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David S. Evans

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Multi-sided platforms coordinate the demands of distinct groups of customers who need each other in some way. Dating clubs, for example, enable men and women to meet each other; magazines provide a way for advertisers to find an audience; and computer operating system vendors provide software that applications users and applications developers can use together. When devising pricing and investment strategies, multi-sided platforms must account for interactions among the demands of multiple groups of customers. In theory, the optimal price to customers on one side of the platform is not based on a markup formula such as the Lerner condition, and price does not track marginal cost. Indeed, many actual platform businesses charge one side little or nothing—shopping malls seldom charge shoppers; operating system vendors give developers many services for free; most Internet portals and free television providers do not charge viewers. Competition among platforms takes place in multi-sided markets in which seemingly distinct customer groups are connected through interdependent demand and a platform that, acting as an intermediary, internalizes the resulting indirect network externalities. Multi-sided platforms arise in many economically significant industries from media to payment systems and software; they arise in bricks and mortar industries such as shopping malls as well as information-based industries such as portals.

The economics of platform competition has implications for analyzing antitrust and regulatory policies affecting businesses that compete in multi-sided markets. For example, market definition and market power analyses that focus on a single side will lead to analytical errors; since pricing and production decisions are based on coordinating demand among interdependent customer groups, one must consider the multiple market sides in analyzing competitive effects and strategies. To take another example, efficient pricing may result in setting price on a particular market side below measures of average variable or marginal cost incurred for customers on that market side. Economic analysis that

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ignores the multi-sided nature of the market might conclude erroneously that below-cost prices are predatory. Line-of-business restrictions in regulation as well as theories of market leveraging in antitrust are other areas that are illuminated by the economics of multi-sided platform markets. Line-of-business restrictions may hinder the emergence of a platform and deprive consumers of its benefits. Efforts to coordinate interdependent markets—and thereby produce potential efficiency gains in multi-sided markets—must be distinguished from efforts to extend a monopoly from one product to another. Businesses may devise anti-competitive strategies in multi-sided platform markets just as in single-sided markets. Multi-sided strategies for doing so, though, are likely to be more complex and less transparent than those used in single-sided markets. There is, however, no basis for asking regulators or antitrust enforcers to steer clear of these industries or to spend extra effort on them. An understanding of the unique economic principles that govern pricing and investment in multi-sided markets will lead to discerning and efficient regulation of this important type of business.

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, for example, 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.[2] Dating clubs sell patrons the prospect of making a match.[3] 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 men. The club must figure out how much to charge men and women to get the right number and mix of patrons, while at the same time make money. One bar does this by charging men $100 for membership plus $20 a visit, and letting female members in free of charge.[4] An unscientific survey shows that a pricing structure that obtains a disproportionate share of the revenues from men is common in singles bars, discotheques, and other businesses around the world that help men and women find companionship.[5]

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1 Howard W. French, *Osaka Journal: Japanese Date Clubs Take the Muss Out of Mating*, N.Y. TIMES, Feb.13, 2001, at A4.

2 *Id.*

3 *Id.*

4 *Id.*

5 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, *Las Vegas Nightlife*, BEST READ GUIDE, *at* http://www.bestreadguide.com/lasvegas/nightlife/ (last visited Mar. 8, 2003); the Buddha Lounge in Chicago charges $5-$15 less to women, depending on the day of the week, than to men, *Buddha Lounge*, CENTERSTAGE CHICAGO, *at* http://centerstage.net/dance/clubs/buddha-lounge.html (last visited Aug. 15, 2002); and on Saturday nights, The Wave Nightclub in Atlantic City lets women in for free while men are assessed a cover charge of $10, Pamela Mills-Senn, *Atlantic City Nightlife*, POOL NEWS & SPA ONLINE, Jan. 2002, *at* http://www.poolspanews.com/2002/011/ac_nightlife.html (last visited Mar. 8, 2003). A recently developed online matching service that specializes in matching identical twins has chosen equal prices. *Twins Seek Twins in Online Matchmaking First*, REUTERS, Apr. 11, 2002; Twins Realm Home Page, *at* http://www.twinsrealm.com/ (last visited Mar. 8, 2003). Yahoo! Personals is another example of a dating service that has symmetric prices. There is no charge to view or post personal ads, and men and women pay the same fee for contacting each other through the service. Yahoo! Personals, *Why Subscribe to Yahoo! Personals?*, *at* http://personals.yahoo.com/display?ct_hft=billingsplash (last visited Mar. 8, 2003).

Matchmaking is an example of a product that must be used by two or more groups of customers to be valuable to any single customer. Businesses that sell these products need customers of type *A* to get customers of type *B* and vice versa. To get both sides on board, businesses operate a "platform" that connects or coordinates the activities of multiple groups of customers. The dating club, for example, aggregates men and women and provides a place for them to meet and transact a date. Many economically significant industries are based on platform businesses that serve multiple disparate communities. Examples include shopping malls (retailers and shoppers), video game consoles (game developers and users), debit cards (cardholders and merchants), operating system software (applications developers, hardware manufacturers, and users), media (advertisers and viewers), and exchanges (buyers and sellers).

Platform businesses compete in "multi-sided markets." For example, video game console companies such as Sony, Nintendo, and Microsoft compete for game developers and users, while payment card companies such as American Express, MasterCard, and Visa compete for merchants and cardholders. Platform businesses must deal with interdependent demand when devising pricing, production, and investment strategies. These strategies can be quite different from non-platform businesses that do not serve mutually dependent customer groups. The optimal price on a particular side of the market, whether measured socially or privately, does not follow marginal cost on that side of the market. Many platform businesses charge one side little or nothing; for example, most operating system vendors collect scant revenue from software developers who use their intellectual property. In many cases, the joint provision of a good that services multiple groups of customers makes the assignment of costs to any one side arbitrary; for example, there is no economically meaningful allocation of the costs of developing or manufacturing video game consoles to individual game developers or users.

The economics of platform competition has implications for antitrust and regulatory policies in multi-sided markets. Predatory pricing is an obvious example. Efficient pricing may result in setting price on a particular market side below measures of average variable or marginal cost incurred for customers on that market side. Economic analysis that ignores the multi-sided nature of the market might conclude erroneously that this is an example of simultaneous recoupment—low prices on one side are being used to obtain or maintain market power on another side.

Market definition and market power analyses are another example. These analyses typically focus on the effect of a price change on demand in a narrowly defined market. For firms that compete in multi-sided markets, a price change on one side of the market has positive feedback effects on the other sides of the market; the analyst must consider these

crossover effects to determine the overall effect of a price change on profits.

Line-of-business restrictions in regulation as well as theories of market leveraging in antitrust are other areas that the economics of multi-sided platform markets illuminates. Line-of-business restrictions may hinder the emergence of a platform and deprive consumers of its benefits. Efforts to coordinate interdependent markets—*and thereby produce potential efficiency gains* in multi-sided markets—need to be distinguished from efforts to extend a monopoly from one product to another. Businesses may devise anti-competitive strategies in multi-sided platform markets just as they may do in single-sided markets. Multi-sided strategies for doing so are likely to be more complex and less transparent than those used in single-sided markets. The fact that pro-competitive practices will be no less complex makes antitrust analysis difficult.

U.S. and foreign antitrust enforcement agencies have scrutinized multi-sided platform businesses in several significant antitrust matters. These include the AOL-Time Warner merger (U.S. and European authorities investigated two-sided markets such as Internet portals, magazines, and free television);[6] the credit card association investigations (Australian and European authorities investigated a two-sided market involving merchants and card users);[7] U.S., European, and private antitrust cases against Intel (which competes in a two-sided hardware platform market);[8] the Microsoft cases (U.S. and European authorities investigated multi-sided markets involving operating systems and other possible computer platforms);[9] the proposed merger of HotJobs and Monster.com (FTC investigated a two-sided market of online job services);[10] and probes

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6 *See In re* America Online, Inc. & Time Warner Inc., FTC Docket No. C-3989 (Dec. 14, 2000) (complaint), http://www.ftc.gov/os/2000/12/aolcomplaint.pdf. Other relevant documents may be found at http://www.ftc.gov/os/caselist/c3989.htm (last visited July 25, 2002).

7 Press Release, European Commission, Commission Plans to Clear Certain Visa Provisions, Challenge Others (Oct. 16, 2000), http://europa.eu.int/comm/competition/antitrust/cases/29373/studies/ (last visited Mar. 8, 2003); Press Release, Reserve Bank of Australia, Designation of Credit Card Schemes in Australia (Apr. 12, 2001), http://www.rba.gov.au/MediaReleases/2001/mr_01_09.html (last visited Mar. 8, 2003).

8 *See* Michael Kanellos, *Court Lifts Injunction in Intel-Integraph Case*, NEWS.COM, Nov. 5, 1999, *at* http://news.com.com/2100-1040-232538.html?legacy=cnet (last visited Mar. 9, 2003); Matt Loney, *EC to Drop Intel Antitrust Investigation*, ZDNET, Feb. 4, 2002, *at* http://news.zdnet.co.uk/story/0,,t269-s2103680,00.html (last visited Mar. 9, 2003); Jennifer Disabatino, *FTC Closes Intel Investigation*, COMPUTERWORLD, Sept. 26, 2000, *available at* http://www.computerworld.com/governmenttopics/government/legalissues/story/0,10801,51253,00.html (last visited Mar. 13, 2003).

9 *See* Stipulation, United States v. Microsoft Corp., 65 F. Supp. 2d 1 (D.D.C. 1999) (No. 98-1232), *available at* http://www.usdoj.gov/atr/cases/f9400/9462.htm (last visited Mar. 8, 2003); Press Release, European Commission, Commission Initiates Additional Proceedings against Microsoft (Aug. 30, 2001), http://europa.eu.int/comm/competition/index_en.html (last visited Aug. 20, 2001) (on file with Yale Journal on Regulation). Other relevant documents may be found at http://www.usdoj.gov/atr/cases/ms_index.htm (last visited Mar. 8, 2003).

10 *See* Nora Macaluso, *U.S. Wants Details on HotJobs-Monster.com Merger*, E-COMMERCE

into online broker-dealers (six separate U.S. regulatory investigations and one European investigation looked into anti-competitive behavior in two-sided e-dealer markets).[11] In some cases the multi-sided nature of the market was central to the allegations in the antitrust case,[12] while in others it provided an important backdrop for understanding the workings of the business.[13]

Despite their economic importance, multi-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.[14] This Article explains the economics of multi-sided platform markets and examines its implications for antitrust analysis. Part II defines the necessary conditions for the emergence of

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TIMES, Aug. 14, 2001, *at* http://www.ecommercetimes.com/perl/story/12785.html (last visited Mar. 8, 2003).

11 *See Update 1—BrokerTec Says Profitable since Q4 of 2001*, REUTERS NEWS, June 6, 2002, *in* FORBES.COM, *at* http://www.forbes.com/newswire/2002/06/10/rtr627112.html (last visited June 10, 2002) (on file with Yale Journal on Regulation); *see also* Chris Sanders, *BrokerTec Confirms Probe by US Antitrust Official*, REUTERS NEWS, May 16, 2002; *Online Trading Draws Greater Scrutiny*, REUTERS NEWS, *in* CNET.COM, May 17, 2002, http://news.com.com/2100-1017-916334.html?legacy=cnet&tag=lh (last visited Aug. 21, 2001).

12 The credit card investigations involved the pricing structure used to balance the two-sided demand. *See* Christian Ahlborn et al., *The Problem of Interchange Fee Analysis: Case Without a Cause?*, 22 EUR. COMPETITION L. REV. 304, 305 (2001). The U.S. Microsoft case included the claim that one side of the market (applications) was the source of a barrier to entry. *See* United States v. Microsoft Corp., 253 F.3d 34, 52 (D.C. Cir. 2001) (Microsoft III). For other relevant documents, see the DOJ Web site at http://www.usdoj.gov/atr/cases/ms_index.htm (last visited Mar. 8, 2003).

13 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. *See* Chris Sanders, *Analysis—Investigators Sniff Out Online Trading, Again*, REUTERS NEWS, May 16, 2002; Sanders, *supra* note 11. 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 thirty to forty percent of music content in Europe according to the Commission. Press Release, European Commission, Commission Opens Full Investigation into AOL/Time Warner Merger (Oct. 19, 2000), http://europa.eu.int/comm/competition/index_en.html (last visited Mar. 8, 2003); *see also* EEC Regulation No. 4064/89, Merger Procedure, Art. 8(2) ¶ 46 (Nov. 10, 2000).

14 The general economics of multi-sided markets are discussed in a seminal paper by Jean-Charles Rochet and Jean Tirole. Jean-Charles Rochet & Jean Tirole, *Platform Competition in Two-Sided Markets*, J. EUR. ECON. ASS'N (forthcoming Spring 2003) [hereinafter Rochet & Tirole, *Platform*]. *See also* BERNARD CAILLAUD & BRUNO JULLIEN, CHICKEN & EGG: COMPETING MATCHMAKERS (Ctr. For Econ. Policy Research, Working Paper No. 2885, 2001); BRUNO JULLIEN, COMPETING IN NETWORK INDUSTRIES: DIVIDE AND CONQUER (Institut D'Economie Industrielle, Working Paper No. 9, 2001); Geoffrey G. Parker & Marshall W. Van Alstyne, Unbundling in the Presence of Network Externalities (June 14, 2002) (unpublished manuscript, on file with Yale Journal on Regulation). 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.*, Jean-Charles Rochet & Jean Tirole, *Cooperation Among Competitors: Some Economics of Payment Card Associations*, 33 RAND J. ECON. 549 (2002) [hereinafter Rochet & Tirole, *Cooperation*]; Richard Schmalensee, *Payment Systems and Interchange Fees*, 50 J. INDUS. ECON. 103 (2002). 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 J.L. & ECON. 541 (1983).

multi-sided platform businesses and then describes the profit-maximizing business strategies for these platforms. Part III discusses the implications of these features of multi-sided markets for antitrust analysis. It shows how standard market definition, unilateral effects, predatory pricing, vertical restraints, and coordinated effects analyses must be modified to take into account the multi-sided nature of these markets. Part IV presents conclusions.

The economics of multi-sided platform markets brings to light a novel understanding of the pricing, production, and investment decisions of those businesses. A fundamental insight of the theoretical research is that these businesses need to determine an optimal pricing structure—one that balances the relative demands of the multiple customer groups—as well as optimal pricing levels. That insight has implications for many other strategic variables. Empirical examination of these industries finds that key business decisions are driven by the need to get critical levels of multiple customer groups on board and to balance complementary customer communities.[15] Antitrust analysis should always pay careful attention to the market context in which it is being applied. One size does not fit all. The theory and empirics of multi-sided platform markets provide guidance for the analysis of competitive practices in platform markets.

I. Economics of Multi-Sided Platform Markets

A. *Necessary Conditions for the Emergence of a Platform Business*

A platform can increase social surplus when three necessary conditions are met:[16]

(1) *There are two or more distinct groups of customers.* In some cases, these customers are immutably different entities—men and women; shopping mall retailers and customers; individuals who have debit cards, merchants who take debit cards; software developers and software users. In other cases, these customers are different only for the purpose of the

15 David S. Evans & Marco Iansiti, Harnessing the Power of Market Platforms (Jan. 7, 2003) (unpublished manuscript, on file with Yale Journal on Regulation).

16 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 35 ("A market with network externalities is a two-sided market if platforms can effectively cross-subsidize between different categories of end users that are parties to a transaction"); MARK ARMSTRONG, COMPETITION IN TWO-SIDED MARKETS 3 (Nuffield College, Oxford, Working Paper, 2002) ("[Two-sided] markets or institutions involv[e] two groups of participants, say group 1 and group 2, who interact via intermediaries. Surplus is created—or destroyed in the case of negative externalities—when 1 and 2 interact, but this interaction must be mediated in some way"); Parker & Van Alstyne, *supra* note 14, at 6-7 ("Our distinction is that network effects must cross market populations. . . . [I]n two-sided networks coordination across markets matters"). For a discussion of these issues in the specific context of payment cards, see generally Rochet & Tirole, *Cooperation*, *supra* note 14, at 549-52; Jean-Charles Rochet, The Theory of Interchange Fees: A Synthesis of Recent Contributions 2-7 (Jan. 7, 2003) (unpublished manuscript, on file with Yale Journal on Regulation).

transaction at hand—eBay users are sometimes buyers, sometimes sellers; mobile phone users are sometimes callers, sometimes receivers. In many cases, members of customer group *A* consume a different product than members of customer group *B*; these products are related by the second condition.

