rules Credit Card Fees to Retailers Excessive*, FIN. TIMES, Sept. 26, 2001.

Netscape followed suit.¹⁶¹ Microsoft is reportedly subsidizing the sales of its X-box hardware to consumers to get them on board.¹⁶²

Another way to solve the chicken-and-egg problem is to invest in one side of the market to lower the costs to consumers on that side of participating in the market. Microsoft provides a good example of this. As we saw earlier it invests in applications developers by developing tools that help them write applications and providing other assistance that makes it easier for developers to write applications using Microsoft operating systems. To take another example, bond dealers take positions in their personal accounts for certain bonds they trade. They do this when the bond is thinly traded and the long time delays between buys and sells would hinder the market's pricing and/or liquidity. By investing in this manner, two-sided intermediaries are able to cultivate (or even initially supply) one side, or both sides, of their market in order to boost the overall success of the platform.

Providing low prices or transfers to one side of the market helps the platform solve the chicken-and-egg problem by encouraging the benefited group's participation—which in turn, due to network effects, encourages the non-benefited group's participation. Bernard Caillaud and Bruno Jullien refer to this strategy as “divide-and-conquer.”¹⁶³ Another effect of providing benefits to one side is that this assistance can discourage use of competing two-sided firms. For example, when Palm provides free tools and support to PDA applications software developers,

¹⁶¹ Wylie Wong, *Netscape Applauds Microsoft Suit*, TECHWEB, May 20, 1998 (visited Aug. 21, 2002) <<http://www.techweb.com/wire/story/msftdoj/TWB19980519S0007>>.

¹⁶² David Becker, *Xbox Drags on Microsoft Profit*, CNET.COM, Jan. 18, 2002 (visited Aug. 21, 2002) <<http://news.com.com/2100-1040-818798.html>>.

¹⁶³ See Caillaud & Jullien, *supra* note 4, at 16. See also Jullien, *supra* note 4, at 1.

it encourages those developers to write programs that work on the Palm OS platform, but it also induces those developers to spend less time writing programs for other operating systems.¹⁶⁴

2. Pricing Strategies and Balancing Interests

Firms in mature two-sided markets—i.e. those that have already gone through the entry phase in which the focus is on solving the chicken-and-egg problem—still have to devise and maintain an optimal pricing structure. In most observed two-sided markets, companies seem to settle on pricing structures that are heavily skewed towards one side of the market. Table 1 in Appendix A summarizes the pricing structure for the markets we have identified as two-sided. For example, in 2001, excluding finance charge revenue American Express earned 82 percent of its revenues from merchants.¹⁶⁵ Microsoft earns the substantial majority of its revenue from Windows from licensing Windows to computer manufacturers or end-users.¹⁶⁶ Real estate brokers usually earn most or all of their revenues from the sellers.

Discerning the optimal pricing structure is one of the challenges of competing in a two-sided market. Sometimes all the platforms converge on the same pricing strategy. Microsoft, Apple, IBM, Palm and other operating system companies could have charged higher fees to applications developers and lower fees to end-users. They all discovered that it made sense to

¹⁶⁴ See Rochet & Tirole, *supra* note 4, at 6.

¹⁶⁵ If finance charge revenues are included, American Express earned 62 percent of its revenues from merchants in 2001. See American Express Company Annual Report 2001, *supra* note 138, at 35.

¹⁶⁶ From 1988 through 2000, Microsoft earned at least 67 percent of its revenues from licensing packaged software (such as Windows and Office) to end-users (either directly at retail or through manufacturer pre-installation on PCs). See *1994 Worldwide Software Review and Forecast*, IDC REPORT #9358 (Nov. 1994); *1995 Worldwide Software Review and Forecast*, IDC REPORT #10460 (Nov. 1995); *1996 Worldwide Software Review and Forecast*, IDC REPORT #12408 (Nov. 1996); *1997 Worldwide Software Review and Forecast*, IDC REPORT #14327 (Oct. 1997); *1999 Worldwide Software Review and Forecast*, IDC REPORT #20161 (Oct. 1999); *Worldwide Software Market Forecast Summary, 2001-2005*, IDC REPORT #25569 (Sept. 2001). Note that the 67 percent figure underestimates the amount of revenue Microsoft earns from end-users because the other third of revenue coming from "Applications Development and Deployment" includes some end-user revenues as well. For
(continued...)

charge developers relatively modest fees for developer kits and, especially in the case of Microsoft, to give a lot away for free. Nevertheless, Microsoft is known for putting far more effort into the developer side of the business than the other operating system companies.¹⁶⁷

The debit card is an example in which different platforms made different pricing choices. In the late 1980s, the ATM networks had a base of cardholders who used their cards to withdraw cash or obtain other services at ATMs. They had no merchants that took these cards. To add debit services to existing ATM cards, the ATM networks charged a small interchange fee (8 cents per transaction on a typical \$30 transaction) to encourage merchants to install pin-pads that could read the ATM cards that cardholders already had and accept the pins they used to access the ATM machines.¹⁶⁸ Many merchants invested in the pin-pads—the number of pin-pads increased from 53,000 in 1990 to about 3.6 million in 2001.¹⁶⁹ The credit-card systems had a base of merchants who took their cards but it did not have cards that, like the ATM cards, accessed consumers' checking accounts. The credit-card systems imposed a much higher interchange fee than the ATM networks, about 38 cents versus 8 cents on a typical \$30 transaction.¹⁷⁰ They did this to persuade banks to issue debit cards and cardholders to take

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example, database products used by business IT departments are included in the Applications Development category.

¹⁶⁷ See GAWER & CUSUMANO, *supra* note 28, at 150-151.

¹⁶⁸ See EVANS & SCHMALENSEE, *supra* note 10, at 300.

¹⁶⁹ *Id.* at 308-309; and THE NILSON REPORT No. 759 (March 2002), at 6.

¹⁷⁰ The ATM systems typically charged a flat interchange fee per transaction, while the interchange fee set by Visa and MasterCard varied with the size of the transaction. The reported interchange fee comparison is from 1998, around the time of substantial growth in debit for the ATM and credit-card systems. *Id.* at 300.

these cards.¹⁷¹ The number of Visa debit cards in circulation increased from 7.6 million in 1990 to about 117 million in 2001.¹⁷²

Two other factors influence the pricing structure. There may be certain customers on one side of the market—Rochet and Tirole refer to them as “marquee buyers”—that are extremely valuable to customers on the other side of the market. The existence of marquee buyers tends to reduce the price to all buyers and increases it to sellers. A similar phenomenon occurs when certain customers are extremely loyal to the two-sided firm—perhaps because of long-term contracts or sunk-cost investments. For example, American Express has been able to charge a relatively high merchant discount as compared to other card brands, especially for their corporate card, because merchants viewed the American Express business clientele as extremely attractive. Corporate expense clients were “marquee” customers that allowed American Express to raise its prices to the other side of the market, merchants. In the online debit-card market, however, card issuers faced “captive” customers—ATM cards could be used as online debit cards, so consumers did not need to be courted to accept the new payment form. Therefore, it has been the merchants—who must purchase and install expensive machinery in order to process online debit transactions—who have been courted, as we saw above.

3. Multihoming

Most two-sided markets we observe in the real world appear to have several competing two-sided firms and at least one side appears to multihome. Table 2 in Appendix A presents a summary. Consider, for example, personal computers. One could consider the two sides as

¹⁷¹ Visa attracted consumers through an effective advertising campaign and attracted issuers through heavy investment in a debit processing facility, among other strategies. *Id.* at chapter 12.

¹⁷² See THE NILSON REPORT No. 760 (March 2002), at 7; THE NILSON REPORT No. 500 (May 1991), at 6.

consisting of personal computer end-users and as developers of applications. The end-users do not multihome. They almost always use a single operating system and by far the preponderance of them use a Microsoft operating system.¹⁷³ The developers do multihome. According to Josh Lerner, in 2000, 68 percent of software firms developed software for Windows operating systems, 19 percent for Apple computers operating systems, 48 percent for Unix operating systems including Linux, and 36 percent and 34 percent for proprietary non-Unix operating systems that run on minicomputers and proprietary operating systems that run on mainframes respectively.¹⁷⁴ In fact, in recent years the percentage of software firms developing for non-Microsoft operating systems has increased. The fastest-growing category has been software firms developing for Unix operating systems including Linux. The percentage of developers in this category increased from 29 percent in 1998 to 48 percent in 2000.¹⁷⁵

Multihoming affects both the price level and the pricing structure. Not surprisingly the price level tends to be lower with multihoming—the availability of substitutes tends to put pressure on the two-sided firms to lower their prices. The seller has more options dealing with a multihomed buyer on the other side and can steer toward its preferred platform. As buyer multihoming becomes more prevalent, prices to sellers will tend to decrease since they have more substitution options.

¹⁷³ *Worldwide Operating Environments Market Forecast and Analysis Summary, 2001-2005*, IDC REPORT #25119 (Aug. 2001), at 12.

¹⁷⁴ See Josh Lerner, *Did Microsoft Deter Software Innovation?* WORKING PAPER (Jan. 2002) (downloaded Aug. 15, 2002) <<http://gsbwww.uchicago.edu/research/workshops/elo/lerner2.pdf>>; and CORPORATE TECHNOLOGY DIRECTORY, EDITIONS 1990-2000. The percentages total to 205, indicating substantial multihoming on the part of developers.