(2) *There are externalities associated with customers A and B becoming connected or coordinated in some fashion.* A shopper benefits when she can shop at her favorite retail store at the mall next door; a retailer benefits from being in a location that attracts such shoppers. A cardholder benefits when a merchant takes his card for payment; a merchant benefits when a cardholder has a form of payment he accepts. Although not necessary for a platform to arise, the presence of indirect network effects seems to explain empirically why a platform emerges. Indirect network effects[17] occur when the value obtained by one kind of customer increases with measures of the other kind of customer.[18] Video game developers value video game consoles more when they have more game users; game users value consoles that have more games. Sellers of antique harpoons value exchanges that have more people who would like to buy harpoons, and vice versa. Generally, in matchmaking markets customers of each type benefit from being able to search a larger group of customers of the other type for a suitable match. They also benefit from being able to search among a group that has been narrowed to suitable matches.

(3) An intermediary is necessary to internalize the externalities created by one group for the other group. If the members of group *A* and group *B* could enter into bilateral transactions, they would be able to internalize the indirect externalities under Condition 2. Information and

17 Direct network effects arise when the value of a good increases with the number of people using that good. For example, a word processing package is more valuable to people if more people use it to the extent that standardization makes it easier to exchange documents. However, direct network effects often can be interpreted as indirect network effects. For example, the network effects for word processing packages arise mainly because people who use the package to "write" value it more if more people can use the package to "read." To take another example, economists often use telecommunications networks as examples of direct network effects: Each user of a telecommunications network benefits when more people also use that network because that user can connect to more people. There are, however, two distinct groups of consumers: senders and receivers. The distinction is material because operators of communications networks can and do establish separate prices for making versus receiving a call. *See* Rochet & Tirole, *Platform*, *supra* note 14, at 36 n.26; *see also* DOH-SHIN JEON ET AL., ON THE RECEIVER PAYS PRINCIPLE (Dep't of Econ. and Bus., Universitat Pompeu Fabra, Working Paper, 2001), *available at* http://www.econ.upf.es/deehome/what/wpapers/postscripts/561.pdf (last visited Jan. 30, 2003) (on file with Yale Journal on Regulation).

18 Ordinarily the measure will involve the quality-adjusted number of other companies where the quality adjustment may be based on size, variety, or some other quality dimension. Wal-Mart is more important than the Sheboygan Hardware Store for credit card holders; wealthier consumers are more important than poorer consumers for a shopping mall anchored by a Saks Fifth Avenue store.

transaction costs as well as free-riding make it difficult in practice for members of distinct customer groups to internalize the externalities on their own. This is especially true when the externalities arise from indirect network effects.[19] Men could in theory go around a singles bar and pay women to consider them as romantic prospects, but it tends not to happen.

The intermediary does not have to be a business in the usual sense; it could be an institution or set of rules. Consider paper money: It is more valuable to customers as a medium of exchange if more merchants take it and vice versa. Laws requiring that paper money be accepted to settle debts and institutions bolstering the government as a credible backer of paper money help get both sides on board.[20] The existence of indirect network externalities, however, provides profit opportunities for entrepreneurs to establish a platform that couples multiple customer groups. Exploiting these profit opportunities requires entrepreneurs to find pricing, product, and investment strategies to balance the interests of the many market sides.[21]

An intermediary does not necessarily arise to solve the externality problem. Businesses may engage in tacit coordination. The music industry, for instance, manages to produce content for CDs, the CDs themselves, and the components to play CDs without much explicit coordination. In other cases, businesses may solve the problem through vertical integration into one side of the market. For example, Bill Gates faced the following problem at Microsoft: "In 1989, I personally went to all the applications developers and asked them to write applications for Microsoft Windows. They wouldn't do it."[22] His solution was simple: "So I went to the

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19 Consider the following example from Rochet and Tirole. Suppose that there were no fixed costs of having or taking payment cards. If a cardholder and merchant could negotiate a fee between themselves for the joint net benefit of using cards then they would internalize the externality. *See* Rochet & Tirole, *Platform*, *supra* note 14, at 35-36. In practice, however, most merchants do not pass along the extra fees associated with taking payment cards to cardholders even in those situations in which such surcharging is permitted by law or by the rules of the card company. *See* Alan S. Frankel, *Monopoly and Competition in the Supply and Exchange of Money*, 66 ANTITRUST L.J. 313 (1998).

20 U.S. coin and currency are, by law, legal tender for payment of all debts in the United States. Bureau of Engraving and Printing, Legal Tender: A Definition, *at* http://www.bep.treas.gov/document.cfm/18/110 (last visited Jan. 22, 2002). This does not mean, however, 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 do not specifically mandate merchant acceptance, leaving businesses free to form their own payment guidelines. U.S. Treasury, FAQs: Currency, *at* http://www.ustreas.gov/education/faq/currency/legal-tender.html (last visited Jan. 22, 2002). The National Bank Act of 1864 established a national banking system and specified the issuance of banknotes backed by government bonds. Kurt Schuler, *Note Issue by Banks: A Step Toward Free Banking in the United States?*, 20 CATO J. 453, 456 (2001).

21 I discuss what I mean by "balance the interests" below. *See infra* Part II.

22 Jerry Pournelle, *Jerry's Take on the Microsoft Decision: Wrong!*, BYTE.COM, Nov. 8, 1999, *at* http://journals2.iranscience.net:800/www.byte.com/www.byte.com/documents/s=200/byt19991108s0001/index.htm (last visited Mar. 8, 2003); *see also* W. E. PETE PETERSON, ALMOST

Microsoft Applications Group, and they didn't have that option."[23] Even today, when the Windows operating system is a well-established platform, Microsoft continues to produce some of the most important applications for Windows.[24]

Determining when indirect network effects result in the formation of a platform business and whether platforms (versus tacit coordination or integration) are a more socially efficient method for dealing with these effects would be a rewarding topic for further research. This Article, however, focuses on industries in which platform businesses are the dominant mode of organization for internalizing externalities.

B. *Types of Multi-Sided Platform Businesses*

There are three major kinds of multi-sided platforms:

(1) *Market-Makers* enable members of distinct groups to transact with each other. Each member of a group values the service more highly if there are more members of the other group, thereby increasing the likelihood of a match and reducing the time it takes to find an acceptable match. Shopping malls, for example, are more valuable to customers if there are more retail shops at which they can make purchases and more valuable to retail shops if there are more customers who are likely to buy their products.[25] Not surprisingly, shopping mall developers try to create "upscale" or "downscale" malls to match customers and shops.[26] EBay started out as a meeting place for people who wanted to buy or sell Pez dispensers.[27] It has grown to provide a meeting place for people who want to buy or sell many different kinds of goods.[28] Much of its efforts have gone into improving the quality of the match by, for example, aggregating information on repeat sellers from buyers.[29] NASDAQ and dating services such as Yahoo! Personals are similar examples of market-makers.[30]

PERFECT ch. 7 (1998), *available at* http://fitnesoft.com/AlmostPerfect/ap_chap07.html (last visited Jan. 24, 2003) (Pete Peterson, one of the founders of WordPerfect, noted, "Whenever a customer or a writer from the press asked me if we intended to support Windows . . . . [W]e knew Microsoft wanted Windows to succeed, a feat which would require the development of Windows-based applications . . . . I was not going to encourage SSI to accept their [Microsoft's] offer if there was any hope that another company might give us a ride.").

23 Pournelle, *supra* note 22.

24 *See* Microsoft, Microsoft Office, *at* http://www.microsoft.com/office/ (last visited Jan. 30, 2003).

25 *See* B. Peter Pashigian & Eric D. Gould, *Internalizing Externalities: The Pricing of Space in Shopping Malls*, 41 J.L. & ECON. 115, 116 (1998).

26 *See* Jennifer Steinhauer, *Malls Hope Make-Overs Will Attract the Affluent*, N.Y. TIMES, Nov. 3, 1995, at D4.

27 Sam Jaffe, *Online Extra: eBay: From Pez to Profits*, BUS. WEEK ONLINE, May 14, 2001, *at* http://www.businessweek.com/magazine/content/01_20/b3732616.htm.

28 *See* EBAY, 2001 ANNUAL REPORT 3 (2002); eBay, Company Overview, *at* http://pages.ebay.com/community/aboutebay/overview/index.html (last visited Jan. 30, 2003).

29 *See* eBay, Services, *at* http://pages.ebay.com/services/index.html (last visited Jan. 17,

(2) *Audience-Makers* match advertisers to audiences. Advertisers value a service more if there are more members of an audience who will react positively to their messages; audiences value a service more if there is more useful "content" provided by audience-makers.[31] Advertising-supported media such as magazines, newspapers, free television, yellow pages, and many Internet portals are audience makers.[32] Yellow pages, for example, are more valuable to customers if more companies provide information and are more valuable to companies if more customers see the messages.[33] Free television is more valuable to advertisers if there are more viewers. Like many media, though, viewers come mainly for the "content"—the shows—and view the advertisements because it is too costly to avoid them.[34]

(3) *Demand-Coordinators* make goods and services that generate indirect network effects across two or more groups. These platforms do not strictly sell "transactions" like a market maker or "messages" like an audience-maker; they are a residual category much like irregular verbs—numerous, heterogeneous, and important. Software platforms such as Windows and the Palm OS, payment systems such as credit cards, and mobile telephones are demand coordinators.[35] Payment card platforms, for example, enable cardholders and merchants to consummate transactions using a payment card. This involves providing distinct services to cardholders and merchants designed to stimulate demand for the card. For example, even without using financing features, cardholders receive credit services since they have several weeks to pay for a purchase with most credit and charge cards, and merchants also often receive detailed

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30 *See* Pashigian & Gould, *supra* note 25, at 116; NASDAQ, About NASDAQ, *at* http://www.nasdaq.com/about/market_characteristics.pdf (last visited Jan. 30, 2003); Yahoo!, Yahoo! Personals Home Page, *at* http://personals.yahoo.com/ (last visited Jan. 30, 2003).

31 *See* RONALD GOETTLER, ADVERTISING RATES, AUDIENCE COMPOSITION, AND COMPETITION IN THE NETWORK TELEVISION INDUSTRY 1 (Carnegie Mellon Univ., Graduate Sch. of Indus. Admin. Working Paper No. 1999-E28, 1999).

32 James Ferguson, for example, states that:

> 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).

33 MARC RYSMAN, COMPETITION BETWEEN NETWORKS: A STUDY OF THE MARKET FOR YELLOW PAGES 1-2 (Boston Univ. Indus. Studies Project, Working Paper No. 104, 2002). Yellow Pages straddle the market-maker and audience-maker categories. They help connect buyers and sellers. More so than other audience-maker platforms, Yellow Pages readers are likely to value the advertisements; the advertisements are an important aspect of the content.

34 *See* GOETTLER, *supra* note 31, at 2-4.

35 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 30-31, 34-35.

accounting information.[36] Software platforms coordinate users and developers. The platform includes features that many software developers and end users want to avail themselves of and therefore economizes on the production of these features.[37] Such features are more valuable to developers if more computer users rely on the platform and are more valuable to computer users if more applications run on the platform.[38]

Table 1 provides further examples of multi-sided platform markets and businesses that participate in these markets. While by no means exhaustive, it illustrates the variety of multi-sided platform industries.

C. *Multi-Sided Versus Single-Sided Markets*

Since most markets have distinct consumer types—teenagers or retirees, households or businesses, men or women—can existing theories fully explain the economics of platform businesses and multi-sided markets? Multi-sided markets differ from the traditional single-sided markets because platform businesses have to serve two or more of these distinct types of consumers to generate demand from any of them. Hair salons can cater to men, women, or both. Heterosexual dating clubs have to cater to men and women.

Methods of price discrimination provide another useful comparison between single-sided and multi-sided markets. Businesses in single-sided and multi-sided markets engage in price discrimination because it is possible to increase revenue by doing so and because, in the case of businesses with extensive scale economies, it may be the only way to cover fixed costs.[39] A dating club may charge men a higher price just because they have more inelastic demand and because it is easy to identify consumers on the basis of sex.[40] But businesses in multi-sided markets

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36 *See generally* DAVID S. EVANS & RICHARD SCHMALENSEE, PAYING WITH PLASTIC: THE DIGITAL REVOLUTION IN BUYING AND BORROWING 92, 111-12 (1999).

37 For a definition of software platform, see WEBOPEDIA *at* http://www.webopedia.com/TERM/p/platform.html (last visited Jan. 17, 2003).

38 "The more users [the platform] has, the more developers will write applications for it, which in turn attracts more users, and so on." *Extending Its Tentacles,* ECONOMIST, Oct. 20, 2001, at 60, *available at* http://www.economist.com/displayStory.cfm?Story_ID=822234 (last visited Jan. 30, 2003).

39 For a discussion of price discrimination in one-sided markets, see DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 274-96 (2000).

40 Some dating clubs—e.g., exclusive discotheques—have someone who screens the line to make sure that the "right" people get in and in the right proportions. Even at constant prices some "selectors" go through the line and skip over single men for single women. Such non-price rationing is another method to deal with the two-sided nature of the market. Also, price may be used as a screen for other characteristics; for example, one reader suggested that dating clubs may charge men higher prices to attract wealthier men for the women (a cynical observation, but one that has some intuitive foundation).

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 locater 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, the FOX television network earns its revenues primarily from advertisers.[4]
Media	Portals and Web Pages	Web "Surfer"	Advertiser	Side One	For example, Yahoo! earns 75 percent of its revenues from advertising.[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 a significant source of platform revenue.	Both game sales to end users and licensing to third party developers are significant sources of revenue for console manufacturers.[7] Console manufacturers have sold their video game consoles near or below marginal cost (not taking into account research and development). Microsoft, for instance, is selling its Xbox for at least $125 below marginal cost.[8]
Payment Card System	Credit Card	Cardholder	Merchant	Side One	For example, in 2001, American Express earned 82 percent of its revenues from merchants, excluding finance charge revenue.[9]

Sources: (1) U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS, *Real Estate Brokers and Sales Agents, in* OCCUPATIONAL OUTLOOK HANDBOOK, *available at* http://www.bls.gov/oco/ocos120.htm (last visited Sept. 3, 2002); (2) Courtney Ronan, *Apartment Locaters: How Do They Make Their Money?*, REALTY TIMES, June 30, 1998, *at* http://realtytimes.com/rtnews/rtcpages/19980630_aptlocator.htm (last visited Aug. 22, 2002); (3) LISA GEORGE & JOEL WALDFOGEL, WHOM BENEFITS WHOM IN DAILY NEWSPAPER MARKETS? 11 (Nat'l Bur. Econ. Research, Working Paper No. 7944, 2000); (4) FOX Entm't Group, 2000 Annual Report 26, *available at* http://www.newscorp.com/feg/foxReport2000/fin_m_d_a.html; (5) Yahoo!, 2001 Annual Report 29, *available at* http://docs.yahoo.com/info/investor/ar01/yahoo_ar2001.pdf; (6) IDC, 1994 WORLDWIDE SOFTWARE REVIEW AND FORECAST (IDC 9358, Nov. 1994); IDC, 1995 WORLDWIDE SOFTWARE REVIEW AND FORECAST (IDC 10460, Nov. 1995); IDC, 1996 WORLDWIDE SOFTWARE REVIEW AND FORECAST (IDC 12408, Nov. 1996); IDC, 1997 WORLDWIDE SOFTWARE REVIEW AND FORECAST (IDC 14327, Oct. 1997); IDC, 1999 WORLDWIDE SOFTWARE REVIEW AND FORECAST (IDC 20161, Oct. 1999); IDC, WORLDWIDE SOFTWARE MARKET FORECAST SUMMARY, 2001-2005 (IDC

25569, Sept. 2001); (7) David Becker, *Revenue from Game Consoles will Plunge, Report Predicts*, CNET.COM, Jul. 31, 2000, *at* http://techrepublic-cnet.com.com/2100-1040-243841.html?legacy=cnet (last visited Aug. 5, 2002); (8) Rob Fahey, *MS to Lose £525M on Xbox This Year*, GameIndustry.biz, June 26,2002, *at* http://www.gamesindustry.biz/content_page.php?section_name=pub&aid=210; (9) AMERICAN EXPRESS COMPANY, 2001 ANNUAL REPORT 35, *available at* http://www.onlineproxy.com/amex/2002/ar/pdf/axp_ar_2001.pdf (last visited Aug. 15, 2002).

have an additional reason: By charging one group a lower price the business can charge another group a higher price; and unless prices are low enough to attract enough of the former group, the business cannot obtain sales at all.[41] A dating club has a reason to charge men a higher price if too many men show up compared to women at equal prices.[42]

Like firms in multi-sided markets, many firms in single-sided markets sell multiple products, and there is an extensive economic literature explaining why they do so.[43] 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.[44] These standard explanations for why firms produce multiple products probably apply to many of the platforms discussed here. But firms that make multiple products for several one-sided markets (e.g., General Electric makes light bulbs and turbine engines[45]) or several complementary products for a distinct set of consumers (e.g., IBM sells computer hardware and computer services[46]) do not secure profit opportunities from internalizing indirect network effects.

Multi-sided platform markets, on the other hand, are subject to indirect network effects. A lengthy literature in economics, dating back to

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41 This is different from the joint pricing of complements analyzed by Cournot or the standard razor-blade example discussed in Allen. *See* AUGUSTIN A. COURNOT, RESEARCHES INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH 99-116 (Nathaniel T. Bacon trans., Macmillan 1897) (1897); *see also* ROY G. D. ALLEN, MATHEMATICAL ANALYSIS FOR ECONOMISTS 361-62 (1938). In those cases, a multi-product business sets prices to a given group of consumers for whom these products are complements; the price for one good may be less than marginal cost because it stimulates consumption of the other good.

42 Or vice versa. The dating agency *Dinner for Six* waives a $150 joining fee for men over 50—apparently because they are scarce relative to women over 50 looking for mates. *See* Victoria Button, *Dating Agency Seeks Fees Based on Age, Gender*, THE AGE, Sept. 24, 1997, at 3.

43 *See, e.g.*, WILLIAM J. BAUMOL ET AL., CONTESTABLE MARKETS AND THE THEORY OF INDUSTRY STRUCTURE 65-79, 157-60 (1982); John C. Panzar, *Technological Determinants of Firms and Industry Structure*, *in* 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 3 (Richard Schmalensee & Robert D. Willig eds., 1989); Jeffrey Rohlfs, *A Theory of Interdependent Demand for a Communications Service*, 5 BELL J. ECON. 16 (1974).

44 That was first recognized by Cournot in 1838 and now goes by the unhelpful name of "double marginalization." *See* COURNOT, *supra* note 41, at 99-116.

45 *See* General Electric Company, Home Page, *at* http://www.ge.com/en/index2.htm (last visited Jan. 30, 2003).

46 *See* IBM, Home Page, *at* http://www.ibm.com/products/us/ (last visited Jan. 30, 2003).

the mid-1980s, analyzes the economic implication of these effects.[47] That literature considers first-mover advantages,[48] the difficulties of coordinating the production of complementary products,[49] and problems that result from markets tipping to a possibly bad technology or having so much inertia that they cannot move to a better technology.[50] The literature does not, however, consider the economics of businesses that harness these indirect network effects through the creation of a multi-sided platform.[51] Related work examines the role of cooperation among businesses to produce complements but does not consider the role of platform businesses as such.[52]

D. *Profit-Maximizing Pricing by Multi-Sided Platform Businesses*

The special problems that platform firms must solve are best developed by considering their pricing strategies. To simplify the terminology, consider a two-sided market in which both sides are purchasing goods that have the same metric—such as a transaction or a date.[53] The platform business faces two demand curves, each of which depends on the quality-adjusted quantity purchased on the other side. The platform incurs a fixed cost for operating the platform and variable costs for servicing each side.

The optimal price for side *A* depends on the responsiveness of demand to changes in price on side *A*, the responsiveness of demand on side *B* to changes in quality-adjusted sales on side *A*, and changes in

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47 For a discussion of network effects, see Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985); Michael L. Katz & Carl Shapiro, *Systems Competition and Network Effects*, J. ECON. PERSP., Spring 1994, at 93 [hereinafter Katz & Shapiro, *Systems*]; Michael L. Katz & Carl Shapiro, *Technology Adoption in the Presence of Network Externalities*, 94 J. POL. ECON. 822 (1986) [hereinafter Katz & Shapiro, *Technology*]; S.J. Liebowitz & S.E. Margolis, *Network Externality: An Uncommon Tragedy*, J. ECON. PERSP., Spring 1994, at 133.

48 *See, e.g.*, Katz & Shapiro, *Technology*, *supra* note 47, at 825; *see also* David Gabel, *Competition in a Network Industry: The Telephone Industry, 1894-1910*, 54 J. ECON. HIST. 543, 560-66 (1994).

49 *E.g.*, CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES 227-59 (1999).

50 *E.g.*, Katz & Shapiro, *Systems*, *supra* note 47, at 108. For an alternative view, see David S. Evans & Richard Schmalensee, *A Guide to the Antitrust Economics of Networks*, ANTITRUST, Spring 1996, at 36.

51 Stanley Liebowitz has argued that the prescriptive advice that businesses took from this literature—and in some cases were given specifically by economists who contributed to this literature—contributed to the failure of many dot coms. The network effects literature focuses on building market share quickly through penetration pricing strategies. *See* STAN J. LIEBOWITZ, RE-THINKING THE NETWORK ECONOMY: THE TRUE FORCES THAT DRIVE THE DIGITAL MARKETPLACE 26-49 (2002).

52 *See* ADAM M. BRANDERBURGER ET AL., CO-OPETITION 11-22 (1998).

53 More generally, platform businesses—especially audience makers and demand-coordinators—are selling different products to the different sides. For some of the points below one would have to transform prices into a measure that applies to both sides (for example, contribution to margin or profit).

variable costs on both sides. To see this, suppose we have found the optimal prices for sides *A* and *B*. An increase from the optimal price on side *A*, holding the optimal price on side *B* constant, will have the following effects: Demand on side *A* will fall, demand on side *B* will fall since side *B*'s product is less valuable, variable costs will fall on side *A* and variable costs will fall on side *B*. Therefore, all of those factors have to be taken into account when searching for the optimal price pair. (The same intuition applies to discovering the social welfare-maximizing price.)

1. Pricing by a Multi-Sided Platform Facing Multiplicative Demand

All of the theoretical models of pricing by platforms in multi-sided markets confirm this intuition.[54] Here we consider the Rochet-Tirole model, which is motivated by payment cards. The model assumes that the total demand facing the platform increases proportionately with the number of merchants and the number of cardholders. A simple regression provides some support for this assumption. Based on annual data from 1981 to 2001 for Visa, a regression of the log of the number of transactions against the log of the number of merchants and the log of the number of cardholders yields:[55]

$$\log(\textit{transactions}) = -8.49 + 1.73 \cdot \log(\textit{merchants}) + 0.84 \cdot \log(\textit{cardholders})$$

A coefficient of 1 on each variable would indicate that transactions were exactly proportional to the relevant variable. These results indicate that transactions increase somewhat more than proportionately with the number of merchants and just slightly less than proportionately with the number of cardholders.[56] This model also describes many matchmaking services.[57] More dates will result when there are more men and women in a club.

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54 The equilibrium conditions noted in the literature all illustrate the dependence of one side of the market on another. *See, e.g.*, Rochet & Tirole, *Platform*, *supra* note 14, at 10-12, 18-21 (deriving four equations that show mathematically how one side of the market depends on the other); Schmalensee, *supra* note 14, at 111-18; Parker & Van Alstyne, *supra* note 14, at 11.

55 Data was collected from various Nilson Report issues from 1982 to 2002 (Nos. 285, 338, 347, 372, 374, 406, 422, 456, 475, 500, 522, 545, 569, 591, 617, 640, 664, 689, 712, 738, 760). The estimated coefficients were significant at the ninety-nine percent level. The standard errors of log(merchants) and log(cardholders) equal 0.25 and 0.3, respectively; R2 equals 0.97.

56 The coefficients imply that a ten percent increase in cardholders corresponds to a seventeen percent increase in transactions and a ten percent increase in merchants corresponds to an 8.5 percent increase in transactions.

57 This is true only within limits. Especially when a matchmaking service occurs in a physical location—a dating club, a trading pit, or a flea market—congestion makes search harder, thereby offsetting the gains from more potential partners.

More transactions will take place on exchanges that have more buyers and sellers.

While the results do not fit the Rochet-Tirole formulation precisely, they suggest that a multiplicative demand function is a reasonable simplifying assumption. Specifically, the Rochet-Tirole model assumes total demand, D_T, is given by:

$$D_T = D_1(p_1) \times D_2(p_2) \qquad (1)$$

Here, the subscripts indicate the respective sides of the market, so that $D_1(p_1)$ denotes the demand on side 1 of the market, which depends on the price on side 1, and similarly for side 2. Although simple, this demand structure captures the key interaction between the two market sides from the standpoint of the platform. More complex and realistic demand structures would be less tractable but would yield qualitatively similar results.[58] In particular, making one side's demand depend on the demand for the other side would strengthen the result, presented below, that relative prices between the two sides depend on relative demand, not on costs.[59]

Rochet and Tirole assume that there is a per unit (variable) cost of a transaction equal to c. Note that this variable cost is incurred when a transaction takes place and is therefore not attributable to either side alone. In fact, much of the costs of payment card transactions is either joint, in the sense that the costs arise when a transaction occurs (the cost of authorization and settlement), or the allocation of costs to one side or the other is economically arbitrary (the cost of funds, charge-offs, fraud, and other risks).[60]

The first condition in Rochet-Tirole for a monopolist in a two-sided market is that the total price, p_T, is given by:[61]

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58 Note that the multiplicative structure does not imply that each cardholder buys from each merchant, since total demand could be scaled down by any constant factor and all the results below would still obtain. Note also that the respective merchant and cardholder bases could be defined in terms of the dollar volume of transactions accounted for by merchants and cardholders rather than a straight headcount of merchants and cardholders.

59 With the structure in Equation 1, an increase in demand on side one, for example, affects total output through the multiplicative interaction. If demand on side two increased as a result of higher demand on side one, that would further increase total output; prices on each side would therefore need to take into account that additional interaction.

Parker & Van Alystne take the alternative approach of making total demand additive rather than multiplicative and assuming that demand on each side does depend on demand on the other side. They obtain results that are similar to those of Rochet & Tirole in that prices on each side depend on demand conditions on the two sides, specifically the externalities between the two sides. Parker & Van Alstyne, *supra* note 14, at 14.

60 For issuers, almost three quarters of operating costs are for cost of funds, charge-offs, and fraud. *See* EVANS & SCHMALENSEE, *supra* note 36, at 214.

61 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 9-10.

$$(p_T - c)/p_T = 1/\eta \qquad (2)$$

Here c is the per unit (variable) cost of a transaction on the platform, and p_T is equal to the sum of p_1 and p_2. The expression on the left-hand side gives the total price-cost margin charged by the firm. The term η on the right-hand side is a measure of "elasticity" or the responsiveness of demand on the two sides to changes in price.[62] The condition indicates that, as the responsiveness of demand increases, the price-cost margin falls. Roughly speaking, as consumer sensitivity to prices increases, the price a monopolist gets to charge falls.

This result is analogous to the familiar Lerner condition for monopoly pricing in one-sided markets.[63] As far as the overall price level is concerned, two-sided pricing is similar to one-sided pricing. The difference, however, is that two-sided pricing must involve a price structure that divides total price between the two sides of the system. Consider the impact on total demand from a small change in the price of, for example, side 1. With proportional demand, the change in total demand is proportional to the percent change in demand on side 1:[64]

$$\Delta D_T = (\Delta D_1(p_1)/D_1(p_1)) \times D_T \qquad (3)$$

If a monopolist is maximizing profits, it must be unable to do better by raising prices slightly on one side and decreasing prices by the same amount on the other side. That is, the impact on total demand must be the same from changing prices on either side. Equation 3 above implies that the percentage change in demand on each side must be equal, because total demand will change by exactly that percentage. Formally, this means that:[65]

$$\Delta D_1(p_1)/D_1(p_1) = \Delta D_2(p_2)/D_2(p_2) \qquad (4)$$

In equilibrium, the ratio of the prices on the two sides is proportional to the ratio of the elasticities of demand on the two sides.[66]

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62 To be precise $\eta = \eta_1 + \eta_2$ where the η_i are given by the standard elasticity formulae, $\eta_i = -p_i \cdot (dD_i/dp_i)/D_i$.

63 The Lerner condition was first stated in Abba Lerner, *The Concept of Monopoly and the Measurement of Monopoly Power*, 1 REV. ECON. STUD. 157 (1934); *see also* CARLTON & PERLOFF, *supra* note 39, at 91-92.

64 For ease of exposition, I express the changes as discrete rather than differential changes in demand as is the case in the Rochet-Tirole model.

65 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 9. Rochet & Tirole present a rigorous derivation of the equilibrium condition derived heuristically here.

66 That is, $(p_1/\eta_1) = (p_2/\eta_2)$, where η is the elasticity of demand for each side of the market.

The most important thing to notice is that Equation 4 does not depend on variable costs. Consequently, the prices charged to either side do not depend directly on the variable cost; they only depend on variable cost through the apportionment of the total price. This is a very different result than pricing in one-sided markets. For example, in one-sided markets with heterogeneous customers, businesses might charge different prices. Each of those prices follows some variant of the Lerner condition, where the price-cost margin is inversely proportional to the elasticity of demand.[67] Even pricing in multiproduct firms follows some variant of the Lerner condition.[68] The key result of the economics of multi-sided platforms is that the Lerner condition does not hold and, consequently, the profit-maximizing price of a product does not vary directly with the marginal cost of product—an otherwise robust result of most economic theories of pricing.[69]

2. The Pricing Structure and Indirect Network Externalities

Using a model in which the demand by one side is an increasing function of the demand on the other side, Geoffrey Parker and Marshall Van Alstyne show that the relative pricing structure is determined by the relative indirect network externalities on each side.[70] If there are strong indirect network externalities on both sides, then it will appear as if the platform business is ignoring them—as it should because they tend to cancel out. The side with much lower indirect network externalities is more likely to receive "lower prices" compared with the side with greater indirect network externalities.[71]

Figure 1, drawn from Parker and Van Alstyne's analysis, describes three possible equilibria for a monopoly platform. Panels A through C show the change in prices for the two sides as the externality from side 2 to side 1 increases. The two lines in each panel are the firm's optimal choice of price on one side given a price on the other side—the intersection is the optimal pair for the firm at a given level of externalities between the two sides. The results in Panels A through C show that as the effect of side 2 demand on side 1 demand increases, the price on side 2 decreases. Intuitively, this is because it becomes more profitable for the firm to "subsidize" price cuts on side 2 if the resulting impact on demand

67 *See* Lerner, *supra* note 63, at 157.

68 *See* BAUMOL ET AL., *supra* note 43, at 243-78.

69 *See* CARLTON & PERLOFF, *supra* note 39, at 246; DON E. WALDMAN & ELIZABETH J. JENSEN, INDUSTRIAL ORGANIZATION: THEORY AND PRACTICE 437-38 (1998).

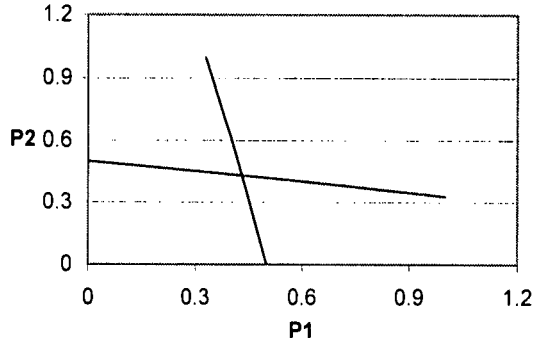
70 *See* Parker & Van Alstyne, *supra* note 14, at 2-3.

71 *See* Schmalensee, *supra* note 14, at 113-14; *see also* Parker & Alstyne, *supra* note 14, at 12, 14 ("A monopolist that sells to two complementary markets discounts . . . the product with the greater spillover effect.").

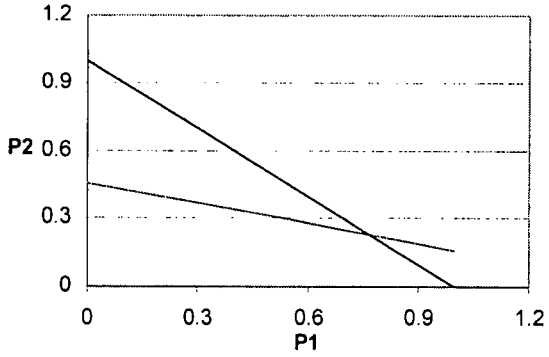
on side 1 is greater. We see in Panel A, where the externalities are equal between the two sides, that prices are symmetric. As the externality from

Figure 1. Possible Equilibria for a Monopoly Platform

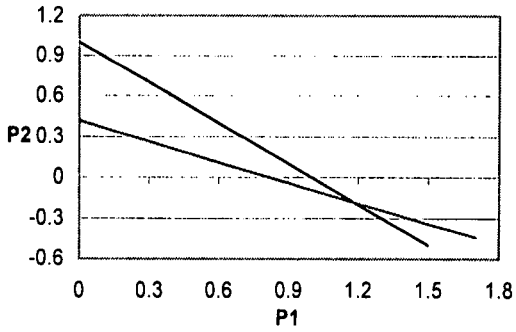
(A)



(B)



(C)



Note: P1 refers to side 1, and P2 to side 2. Panel A shows a symmetric positive price equilibrium, Panel B shows an asymmetric positive price equilibrium, and Panel C shows a positive/negative price equilibrium.