¹⁷⁵ *Id.*

Even when multihoming is not prevalent on one side of a two-sided market the possibility of multihoming may have significant consequences for pricing. The possibility of multihoming may encourage firms to lower their prices on the side of the market in which multihoming could occur. By lowering their prices they discourage customers on that side from affiliating with other two-sided firms. This is not entirely a free lunch for consumers. The firm can then charge more to customers on the other side, for whom fewer substitutes are available.¹⁷⁶

D. Two-Sided Markets and Social Welfare

A relatively small number of firms tend to compete in two-sided markets. That is because these markets have network effects and usually incur substantial fixed costs for getting one or both sides on board. Larger firms have advantages over smaller firms, at least up to a point, because their larger size delivers more value—a bigger network—to consumers. In the case of two-sided markets, larger firms are able to deliver a bigger network of customers on one side of the market to customers on the other side of the market. As we have seen, other economic factors, in particular the existence of heterogeneous consumers on one side of the market or the other, tend to limit the importance of network effects so that it is possible for multiple firms to compete in two-sided markets.

Firms in concentrated two-sided markets, like firms in all concentrated markets, may have opportunities to earn supra-competitive profits—i.e. profits that exceed those necessary to

¹⁷⁶ In Jullien's model, when multiple platforms compete and price discrimination between the two customer types is possible, then prices are lower overall: "This forces the established firm to set on average prices at a much lower level than it would do with uniform prices. It turns out that it is impossible for a network to capture in equilibrium the surplus generated by the inter-group network externalities." Jullien assumes the incumbent initially offers uniform prices because in his model the two customer types have identical valuations for the network goods and both receive the same extra value if they both join the same network. *See* Jullien, *supra* note 4, at 4.

attract capital to the industry after accounting for risk. Several factors affect the extent to which this can happen over time.

1. The extent to which firms are competing to become established in a two-sided market. Firms tend to compete to establish customer bases on both sides of the market. This results in investments to court customers, to provide them with subsidies in the form of equipment, and to offer them low or negative prices.¹⁷⁷ If the competition is sufficiently intense the losses incurred during the “getting both sides on board” stage may significantly offset the profits earned during the mature phase of the industry. For example, firms that have entered the payment-card industry have all incurred sizeable losses during their startup phases.¹⁷⁸
2. The extent to which there are first-mover advantages in getting either side of the market on board. If any firm can make investments to get a side of the market on board then competition to make these investment should reduce the opportunities to earn significant supra-competitive returns. Supra-competitive profits could arise if one firm has an advantage that other firms cannot replicate. For example, the network economics literature argues that the first mover in an industry always has an advantage over the subsequent movers.¹⁷⁹ Since customers value other customers whoever gets customers first naturally wins.¹⁸⁰ It could also be that a firm has some asset that gives it a hard start. For example, a firm may have already developed a product that gives it a large customer base on one side of a market. When the demand for a two-sided version of this (or a related) product appears it will have a significant head start over rivals. Online debit is an example. Banks issued ATM cards to customers for use at its ATM machines. The ATM networks they belonged to eventually realized that these same ATM cards could be used to pay at merchants. The fact that they had the cardholder side on board gave them a significant advantage.
3. Even markets that appear to be dominated by a single player may in reality be contestable. Jullien’s “model suggests that it may be easier than expected for a superior technology to enter, provided that the quality improvement is large enough.”¹⁸¹ Because many of the two-sided markets are fast moving, current leaders often face considerable competition in the form of potential entrants—other platforms striving to displace today’s leader. Caillaud and Jullien argue that the Internet represents one such environment: “Too many ways of stealing the competitors’ business appear.

¹⁷⁷ Losing money initially to buy penetration can also be an important phenomenon in one-sided networks.

¹⁷⁸ See EVANS & SCHMALENSSEE, *supra* note 10, at ch. 4.

¹⁷⁹ See, e.g., CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES 29-32 (1999).

¹⁸⁰ There is little empirical support, however, for this view. See Evans & Schmalensee, *supra* note 7. See also STAN J. LIEBOWITZ & STEPHEN E. MARGOLIS, WINNERS, LOSERS & MICROSOFT: COMPETITION AND ANTITRUST IN HIGH TECHNOLOGY (1999).

¹⁸¹ See Jullien, *supra* note 27, at 34.

Unsurprisingly, the strategic situation is very unstable and the only equilibrium situation that is tenable is for a firm to exert dominance on the intermediation market, i.e. to be the sole supplier of intermediation services, without enjoying any market power as potential entrants create a strong disciplinary device for the dominant firm. In some sense, this market is extremely contestable.¹⁸²

4. Two-sided markets in which non-profit associations determine the pricing structure are not likely to permit the participants to earn supracompetitive profits. Payment-card associations have put an effectively non-profit institution in charge of managing a physical network for members and for determining pricing policies. Pricing levels are determined by competition among members of the association. For example, in the United States payment-card industry, thousands of banks compete for cardholders; although a small number of firms compete for merchant services this business is considered to be highly competitive also. Interest rates, card fees, merchant charges, and so forth are determined through intense competition. Pricing structures are affected by the non-profit institution. In the case of payment cards, the interchange fee affects the relative price to cardholders and merchants.

The consequences of having relatively few competitors in two-sided markets, and the existence of network effects, raise familiar issues concerning the efficacy of competitive markets and the possible roles for government intervention. The pricing and investment strategies that firms in two-sided markets use to “get both sides on board” and “balance the interests of both sides” raise novel ones. These pricing and other business strategies are needed to solve a fundamental economic problem arising from the interdependency of demand on both sides of the market. In some cases, the product could not even exist without efforts to subsidize one side of the market or the other.

Rochet and Tirole, in an admittedly simplified setting, have compared the pricing structure adopted by firms in two-sided markets to the pricing structure that would maximize social welfare. Interestingly, they find that a monopoly firm, a firm with competition, and a benevolent social planner would adopt similar pricing structures. The precise relative prices

¹⁸² See Caillaud & Jullien, *supra* note 4, at 40. The authors are speaking of Internet intermediaries, but the point holds for other fast-moving dynamic markets.

would differ somewhat.¹⁸³ However, Rochet and Tirole find that the pricing structure adopted by the market (monopoly or two-firm oligopoly) is not biased towards one side of the market or the other side of the market compared to the pricing structure that would be adopted by a benevolent social planner.¹⁸⁴ (Schmalensee finds similar results for interchange fees.¹⁸⁵) Therefore, there is no reason to believe that the preferences that one side or the other of the market have gotten, as summarized in Table 1, are systematically different from what a social planner would seek to achieve.

IV. ANTITRUST ISSUES RAISED BY TWO-SIDED MARKETS

The economics of two-sided markets differ from the economics of one-sided markets in important respects. First, the individual prices charged on either side of the market do not track costs or demand on that side of the market. Indeed, the fact that benefits and costs arise jointly in the two sides of the market means that there is no meaningful economic relationship between benefits and costs on either side of the market considered by itself. It takes two to tango. Second, one cannot talk about the individual prices in isolation. Any change in demand or cost on either side of the market will necessarily affect both prices along with the sum of those prices. Third, products in two-sided markets cannot come into existence and cannot remain in existence unless firms in those markets get “both sides on board.” This gives rise to pricing and investment strategies that differ from those taken in one-sided markets and seem odd unless considered in the context of competition in a two-sided market. Fourth, any analysis of social welfare must account for the pricing level, the pricing structure, and the feasible alternatives for

¹⁸³ In the very special case of linear demand the pricing structures would be identical. *See* Rochet & Tirole, *supra* note 4, at 25.

¹⁸⁴ *Id.* at 24.

¹⁸⁵ *See* Schmalensee (2002), *supra* note 4, at 118-120.

getting both sides on board. It must also account for the extent to which not-for-profit institutions manage those aspects of the network that could give rise to supra-competitive profits.

These differences matter for antitrust analysis. To see the principles consider the following hypothetical merger. There are two chains of dating clubs in Tokyo—AAA Mates and Best Match (clubs A and B, respectively). They cater to somewhat different clienteles. Club A charges men \$20 for admission and women \$0; Club B charges men \$30 for admission and gives women a \$5 credit (in the form of free drinks). Club B has a 40 percent market share while Club A has a 10 percent market share. Club B has been more successful because it attracts more women and as a result of that it attracts more men. In fact, it is so successful that—like an “in” discotheque—it typically has a line and can select the men and women to admit. It tries to weed out “undesirable” men and women.

In analyzing whether this merger would be bad for consumers, a competition regulator would have to take several factors into account. Let us start by considering market definition. A preliminary issue is whether dating clubs is the relevant antitrust market in which this merger should be evaluated. Under the U.S. merger guidelines, it would be a market if a merger of all the dating clubs in Tokyo (assume Tokyo is the relevant geographic market) would enable the combined firm to raise price by a small but significant non-transitory amount—let us say 10 percent. For analyzing that question one should look at the “total price” charged by the club—although the average price across all patrons of the club would provide the same information. There is no reason to focus on the individual prices for men and women (except perhaps as they say something about product differentiation among the clubs). Different competitors may

choose different pricing structures depending on the mix of men and women they want to attract. They could easily adjust these pricing structures in response to a change in the market.

If dating clubs is a relevant antitrust market, the next issue is whether a merger of clubs A and B would result in prices increasing. One cannot answer that question by looking just at the demand for patrons overall—e.g. by estimating the demand for admission against the average price. The mix of men and women is critically important. One would have to estimate the demand for men and the demand for women simultaneously. Then, using the theory of pricing in two-sided markets considered earlier together with information on cost, one could predict whether the merger would lead the combined firms to increase their total price.

Let us suppose that the competition authority has completed this exercise and found that the merged dating clubs would charge \$32 for men and give women a credit of \$6. Assuming equal numbers of men and women, the average price charged at Club A would rise from \$10 to \$13 and the average price charged at Club B would rise from \$12.50 to \$13. Should the competition authority ban the merger based on this price increase? From the standpoint of consumers the answer is unclear. At this point in a merger investigation the companies could come back and argue that there are efficiencies from the merger and that the reductions in cost will pull prices back down. There are no such savings here. But there is something else. Club B may have efficiencies that enable it to provide a higher value to consumers on the two sides of the market. On average the customers pay more but the men may have a better selection of women to choose from and the women may have a better selection of men to choose from.¹⁸⁶

¹⁸⁶ Merger analysis in one-sided markets faces similar problems. Sometimes mergers permit the parties to create new products. The value of these new products should be considered as part of the efficiency analysis.