Source: Geoffrey G. Parker & Marshall W. Van Alstyne, Unbundling in the Presence of Network Externalities 13 (Aug. 31, 2002) (unpublished manuscript, on file with Yale Journal on Regulation) (notation changed from original for ease of exposition).

side 2 to side 1 increases, as in Panel B, the price on side 2 decreases and the price on side 1 increases. In Panel C, where the externality from side 2 to side 1 is even greater, we see that it actually makes sense for the firm to set a negative price on side 2 because of the benefits from stimulating demand on side 1.

An important result is that the profit-maximizing price structure can include a negative price on one side.[72] This is similar to the familiar razor and blade result but arises for a different reason. The razor and blade are complementary products for an individual consumer. The blade seller stimulates demand for blades by giving the razor away to the consumer. In multi-sided platform markets, it is possible that one group of consumers will get a product for free (or be paid to take it) so that the platform can, in effect, deliver this group of consumers to the consumers on the other side(s). I will return to this result in the discussion of predatory pricing in Part II.C.

3. The Relationship Between Prices and Costs

The relationship between prices and costs in platform businesses is worth dwelling on since it will prove important for analyzing antitrust and other public policies. It is well recognized by economists that in multi-product businesses the allocation of joint costs to a particular product is arbitrary and that there is no economic rationale behind any proposed formula for doing so.[73] That proposition is also true for fixed costs that platform businesses incur for a product or service on just one side of the market. Incurring these fixed costs enables the business to provide a product or service that creates demand on the other side. In fact, in some cases incurring these fixed costs may be essential for there to be any demand on the other side. Thus, calculations of profit (such as gross operating margins) based on allocations of fixed costs—either joint or side-specific—are necessarily arbitrary. Price-marginal cost relationships for one side do not have any economic meaning either. By themselves they do not guide the business to profit-maximizing prices or regulators to social-welfare-maximizing prices. One needs to consider prices and marginal costs on all sides jointly (along with demand characteristics). The platform faces a challenging optimization problem, and the regulator an onerous information problem.

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72 *See* CAILLAUD & JULLIEN, *supra* note 14, at 24.

73 *See* ALFRED E. KAHN, THE ECONOMICS OF REGULATION, PRINCIPLES AND INSTITUTIONS 78 (1989); W. Baumol et al., *How Arbitrary is Arbitrary—or, Toward the Deserved Demise of Full Cost Allocation*, PUBLIC UTILITIES FORTNIGHTLY, Sept. 3, 1987, at 16-21.

4. Pricing with Platform Competition

Pricing considerations are broadly similar when there are competing firms selling to multiple sides of the market.[74] Rochet and Tirole consider an interesting case of this, which they refer to as "multihoming"[75]—consumers on one or more sides of the market rely on more than one seller of multi-sided services.[76] Most platforms face competition on at least one side, as noted in Table 2, so multihoming is prevalent. Many cardholders have cards issued by and many merchants accept cards from several competing platforms—an example of multihoming on both sides.[77] Developers of applications for operating systems or game consoles generally write for multiple platforms, while most people use only one computer operating system or game console—an example of multihoming on just one side.[78]

Multihoming affects both the price level and the pricing structure. Not surprisingly, the price level tends to be lower with multihoming because the availability of substitutes tends to put pressure on the multi-sided firms to lower their prices.[79] The seller has more options when dealing with a multihomed buyer on the other side and can select its preferred platform. As buyer multihoming becomes more prevalent, prices to sellers will tend to decrease since they have more substitution options. Even when multihoming is not observed on one side of a multi-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

74 *See* Rochet & Tirole, *Platform*, *supra* note 14.

75 "Multihomed" was originally an Internet term. According to *Webopedia*, an online technical dictionary, it is "used to describe a host that is connected to two or more networks or having 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 a definition of "multihomed," see WEBOPEDIA, *at* http://www.webopedia.com/TERM/m/multihomed.html (last modified Dec. 12, 2002). 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, *Platform*, *supra* note 14, at 5.

76 Parker and Van Alstyne consider a related topic—the situation where a platform business competes with another firm on just one side of the market. *See* Parker & Van Alstyne, *supra* note 14.

77 *See* EVANS & SCHMALENSEE, *supra* note 36, at 170.

78 For multihoming in operating system platforms, see Josh Lerner, Did Microsoft Deter Software Innovation? 31 (2002) (unpublished manuscript, on file with Yale Journal on Regulation), *available at* http://gsbwww.uchicago.edu/research/workshops/elo/lerner2.pdf (last visited Aug. 15, 2002); Scot Hacker, *He Who Controls the Bootloader*, BYTE.COM, *at* http://www.byte.com/documents/s=1115/byt20010824s0001/0827_hacker.html (last visited Aug. 20, 2002). For multihoming in game console platforms, see *Yankee Group: Video-Game Penetration Grows to 36 Million Households in 2001*, REUTERS NEWS, Nov. 19, 2001, *available at* http://about.reuters.com/newsreleases/art_19-11-2001_id785.asp (last visited Aug. 30, 2002); *Game Makers Hedge Bets in Console Wars*, USATODAY.COM, Nov. 16, 2001, *at* http://www.usatoday.com/life/tech/techreviews/games/2001/11/19/game-makers.htm (last visited Mar. 14, 2003).

79 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 5, 23.

their prices, they discourage customers on that side from affiliating with other multi-sided firms.[80] This is not entirely a free lunch for consumers. The firm can then charge more to customers on the other side(s), for whom fewer substitutes are available.[81]

Table 2: The Presence of Multihoming in Selected Two-Sided Platforms

Two-Sided Platform	Presence of Multihoming for Side One	Presence of Multihoming for Side Two
Residential Property Brokerage	Buyer—*Uncommon*: Multihoming may be unnecessary, since a Multiple Listing Service ("MLS") allows buyers to see property listed by all member agencies.[1]	Seller—*Uncommon*: Multihoming may be unnecessary, since an MLS allows the listed property to be seen by all member agencies' customers.[1]
Securities Brokerage	Buyer—*Common*: The average securities brokerage client has accounts at three firms.[2] Note that clients can be either or both buyers or sellers.	Seller—*Common*: The average securities brokerage client has accounts at three firms.[2] As mentioned, clients can be either or both buyers or sellers.
B2B	Buyer—*Varies*: 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—*Varies*: Multihoming may be unnecessary since the B2B can inexpensively reach a large audience.[4]
P2P	Buyer—*Varies*: 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).[5] Alternatively, multihoming may be more common for online dating services where there are many sites and a large audience of online singles (considered to be available singles, as opposed to buyers).[6]	Seller—*Varies*: 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).[5] Alternatively, multihoming may be more common for online dating services where there are many sites and a large audience of online singles (considered to be available singles, as opposed to sellers).[6]

80 *Id.* at 6.

81 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, *supra* note 14, at 4. 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.

Two-Sided Platform	Presence of Multihoming for Side One	Presence of Multihoming for Side Two
Newspapers and Magazines	Reader—*Common*: In 1996, the average number of magazine issues read per person per month was 12.3.[7]	Advertiser—*Common*: For example, Sprint advertised in the New York Times, Wall Street Journal, and Chicago Tribune, among many other newspapers, on Aug. 20, 2002.[8]
Network Television	Viewer—*Common*: 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.[9]	Advertiser—*Common*: For example, Sprint places television advertisements on ABC, CBS, FOX, and NBC.[10]
Operating System	Application User—*Uncommon*: Individuals typically use only one operating system.[11]	Application Developer—*Common*: As noted earlier, the number of developers that develop for various operating systems indicates that developers engage in significant multihoming.[12]
Video Game Console	Game Player—*Varies*: A household that already owns at least one console on average owns 1.4 consoles.[13]	Game Developer—*Common*: For example, Electronic Arts, a game developer, develops for Nintendo's GameCube, Microsoft's Xbox, and Sony's Playstation 2, among other consoles.[14]
Payment Card	Cardholder—*Common*: Most American Express cardholders also carry at least one Visa or MasterCard.[15]	Merchant—*Common*: American Express cardholders can use Visa and MasterCard at almost all places that take American Express.[15]

Sources: (1) 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 & Richard O. Zerbe, Jr. eds., 1987); (2) Susan Scherreik, *Is Your Broker Leaving You Out in the Cold?*, BUSINESS WEEK ONLINE, Feb. 18, 2002, http://www.businessweek.com/magazine/content/02_07/b3770110.htm (last visited Aug. 22, 2002); (3) David Lucking-Reilly & Daniel F. Spulber, *Business-to-Business Electronic Commerce*, J. ECON. PERSPECTIVES, Winter 2001, at 57-58; (4) FED. TRADE COMM'N, *Efficiencies of B2B Electronic Marketplaces*, *in* 2 ENTERING THE 21ST CENTURY: COMPETITION POLICY IN THE WORLD OF B2B ELECTRONIC MARKETPLACES 5 (Oct. 2000), *available at* http://www.ftc.gov/os/2000/10/index.htm#26 (last visited Aug. 14, 2002); (5) Oscar S. Cisneros, *EBay Accused of Monopolization*, WIRED NEWS, July 31, 2000, http://www.wired.com/news/print/0,1294,37871,00.html (last visited Aug. 20, 2002); (6) Paul Festa, *Looking for Love Online*, CNET NEWS.COM, Dec. 17, 1996, http://news.com.com/2100-1023-255523.html?tag=rn (last visited Aug. 22, 2002); (7) FOOTE, CONE & BELDING MEDIA RESEARCH REPORT, MAGAZINES IN THE INFORMATION AGE (Spring 1998), *at* http://www.magazine.org/resources/research/fcb_magazines_infoage.html (last visited Apr. 12, 2003); (8) Sprint, Advertisement, CHI. TRIB., Aug. 20, 2002, § 1, at 11; Sprint, Advertisement, N. Y. TIMES, Aug. 20, 2002, at A20; Sprint, Advertisement, WALL ST. J., Aug. 20, 2002, at A15; (9) ABC.com, Local Stations, http://abc.abcnews.go.com/site/localstations.html (last visited Sept. 3, 2002); CBSNEWS.com, Local CBS Affiliates, http://www.cbsnews.com/stories/2002/07/31/utility/main517034.shtml (last visited Apr. 12, 2002); FOX.com, FOX Affiliates, http://www.fox.com/links/affiliates.htm (last visited Sept. 3, 2002); NBC.com, Local Stations, http://www.nbc.com/nbc/header/Local_Stations/ (last visited Sept. 3, 2002); (10) Press Release, James Fisher, Sprint, An Ad Blitz for the 21st Century (Sept. 24, 1997),

http://www3.sprint.com/PR/CDA/PR_CDA_Press_Releases_Detail/0,3245,,00.html?ID=1294 (last visited Aug. 23, 2002); (11) Scot Hacker, *He Who Controls the Bootloader*, BYTE.COM, Aug. 27, 2001, *at* http://journals2.iranscience.net:800/www.byte.com/www.byte.com/documents/s=1115/byt20010824s0001/default.htm (last visited Aug. 20, 2002); (12) Josh Lerner, Did Microsoft Deter Software Innovation? 31, (May 28, 2001) (unpublished manuscript, on file with the Yale Journal on Regulation), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=269498; (13) *Yankee Group: Video-Game Penetration Grows to 36 Million Households in 2001*, REUTERS NEWS, Nov. 19, 2001, http://about.reuters.com/newsreleases/art_19-11-2001_id785.asp (last visited Aug. 30, 2002); (14) ELECTRONIC ARTS INC., 2002 SEC FORM 10-K, at 3 (June 28, 2002); (15) DAVID S. EVANS & RICHARD SCHMALENSEE, PAYING WITH PLASTIC: THE DIGITAL REVOLUTION IN BUYING AND BORROWING 170 (1999).

5. Complexity and Dynamics

The above economic analysis highlights two important aspects of platform businesses. Complexity is the first. Firms in single-sided markets have to search for the best price level which, at a purely theoretical level, is an easy informational hurdle to surmount. Firms can adjust price, observe the effect on sales, and measure the direct correspondence to production costs. Firms in multi-sided markets, however, have to search for two or more interdependent price levels and discern the interaction effects. They also have to worry about instabilities: Seemingly small changes on one side can have dramatic changes on the other side due to the resulting interactions. For example, Yahoo operated an Internet auction site that, in 2000, was second only to eBay in number of listings. It was able to reach that level because, unlike eBay, Yahoo did not charge sellers a fee for listing their products. When Yahoo attempted to charge sellers for listings in early 2001, its listings fell by ninety percent, leaving little for buyers to bid on.[82] Presumably, sellers concluded that if they had to pay for offering a product in an online auction, they would be better off focusing on the largest venue, eBay.

Not surprisingly, many successful platform businesses have developed gradually through a process of trial and error. For example, Diners' Club—the first charge card that could be used at multiple merchants—began by providing a card product for paying at restaurants in New York. It expanded the restaurant model to Los Angeles, and then to travel and entertainment businesses nationwide.[83] EBay—while operating on Internet time—expanded from Pez dispensers to more than 18,000 item categories sold worldwide.[84] Examples of the reverse situation, in which businesses have gotten their structure wrong, are readily available. B2B

82 Saul Hansell, *Red Face for the Internet's Blue Chip*, N.Y. TIMES, Mar. 11, 2001, § 3, at 1.
83 *See* EVANS & SCHMALENSEE, *supra* note 36, at 62-65.
84 *See* EBAY, *supra* note 28.

exchanges invested in substantial infrastructures to make markets, established a pricing scheme, and opened to find few takers.[85]

The practical complexity of getting all sides on board may explain why real-world multi-sided platform markets do not appear "tippy." Some economists argued from theory that customers would stampede toward the network with the greatest number of members. Therefore, if one network got even a small lead over another network the market would tip to the former, which would then achieve ubiquity.[86] In practice, successful multi-sided platforms evolve relatively slowly as businesses grope for the optimal pricing structure and gradually develop customers on all sides of the market.[87] Aspiring platforms that have heeded the prescriptive advice of network economics—build share early and quickly—have not done well.[88]

Critical mass is the second important challenge for platform businesses and is a key start-up issue. Known in the literature as the chicken-and-egg problem, the name does not do the problem justice. In some situations coupled products cannot come into existence without a sufficient number of customers on both sides from the start. Payment cards are the clearest example: The card is worthless to individuals if few merchants take it and is worthless to merchants if few individuals use it. Among electronic exchanges, the B2B platform discussed above is again relevant, since neither buyers nor sellers showed up in sufficient numbers to make either side interested.[89]

Sometimes, though, platforms can evolve sequentially by providing products and services to build up one customer base before pursuing the second. The evolution of Microsoft's software platform is an example. The early versions of DOS offered relatively few services to applications developers. Over time the base of computer owners who used Microsoft's operating system software expanded, making it attractive for software

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85 Evans & Iansiti emphasize the importance of developing scalable platforms that achieve profitability quickly. *See* Evans & Iansiti, *supra* note 15.

86 *See* W. Brian Arthur, *Competing Technologies and Lock-In by Historical Events*, 99 ECON. J. 116 (1989).

87 *See* Evans & Iansiti, *supra* note 15, at 3-4.

88 Stanley Liebowitz states that:

> A company that takes big losses this year in order to win the market share wars is likely to find that it has won only a Pyrrhic victory. Businesses that still adhere to this notion and invest enormous sums for early advantage are likely to fail in the market. Much of the recent melt-down in high-tech sectors of the economy can be blamed on these misguided ideas.

LIEBOWITZ, *supra* note 51, at 48.

89 *See* AJIT KAMBIL & ERIC VAN HECK, MAKING MARKETS: HOW FIRMS CAN DESIGN AND PROFIT FROM ONLINE AUCTIONS AND EXCHANGES 103-27 (2002); *see also* John Frederick Moore, *Ebusiness Dispatch: What's Next for B2B?*, BUSINESS 2.0, Sept. 18, 2001, *at* http://www.business2.com/articles/web/0,1653,17177,FF.html (last visited Jan. 21, 2002).

developers to use this operating system and for Microsoft to add features they could use.[90]

E. *Pricing Structures and Strategies*

Many platform companies settle on pricing structures that are heavily skewed towards one side of the market. Table 1 summarizes the pricing structure for selected multi-sided platforms. For example, in 2001 American Express earned eighty-two percent of its revenues from merchants, excluding finance charge revenue.[91] Microsoft earns the substantial majority of its Windows revenue from licensing the operating system to computer manufacturers or end users.[92] Shopping malls earn virtually all their revenues from leasing space; not only do they not charge for admittance, they sometimes offer free parking and other amenities.

Zero or negative prices also appear as suggested by the multi-sided platform theory.[93] The pure case involves platforms such as Adobe, which gives away its reader software—for which it incurs some cost—to increase the demand for its production software.[94] Impure cases involve platforms such as RealNetworks, which gives a basic version of its player away to users but collects some revenues from individuals who want more features. However, the fraction of users paying for the premium edition is small—only 1.4 percent of the user base in 2000.[95] Similarly, Apple gives away the basic QuickTime Player while charging for the premium edition.[96]

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90 *See* AL GILLEN, IDC, WORLDWIDE CLIENT AND SERVER OPERATING ENVIRONMENTS FORECAST AND ANALYSIS, 2002-2006: MICROSOFT EXTENDS ITS GRIP ON THE MARKET (IDC 27969, Sept. 2002); Michael J. Miller, *Windows 98 Put to the Test,* PC MAG., Aug. 1, 1998, at 100.

91 If finance charge revenues, net of interest expense, are included, American Express earned sixty-two percent of its revenues from merchants in 2001. If gross finance charge revenues are included, American Express earned fifty-five percent of its revenues from merchants in 2001. *See* AMERICAN EXPRESS CO., 2001 ANNUAL REPORT 35 (2002), http://www.onlineproxy.com/amex/2002/ar/pdf/axp_ar_2001.pdf (last visited Aug. 15, 2002). While finance charges are an important revenue stream, they represent a second service, that of credit provision, separate from payment services.

92 From 1988 through 2000, Microsoft earned at least sixty-seven 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* IDC, 1994 WORLDWIDE SOFTWARE REVIEW AND FORECAST (Nov. 1994); *through* IDC, WORLDWIDE SOFTWARE MARKET FORECAST SUMMARY, 2001-2005 (Sept. 2001), IDC 25569.

Note that the sixty-seven 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 example, database products used by business IT departments are included in the Applications Development category.

93 Bernard Caillaud and Bruno Jullien refer to the low or negative price strategy as "divide-and-conquer." *See* CAILLAUD & JULLIEN, *supra* note 14, at 1; *see also* JULLIEN, *supra* note 14, at 1.

94 *See* Adobe, Acrobat Family, *at* http://www.adobe.com/products/acrobat/readstep.html (last visited Jan. 30, 2003).

95 Brian Quinton, *Priming the Content Pump,* TELEPHONY, Aug. 21, 2000, *available at* http://currentissue.telephonyonline.com/ar/telecom_priming_content_pump/ (last visited Jan. 20, 2003). RealNetworks earns the majority of its revenues through sales of servers, various authoring and

Zero or negative prices are especially likely at the entry phase to get critical mass on one side of the market.[97] Diners Club gave its charge card away to cardholders at first; there was no annual fee, and users received the benefit of the float.[98] 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 Netscape followed suit.[99] Microsoft is reportedly subsidizing the sales of its X-box hardware to consumers to get them on board.[100]

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 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.[101] To take another example, in the battle between Microsoft and Netscape over Internet browsers, Microsoft gave away developer kits to Internet portals, while Netscape charged for them.[102]

The debit card is an example in which different platforms made different pricing choices because they had different customers on board when they entered. In the late 1980s, 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, ATM networks charged a smaller interchange fee than did credit card systems to encourage merchants to install PIN pads. Compared to credit card systems' interchange fee of 38 cents on a typical $30 transaction, ATM networks only charged 8 cents.[103]

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publishing tools, entertainment software other than RealPlayer, provision of support and maintenance services, and sales of advertising. *See* REALNETWORKS, SEC FORM 10-K 20-24 (2001).

96 There are now 100,000,000 basic QuickTime Player users. Information on the number of premium edition users is not available. *See* Apple, QuickTime Home Page, *at* http://www.apple.com/quicktime/whyqt (last visited Jan. 23, 2003).

97 Of course, such penetration pricing strategies are also common in one-sided markets. For example, giving away samples may be an effective strategy to build business for the future. *See, e.g.*, CARLTON & PERLOFF, *supra* note 39, at 332-76.

98 *See* EVANS & SCHMALENSEE, *supra* note 36, at 62.

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

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

101 *See* ANNABELLE GAWER & MICHAEL A. CUSUMANO, PLATFORM LEADERSHIP: HOW INTEL, MICROSOFT, AND CISCO DRIVE INDUSTRY INNOVATION 150-51 (2002).

102 Direct Testimony of Cameron Myhrvold, at ¶¶ 25-96, United States v. Microsoft Corp. (D.D.C. 1999) (No. 98-1232), *available at* http://www.microsoft.com/presspass/trial/mswitness/myhrvold/myhrvold_pt2.asp (last visited Jan. 20, 2003).

103 The ATM systems typically charged a flat interchange fee per transaction, while the

(On debit and credit transactions, the interchange fee is paid by the merchant's bank to the cardholder's bank. A lower interchange fee will tend to lower prices on the merchant's side and to raise them on the cardholder's side.) The PIN pads merchants installed could read the ATM cards that cardholders already had and accept the PINs they used to access ATMs.[104] In response to ATM networks' low interchange fee, many merchants invested in the PIN pads, whose numbers increased from 53,000 in 1990 to about 3.6 million in 2001.[105] In contrast to the credit card systems, which already had a base of merchants who took their cards and consumers who used them, ATM systems had to persuade banks to issue debit cards and cardholders to take these cards.[106] Their strategy worked: The number of Visa debit cards in circulation increased from 7.6 million in 1990 to about 117 million in 2001.[107]

Two other factors besides market share appear to affect the pricing structure of platform businesses. There may be certain customers on one side of the market—Rochet and Tirole refer to them as "marquee buyers"[108]—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 increase it to sellers. For example, American Express has been able to charge a relatively high price to merchants as compared to other card brands, 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.[109]

A similar phenomenon occurs when certain customers are extremely loyal to the platform business—perhaps because of long-term contracts or sunk-cost investments. In the case of the ATM networks, 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.

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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. *See* EVANS & SCHMALENSEE, *supra* note 36, at 300.

104 *See* EVANS & SCHMALENSEE, *supra* note 36, at 300.

105 *Id.* at 308-09; *PIN-based Shared & National POS Debit Card Systems*, NILSON REP., Mar. 2002, at 6.

106 Visa attracted consumers through an effective advertising campaign and attracted issuers through heavy investment in a debit processing facility, among other strategies. EVANS & SCHMALENSEE, *supra* note 36, at 297-319.

107 *See Debit Cards*, NILSON REP., Mar. 2002, at 7; *Bank Debt Cards-U.S.*, NILSON REP., May 1991, at 6.

108 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 22.

109 EVANS & SCHMALENSEE, *supra* note 36, at 184-85.

Skewed pricing structures are not the only way to obtain critical mass. Platforms sometimes invest in one side of the market to lower the costs of participation for consumers on that side of the market. Microsoft provides a good example of this. It invests in applications developers by developing tools that help them write applications and providing other assistance that makes it easier to write applications using Microsoft operating systems.[110] 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, multi-sided intermediaries are able to cultivate (or even initially supply) one side, or many sides, of their market in order to boost the overall success of the platform. Another effect of providing benefits to one side is that this assistance can discourage use of competing platform firms. For example, when Palm provides free tools and support to PDA applications software developers, 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.[111]

F. *Multi-Sided Markets and Social Welfare*

In practice, a relatively small number of firms tend to compete in multi-sided platform markets because of indirect network effects on the demand side and fixed costs of establishing platforms. The benefits of demand and cost-side scale economies are often limited, however, by the existence of heterogeneous customers on one side of the market. As a result, we see few firms in each market, but also few monopolies.

The consequences of having relatively few competitors in multi-sided markets, and the existence of network effects, raise familiar issues concerning the efficacy of competitive markets and the possibility of a role for government intervention. However, the pricing and investment strategies that firms in multi-sided markets use to "get all sides on board" and "balance the interests of all sides" raise novel issues. One issue is whether the relative prices adopted by multi-sided firms—which in practice often result in one side seemingly subsidizing the other side—are socially inefficient.

In an admittedly simplified setting, Rochet and Tirole analyze the pricing structure—relative prices as opposed to absolute prices—adopted by firms in two-sided markets as compared to the pricing structure that would maximize social welfare. They find that a firm with a monopoly, a

110 *See* Microsoft, Developer Tools and Information for Developers, *at* http://msdn.microsoft.com/vstudio/ (last visited Jan. 30, 2003).

111 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 4.

firm with competition, and a benevolent social planner would all adopt similar pricing structures. The precise relative prices would differ somewhat.[112] However, Rochet and Tirole find that the relative prices chosen by a monopoly and competing platforms are not biased toward one side or the other compared to the pricing structure a benevolent social planner would adopt.[113] (Schmalensee finds similar results for interchange fees.[114]) There is no reason to believe that charging one side of the market relatively low prices and the other side relatively high prices is inefficient in and of itself.

Nevertheless, firms in concentrated multi-sided markets have the same opportunities as firms in concentrated single-sided markets to establish price levels that permit them to earn supra-competitive profits—i.e., profits that exceed those necessary to attract capital to the industry after accounting for risk. In multi-sided markets as in single-sided markets, however, the relevant measure is ex ante rather than ex post profits: Did the business have risk-adjusted expected profits that exceeded competitive levels upon entry? One day Amazon.com and eBay may be extremely profitable companies. If that day comes one should ignore neither the losses they incurred nor the risk they faced in getting to that point; the risk is reflected in the multitude of failures by other companies that attempted to create similar platforms, failed, and caused massive financial losses for their investors.[115]

II. Antitrust Analysis of Multi-Sided Platform Markets

The economics of multi-sided markets differs from the economics of single-sided markets in important respects. First, the individual prices charged on each side of the market do not track costs or demand on that side of the market. The fact that benefits and costs arise jointly in multiple sides of the market implies that there is no meaningful economic relationship between benefits and costs on each side of the market considered alone. Second, one cannot talk about the individual prices in isolation. Any change in demand or cost on one side of the market will necessarily affect the level and relationship of prices on all sides. Third, products in multi-sided markets may not be able to come into existence unless firms in those markets get all sides on board. This gives rise to pricing and investment strategies that differ from those taken in one-sided

112 In the special case of linear demand the pricing structures would be identical. *Id.* at 35-36.

113 *Id.* at 25.

114 *See* Schmalensee, *supra* note 14, at 118-20.

115 Josh Lerner, *Risk and the New Economy*, THE MILKEN INSTITUTE REVIEW, Third Quarter 2002, at 24.

markets and seem odd unless considered in the context of multi-sided market competition. Fourth, any analysis of social welfare must account for the pricing level, the pricing structure, and the feasible alternatives for getting all sides on board. It must also account for the possible role of not-for-profit institutions such as standards setting bodies and cooperatives.

These differences matter for antitrust analysis. Considering them will avoid the error of condemning procompetitive behavior. It is important to emphasize that multi-sided platform markets are no more or less susceptible to anti-competitive conduct than are single-sided markets. There are, however, opportunities for different kinds of anti-competitive conduct in multi-sided platform markets than in others. For example firms can engage in tactics on one side—such as exclusive contracts—that could increase their market power on all sides. There are also markets where the economics of platform businesses suggests that certain practices that may appear anti-competitive—recouping losses from "low prices" on one side through "high prices" on the other side—are natural, pro-competitive practices. Market definition, to which we now turn, is another important area where the economics of multi-sided markets change the standard analysis. One needs to take the multi-sided nature of platform businesses into account to determine market boundaries, but doing so does not have any uniform effect on whether a merger in a platform business should be considered pro-competitive or anti-competitive.

A. *Market Definition and the Evaluation of Market Power*

1. Market Definition

The general purpose of market definition is to provide a context for examining the issues that arise in an antitrust matter.[116] For cases involving alleged anti-competitive conduct, market definition helps to determine whether the defendant has enough market power to engage in certain anti-competitive tactics and whether those tactics will result in an increase in or maintenance of its market power. For merger cases, market definition helps to identify the firms that could constrain possible price increases by the merging parties and thereby helps to determine whether the merging parties will realize a significant increase in their market power. Often, market definition determines whether a firm's product is in the market or out of the market by looking at substitution in demand or supply.[117] The degree of competitiveness of the market is then assessed by calculating the distribution of market shares that participants hold, the Herfindhal-

116 RICHARD A. POSNER, ANTITRUST LAW: AN ECONOMIC PERSPECTIVE 125 (1976); *see also* CARLTON & PERLOFF, *supra* note 39, at 611-12.

117 *See* CARLTON & PERLOFF, *supra* note 39, at 612-15.

Hirschman Index ("HHI") being a commonly used measure.[118] A firm's market share is often taken as a proxy for its market power.

The U.S. Department of Justice and Federal Trade Commission, along with several economists, take a standard, mechanical approach to determining whether a firm is in the market.[119] 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 five to ten percent). If the collection of firms could do so, then presumably the firms "outside of the market" do not substantially constrain the firms "inside the market". Although primarily developed as a screening device for clearing inconsequential mergers,[120] economists and lawyers sometimes advocate using this approach to market definition in conduct cases as well.[121]

This approach, however, must be used with special care when multi-sided platforms are involved. The pricing analysis must consider all sides of the market and their interactions. This is apparent from looking at the equilibrium conditions for determining pricing levels and pricing structures in multi-sided platform markets (see, for example, Equations 2, 4 and 5 above). The Justice Department's approach in *United States v. Visa U.S.A.*[122] illustrates the problem. MasterCard and Visa service cardholders and merchants. The DOJ's economic expert asked 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.[123] This analysis failed to consider two factors. First, any decrease in cardholder volume would lead to a decrease in merchant volume. Second, if merchant volume decreases, then any profits on the merchant side would

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118 *Id.*

119 U.S. Department of Justice & Federal Trade Commission, 1992 Horizontal Merger Guidelines, 57 Fed. Reg. 41,552 (1992), revised, 4 Trade Reg. Ep. (CCH) ¶ 13,104 (Apr. 8, 1997); *see also* Alan A. Fisher et al., *Price Effects of Horizontal Mergers*, 77 CAL. L. REV. 777 (1989); Janusz A. Ordover & Robert D. Willig, *1982 Merger Guidelines: The 1982 Department of Justice Merger Guidelines: An Economic Assessment*, 71 CAL. L. REV. 535 (1983); Gregory J. Werden, *Market Delineation and the Justice Department's Merger Guidelines*, 1983 DUKE L.J. 514; Gregory J. Werden, *The History of Antitrust Market Delineation*, 76 MARQ. L. REV. 123, 190 (1992).

120 Debra A. Valentine, Federal Trade Commission, The Evolution of U.S. Merger Law, Address at the INDECOPI Conference, Federal Trade Commission, Aug. 13, 1998, *available at* http://www.ftc.gov/speeches/other/dvperumerg.htm (last visited Mar. 8, 2003).

121 For instance, the five-percent test was used to establish the relevant market in *Eastman Kodak Co. v. Image Technical Services*. Eastman Kodak Co. v. Image Technical Serv., 523 U.S. 1094 (1998). *See* Mark Patterson, *Product Definition, Product Information, and Market Power:* Kodak *in Perspective*, 73 N.C. L. REV. 185, 215-24 (1994). For recent non-merger cases, see United States v. Visa U.S.A., Inc., 163 F. Supp. 2d 322, 335-40 (S.D.N.Y. 2001); Direct Testimony of Frederick R. Warren-Boulton on behalf of the United States, at ¶¶ 26-32, United States v. Microsoft Corp. (D.D.C. 1999) (No. 98-1233) [hereinafter Warren-Boulton Testimony].

122 *See Visa U.S.A., Inc*, 163 F. Supp. 2d 322.