In effect, there are demand-side efficiencies that result from increasing the indirect network effects realized by both sides of the market.

The remainder of this section examines how the economics of two-sided markets affects several key areas of antitrust analysis. Part A considers market definition. It focuses on how the merger guidelines approach should be modified for mergers of firms in two-sided markets. Part B examines the analysis of market power—the ability of firms to hold prices significantly above marginal cost. It considers the implications of the breakdown of the usual price equals marginal cost condition in two-sided markets. Part C considers the analysis of barriers to entry in two-sided markets—this is an important topic that comes up in both market definition and market power. Part D looks at efficiency considerations for two-sided markets; as part of this exercise it examines how the two-sided nature of markets should affect the classification of practices as *per se* versus rule of reason. Part E examines the implication of getting and keeping both sides on board in two-sided markets for the analysis of predation. Part F looks at a variety of other issues.

A. Market Definition

The general purpose of market definition is to provide a context for examining the issues that arise in an antitrust matter. For merger cases market definition helps identify the firms that could constrain possible price increases by the merging parties. For cases involving alleged anticompetitive behavior, market definition helps determine whether the defendant has enough market power for its behavior to have ultimately harmful effects on competition and consumers. Often market definition results in determining whether a firm is “in” the market or “out of” the market and then calculating the shares of the firms “in the market.” A high share indicates market power or monopoly power.

In the case of mergers, the U.S. Department of Justice and Federal Trade Commission have developed techniques for determining whether a firm is in the market. They start with the firm(s) under consideration and add competitors to the market. The market boundary results (in a geographic or product dimension) when the collection of firms could, acting as a monopolist, raise price by a small but significant non-transitory amount (often taken to be 5-10 percent). If the collection of firms could do so, then presumably the firms “outside of the market” do not constrain the firms “inside the market” much.

For two-sided markets, this analysis must pay attention to both sides. It should consider firms that currently supply both sets of customers. Here the main controversy is likely to be over whether the two-sided firms offer sufficiently differentiated products that they should not be considered in the same market. Dating Club B might be the uptown/yuppie club and Dating Club A might be the downtown/blue collar club. To take another example, one of the issues in litigation concerning credit cards is whether other two-sided products such debit cards, checks, and cash compete with credit cards. The market analysis should also consider the possibility that other firms could enter. Dating Club A may be able to enter the uptown/yuppie market rather easily. During the early years of Palm PDAs it would have been reasonable to argue that Microsoft could easily enter this operating system category—in fact it eventually did so by producing and licensing a small operating system to a PDA manufacturer.¹⁸⁷ Of course, in considering the possibility of entry it is necessary to examine whether and to what extent there are barriers to entry, a topic we consider below.

The right question to ask, for the merger guidelines price test, is whether the firms under consideration, if they merged today and priced as a monopolist, could raise the total price

by 10 percent or more. There is no particular reason to focus on price effects on one side or the other—both groups of consumers matter. That is especially true in matching markets in which both sides must buy for there even to be a product. Moreover, competition authorities should not consider a price increase of 10 percent to one side of a two-sided market (in which the other side has no increase) as seriously as a price increase of 10 percent price to a one-sided market. Likewise, they should not ignore any countervailing price decreases that occur on the other side of the market.

Generally, it is not possible to examine price effects on one side of a market without considering the effect on the other side and the feedback effects between them.¹⁸⁸ For example, holding the female side of the market constant (price and quantity), perhaps the merger of dating clubs would result in an increase in the price to the male side of the market by 10 percent. But in reality it is not possible to hold the female side of the market constant. A 10 percent price increase to men would reduce the number of male patrons and therefore reduce the value of the service to women. Once these interdependencies are taken into account it could be that the merged firms could raise combined prices by only a trivial amount.

The Justice Department's approach in *U.S. v. Visa U.S.A. et al.*¹⁸⁹ illustrates the mistake. MasterCard and Visa service cardholders and merchants. The DOJ's economic expert

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¹⁸⁷ See Microsoft Corp. website (visited Aug. 20, 2002) <<http://www.microsoft.com/windows/embedded/>>.

¹⁸⁸ Ignoring interdependencies between the two sides is a common mistake in the antitrust analysis of two-sided markets. For example, this mistake was made in the analysis of class certification issues in *Visa Check/MasterMoney*. See *In re Visa Check/MasterMoney Antitrust Litig.*; *Wal-Mart, et al. v. Visa U.S.A. Inc. and MasterCard International, Inc.*, 280 F.3d 124 (2d Cir. 2001). The plaintiffs' expert claimed that it was possible to change a significant price on one side of the market (debit-card interchange fees) without any other changes in the two-sided market. For more details, see David S. Evans, *Class Certification, the Merits, and Expert Evidence*, GEO. MASON L. REV. (forthcoming).

¹⁸⁹ See *United States v. Visa*, 163 F. Supp. 2d 322 (S.D.N.Y. 2001).

asked the question of whether a hypothetical merger of all credit and charge card issuers could profitably raise prices to cardholders, looking only at profits on the issuer/cardholder side.¹⁹⁰ He thus failed to consider two important factors. First, any decrease in cardholder volume would necessarily and directly lead to a decrease in merchant volume. And if merchant volume decreases, then any profits on the merchant side also decrease. DOJ's economist did not consider effects on profits on the merchant side. And second, a decrease in the cardholder base makes the system less attractive for merchants, thus potentially leading to a decrease in merchant demand for the system. (Which could then lead to a decrease in cardholder demand, and so on.) These changes, not accounted for by the government's analysis, would affect profits on both the issuing and acquiring sides. By focusing only on the cardholder side, the analysis put forward by the government's economist neglected at least half of the story.

B. Market Power

Taking both sides of the market into account is also important for analyzing market power. A traditional question is whether the firm under consideration prices above marginal cost by a significant amount. We saw earlier that there is no necessary relationship between price and marginal cost on either side of the market. In fact, the price on one side of the market could be well above marginal cost while the price on the other side of the market could be below marginal cost. To analyze market power one therefore has to examine whether the total price is significantly above marginal costs. For example, in the residential real estate market, agents must expend time and effort each time an open house is held for a seller and each time a buyer is taken to visit another property. Assuming only one agent is involved, the agents' 6 percent commission may well exceed some conception of the costs incurred directly for the

¹⁹⁰ *Id.* at 336.

seller (although, as we have discussed, all costs are really incurred for both sides), but the potentially numerous appointments with home buyers must be considered as well. And, as is true in one-sided markets, the risk of making no sale at all must also be considered.

Of course, in markets in which there are significant fixed costs, looking at price-cost margins is never a meaningful measure of market power. In those cases it makes more economic sense, in theory, to look at the risk-adjusted rate of return on investment. (Unfortunately, in practice it is extremely difficult to determine whether a firm or an industry—one-sided or two-sided—earns a supra-competitive risk-adjusted rate of return.¹⁹¹) For two-sided markets that analysis should consider the total returns and the total investment in both sides. In the video game market, while the cost of producing one more CD copy of an existing game is trivial, considerable investment is required to initially develop that game. Platforms, such as Sony PlayStation, need to price all of the components—the console, the internally developed games, and the licensing fees for externally developed games—such that it recovers its R&D expenses at the same time as it maximizes the popularity of the platform.

C. Barriers to Entry

The existence of barriers to entry comes up in both market definition and market power analyses and deserves a separate treatment. In market definition, barriers to entry come up in determining whether it is possible for other competitors to come into the market. In market power, barriers to entry come up in determining whether the defendant can exclude competitors and thereby maintain higher prices. This is of particular concern in monopoly maintenance cases where a preliminary issue is whether the defendant has monopoly power. According to

du Pont, a firm has monopoly power if it has the power to “control prices or exclude competition.”¹⁹²

There is some disagreement among economists and the courts over the proper definition of a barrier to entry. Consider the following example. A firm spent \$100 million to build a plant to make widgets. There is nothing special about this plant—anyone could build a similar plant for \$100 million. Suppose there are two widget firms that have built two plants each costing \$100 million. Is there a barrier to entry into the market? Some economists and courts have used barriers to entry in the colloquial sense—it is hard to get into a market because it costs money and effort.¹⁹³ They would agree that there is a barrier to entry into the widget market.

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¹⁹¹ See Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, 73 AM. ECON. REV. 82 (1983) for the seminal treatment of this issue which turns on the fact that it is difficult to measure *ex post* the expected return *ex ante*.

¹⁹² *United States v. E.I. du Pont*, 351 U.S. 377, 391 (1956).

¹⁹³ PHILLIP E. AREEDA *ET AL.*, ANTITRUST LAW, VOLUME IIA: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 55-56 (1994). “A barrier to entry is any factor that permits firms already in the market to earn returns above the competitive level while deterring outsiders from entering” (footnote omitted). This definition follows J.S. BAIN, *BARRIERS TO NEW COMPETITION: THEIR CHARACTER AND CONSEQUENCES IN MANUFACTURING INDUSTRIES* (1962). For a list of court cases relying on this definition of entry barriers, see PHILLIP E. AREEDA *ET AL.*, VOLUME IIA: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 123-124 (Supp. 1999). In practice, the condition that the factor must result in the ability of the firm “to earn returns above the competitive level” is dropped in one of two ways. First, the condition is just ignored. The correct economic concept is whether the expected rate of return to the firm based on the information available to the market at the time it made the investment exceeds the competitive level after adjusting for risk. See Fisher & McGowan, *supra* note 191, at 90-91. It is almost impossible to measure this *ex ante* return with *ex post* information. Second, the competitive rates of return are calculated from *ex post* data with no adjustment for the risk perceived *ex ante*. For example, it is common for analysts to calculate the returns based on survivors in an industry without adjusting for the losses incurred by failures. The result is that almost all industries involving substantial investments in research and development or other fixed costs are identified, incorrectly, as earning a supra-competitive return. See Fisher & McGowan, *supra* note 191, at 91; and FRANKLIN M. FISHER *ET AL.*, *FOLDED, SPINDLED AND MUTILATED: ECONOMIC ANALYSIS AND U.S. v. IBM* ch. 7 (1983). Not surprisingly, Areeda, Hovenkamp and Solow identify almost any advantage of incumbency as a barrier to entry. They include “economies of scale, high initial investment, capital market imperfections, risk, low prices, scarce inputs or customers, product reputation and promotion, and government constraints” as barriers to entry. AREEDA *ET AL.* (1994), *supra*, at 63.

Many economists have adopted a different definition of barriers to entry, at least for the purpose of antitrust analysis. They argue that a barrier to entry should refer to an advantage that the incumbent firm has that an entrant cannot secure.¹⁹⁴ The \$100 million plant is not an example of such a barrier because anyone with the money can build one. The incumbent does not have any special advantage. It may be that the addition of a third plant would drive price so low that it is not worth building a plant. That, however, is an indicator that it is not socially worthwhile to use society's scarce resources to build another plant.¹⁹⁵

Which definition is more appropriate? For most antitrust issues we are interested in knowing whether incumbent firms can earn supra-competitive returns without attracting entry. From society's standpoint we would like to attract entry into various lines of business until the risk-adjusted return from entry is competed down to the competitive level. The fact that significant investments are required to enter an industry does not provide any information on this issue. Incumbents could be earning a risk-adjusted competitive rate of return in an industry as a result of having made significant risky investments over time. The fact that it is costly for another firm to enter the industry is not evidence of a problem. If demand expanded unexpectedly incumbents would temporarily earn supra-competitive returns as a result of raising prices. Either they could expand capacity by making more investments or an entrant could do so. With today's highly liquid capital markets there is no basis for arguing that firms cannot secure the funding for investments that will yield a more than competitive rate of return.

¹⁹⁴ See GEORGE STIGLER, *THE ORGANIZATION OF INDUSTRY* (1968). See also CARLTON & PERLOFF, *supra* note 6, at 76-77. Unlike the Bain definition one does not need to inquire into whether the "barrier" gives rise to a supra-competitive rate of return. One only has to ask whether the alleged barrier is something that entrants could obtain at the same cost as the incumbent.

¹⁹⁵ For a survey of court decisions pertaining to barriers to entry, see Werden, *supra* note 194.

Consequently, the first definition—an entry barrier means it is “hard” to enter—does not advance the ball.

Suppose, however, that entrants lack some special advantages that the incumbents had. In this case the incumbents would be earning a return from those special advantages. For example, perhaps the incumbent has a patent that raises the cost of entry—maybe the entrant has to invest in a costly design-around; maybe the entrant cannot produce as good a product; or maybe the entrant will have higher costs of production. The patent is not necessarily a barrier to entry under the second definition even though it may enable the incumbent to earn what seems, *ex post*, to be a supra-competitive rate of return. It is possible that the entrant could obtain similar advantages for itself by making a similar risky investment. But the patent may be a barrier—suppose the patent is not really the result of risky investment but simply the result of a sloppy (but costly to overturn) decision by the U.S. Patent Office.

To take another example, suppose the incumbent received tax breaks that enabled it to build its plant for \$50 million. If the entrant does not receive those same tax breaks it could never enter the industry on the same cost terms as the incumbent. In effect, the incumbent would end up receiving a return on its tax breaks. Whether one considers that return to be supra-competitive would depend on the details of how the tax breaks came to be. A related example involves government policies or regulations that make it harder for entrants to come in. For many years the Federal Communications Commission (FCC) made it extremely difficult for firms to compete in long-distance telecommunications. Only legal challenges forced the

FCC ultimately to permit the entry of MCI.¹⁹⁶ The FCC prohibitions were a barrier to entry under the second definition.

U.S. v. Microsoft provides an interesting example since the case involved a two-sided market (operating systems) and barriers to entry figured prominently.¹⁹⁷ The government argued that the stock of applications that had been written for Microsoft Windows was a barrier to entry that prevented other firms from competing in the market for operating systems for Intel-compatible computers.¹⁹⁸ Applications developers write to Windows because a large number of end-users, and end-users use Windows because it has a large number of applications. The district court agreed with the government.¹⁹⁹

This analysis of barriers to entry is not controversial under the first definition. Developing an operating system that is attractive to end-users and software developers is expensive.²⁰⁰ However, as mentioned above, the fact that this development is expensive does not really provide any useful information. First, expensive is a relative concept. The costs of entering the two-sided market for operating systems would need to be weighed against the

¹⁹⁶ GERALD BROCK, TELECOMMUNICATION POLICY FOR THE INFORMATION AGE: FROM MONOPOLY TO COMPETITION (1994).

¹⁹⁷ See *United States v. Microsoft Corp.*, 253 F.3d 34 (D.C. Cir. 2001).

¹⁹⁸ *United States v. Microsoft Corp.*, Civil Action Nos. 98-1232 and 98-1233 (TPJ), Findings of Fact, Nov. 5, 1999, at ¶ 36.

¹⁹⁹ *United States v. Microsoft Corp.*, Civil Action Nos. 98-1232 and 98-1233 (TPJ), Direct Testimony of Franklin M. Fisher, Oct. 14, 1998, at ¶ 70.

²⁰⁰ For instance, it took about three years for Linus Torvalds and the open source programmers contributing to Linux to develop version 1.0 of the Linux Kernel. See *What is Linux*, Linux Online (visited Mar. 22, 2002) <<http://www.linux.org/info/index.html>>. It took more than four years for Microsoft to release version 1.0 of Microsoft Windows. See *Windows Timeline* (visited Aug. 15, 2002) <http://www.technicalminded.com/windows_timeline.htm>. It took more than two years of mutual effort by Microsoft and IBM to develop OS/2. See *OS/2 1.0* (visited Aug. 15, 2002) <<http://pages.prodigy.net/michaln/history/os210/index.html>>. It took approximately four years to develop LisaDesk, the first Apple operating system based on Alto research of Xerox Corporation. See *History of Apple Macintosh Operating System*, (visited Aug. 15, 2002) <<http://perso.club-internet.fr/jctrotot/Perso/History.html>>.

profits that could be earned in this market. Microsoft's annual revenues from its desktop operating system products exceeded \$8 billion in 2001.²⁰¹ Second, the fact that it is expensive to enter does not provide any information on whether entrants are deterred from making investments that could reduce any supra-competitive returns that Microsoft realizes.

The government's testimony and the district court's opinion suggest that they were analyzing barriers under the more stringent but more relevant second definition.²⁰² They argued that Microsoft had special advantages over rivals because it was the first entrant into the market for operating systems for Intel-compatible computers.²⁰³ Applications developers wrote for Microsoft's operating system because it was the only alternative. Microsoft did not have to expend resources to persuade application developers to write for its operating system versus other alternatives.

Let us consider this analysis through the lens of two-sided markets. Participation in a two-sided market naturally requires the development of customers on both sides. The fact that Microsoft has attracted a large number of applications is no more or less remarkable than the fact that it has attracted a larger number of users. It is also no more remarkable than the fact that Sony has attracted a large number of game developers, and that ATM networks have a large number of ATM machines that connect with their networks throughout the country.

Indeed, the fact that a firm in a two-sided market has developed customers on one side is, from society's standpoint, a good thing. Not only do these customers benefit directly from the services they obtain—they are inputs into the provision of services to customers on the

²⁰¹ Microsoft Corp. 10-K (FY2001) (downloaded Aug. 30, 2002) <<http://www.sec.gov/Archives/edgar/data/789019/000103221001501099/0001032210-01-501099.txt>>.

²⁰² See Findings of Fact, *supra* note 198, at 13-16.

²⁰³ *Id.*, at 16. ("Microsoft never confronted a highly penetrated market dominated by a single competitor").

other side. The fact that Microsoft has a large stock of applications reflects the fact that applications developers are receiving useful services from the features included in Microsoft's operating system. It also reflects considerable value to end-users who, as the government and district court correctly observed, value these applications. There is no basis for suggesting that it is a bad thing for Microsoft to invest resources in getting more applications written for Windows, anymore than it is a bad thing for Nintendo to try to get more games written for its console, for Discover to try to get more merchants to take its card, or for Goldman Sachs to try to find more companies that want to go on the block.

By themselves positive feedback effects do not prevent entry. Indeed, many two-sided markets have multiple providers. In the case of payment cards, there was successive entry by Diners Club (1950), American Express (1958), Visa (1966), MasterCard (1966), and Discover (1986).²⁰⁴ In the case of video games in the US, there was successive entry by Magnavox (1972), Atari (1975), Coleco (1976), Fairchild (1976), Mattel (1979), Nintendo (1985), Sega (1989), Sony (1995), and Microsoft (2001).²⁰⁵

It could be that Microsoft has special advantages that constitute a barrier to entry under the second definition. But neither the government nor the district court put forward an analysis that could distinguish these special advantages, if any, from the investments that Microsoft made in getting and keeping both sides on board. The relevant question to ask concerning barriers to entry into a two-sided market is whether the incumbent has special advantages that could not be replicated by entrants. That question needs to focus on the costs of getting into both sides of the market. Saying that Microsoft has a lot of applications written for its

²⁰⁴ See EVANS & SCHMALENSEE, *supra* note 10, at 10, 62-66.

operating system is no more probative than saying that Dating Club B has a lot of women lined up at the door or that American Express has many companies signed up for its corporate charge cards. Getting customers on both sides is the name of the game in two-sided markets.