123 *Id.* at 336.

also decrease, leading to a decrease in merchant demand for the system (which could then lead to a decrease in cardholder demand, and so on). The DOJ's economist did not consider effects on profits on the merchant side. Changes in cardholder volume 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. The importance of the interaction between the two sides is, of course, an empirical question.[124]

This kind of mistake is easy to make. One tends to think of the services being supplied to merchants as different than the services supplied to cardholders and therefore categorize the services as being in different markets. It is natural, although wrong, to ignore the coupling. The error of treating multi-sided markets in isolation from one another is even easier when the other market is one in which the "product" is priced at zero or is given away, because in that case one does not think of firms as competing for sales. Thus, it is easy to think of shopping malls as renting space to retailers (ignoring the market for shoppers), Adobe as selling document production software (ignoring the market for readers), Palm as selling software and hardware systems for personal data management (ignoring the market for applications), and television stations as selling advertising (ignoring the market for providing content to viewers). In all these cases, the pricing and production decisions are inextricably intertwined.

There may be cases where the crossover effects are small enough that a single side constitutes a market under the merger guidelines test described above. That, however, demonstrates a weakness in the merger guidelines approach, since an understanding of multi-sided markets is necessary to identify anti-competitive conduct even if the crossover effects are small. Suppose a correct application of the merger guidelines approach finds that a single side of a multi-sided market is a relevant antitrust market. In practice, that will tend to lead the court to view market power and anti-competitive conduct within the four corners of that market. The court will tend to get the economics wrong, since the principles that explain pricing and other business behavior in a multi-sided market are fundamentally different than in a single-sided market.

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124 A full discussion of the appropriate use of market definition and market power in antitrust is beyond the scope of this Article. It should be noted, however, that the DOJ's economic expert failed to consider whether any market power that existed could have been used to harm consumers in the form of limiting American Express's ability to compete. In particular, because Visa and MasterCard operate on a not-for-profit basis, setting member fees to cover costs, any market power would not be used to raise prices, which is the typical antitrust concern. *See* HOWARD H. CHANG ET AL., HAS THE CONSUMER HARM STANDARD LOST ITS TEETH? 29-41 (AEI-Brookings Joint Ctr. for Regulatory Studies, Related Publication, August 2002), http://aei.brookings.org/admin/pdffiles/ConsumerHarm_related_pub.pdf (last visited Feb. 15, 2003).

2. Market Power

Market share as a proxy for market power is problematic in many circumstances but is especially so for businesses that compete in multi-sided platform markets.[125] Economists have shown that Cournot-competition or differentiated-market Bertrand competition among firms in single-sided markets implies that the equilibrium prices will depend on some function of market shares.[126] Those models do not apply when looking at just one side of multi-sided platform businesses. Pricing power on each side depends on the degree of competition on both sides. For example, in Rochet and Tirole's model, multihoming on one side of the market "intensifies price competition" on the other side of the market.[127] Consider also the video game industry. The pricing power of a video game console maker depends on its share of game developer efforts as well as its share of console sales.

More sophisticated analyses do not rely on market share as a proxy but instead seek to determine directly whether the firm under consideration prices above marginal cost by a significant amount. As seen earlier, however, there is no necessary relationship between price and marginal cost on any side of multi-sided platform markets. 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 from this perspective, one has to examine whether the total price is significantly above total marginal costs.

In markets in which there are significant fixed costs—the case in most, if not all, platform markets—one needs to be careful about inferring too much competitive significance even from the fact that firms' prices exceed marginal costs. If the purpose of the market power inquiry is to assess the state of competition in the industry, it makes more economic sense, in theory, to look at the risk-adjusted rate of return on investment.[128] For multi-sided platform markets, that analysis should consider the total

125 Economists have criticized for a long time the use of market share as a proxy for market power. *See* FRANKLIN M. FISHER ET AL., FOLDED, SPINDLED, AND MUTILATED: ECONOMIC ANALYSIS AND *U.S. VS. IBM* 99-100 (1983); JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM, AND DEMOCRACY 81-86 (1942); Robert Pitofsky, *New Definitions of Relevant Market and the Assault on Antitrust*, 90 COLUM. L. REV. 1805, 1810-13 (1990).

126 *See* Robert D. Willig, *Merger Analysis, Industrial Organization Theory, and Merger Guidelines*, *in* BROOKINGS PAPERS ON ECONOMIC ACTIVITY, MICROECONOMICS 199, 281 (Bailey & Winston eds., 1991); Joseph Farrell & Carl Shapiro, *Horizontal Mergers: An Equilibrium Analysis*, 80 AM. ECON. REV. 107 (1990).

127 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 5.

128 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. What is difficult is measuring *ex post* the expected return *ex ante*. Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return To Infer Monopoly Profits*, 73 AM. ECON. REV. 82 (1983).

returns and the total investment in all sides.[129] For example, eBay has made significant investments in developing buyer communities even though it realizes most of its revenues from sellers.[130] It likely charges sellers more than the marginal cost of serving them.[131] Alternatively, one could assess the degree of market power by determining the extent to which incumbents are constrained in their pricing and innovation behavior by the prospect of entry. That involves assessing the extent to which there are barriers to entry by equal or more efficient rivals—a topic I consider separately below.[132] Even markets that appear to be dominated by a single player may 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."[133] Because many of the multi-sided markets are fast moving, current leaders often face 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. 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.[134]

In merger inquiries, market power is the central inquiry: Would the merging parties have the power to increase price significantly? For mergers that involve platforms, it is not possible to answer that question without considering the combined and interrelated effects on all customer groups served by the platform. The merger of two platforms will affect their price levels and price structures. Depending on their cost and demand structures and the state of competition, the equilibrium post-merger prices

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129 *See* David S. Evans & Richard Schmalensee, *Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries*, *in* 2 INNOVATION POLICY AND THE ECONOMY 1 (Adam B. Jaffe et al. eds., 2002) (Market definition and market power are particularly complex in new-economy industries).

130 *See* EBAY, 2001 ANNUAL REPORT 7-8, 24 (2002); *see also* Evans & Iansiti, *supra* note 15.

131 Comparing price and marginal cost is problematic in dynamically competitive markets, since one would expect the dynamic competitive equilibrium to consist of surviving firms with price higher than marginal cost. Such an ex-post premium is necessary to induce firms to enter in dynamic competition in which many of them will fail. *See* Evans & Schmalensee, *supra* note 129, at 141.

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

133 *See* JULLIEN, *supra* note 14, at 34.

134 *See* CAILLAUD & JULLIEN, *supra* note 14, at 39. The authors are speaking of Internet intermediaries, but the point holds for other fast-moving dynamic markets.

could result in prices changing disproportionately and could conceivably result in one price falling.[135] There is an additional point the merger inquiry would need to consider. Mergers that increase the customer base on one side increase the value on the other side(s). Therefore, consumer welfare may increase even though prices increase on one side or in total.[136]

Consider the following hypothetical merger. There are two chains of dating clubs in Boston—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 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. Assume that dating clubs in Boston is the relevant market. Club *A* has a twenty percent share of admissions and *B* a forty percent share. Will the merger raise prices? 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.[137]

Let us suppose that the analysis shows that the merged club would charge $32 for men and give women a credit of $6 at both locations. 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. It is unclear whether dating customers are better or worse off. On average the customers pay more. But in the aggregate they could get more as well: The men may have a better

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135 For example, in the Rochet-Tirole model multihoming will, all else equal, lead to relatively lower prices on the other side of the market and relatively higher prices on the side with multihoming. *See* Rochet & Tirole, *Platform*, *supra* note 14, at 29. For example, if there are two game console platforms and most developers write games for both platforms, prices to console purchasers will be relatively lower because they could choose either platform and still get access to most games, while prices to game developers will be relatively higher. With a merger of the two game console platforms, although overall prices might increase, prices for game developers will decrease relative to prices for console purchasers and may decrease absolutely if the elimination of multihoming has a significantly strong effect.

136 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. *See* David S. Evans et al., *Demand-side Efficiencies in Merger Analysis*, 26 WORLD COMPETITION (forthcoming Summer 2003) at 10-14.

137 For an empirical application along these lines, see RYSMAN, *supra* note 33.

selection of women to choose from and the women may have a better selection of men to choose from.

3. Barriers to Entry

Barriers to entry merit separate treatment because they are important to the analysis of both market definition and market power. In market definition, barriers to entry are relevant for assessing whether firms can come into the market and thereby constrain price increases of incumbent firms. In measuring market power, barriers to entry may determine whether the firm in question[138] can exclude competitors and thereby maintain prices that exceed some competitive norm. 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."[139] The definition of barriers to entry is a controversial topic, much debated among antitrust scholars. Some take the position that anything that makes it "hard" to get into a market should be considered a barrier,[140] while others prefer to restrict use of the term to advantages that an incumbent firm has that an entrant cannot secure.[141]

Multi-sided platform markets are usually "hard" to get into in the sense sometimes used in antitrust analyses: Getting into these markets is

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138 This could involve the proposed combination of firms in a merger inquiry.

139 *E.I. du Pont*, 351 U.S. at 391.

140 "An entry barrier is any factor that permits firms already in the market to earn returns above the competitive level while deterring outsiders from entering." 2A PHILLIP E. AREEDA ET AL., ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION 56-57 (2002) (footnote omitted). This definition follows J.S. BAIN, BARRIERS TO NEW COMPETITION: THEIR CHARACTER AND CONSEQUENCES IN MANUFACTURING INDUSTRIES 11-19 (1956). For a list of court cases relying on this definition of entry barriers, see 2A PHILLIP E. AREEDA ET AL., *supra*, at 123-24.

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 128, 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 firms in industries involving substantial investments in research and development or other fixed costs are identified, incorrectly, as earning a supra-competitive return. *See id.* at 91; FISHER ET AL., *supra* note 125, at 119-69. 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. 2A AREEDA ET AL., *supra*, at 65.

141 *See* GEORGE STIGLER, THE ORGANIZATION OF INDUSTRY 67-69 (1983); *see also* CARLTON & PERLOFF, *supra* note 39, 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.

hard just as climbing stairs is hard, but entering is not hard in the same sense as gaining membership to the Augusta National Golf Club is hard.[142] Entrants may require large sums of capital.[143] That appears less true during the fairly lengthy childhoods of some platform industries; Marco Iansiti and I have found that many successful platforms start out small and expand over time.[144] Multi-sided platform markets are also hard to get into because firms must solve quite complex business problems. That complexity may, however, give subsequent entrants an advantage; they can look to the pricing structures and business models adopted by successful incumbents. When American Express entered the charge card business in 1958, for example, it could observe the success of the pricing structure that Diners Club had adopted when it entered in 1950. When Palm entered the operating system business for handheld devices, it could observe the success of Microsoft's business model of both developing applications internally as well as assisting independent developers to write applications. Lastly, building up critical mass on multiple market sides is hard. Of course, as in any market in which there are substantial scale economies in demand or supply, there is no guarantee that entry is sufficient to prevent incumbent firms from realizing risk-adjusted returns that exceed the competitive level.

The need to develop two or more sides of the market raises a potential competitive problem that does not exist in one-sided markets. A coordination problem is possible: Consumers on one side are reluctant to switch unless they expect that some consumers on the other side(s) will also switch. In a one-sided market, a consumer need only be concerned about its own decision to switch, not what other consumers will choose. In many ways, the coordination issue in multi-sided markets is analogous to the question of whether network industries exhibit lock-in effects—where consumers may be reluctant to switch to a new network and lose the benefits of network externalities unless others also switch.[145] And similar analyses are necessary to determine whether the theoretical possibility of a coordination problem is, for any particular industry, a significant one for antitrust analysis.

First, we must consider whether coordination is a big or a small problem. For example, as Microsoft entered the handheld computing industry with its PocketPC platform facing Palm, a successful incumbent,

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142 Women are never admitted, and many wealthy and influential golfers have not gotten the nod. Jeffrey Gettleman, *In a Town Tied to a Golf Club, Tradition Trumps All That Gets in Its Way*, N.Y. TIMES, Jan. 20, 2003, at 15.

143 Of course, with well-developed capital markets it is difficult to see why raising capital should be considered a barrier. *See* RICHARD A. BREALEY & STEWART C. MYERS, PRINCIPLES OF CORPORATE FINANCE 9-12 (2000).

144 *See* Evans & Iansiti, *supra* note 15.

145 Evans & Schmalensee, *supra* note 50, at 36-40.

it had to convince developers to write for its new platform. While writing for the more established platform might seem preferable, developers may also be willing to transfer (or "port") existing programs to a new platform, which might be cheaper given the initial development of the program for Palm. Moreover, even if developers are willing to write for only one platform, a new platform offers developers a choice of less competition on a smaller platform (at least initially) versus more competition on the established, larger platform. At least some developers are likely to take a bigger piece of a smaller pie.

Second, even if coordination is a non-trivial concern, competition is still likely to occur. In the extreme, suppose that coordination problems mean that only one platform will be successful at any given time. There is still likely to be competition "for the market," rather than "in the market."[146] While there may be initial losses from entering multiple sides of the market, the potential gains from becoming the one successful platform can provide substantial incentives for firms to enter and attempt to displace the incumbent. If consumers on many sides congregate to one platform, they may also congregate to a new platform that offers something better. An incumbent platform can find itself displaced quickly if it does not continue to offer all its consumers a better deal than potential entrants. (This is analogous to the situation in network industries where consumers could "tip" to an entrant much as they might tip to the incumbent network.)

Third, it is important to note that coordination is not an issue in multi-sided platform markets where multihoming is possible or common on at least one side of the market. For example, because many video game developers are willing to write for multiple platforms, potential end users of a new video game platform can expect that there will be games for it as long as the platform is sound. When multihoming is possible or common on all sides, coordination cannot be an issue at all. For instance, both cardholders and merchants typically belong to multiple card systems. Both potential cardholders and merchants of a new card system can expect that consumers on the other side will join as long as the system is attractive. The card system must still develop both sides, and that may or may not be a difficult business problem. But these are, in general, problems that all firms have to face, whether they enter early or late. Firms have to develop critical mass on all significant sides of the market. Sometimes this development requires significant investments, including foregone revenues from lower prices. However, there is no reason why this development should necessarily cost entrants more than it cost incumbents.

146 *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 HARV. L. REV. 697 (1975).

Historically, the need to build up critical mass on multiple sides in many instances has not deterred entry. In the case of payment cards, for example, there was successive entry by Diners Club (1950), American Express (1958), Visa (1966), MasterCard (1966), and Discover (1985).[147] 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).[148] Of course, in any particular platform market, switching costs or some other transaction cost may prevent a more efficient competitor from building critical mass.

The existence of significant entry barriers was a key issue in the analysis of market power in *United States v. Microsoft*—a case that involved software platforms.[149] The government and Microsoft agreed there were tens of thousands of software applications that ran on Windows. The government viewed these as a strategic asset that deterred entry into the market for operating systems. It termed this asset the "applications barrier to entry."[150] While this is not the place to treat fully whether the stock of applications was a barrier to entry in the senses discussed above, the economics of multi-sided markets does provide some notable insights. Firms in multi-sided businesses routinely invest in developing customer bases that provide value to other customers. Every firm selling a platform, from Diners Club in 1950 to eBay in 1995, has done this.[151] Many times one customer base is served at a low price, such as the developer community writing programs for Windows and other software platform vendors. This investment is pro-competitive; it makes the platform product more valuable for all customer communities. The fact that a dating club has a queue of appealing men, that American Express has premier

147 *See* EVANS & SCHMALENSEE, *supra* note 36, at 173.

148 *See* STEVEN L. KENT, THE ULTIMATE HISTORY OF VIDEO GAMES, at xi-xvi (2001).

149 *See* United States v. Microsoft Corp., 253 F.3d 34 (D.C. Cir. 2001) (*Microsoft III*); *see also* David S. Evans et al., *An Analysis of the Government's Economic Case in* U.S. v. Microsoft, 46 ANTITRUST BULL. 163 (2001); TIMOTHY F. BRESNAHAN, THE ECONOMICS OF THE MICROSOFT CASE 12 (Stanford Law School, John M. Olin Program in Law & Econ., Working Paper No. 232, Mar. 2002).

150 Warren-Boulton Testimony, *supra* note 121, ¶ 54 (This phenomenon...creates what is best termed the "applications barrier to entry." Simply put, an operating system product can rise to dominate the market, and once that dominance is achieved maintain it, because of both the large number of complementary software applications available for it and the flow of new applications that are written to it."); *see also* Direct Testimony of Franklin M. Fisher on behalf of the United States, ¶¶ 14, 70, United States v. Microsoft Corp. (D.D.C. 1999) (No. 98-1233) [hereinafter Fisher Testimony] ("As the result of economies of scale and network effects, Microsoft's high market share leads to more applications being written for its operating system, which reinforces and increases Microsoft's market share, which in turn leads to still more applications being written for Windows than for other operating systems, and so on.").