One way to think of this is to consider two operating system companies. Entrant 1 comes in before Entrant 2. To get both sides on board, the company with the head start, Entrant 1, has to spend \$1 billion to get developers to write applications. If Entrant 2 had to spend \$1.1 billion to get both sides on board we would probably conclude that the entry barrier is fairly modest relative to the risk-adjusted profits that could be earned in this business. If Entrant 2 had to spend \$2 billion we might reach the opposite conclusion. In both cases we would want to consider these entry barriers relative to prospective profits.

IBM's experience in entering the operating system business with OS/2 is instructive. Shortly after the introduction of Windows 2.0, OS/2 was completed. However, due to its high price and incompatibility with other existing applications it was deemed a failure.²⁰⁶ If IBM had made the same investment as Microsoft in getting both sides of the market on board it is not clear that, with an equal or superior operating system, it would not have succeeded. In any case, my point is not that there were or were not barriers to entry to the operating system market. It is that by ignoring the economics of two-sided markets the government failed to conduct the relevant inquiry.

The government also relied on the applications barrier to entry in its liability theory. It argued that Netscape and Java would help erode the applications barrier to entry by allowing

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²⁰⁵ See KENT, *supra* note 105, at xi-xvi.

software developers to write to a middleware layer that would sit between Windows and the applications.²⁰⁷ The words here matter. The phrase applications barrier to entry is a pejorative term that suggests that the stock of applications served primarily as an entry barrier. The Government's chief economic witness in *U.S. v. Microsoft* has written that:

That positive feedback effect—the applications barrier to entry—has made it difficult or impossible for rival operating systems to compete effectively with Microsoft by gaining more than a niche in the market. New entry is not likely to erode Microsoft's market share and market power as long as the applications barrier to entry remains strong[.]²⁰⁸

And the district court in *U.S. v. Microsoft* stated that:

[T]he applications barrier would prevent an aspiring entrant into the relevant market from drawing a significant number of customers away from a dominant incumbent even if the incumbent priced its products substantially above competitive levels for a significant period of time.²⁰⁹

The theory of two-sided markets sees the stock of applications in neutral terms—it is simply the amount of demand satisfied on the developer side of the market and the value that can be brought to user side of the market. All two-sided firms want to increase demand on both sides and increase their advantages on both sides over rivals. Visa has more merchant acceptance than American Express, Sony has more videogames written for its console than Microsoft, and Time magazine has more readers than The New Republic.

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²⁰⁶ Martin Campbell-Kelly, *Not Only Microsoft: The Maturing of the Personal Computer Software Industry, 1982-1995*, 75 BUS. HIST. REV. 103 (2001), available in NEXIS, at 12. See also *United States v. Microsoft Corp.*, 253 F.3d 34, 55 (D.C. Cir. 2001).

²⁰⁷ See Direct Testimony of Franklin M. Fisher, *supra* note 199, at ¶¶ 36, 95.

²⁰⁸ DAVID S. EVANS *ET AL.*, DID MICROSOFT HARM CONSUMERS? TWO OPPOSING VIEWS 11 (2000).

²⁰⁹ See Findings of Fact, *supra* note 198, at ¶ 36.

D. *Per Se* vs. the Rule of Reason—the Role of Efficiencies

Efficiencies play an important role in evaluating antitrust matters. In the merger context, the social benefits of economies of scale and scope weigh against the social costs of price increases through reduced competition; these economies may be so large that consumers benefit from lower prices even after accounting for price increases from reduced competition. In cases involving a full-blown rule-of-reason analysis, the courts consider whether the efficiencies that result from challenged practices outweigh their anticompetitive effects. Finally, in cases involving practices that are usually considered *per se* illegal, the courts consider whether efficiencies are so pronounced that the practices should be analyzed under the rule of reason.

Two special issues concerning efficiencies arise in two-sided market cases. The first concerns the benefits that consumers in each group receive as a result of having access to the other group of consumers. The second concerns the benefits that consumers receive from practices that are either essential for getting both sides on board or that get both sides on board at lower costs than alternative practices. This issue arises when coordination among competitors is used to establish the pricing structure.

1. Benefits from Indirect Network Effects

The net value—benefits less price paid—that each consumer receives from purchasing a product with network effects increases with the number of other consumers that also use that product. Any analysis of antitrust issues in markets with network effects should take these benefits into account. In two-sided markets, the net value increases with the number of consumers on the other side of the market.

The value of indirect network effects are likely to be substantial in many contexts. That is because each consumer is providing a benefit (directly in the case of matching markets like dating clubs, indirectly in the case of other markets such as operating systems). Some numerical examples can demonstrate the possible magnitudes of the effects. Using the Rochet-Tirole formulation above, consider a two-sided market with 100 “buyers” and 100 “sellers,” which would lead to 10,000 (100×100) transactions. Let us also assume that buyers (and sellers) have preferences such that the 100th (or marginal) buyer has a 1 cent benefit per transaction, the 99th has a 2 cent benefit, and so on, up to the 1st buyer, which has a \$1.00 benefit per transaction. It is straightforward to show that the per-transaction benefit received by the average buyer is 50.5 cents.

The 100th buyer gets relatively little benefit from the 100 transactions it engages in, only $100 \times 1 \text{ cent} = \1.00 . On the other hand, its decision to join has benefited each of the 100 sellers. The 100th seller only benefits as much as the 100th buyer for that transaction, but everyone else benefits by much more. The 100 transactions generated by the last buyer produces benefits on the seller side averaging 50.5 cents per transaction, for a total benefit of \$5.05. That is, the indirect benefits to sellers are more than 5 times the direct ones to the 100th buyer. On average, across all buyers and sellers, the indirect benefit is essentially equal to the direct benefit.²¹⁰

The merger of two firms in a two-sided market is an obvious place in which competition regulators should consider the efficiencies from the merger as well as its prospect

²¹⁰ The Rochet-Tirole model assumes buyers are not more likely to join if there are more sellers (or vice versa). If we assumed the base of sellers were important to attracting buyers (and vice versa), the indirect benefits would be even greater because a buyer joining the system would induce additional sellers to join (and so on), which would generate additional indirect benefits on both the seller and buyer sides.

for increasing prices. ATM network mergers serve as a good example.²¹¹ In rule of reason cases the courts need to examine the effect of the challenged practice on consumer demand on each side of the market and the indirect effects from each side to the other side. Consider the *Visa Check/MasterMoney* litigation.²¹² Plaintiffs claim that Visa and MasterCard have policies that result in a tie between credit cards and debit cards and that without this tie the interchange fee to merchants would be lower. Let us suppose this is correct. That cannot be the end of the analysis because one must analyze the effect of the practice on the inextricably linked sides of the market. A forced reduction in the interchange fee to merchants would reduce the stream of revenues to banks that issue debit cards; under competition, these banks would increase the fees they charge for debit cards; that in turn would reduce the number of debit cards held and used; and that in turn would reduce the value that merchants get from debit cards.²¹³

2. Methods for Getting both Sides on Board

Some two-sided markets have competing sellers on both sides of the market but have developed institutions that provide the coordination necessary to get both sides on board. One example is residential real estate. Multiple Listing Services (MLS) provide a central location in which selling agents can post properties and buyer agencies can locate these properties. MLS agencies and members are able to show all of the listed homes to the buyer side of their

²¹¹ Robin A. Prager, *ATM Network Mergers and the Creation of Market Power*, ANTITRUST BULL. 355 (Summer 1999). Some examples of ATM mergers include Peak-Minibank (1996), Exchange-Instant Teller (1996), and SCS-Pacific Interchange (1992). See *supra*, at 361.

²¹² See *In re Visa Check/MasterMoney Antitrust Litig.*; *Wal-Mart, et al. v. Visa U.S.A. Inc. and MasterCard International, Inc.*, 280 F.3d 124 (2d Cir. 2001)

²¹³ Based on the arguments presented at class certification the plaintiffs appear to be arguing that it is possible to change one element of the pricing structure without having significant effects on the other elements. They argued that “under the particular circumstances of the market at issue in this case, credit card interchange fees would not have increased in the ‘but-for,’ untied world.” See *In re Visa Check/MasterMoney Antitrust Litig.*; *Wal-Mart, et al. v. Visa U.S.A. Inc. and MasterCard International, Inc.*, 280 F.3d 124, 154 (2d Cir. 2001).

respective client bases.²¹⁴ Thus, retaining one MLS realtor enables the sellers to attract a larger number of offers than would otherwise be possible through retaining each of the individual member agencies.²¹⁵ Another example is payment cards. There are many associations around the world of entities that issue payment cards or service merchants.²¹⁶ The association typically establishes an interchange fee that ultimately determines the price structure—the relative prices to cardholders and merchants. An alternative to these institutions would be to have a single firm provide the coordination as well as supplying both sides. Some of the payment-card firms were organized just this way—Diners Club, American Express, and Discover choose both pricing levels and pricing structures; MasterCard and Visa, as associations, choose pricing structures but let the pricing levels emerge through competition among their members.

Coordination among competitors over prices is usually a *per se* violation of the antitrust laws. The courts have recognized that it is more appropriate to analyze a practice under the rule of reason if there is reason to believe that significant efficiencies may result from this practice.²¹⁷ Two issues arise in analyzing whether there are significant efficiencies through coordinated pricing in two-sided markets. The first is whether there are absolute efficiencies from the practice: does the coordinated pricing in fact provide a mechanism for getting both sides on board and for choosing an optimal pricing structure? Agreements on pricing levels as opposed to pricing structures will often fail this test. The second is whether there are relative

²¹⁴ Frew and Jud, *supra* note 33, at 178.