151 *See* EVANS & SCHMALENSEE, *supra* note 36, at 61-84; EBAY, 2001 ANNUAL REPORT 2, 7-8 (2002). For a more complete discussion of the strategies used by successful multi-sided firms see Evans & Iansiti, *supra* note 15.

merchants, or that the Sony PlayStation has cool games does not by itself imply that the incumbent has an advantage an entrant could not also secure.

It seems intuitive to argue, as the government did in *Microsoft*, that there is a coordination problem: The positive feedback effects between the two sides and the fact that a firm must succeed on both sides make entry difficult. However, this holds true in all multi-sided platform markets. Coordination must be shown to be a serious problem in practice, not just a theoretical possibility. Given the extent to which sequential—and often displacing—entry has taken place in these markets, the existence of the "chicken and egg" theoretical conundrum[152] does not appear empirically to be a prohibitive barrier to aspiring platform entrants.

The economics of multi-sided platform markets provides some insight into how one might analyze the applications barrier to entry issue for software platforms. Consider two software platform companies. Entrant 1 comes in before Entrant 2. To get both sides on board, 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 consider these entry barriers relative to prospective profits. For example, shortly after Microsoft introduced Windows 2.0, IBM completed OS/2.[153] However, due to its high price and incompatibility with other existing applications, OS/2 was deemed a failure.[154] The relevant question for assessing whether the stock of applications was an entry barrier is whether IBM could have succeeded had it made the same investment as Microsoft in getting both sides of the market on board, with an equal or superior operating system. Neither side in *United States v. Microsoft* addressed that question.

B. *Predatory Strategies Under the Rule of Reason*

Businesses engage in various price and non-price strategies to increase their sales and to decrease their competitors' sales. Courts

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152 *See* United States v. Microsoft Corp., 84 F. Supp. 2d 9, 18 (D.D.C. 1999).

153 The first version of OS/2 was released in December 1987, seven months after the release of Windows 2.0. *See* Michael Necasel, OS/2 Timeline 1987-1997, *at* http://pages.prodigy.net/michaln/history/timeline.html (last visited Mar. 8, 2003); *see also* Thecyberprice.com, Windows Timeline, *at* http://www.geocities.com/thecyberprice/wintimeline.htm (last visited Mar. 8, 2003).

154 *See* Martin Campbell-Kelly, *Not Only Microsoft: The Maturing of the Personal Computer Software Industry, 1982-1995*, 75 BUS. HIST. REV. 103, 127 (2001). *See also Microsoft III*, 253 F.3d at 55.

evaluate these strategies under the rule of reason to determine whether, on balance, they harm consumers and competition.

1. Predatory Pricing

The recognition that business strategies and their effects on consumers must be evaluated with respect to multiple sides of the market has 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 that side. That is true not only during the initial stage in which economists and courts have recognized the virtues of "penetration pricing,"[155] but also during the long-run equilibrium of the industry. 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.

The analyst can mistake competitive for predatory prices when looking at only one side of a multi-sided market. In Figure 1, Panel C shows an equilibrium with a negative price on one side, and Panel B shows an example with a "low price" on one side that could be lower than some measure of variable cost on that side. Either price might be deemed predatory when looked at from a one-dimensional perspective. That is not to say that multi-sided platform businesses do not engage in predatory pricing as defined by courts. Before making that determination, though, one needs to take all sides of the market into account.

To clarify the issues, let us consider extending the Brooke Group test of predatory pricing to multi-sided markets.[156] That test has two prongs: (1) Are the defendant's prices below cost? (2) Did the defendant have a reasonable prospect of recouping predatory losses?

Under the first prong, the plaintiff alleging predation must show that the defendant's prices were "below an appropriate measure of . . . costs."[157] In multi-sided markets, one needs to compare the combined price charged to all sides to the combined costs incurred for all sides. That is straightforward in matchmaking markets. One can look at the total price incurred by both sides (men and women, buyers and sellers, cardholders and merchants) for a transaction and compare that total price to the incremental cost of providing that transaction to both sides.

Consider the American Express corporate charge card. The cardholder pays nothing for a transaction and often receives various inducements that make the effective price of a transaction negative. The

155 *See* Areeda & Turner, *supra* note 146.
156 Brooke Group Ltd. v. Brown & Williamson Tobacco Corp. 509 U.S. 209, 222-24 (1993).
157 *Id.* at 222.

merchant pays about 2.7 percent of the transaction price to American Express.[158] For each transaction, American Express incurs costs for authorizing and settling the transaction with the merchant, billing the cardholder, incurring some risk of fraud or non-payment, awarding airline reward miles to the cardholder, and other expenses. With discovery from American Express, it may be relatively straightforward to calculate the total price as a percent of a typical transaction and the incremental cost for that transaction.[159] That comparison is relevant for the price prong of the Brooke Group test. The fact that cardholders pay a negative price is not relevant; it is a consequence, and quite possibly a socially efficient one, of pricing in a multi-sided market.

Comparing price and cost is a harder task in multi-sided markets that do not involve matchmaking. The problem is that there is no natural unit of account for combining and comparing prices and costs. Consider Adobe—it gives its reader away, so that price is zero. It charges $249 per license for its production software—Adobe Acrobat.[160] There is no economically meaningful way to combine those two prices. Adobe incurs a fixed cost for producing the reader and writer software. It incurs a small per copy cost for distributing the reader software and a more substantial one for distributing the writer software.[161] But with no common unit of account there is no way to add these costs up. So one cannot compare total price with total incremental cost as we did in the matchmaker situation. One could compare the total revenues received from the multiple sides of a non-matchmaking market with the total variable costs incurred for providing the multiple products—e.g., the total revenues from Adobe readers and writers versus the total variable costs of these software packages. This would identify extreme forms of predation but would not identify all situations in which incremental costs are less than incremental revenue.

Under the second prong of the test, the plaintiff must show that the defendant had "a reasonable prospect, or, under Section 2 of the Sherman Act, a dangerous probability, of recouping its investment in below-cost prices."[162] For multi-sided markets, the court needs to consider whether

158 *See* AMERICAN EXPRESS, 2001 ANNUAL REPORT 37 (2002).

159 Of course, we know from the profitability of American Express that the total price per transaction exceeds the total incremental cost per transaction. *Id.* at 35.

160 *See* Adobe, Adobe Store: Adobe Acrobat, *at* http://www.adobe.com/store/products/master.jhtml?id=catAcrobat&sourcecode=106501 (last visited Mar. 8, 2003). Various license packages are available at discount prices.

161 Data on distribution costs on each side are not available. Overall, for all Adobe products, sales and marketing expenses accounted for fifty-two percent of total operating expenses and thirty-three percent of total revenues in 2001. Sales and marketing expenses include costs incurred by sales, marketing, customer support, and distribution personnel. *See* ADOBE SYSTEMS INC., SEC FORM 10-K 27, 61 (2002).

162 *Brooke Group*, 509 U.S. at 224.

there is a dangerous probability that the defendant will raise its total price high enough and for long enough to recoup its losses during the alleged predatory phase. There is nothing novel about implementing this prong for multi-sided markets other than accounting for the multiple sides. This analysis suggests that one needs to look at recoupment possibilities throughout the multi-sided market and not just for the product whose low prices initially attracted suspicion.

United States v. Microsoft provides an interesting example of predation claims in multi-sided platform markets. The case mainly involved competition between Microsoft's Internet Explorer ("IE") and Netscape's Navigator browsers.[163] Both Microsoft and Netscape competed in multi-sided markets. Microsoft created IE in part to enable Windows to provide services to software developers writing Internet-related applications and to end users who wanted to use the Internet.[164] It included IE in Windows and provided IE for free to users of non-Microsoft software platforms.[165] It also gave away a software tool that made it easier for Internet Service Providers ("ISPs") and corporate IT departments to customize Internet Explorer.[166] Netscape provided Navigator for free to most users. Although its business model varied over time, it expected to earn profits from customer groups that would value a base of Navigator users.[167] For example, customers of Netscape's server software would value this software more if there were more users of Netscape's web browsing software. Advertisers would value Netscape's portal more if there were Navigator browser users who came there by default. And Netscape considered—how seriously is in dispute—developing Navigator into a platform for applications.[168]

The government claimed Microsoft was engaging in predatory pricing by giving IE away (indeed, offering IE at a negative price since Microsoft gave inducements for people to take it) and by giving away its toolkit.[169] Like Microsoft, Navigator had a toolkit for ISPs and corporate users. Initially Netscape sold the kit for $1,995 but subsequently gave it away.[170] This is not the place to address whether Microsoft's strategy was predatory—that would require the analysis described above. However, from the standpoint of multi-sided platform competition there is nothing

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163 United States v. Microsoft Corp., 65 F. Supp. 2d 1 (D.D.C. 1999).

164 Direct Testimony of Professor Richard Schmalensee on behalf of Microsoft Corp., at ¶¶ 206-253, United States v. Microsoft Corp. (D.D.C. 1999) (No. 98-1233).

165 *Id.*

166 Microsoft III, 253 F.3d 34, 70 (D.C. Cir. 2001).

167 *See* MICHAEL A. CUSUMANO & DAVID B. YOFFIE, COMPETING ON INTERNET TIME, LESSONS FROM NETSCAPE AND ITS BATTLE WITH MICROSOFT 97-100 (2000).

168 *See* Fisher Testimony, *supra* note 150, ¶¶ 85-86.

169 *See* Fisher Testimony, *supra* note 150, ¶¶ 91-139.

170 *See Microsoft*, 84 F. Supp. 2d at 71.

obviously unusual about either Microsoft's or Netscape's pricing strategies.[171] They both operated multi-sided platforms. They competed for one customer group (browser users) to attract other customer groups (although the two company's second sides were different). The government claimed that Microsoft invested in a no-revenue product, IE, to maintain the applications barrier to entry.[172] In the language of multi-sided platform markets, the government's claim translates into the observation that Microsoft invested in a no-revenue product to deliver one customer group (applications developers) valued by another customer group (end users). Microsoft's strategy—and Netscape's similar behavior—is common in multi-sided platform markets.[173]

2. Market Foreclosure Strategies

Exclusive contracts and product tying can be used to foreclose competitors from a market and thereby help the firm that uses these strategies to maintain or obtain a monopoly. This is a controversial and unsettled area of antitrust law, and this Article will not address all its facets.[174] Here I focus on how platform competition in multi-sided markets affects the analysis of market foreclosure strategies. With platform competition, one needs to consider how action on one side of the market affects the other sides of the market, and what competitive effects foreclosing behavior has. Successfully foreclosing a competitor on one side of a market could prevent that firm from succeeding on the other side and thereby deter platform entry. This is consistent with several post-Chicago analyses of tying, which argue that a firm may attempt to force

171 A related point concerns the fact that competition in these markets was "winner-take-all" because of substantial network effects. It is empirically difficult, if not impossible, to distinguish predatory from competitive pricing strategies in these circumstances. *See* Evans & Schmalensee, *supra* note 50; *see also* Joseph Farrell & Michael L. Katz, Competition or Predation? Schumpeterian Rivalry in Network Markets (Aug. 2001) (unpublished manuscript, on file with Yale Journal on Regulation).

172 *See* Fisher Testimony, *supra* note 150, ¶¶ 82, 92, 142.

173 The D.C. Circuit Court of Appeals rejected the government's predation claim here, although mainly because of its general skepticism about low prices being anti-competitive.

> 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.

Microsoft III, 253 F.3d 34, 68 (D.C. Cir. 2001).

174 *See* ROBERT BORK, THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF 299-309, 365-81 (1995); Christian Ahlborn, David S. Evans & Jorge Padilla, *The Antitrust Economics of Tying: A Farewell to Per Se Illegality*, ANTITRUST BULL. (forthcoming Summer 2003); Warren S. Grimes, *The Antitrust Tying Law Schism: A Critique of* Microsoft III *and a Response to Hylton and Salinger*, 70 ANTITRUST L.J. 199 (2002); Keith N. Hylton & Michael Salinger, *Tying Law and Policy: A Decision-Theoretic Approach*, 69 ANTITRUST L.J. 469 (2001); Jonathan M. Jacobson, *Exclusive Dealing, "Foreclosure," and Consumer Harm*, 70 ANTITRUST L.J. 311 (2002).

the exit of a competitor that produces a complementary good to deter future entry into the firm's primary market.[175]

Another possible difference between multi-sided and one-sided markets is that the potential for profits on the other side provides a possible incentive for exclusive contracts. One of the main Chicago School observations about exclusive contracts is that a consumer is always free not to agree to exclusivity. The conclusion is that exclusivity in contracts must reflect consumers' judgment that the benefits (lower prices or efficiencies) outweigh the costs of only dealing with one firm. In multi-sided markets, it is at least possible that there is an externality; exclusive contracts on one side might help a platform gain market power on other sides. The consumers agreeing to the exclusive contracts on one side might, at least in the short run, gain from or be indifferent to exclusivity, but they may not take into account the costs to consumers on the other sides from decreased platform competition.

As with exclusivity in one-sided markets, however, this can only be a concern if one firm has exclusivity over most or all of the market and if the exclusivity is persistent and durable. For example, consumers on the non-exclusive side could respond by moving to a competing platform, thus exerting pressure on consumers on the exclusive side to end exclusivity. Moreover, in markets with significant buyer concentration, the buyers would be reluctant to agree to exclusivity if there is some expectation that it will lead to dominance by that platform, as that will likely result in higher prices in the future for all sides. As with one-sided markets, one needs to consider whether the efficiencies from exclusive contracts—for example, in helping to create a platform that might not otherwise exist for the benefit of consumers—offset possible costs from reducing competition.

Economists and antitrust scholars recognize that exclusive dealing and tying may be innocuous or even pro-competitive in some circumstances.[176] The courts have, over time, come to agree.[177] The usual

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175 *See* Dennis W. Carlton & Michael Waldman, *The Strategic Use of Tying To Preserve and Create Market Power in Evolving Industries*, 33 RAND J. ECON. 194 (2002).

176 *See* POSNER, *supra* note 116, at 171-84; CARLTON & PERLOFF, *supra* note 39, at 303-06.

177 The Court in *Jefferson Parish* noted the potential efficiencies from tying arrangements. Jefferson Parish Hosp. Dist. No. 2 v. Hyde, 466 U.S. 2, 41 (1984). The Court in *Tampa Electric* also found that the contract in question did not foreclose competition:

> [W]e seem to have only that type of contract which "may well be of economic advantage to buyers as well as to sellers"... In the case of the buyer it 'may assure supply,' while on the part of the seller it 'may make possible the substantial reduction of selling expenses, give protection against price fluctuations, and . . . offer the possibility of a predictable market.

Tampa Electric Co. v. Nashville Coal Co., 365 U.S. 320, 333-35 (1961); *see also* Richard Posner, *The Rule of Reason and the Economic Approach: Reflections on the* Sylvania *Decision*, 45 U. CHI. L. REV. 1, 2 (1977) ("the Court in *Continental T.V., Inc. v. GTE Sylvania Inc.* repudiated *Schwinn* and held that nonprice restrictions on dealer competition are not illegal per se even if imposed in a sales contract.").

explanations for why firms engage in these practices apply, of course, to platform markets. Other plausible reasons may depend on the multi-sided nature of the markets. Consider exclusive dealing. An essential characteristic of a platform is the fact that to be viable it must be able to deliver customer group *A* to customer group *B* (and often vice versa). And there may be marquee customers whose allegiance makes it easier to get all sides on board during platform entry. Therefore, platforms may find that they can provide a more valuable product to customer group *A* if they can guarantee the delivery of some portion of customer group *B*—either a critical mass or the marquee players. Exclusive dealing contracts would appear to be efficient especially when it is expensive to multihome and when there are significant switching costs between competing platforms on, let us say, side *B*. In that case, customers on side *B* realize benefits when they can base their choice of platform providers on the number and types of *A* customers they get from this platform. Empirically, however, exclusive contracts that foreclose market competition do not appear prevalent in multi-sided markets; as we saw earlier, most multi-sided markets have multihoming on at least one side.