²¹⁵ *Id.*

²¹⁶ Many countries have associations that serve those countries but belong to one of the global associations for the purpose of having their cards accepted outside the country. For example, banks belonging to Groupement des Cartes Bancaires in France issue the “CB” card. There is a domestic version only on Cartes Bancaires’ domestic network, but most cards have Visa or MasterCard logos and can be used at merchants outside of France that accept Visa or MasterCard. See Cartes Bancaires website (visited Sep. 2, 2002) <<http://www.cartes-bancaires.com/GB/Pages/FrameVie.htm>>.

efficiencies from the practice: is a market structure with coordinated pricing more efficient than a market structure without coordinated pricing? For example, MasterCard could operate as a single firm rather than an association—it would then set the price level and the price structure. We suspect in most cases agreements that are absolutely efficient are also relatively efficient. That is because moving from coordination among competitors to non-coordination over pricing structures will generally decrease the number of competitors that determine the price level.

3. Antitrust Analysis of Payment-Card Interchange Fees

The role of coordinated pricing in two-sided card markets has been considered by the U.S. courts in *NaBanco v. Visa U.S.A.*²¹⁸ In a case that was filed in 1979, National Bancard Corporation (NaBanco) claimed that the interchange fee was a price fixing agreement that violated of Section 1 of the Sherman Act. Visa did not deny that it had fixed prices. However, argued that setting an interchange fee was necessary for the existence of the product sold by the association.²¹⁹ Visa explained the role of the interchange fee in what we would now call a two-sided market.²²⁰ It argued that the purpose of the interchange fee was to provide a mechanism “to distribute the costs of the system in relation to prospective benefits so as to encourage members to engage in the appropriate balance of card-issuing and merchant-servicing.”²²¹

(...continued)

²¹⁷ See *Broadcast Music, Inc. v. CBS*, 441 U.S. 1 (1979).

²¹⁸ *National Bankcard Corp. (NaBanco) v. VISA U.S.A., Inc.*, 779 F.2d 592 (11th Cir. 1986).

²¹⁹ It relied on *Broadcast Music, Inc. v. CBS*, 441 U.S. 1 (1979).

²²⁰ One of Visa’s consultants went on to write one of the earliest papers on the economics of two-sided markets. See William F. Baxter, *Bank Interchange of Transactional Paper: Legal and Economic Perspectives*, 26 J.L. ECON. 541 (1983).

²²¹ *National Bancard Corp. (NaBanco) v. VISA U.S.A., Inc.*, 596 F. Supp. 1231, 1260 (S.D. Fla. 1984).

The district court and the Eleventh Circuit agreed with Visa. The Eleventh Circuit upheld the district court's rule-of-reason approach in the case, explicitly relying on the two-sided nature of the industry:

Another justification for evaluating the IRF under the rule of reason is because it is a potentially efficiency creating agreement among members of a joint enterprise. There are two possible sources of revenue in the VISA system: the cardholders and the merchants. As a practical matter, the card-issuing and merchant-signing members have a mutually dependent relationship. If the revenue produced by the cardholders is insufficient to cover the card-issuers' costs, the service will be cut back or eliminated. The result would be a decline in card use and a concomitant reduction in merchant-signing banks' revenues. In short, the cardholder cannot use his card unless the merchant accepts it and the merchant cannot accept the card unless the cardholder uses one. Hence, the IRF accompanies "the coordination of other productive or distributive efforts of the parties" that is "capable of increasing the integration's efficiency and no broader than required for that purpose."²²²

The Eleventh Circuit went on to find that "[a]n abundance of evidence was submitted from which the district court plausibly and logically could conclude that the IRF on balance is procompetitive because it was necessary to achieve stability and thus ensure the one element vital to the survival of the VISA system—universality of acceptance."²²³ The Supreme Court declined to review the Eleventh Circuit's decision. Although the economic analysis of two-sided markets cannot by itself say whether Visa's interchange fee resulted in the optimal pricing structure from society's standpoint, the Eleventh Circuit correctly recognized the economic role of interchange fees in devising a price structure that took both sides of the market into account.

²²² National Bankcard Corp. (NaBanco) v. VISA U.S.A., Inc., 779 F.2d 592, 602 (11th Cir. 1986).

²²³ *Id.* at 605.

The Royal Bank of Australia (RBA) reached a different conclusion in a recent investigation.²²⁴ It was concerned that Visa's interchange fees were set too high, so as to encourage overuse of credit cards in Australia. It relied on the findings in economic models of interchange fees that firms may have private incentives to set the fees higher than socially optimal.²²⁵ The reasoning is that an individual merchant may have an incentive to accept Visa cards if it expects to make sufficient incremental sales from doing so, even if Visa cards are more expensive for the merchant than its other alternatives. The RBA argued that these incremental sales were not a social benefit, as they came at the expense of other merchants. For all merchants collectively, acceptance of Visa cards may have generated little or no incremental sales. Thus, the argument was that Visa could exploit each individual merchant's willingness to pay, which derived from private not social benefits. In response to these concerns, the RBA proposed a regulatory scheme for interchange fees that was based on an allocation of cost to the issuer and acquirer sides; the scheme does not consider demand.

The RBA had not established that interchange fees were too high. It relied on the existence of theoretical models that showed that they *could* be too high. But the same models also showed that privately set interchange fees could be at the socially optimal level or lower. It makes no sense to seek to lower interchange fees when we do not know if they are too high. All we know, and this should come as no surprise in any two-sided market, is that one side (the merchants in this case) would prefer to pay less. The RBA's proposed regulatory scheme has no basis in the economics of two-sided markets. The socially optimal price structure depends on a complex contribution of costs and demand.²²⁶ There is no basis for focusing only on costs,

²²⁴ *Reform of Credit Card Schemes in Australia IV*, Finals Reforms and Regulation Impact Statement, Reserve Bank of Australia, Aug. 2002.

²²⁵ *Reform of Credit Card Schemes in Australia I: A Consultation Document*, Reserve Bank of Australia, Dec. 2001, at section 2.4.

²²⁶ See generally Ahlborn *et al.*, *supra* note 21; Schmalensee (2002), *supra* note 4; Rochet & Tirole, *supra* note 4.

nor is there a basis for assigning costs to one side or the other. There is no economic basis for believing that the RBA method for determining the interchange fee would increase or decrease the overall welfare of the consumers in the two sides of the market.

E. Predation

The recognition that business strategies and their effects on consumers must be evaluated with respect to both sides of the market has important implications for the analysis of predation. It may be privately and socially optimal for prices on one side of the market to be below any possible measure of cost on this side. That is true not only during the initial stage in which most economists and courts have recognized the virtues of “penetration pricing.”²²⁷ It is also true during the long-run equilibrium of the industry. Complaints by entrants that they cannot get into one side because the incumbent is engaging in predatory pricing—or has made predatory investments—are likely to have little merit in two-sided markets. It also may be privately and socially optimal for firms to make significant investments in one side even though these investments do not appear to generate profits on that side. Again, this can occur even when the firm is mature.

To clarify the issues, let us consider extending the Brooke Group test of predatory pricing to two-sided markets.²²⁸ The test has two prongs. First, a plaintiff alleging predation must show that the defendant’s prices were “below an appropriate measure of... costs.”²²⁹ Thus, pricing must be below cost to support a claim of predation, even though, in theory, there can be predatory prices that are above cost. Second, the plaintiff must show that the defendant

²²⁷ See, e.g., *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.* 509 U.S. 209 (1993); Phillip Areeda & Donald F. Turner, *Predatory Pricing and Related Practices under Section 2 of the Sherman Act*, 88 HAR. L. REV. 697 (1975).

²²⁸ See *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.* 509 U.S. 209 (1993).

²²⁹ *Id.* at 222.

had “a reasonable prospect, or, under §2 of the Sherman Act, a dangerous probability, of recouping its investment in below-cost prices.”²³⁰ Finding that a competitor was harmed—even driven from the market—is not enough under this test. Moreover, for a dangerous probability of recoupment to exist, low prices must eliminate substantial competition in a way that persists even after a post-predation price increase.

For two-sided markets the pricing prong of this test should be based on the defendant’s pricing level—the overall price to the two markets. This is simple and straightforward when both sides of the market have the same unit of observation (person, transaction, product, etc.). One would calculate whether the total price charged for a given transaction, let us say, exceeds marginal cost (or, following the Areeda-Turner analysis, average variable cost).²³¹ This analysis would apply to payment cards, dating services, B2B exchanges, real estate and other matching-type markets. When the two sides of the market have different units of observation one could normalize them to the same unit by basing the calculation on total revenue and total variable cost. If total variable cost is less than total revenue then the defendant would fail the first prong of the Areeda-Turner version of the Brooke Group test.

The recoupment prong is straightforward. For two-sided markets the court would need to consider whether there is a dangerous probability that the defendant will raise prices high enough and for long enough on both sides of the market to recoup its losses during the alleged predatory phase. There is nothing novel about this for two-sided markets other than accounting for the two sides.

²³⁰ *Id.* at 224.

²³¹ *See* Areeda & Turner, *supra* note 227, at 702, 716-18.

An example of predation in a two-sided market was suggested by the government in *U.S. v. Microsoft*. Microsoft gave away a software tool to make it easier for Internet Service Providers (ISPs) and corporate IT departments to customize Internet Explorer. Netscape sold a similar kit for \$1,995.²³² Microsoft had a two-sided justification: it give away the tool to increase ISP demand (one side of the market) and provide other features to increase the demand for Windows (which included Internet Explorer) among users. The Appeals Court rejected the government’s predation claim here, although mainly because of its general skepticism about low prices being anticompetitive.²³³ The government made several other claims concerning predatory pricing and investments—all these claims ignored the two-sided nature of the market.²³⁴

F. Other Antitrust Issues

Business practices and relationships in two-sided markets tend to be more complex than in one-sided markets. First, firms are more likely to operate as multi-product firms with feet in both markets. More generally, because the production of complementary products is important in two-sided markets, firms may end up producing a variety of other products that stimulate demand on one side of the market or the other. For example, many producers of operating systems also produce application programs for end-users in addition to providing software interfaces for external software developers to use; many payment-card companies own

²³² See Findings of Fact, *supra* note 198, at ¶ 250.

²³³ “The rare case of price predation aside, the antitrust laws do not condemn even a monopolist for offering its product at an attractive price, and we therefore have no warrant to condemn Microsoft for offering either IE or the IEAK free of charge or even at a negative price. Likewise, as we said above, a monopolist does not violate the Sherman Act simply by developing an attractive product.” *United States v. Microsoft Corp.*, 253 F.3d 34, 68 (D.C. Cir. 2001).

²³⁴ *United States v. Microsoft Corp.*, Civil Action No. 98-1232, Complaint, May 18, 1998, at ¶ 16.

companies that provide inputs for the production of services to cardholders or merchants; and several video game companies develop games to run on their consoles.

Second, sometimes there is coordination among competitors—especially when there is what we have referred to as multihoming. One or both sides of the market can benefit when there is a standard technology or protocol that enables them to use products from multiple vendors. Two-sided firms have conflicting profit incentives—they would like to discourage standardization to increase their own market power; they would like to encourage standardization if this will expand overall demand sufficiently. American Express and Visa are both members, for example, of Global Platform, an international organization that sets standards for smart card technology,²³⁵ and are using Global Platform standards in their respective smart card development efforts.²³⁶

Third, two-sided firms sometimes take actions to coordinate the behavior of their customers. That occurs because standardization by one set of customers benefits the other set of customers. For instance, recently B2Bs have been moving towards the standardization of information that might significantly enhance and automate various procedures such as RFPs (request for proposals), RFQs (request for quotes), fax requests, phone inquiries and purchase orders.²³⁷ NMMs, third-party intermediaries whose primary purpose is to match corporate buyers and sellers, play a pivotal role in this process.²³⁸ In *U.S. v. Microsoft*, Microsoft

²³⁵ See the Global Platform website (visited Aug. 15, 2002) <<http://www.globalplatform.org/news2.asp>>.

²³⁶ See Global Platform Specification (visited Aug. 15, 2002) <http://international.visa.com/fb/paytech/productsplatforms/globalplatform.jsp>; and the Global Platform Brochure (downloaded Aug. 15, 2002) <http://www.globalplatform.org/pdf/GlobalPlatform_Brochure.pdf>.

²³⁷ Roopen Roy & Abhijit Roy, *Net Market Makers: The Winners in the B2B Play!* INDIANINITIATIVE.COM, Dec. 21, 2001, (visited Aug. 21, 2002) <http://www.indiainitiative.com/indiainitiative_new/e-business/b2b_abhi_roopen.htm>.

²³⁸ *Id.*

objected to letting computer manufacturers, or for that matter end-users, selectively delete portions of the operating system code. One of its justifications was that applications developers would then lack assurance on what features are available for them to rely on in the operating system on an end-user's machine.²³⁹

Fourth, associations of competitors, joint ventures, and standard-setting bodies may arise to provide coordination among competitors or among customers or among other important input suppliers to either side of the market. Payment-card associations operate the network and set rules that result in the determination of a pricing structure. Real estate agencies have associations that operate the MLS.²⁴⁰ Microsoft collaborates with Intel and many hardware manufacturers to help ensure that the Wintel platform attracts users and developers.²⁴¹

These practices tend to be flypaper for antitrust complaints. The multi-product nature of firms in two-sided markets can lead to a variety of issues surrounding "vertical relationships." For example, a firm might be accused of trying to dominate one side of a two-sided market to reduce competition on the other side. Or to take another example, suppose a firm on one side of a two-sided market wants to deliver customers who possess products A and B to the other side. One way it might do that is to integrate A and B or require that customers purchase B as a condition of purchasing A. The firm might be accused of tying in this

²³⁹ Ronald A. Cass, *Copyright, Licensing, and the 'First Screen,'* 5 MICH. TELECOMMUNICATIONS TECH. L. REV. 35, 59-64 (1999).

²⁴⁰ Real estate boards are non-profit organizations representing local real estate agents/brokers, which operate Multiple Listing Services in local communities. For a definition, see Home and Real Estate Glossary (visited Aug. 28, 2002) <at <http://www.homes-and-real-estate.com/glossary/r.htm>>.

²⁴¹ Carmen Nobel, *Microsoft, Intel Seek to Become Wireless Force*, EWEEK, Feb. 19, 2002 (visited Aug. 28, 2002) <<http://www.eweek.com/article2/0,3959,108489,00.asp>>.

instance—this is the plaintiff’s claim in the *Visa Check/MasterMoney*.²⁴² Although these sorts of vertical relationships may well result in anti-competitive effects, it is necessary to evaluate their effects in the context of competition in two-sided markets.

Coordinated behavior also raises antitrust concerns. Whenever businesses get together there is a worry that they are colluding to raise price or otherwise harm consumers. That may be just as true in two-sided markets as it was for Adam Smith’s tradesmen.²⁴³ Nevertheless, there are legitimate pro-competitive reasons for coordination among competitors or among customers and for having institutions to help do this in two-sided markets.

V. CONCLUSIONS

Two-sided markets are an increasingly important part of the global economy. Firms that provide platforms for multiple customer groups are a critical part of many interrelated segments of the computer industry. These “keystone” firms include Microsoft in operating systems for Intel-compatible computers and Intel for computer chips. In most industrialized countries a large fraction of payments takes place through firms and associations that provide platforms for merchants and customers to exchange money. The increased importance of the Internet for household-to-household, business-to-household, and business-to-business transactions and the emergence of e-pay systems on the Internet will increase the fraction of payments going through commercial payment platforms. And speaking of the Internet, although dot-coms are currently in a slump, Internet-based businesses are sure to flourish over time and many of these are likely to be based on a two-sided model.

²⁴² *In re Visa Check/MasterMoney Antitrust Litig.; Wal-Mart, et al. v. Visa U.S.A. Inc. and MasterCard International, Inc.*, 280 F.3d 124 (2d Cir. 2001).

But two-sided markets are not just in these high-profile sectors. They are dotted across the economy. We began with perhaps a trivial example of dating clubs—discotheques, church clubs for singles, and local village matchmakers could have served just as well. Others range from real estate to video games to media firms. Some of the most recognizable brands in the world operate in two-sided markets: Bloomberg, Century 21, Microsoft, Sony and Visa.

Two-sided markets and firms in those markets behave in ways that seem surprising from the vantage point of traditional industries, but in ways that seem like plain common sense once one understands the business problems they must solve. “Getting both sides on board.” “The chicken-and-egg problem.” These are the mantras ones hears from the entrepreneurs in these industries, the trade press that covers them, business gurus, and journalists. They contain important economic implications.

Two-sided firms have to come up with the right price structure and the right investment strategy for balancing the demands of the customer groups they must get and keep on their platforms. That is a different problem than is faced by one-sided firms. It is also harder. One way to see that is to recognize that different firms have chosen different price structures and have realized different fortunes from their choices. American Express bet on a price structure skewed against merchants—it worked for some years but then got it into trouble.²⁴⁴ Meanwhile

(...continued)

²⁴³ ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS ¶ I.10.82 (Edwin Cannan ed., 1904).

²⁴⁴ Between mid-1980s and 1996 the American Express charge and credit card share dropped from more than 24 percent to 16 percent. By mid-1990s American Express realized the necessity to adopt a new business model. See EVANS & SCHMALENSEE, *supra* note 10, at 185-193.

Visa surpassed American Express, a firm that was once dominant and seemed unbeatable.²⁴⁵ Microsoft bet on a price structure that catered to software developers. Bloomberg bet on a simple formula for its data terminals—a flat fee for subscribers, and few charges for content providers.

There is no reason to believe that anticompetitive problems are more prevalent or less prevalent in two-sided industries than other ones. Likewise, there is no basis for asking regulators to steer clear of these industries or to spend extra effort on them. The message of this article, however, is that antitrust analysis of these industries should heed the economic principles that govern pricing and investment decisions in these industries. Prices do not and prices cannot follow marginal costs in each side of the market. Price levels, price structures, and investment strategies must optimize output by harvesting the indirect network effects available on both sides. By doing so businesses in two-sided industries get both sides on board and they solve the chicken-and-egg problem.

²⁴⁵ By 1996 Visa charge and credit card share was more than 45 percent compared to 16 percent held by American Express. *Id.* at 174, 187.

APPENDIX A

TABLE 1: SOURCES OF PLATFORM REVENUE IN SELECTED TWO-SIDED PLATFORMS

INDUSTRY	TWO-SIDED PLATFORM	SIDE ONE	SIDE TWO	SIDE THAT GETS CHARGED LITTLE	SOURCES OF REVENUE
Real Estate	Residential Property Brokerage	Buyer	Seller	Side One	Real estate brokers derive income principally from sales commissions. ¹
Real Estate	Apartment Brokerage	Renter	Owner/Landlord	Typically Side One	Apartment consultants and locator services generally receive all of their revenue from the apartment lessors once they have successfully found tenants for the landlord. ²
Media	Newspapers and Magazines	Reader	Advertiser	Side One	Approximately 80 percent of newspaper revenue comes from advertisers. ³
Media	Network Television	Viewer	Advertiser	Side One	For example, FOX earns half of its revenues from advertisers. ⁴
Media	Portals and Web Pages	Web “Surfer”	Advertiser	Side One	The average portal gets slightly over half of its revenues from advertisements. All other web pages generally receive about a tenth of their revenue from advertisements. ⁵
Software	Operating System	Application User	Application Developer	Side Two	For example, Microsoft earns at least 67 percent of its revenues from licensing packaged software to end-users. ⁶
Software	Video Game Console	Game Player	Game Developer	Neither – Both sides are significant sources of platform revenue.	Both game sales to end users and licensing to third party developers are significant sources of revenue for console manufacturers. ⁷
Payment Card System	Credit Card	Cardholder	Merchant	Side One	For example, in 2001, American Express earned 82 percent of its revenues from merchants. ⁸

Notes: ¹Real Estate Brokers and Sales Agents, in OCCUPATIONAL OUTLOOK HANDBOOK, U.S. Department of Labor, Bureau of Labor Statistics (visited Sept. 3, 2002), <<http://www.bls.gov/oco/ocos120.htm>>; ²Courtney Ronan, *Apartment Locaters: How Do They Make Their Money?* Realty Times website, Jun. 30, 1998 (visited Aug. 22, 2002) <http://realtimes.com/tnews/rtpages/19980630_aplocator.htm>; ³Lisa George and Joel Waldfoegel, *Whom Benefits Whom in Daily Newspaper Markets?* NBER WORKING PAPER #7944 11 (October 2000); ⁴Brian O’Keefe, *Extra! Extra! Hot Media Stocks!* FORTUNE, June 24, 2002 (visited Aug. 22, 2002) <http://www.pbs.org/wsw/news/fortunearticle_20020620_01.html>; ⁵Clicking into Orbit, Technology Trend Quarterly Report, March 2000 (visited Aug. 15, 2002) <www.deloitte.nl/downloads/website/clicking_into_orbit.pdf>; ⁶1994 Worldwide Software Review and Forecast, IDC REPORT #9358, November 1994, 1995 Worldwide Software Review and Forecast, IDC REPORT # 10460, November 1995, 1996 Worldwide Software Review and Forecast, IDC REPORT #12408, November 1996, 1997 Worldwide Software Review and Forecast, IDC REPORT #14327, October 1997, 1999 Worldwide Software Review and Forecast, IDC REPORT #20161, October 1999, *Worldwide Software Market Forecast Summary, 2001-2005*, IDC REPORT #25569, September 2001; ⁷David Becker, *Revenue from Game Consoles will Plunge, Report Predicts*, CNET.COM, Jul. 31, 2000 (visited Aug. 5, 2002) <<http://techrepublic-cnet.com.com/2100-1040-243841.html?legacy=cnet>>; ⁸American Express Company Annual Report 2001 (visited Aug. 15, 2002), <http://www.onlineproxy.com/amex/2002/ar/pdf/axp_ar_2001.pdf>, at 35.

TABLE 2: THE PRESENCE OF MULTIHOMING IN SELECTED TWO-SIDED PLATFORMS

TWO-SIDED PLATFORM	SIDE ONE	PRESENCE OF MULTIHOMING FOR SIDE ONE	SIDE TWO	PRESENCE OF MULTIHOMING FOR SIDE TWO
Residential Property Brokerage	Buyer	<i>Uncommon:</i> Multihoming may be unnecessary, since an MLS allows buyers to see property listed by all member agencies. ¹	Seller	<i>Uncommon:</i> Multihoming may be unnecessary, since an MLS allows the listed property to be seen by all member agencies' customers. ¹
Securities Brokerage	Buyer	<i>Common:</i> The average securities brokerage client has accounts at three firms. ² Note that clients can be either or both buyers or sellers.	Seller	<i>Common:</i> The average securities brokerage client has accounts at three firms. ² As mentioned, clients can be either or both buyers or sellers.
B2B	Buyer	<i>Varies:</i> For example, multihoming may be unnecessary for some online B2B sites, since buyers can go directly to the B2B platform instead of contacting multiple individual suppliers. ³	Seller	<i>Varies:</i> Multihoming may be unnecessary since the B2B can inexpensively reach a large audience. ⁴
P2P	Buyer	<i>Varies:</i> Multihoming may be unnecessary for buyers using online auction sites since eBay holds 85% of the market share (i.e. it seems that most people purchase their online auction products at eBay). Alternatively, multihoming may be more common for online dating services where there are many sites and a large audience of online singles at each site (considered to be available singles, as opposed to buyers). ⁵	Seller	<i>Varies –</i> Multihoming may be unnecessary for sellers using online auction sites since eBay holds 85% of the market share (i.e. it seems that most people auction their products at eBay). Alternatively, multihoming may be more common for online dating services where there are many sites and a large audience of online singles at each site (considered to be available singles, as opposed to sellers). ⁵
Newspapers and Magazines	Reader	<i>Common:</i> In 1996, the average number of magazines issues read per person per month was 12.3. ⁶	Advertiser	<i>Common:</i> For example, Sprint advertised in the New York Times, Wall Street Journal, and Chicago Tribune, among many other newspapers, on Aug. 20, 2002. ⁷
Network Television	Viewer	<i>Common:</i> For example, Boston, Chicago, Los Angeles, and Houston, among other major metropolitan areas, have access to at least four main network television channels: ABC, CBS, FOX, and NBC. ⁸	Advertiser	<i>Common:</i> For example, Sprint places television advertisements on ABC, CBS, FOX, and NBC. ⁹
Operating System	Application User	<i>Uncommon:</i> It is unlikely that an individual will switch to a new operating system. ¹⁰	Application Developer	<i>Common:</i> As noted earlier, the proportions of developers that develop for various operating systems total to 205 percent, indicating significant multihoming by developers. ¹¹
Video Game Console	Game Player	<i>Varies:</i> The average household (that owns at least one console) owns 1.4 consoles. ¹²	Game Developer	<i>Common:</i> For example, Electronic Arts, a game developer, develops for Nintendo's GameCube, Microsoft's Xbox, and Sony's Playstation 2, among other consoles. ¹³
Payment Card	Cardholder	<i>Common:</i> Most American Express cardholders also carry at least one Visa or MasterCard. ¹⁴	Merchant	<i>Common:</i> American Express cardholders can use Visa and MasterCard at almost all places that take American Express. ¹⁴

Notes: ¹James R. Frew and G. Donald Jud, Who Pays the Real Estate Broker's Commission? in RESEARCH IN LAW AND ECONOMICS: THE ECONOMICS OF URBAN PROPERTY RIGHTS 177, 178 (Austin J. Jaffe ed. 1987); ²Susan Scherrek, *Is Your Broker Leaving You Out in the Cold?*, Business Week Online, February 18, 2002 (visited Aug. 22, 2002) <http://www.businessweek.com/magazine/content/02_07/b3770110.htm>; ³David Lucking-Reilly and Daniel F. Spulber, Business-to-Business Electronic Commerce, 15 J. ECON. PERSPECTIVES 55, 58 (2001); ⁴*Entering the 21st Century: Competition Policy in the World of B2B Electronic Marketplaces, Part 2: Efficiencies of B2B Electronic Marketplaces*, FTC STAFF REPORT (Oct. 2000) (downloaded Aug. 14, 2002) <<http://www.ftc.gov/os/2000/10/index.htm#26>>, at 5; ⁵Oscar S. Cisneros, *Ebay Accused of Monopolization*, WIRED NEWS, July 31, 2000 (visited Aug. 20, 2002) <<http://www.wired.com/news/print/0,1294,37871,00.html>> and Paul Festa, *Looking for Love Online*, CNET NEWS.COM, December 17, 1996 (visited Aug. 22, 2002) <<http://news.com.com/2100-1023-255523.html?tag=rn>>; ⁶*Magazines in the Information Age*, FCB Media Research Report (Spring 1998), <http://www.magazine.org/resources/research/fcb_magazines_infoage.html>; ⁷New York Times at A22, Wall Street Journal at A15, and Chicago Tribune at 11 (sect.1); ⁸ABC website (visited Sept. 3, 2002) <<http://abc.abcnnews.go.com/site/localstations.html>>, CBS website (visited Sept. 3, 2002) <<http://www.cbs.com/info/hdtv/>>, FOX website (visited Sept. 3, 2002) <<http://www.fox.com/links/affiliates.htm>>, and NBC website (visited Sept. 3, 2002) <http://www.nbc.com/nbc/header/Local_Stations/>; ⁹James Fisher, *An Ad Blitz for the 21st Century*, Sprint Press Release, September 24, 1997 (visited Aug. 23, 2002) <http://www3.sprint.com/PR/CDA/PR_CDA_Press_Releases_Detail/0,3245,00.html?ID=1294>; ¹⁰Scot Hacker, *He Who Controls the Bootloader*, BYTE.COM (visited Aug. 20, 2002) <http://www.byte.com/documents/s=1115/byt20010824s0001/0827_hacker.html>; ¹¹Josh Lemer, *Did Microsoft Deter Software Innovation?* Working Paper, January 2002 (downloaded Aug. 15, 2002) <<http://gsbwww.uchicago.edu/research/workshops/elol/lerner2.pdf>> and Corporate Technology Directory, Editions 1990-2000; ¹²*Yankee Group: Video-Game Penetration Grows to 36 Million Households in 2001*, REUTERS NEWS, November 19, 2001 (visited Aug. 30, 2002) <http://about.reuters.com/newsreleases/art_19-11-2001_id785.asp>; ¹³Game Makers Hedge Bets in Console Wars, USA Today, November 16, 2001 (visited Aug. 23, 2002) <<http://www.usatoday.com/life/cyber/tech/review/games/2001/11/19/game-makers.htm>>; ¹⁴DAVID S. EVANS & RICHARD SCHMALENSEE, PAYING WITH PLASTIC: THE DIGITAL REVOLUTION IN BUYING AND BORROWING 170 (1999).