Tying is a fundamental business strategy in a wide variety of markets, and platform businesses are no exception.[178] Most platforms design their products or enforce rules that combine things that could, in principle, be sold separately. Media platforms require subscribers to "buy" advertising as well as content. Exchanges require sellers to "buy" specific auction services as well as access to potential buyers. Software platforms require users to "buy" APIs[179] that they may not want and that take up space on their hard drives. Payment card platforms require merchants to "buy" all of the card transactions generated by cardholders who want to use their cards at the merchant.[180] These ties obviously foreclose customers on one side or the other from certain choices that may prove beneficial to them. However, they enable the platform to internalize externalities and, therefore, provide a more valuable group of interrelated products and services to the diverse customer communities they serve. Most platforms evolve gradually,[181] and

See generally Ahlborn, Evans & Padilla, *supra* note 174, at 23 ("U.S. antitrust policy towards tying had a long journey from the hostile approach of the early *per se* rule to a modified *per se* rule willing to consider the possibility of tying efficiencies (with four judges in favor of a rule of reason) under *Jefferson Parish*, to a neutral position under the *Microsoft III* rule of reason.").

178 *See* Ahlborn, Evans & Padilla, *supra* note 174.

179 Application Programming Interfaces ("APIs") refer to modules of code contained in the operating system that applications developers can access through interfaces exposed by the operating system. The applications developers' software can provide parameters through the interface, which then result in the module performing some task and delivering its result through the interface.

180 For instance, merchants cannot "untie" American Express corporate cards from consumer-oriented American Express "Blue" cards. *See* Defendants' Supplemental Memorandum of Law in Support of Their Motion for Summary Judgment or Partial Summary Judgment at 10-11, *In re* Visa Check/MasterMoney Antitrust Litig., (E.D.N.Y. 2002) (No. CV-96-5238).

181 *See* Evans & Iansiti, *supra* note 15.

will often experiment with ties and integration in their attempts to get all sides on board and internalize externalities.[182]

Two kinds of public policies can discourage the integration of production into efficient multi-sided platforms. Antitrust policies against tying are one, and regulatory policies that impose "line-of-business" restrictions on platforms are another. Both policies are sometimes justified on the grounds that they are necessary to discourage "monopoly leveraging."[183] In the case of multi-sided platform markets, public policy needs to be careful to avoid suppressing the development of platforms that improve social welfare by internalizing externalities across diverse customer communities.

"Tying" products on one side may produce benefits to customers on the other side.[184] That occurs when customers on side *B* derive value from the fact that both they and the customers on side *A* have the same set of products or technologies. The platform may generate more value overall in this case. Given the complexities of determining pricing levels, it is not possible to predict a priori how tying will affect the price levels and the relative prices for two or more sides. However, it is possible that the combined price paid by side *A* for the tied products could be significantly lower than the prices that would emerge if the products were not tied, because the pricing structure may pass much of the overall value of the tie to side *A* rather than *B*.

C. *Countervailing 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 anti-competitive effects. Finally, in cases involving practices that are usually considered per se illegal, the courts

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182 In *Microsoft III* the D.C. Circuit Court of Appeals developed a rule of reason approach for tying in software platform markets. They recognized that, at least in certain circumstances, even the modified per se approach adopted in *Jefferson Perish* would be overly restrictive toward tying arrangements. *See Microsoft III*, 253 F.3d 34, 95-96 (D.C. Cir. 2001).

183 *See* Ahlborn, Evans & Padilla, *supra* note 174; Patrick Rey et al., The Activities of a Monopoly Firm in Adjacent Competitive Markets: Economic Consequences and Implications for Competitive Policy 21-23 (Sept. 21, 2001) (unpublished manuscript, on file with Yale Journal of Regulation).

184 I am using the word "tying" in the colloquial sense to simplify the exposition. There is little economic content in the various legal discussions of whether two products are "tied" or not.

consider whether efficiencies are so pronounced that the practices should be analyzed under the rule of reason.

Two special issues involving efficiencies arise when considering multi-sided platform markets. The first concerns the benefits that consumers receive from practices that are either essential for getting all sides on board or that get all sides on board at lower costs than alternative practices. I have already touched on some of these above in the discussion of pricing and tying strategies, for example. In this part, I discuss the efficiency consequences of cooperation among competitors in platform markets. The second concern relates to the benefits that consumers on each side obtain as a result of having access to consumers on the other side.

1. Cooperation Among Competitors

Cooperation among competitors is a common feature of multi-sided platform markets. We saw earlier that platforms improve efficiency by acting as intermediaries between multiple customer groups and internalizing the indirect externalities generated by these groups. The intermediary need not be a unitary for-profit firm. It may be an institution—a joint venture, a cooperative, or a standard-setting body—that facilitates intermediation. For example, 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 Multiple Listing Services ("MLS").[185] Multihoming also gives competitors incentives to coordinate.[186] American Express and Visa, for example, are both members of Global Platform, an international organization that sets standards for smart card technology,[187] and are using Global Platform standards in their respective efforts to develop smart cards.[188]

Multi-sided firms sometimes take actions to coordinate the behavior of their customers; standardization by one set of customers benefits the other set of customers. For instance, B2Bs have been moving towards the standardization of information that might significantly enhance and

185 Real estate boards are non-profit organizations, which represent local real estate agents and brokers and operate Multiple Listing Services in local communities. For a definition, see Homes and Real Estate: Advice and Information for Home Buyers and Homeowners [sic], Real Estate Glossary, *at* http://www.homes-and-real-estate.com/glossary/r.htm (last visited Mar. 8, 2002).

186 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, but they would also like to encourage standardization to expand overall demand.

187 *See* Global Platform, News, *at* http://www.globalplatform.org/news2.asp (last visited Mar. 8, 2003).

188 *See* Global Platform, Global Platform Specification, *at* http://international.visa.com/fb/paytech/productsplatforms/globalplatform.jsp (last visited Mar. 8, 2003); GLOBAL PLATFORM, GLOBAL PLATFORM BROCHURE, *at* http://www.globalplatform.org/pdf/GlobalPlatform_Brochure.pdf (last visited Mar. 8, 2003).

internalize the indirect network externalities created by merchants for cardholders and vice versa. A centrally set interchange fee enables the cooperatives to establish a pricing structure. A higher interchange fee tends to raise merchant fees and lower cardholder fees. The interchange fee that maximizes the profits of the association's members—or their overall output if that is the objective—is based in a complex way on the cost and demand on both sides.[195] One cannot easily determine whether the pricing structure that emerges here—or in other platform markets—is the socially optimal one.[196] There is, however, no economic basis for concluding a priori that the pricing structure established by the platform is biased toward one side or the other. More importantly, the economics literature shows that cost-based pricing rules are not in general socially or privately optimal for platforms in multi-sided markets.[197]

Antitrust authorities are rightfully suspicious about collaborations among competitors. However, legal rules that deter cooperation can result in the suppression of competition in multi-sided platform markets.[198] Platform markets tend to have significant indirect network effects and fixed costs of operation. We therefore expect that only a few platforms will be viable in many multi-sided markets. That is what we see in most of the examples we have considered. It is possible, however, to secure greater competition over the determination of pricing levels for the multiple sides if setting the pricing structure—the intermediation function—can be done centrally while the determination of the pricing levels can be done competitively. For example, the MasterCard cooperative model provides a more competitive business structure for providing payment card services than the American Express proprietary model. In fact, competition for cardholders and merchants from the bank cooperatives has forced American Express's prices down over time.[199]

2. Efficiencies from Internalizing Network Externalities

The *raison d'etre* of platforms, as we have seen, is to internalize externalities that consumers on the multiple sides cannot internalize on their own. The social surplus thereby generated is likely to be substantial

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195 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 30-31; Rochet & Tirole, *Cooperation*, *supra* note 14, at 558-59; Schmalensee, *supra* note 14, at 118-20; JULIAN WRIGHT, THE DETERMINANTS OF OPTIMAL INTERCHANGE FEES IN PAYMENT SYSTEMS (Univ. of Auckland Dep't. of Econ., Working Paper No. 220, 2001); Parker & Van Alstyne, *supra* note 14, at 12-14.

196 *See* Rochet & Tirole, *Platform*, *supra* note 14, at 31; *see also* Parker & Van Alstyne, *supra* note 14, at 14.

197 *See generally* Schmalensee, *supra* note 14. *See also* Rochet & Tirole, *Platform*, *supra* note 14, at 37-38.

198 *See generally* Howard H. Chang et al., *Some Economic Principles for Guiding Antitrust Policy Towards Joint Ventures*, 2 COLUM. BUS. L. REV. 223 (1998).

199 *See* EVANS & SCHMALENSEE, *supra* note 36, at 188-89.

automate various procedures such as requests for proposals ("RFPs"), requests for quotes ("RFQs"), fax requests, phone inquiries, and purchase orders.[189] Net Market Makers ("NMMs"), third-party intermediaries whose primary purpose is to match corporate buyers and sellers, play a pivotal role in this process.[190]

Antitrust and regulatory authorities have considered coordination among competitors in multi-sided platform markets extensively in the payment card industry in the collective setting of interchange fees (the fees paid by merchants' banks to cardholders' banks) by associations. U.S. courts considered interchange fee setting in the late 1970s and concluded "[a]n abundance of evidence was submitted from which the district court plausibly and logically could conclude that the [interchange fee] 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."[191] The Reserve Bank of Australia ("RBA") reached a different conclusion in a recent investigation.[192] It relied on its economic expert's opinion that Visa's interchange fees "may promote socially excessive card use."[193] It decided to impose cost-based regulation; interchange fees may not exceed the sum of certain direct costs that payment card issuers incurred on behalf of payment card acquirers.

The economics of multi-sided platform competition provides a straightforward analysis of the role of interchange fees.[194] Proprietary systems such as American Express have two price instruments available to get both sides on board—cardholder and merchant fees. Charge card systems—such as Diners Club and, historically, American Express—set these fees so that merchants contributed the preponderance of fees. The fees do not track marginal costs on either side of the system. This pricing structure is similar to that adopted by many other platforms in other multi-sided markets.

Members of cooperative systems such as MasterCard and Visa compete for cardholders and merchants. Absent coordination there is no way for these members to determine pricing structure and thereby

189 Roopen Roy & Abhijit Roy, *Net Market Makers: The Winners in the B2B Play!*, INDIAINITIATIVE.COM, Dec. 21, 2001, *at* http://www.indiainitiative.com/indiainitiative_new/e-business/b2b_abhi_roopen.htm (last visited Mar. 8, 2003).

190 *Id.*

191 Nat'l Bankcard Corp. v. Visa U.S.A., Inc., 779 F.2d 592, 605 (11th Cir. 1986).

192 *See* RESERVE BANK OF AUSTRALIA, REFORM OF CREDIT CARD SCHEMES IN AUSTRALIA IV, FINAL REFORMS AND REGULATION IMPACT STATEMENT (2002). The author was consultant to Visa International on this matter and co-authored a submission to the RBA.

193 *See* MICHAEL L. KATZ, RESERVE BANK OF AUSTRALIA, REFORM OF CREDIT CARD SCHEMES IN AUSTRALIA II 20 (2001) (emphasis added), *quoted in* RESERVE BANK OF AUSTRALIA, REFORM OF CREDIT CARD SCHEMES IN AUSTRALIA: A CONSULTATION DOCUMENT 32 (2001). Professor Katz did not conclude that privately optimal interchange fees in fact promote socially excessive card use, only that they *may* do so.

194 *See* Ahlborn, Evans & Padilla, *supra* note 174.

in many contexts, because each consumer on one side is providing a benefit to all consumers on the other side. This externality will rarely track the proportionality that Rochet and Tirole found in credit cards. In many matching circumstances, consumers on one side benefit from having more search possibilities on the other side, but there are sharply diminishing returns.[200] Nevertheless even small spillovers can easily add up to important magnitudes.

A numerical example based on the same equations from Parker and Van Alstyne that underlie Figure 1 demonstrates this point.[201] To provide a point of comparison, first set the externalities on each side of the market to zero. For this base case, we get a symmetric equilibrium with prices on both sides equal to 0.5 and quantities on both sides equal to 0.5. Thus, the aggregate price and the aggregate quantity each total 1. This symmetric equilibrium is analogous to Panel A in Figure 1 above. Compare this equilibrium to one in which a small positive externality of 0.1 runs from side 1 to side 2,[202] and a larger but still moderate positive externality of 0.5 runs from side 2 to side 1.[203] As compared to the first zero-externality case, for this case the aggregate price remains at 1.0, but aggregate equilibrium quantity increases from 1.0 to 1.4—a forty percent increase in total output.[204] These considerations have been found to be empirically important for yellow pages. Internalizing the indirect effects significantly increases consumer welfare for businesses that advertise in and shoppers who rely on yellow pages.[205]

The merger of two firms in a multi-sided market is an obvious place in which competition regulators should consider the efficiencies from the merger as well as its prospect for increasing prices. ATM network mergers are a good example.[206] Combining ATM networks could generate

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200 *See* Kenneth Burdett & Kenneth L. Judd, *Equilibrium Price Dispersion*, 51 ECONOMETRICA 955, 964-67 (1983); Steven Stern, *The Effects of Firm Optimizing Behaviour in Matching Models*, 57 REV. ECON. STUD. 647, 651-52 (1990).

201 Equilibrium prices are calculated from Equations 5 and 6 in Parker & Van Alstyne, with $Q_i=Q_j=V_i=V_j=1$ and the internetwork externality terms *e21* and *e12* set as described in the text above. The resulting equilibrium prices are then substituted into Equations 3 and 4 to obtain equilibrium quantities. *See* Parker & Van Alstyne, *supra* note 14, at 10-11.

202 That is, the internetwork externality effect for side 1 on side 2, *e12*, equals 0.1.

203 That is, the internetwork externality effect for side 2 on side 1, *e21*, equals 0.5. Recall that in Figure 1, the internetwork externality effect for side 2 on side 1 runs from zero in Panel A to 1.1 in Panel C.

204 The equilibrium is no longer symmetric, either. As a result of the greater externality from side 2's participation, prices on side 2 are "subsidized" by side 1: The price on side 2 falls from 0.500 to 0.357, while the price on side 1 increases to 0.643. Both equilibrium quantities increase: Side 1 quantity rises from 0.500 to 0.705, and side 2 quantity rises to 0.714.

205 *See* RYSMAN, *supra* note 33, at 1-2. This same work, however, finds that the costs of reduced competition outweigh the benefits from internalizing the network effects.

206 Robin A. Prager, *ATM Network Mergers and the Creation of Market Power*, 44 ANTITRUST BULL. 349, 355 (1999). Some examples of ATM mergers include Peak-Minibank (1996), Exchange-Instant Teller (1996), and SCS-Pacific Interchange (1992). *Id.* at 361.

consumer benefits by increasing the number of machines available to network customers; by making off-premise ATMs more feasible in supermarkets, airports, and the like as the customer base increased; and by lowering customer fees as the network providers realized lower per-transaction costs due to economies of scale. ATM network mergers could also increase market power, though, by reducing the number of potential competitors as adjacent networks merged. With fewer networks to choose from, consumers would find it more difficult to switch providers. In that case, consumers could be harmed as prices rose.[207] An empirical study of yellow pages finds that the net effect of mergers may be to reduce consumer welfare: The welfare losses from price increases swamp the welfare gains from the additional indirect network effects on both market sides.[208]

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 interrelated indirect effects. Consider the *Visa Check/MasterMoney* litigation.[209] The merchant plaintiffs claim that Visa's honor-all-cards rule requiring merchants to accept all Visa cards constitutes an illegal "tie" between credit card acceptance and debit card acceptance that forecloses competition by competing debit platforms. (Plaintiffs make the same allegation regarding MasterCard's honor-all-cards rule.) Visa and MasterCard claim that their honor-all-cards rules benefit cardholders and merchants, along the lines discussed. One way to assess these competing claims is to consider how the prices and output in the payment card industry would have evolved in the absence of the "tie"—that is, in the absence of an honor-all-cards rule that applied to debit and credit cards. Such an analysis would have to take feedback effects between the two sides into account. For example, the plaintiff merchants claim that MasterCard and Visa would have charged a lower interchange fee for debit cards to persuade merchants to take the cards in the absence of the rule. The merchants argue that the lower prices would not have any feedback effects on either side of the charge card market.[210] That is quite difficult to imagine. A lower interchange fee 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 it turn would reduce the number of debit cards held and used; that in turn would reduce the value

207 Prager found that the wave of ATM network mergers taking place in the 1990s did not result in higher prices to consumers or slower output growth. He could not distinguish, however, between a lack of increased market power and an offsetting of market power with efficiency gains. *See* Prager, *supra* note 206, at 363.

208 *See* RYSMAN, *supra* note 33.

209 *See In re* Visa Check/MasterMoney, 280 F.3d 124 (2d Cir. 2001).

210 *In re* Visa Check/MasterMoney, 192 F.R.D. 68, 74-77 (E.D.N.Y. 2000).

that merchants get from debit cards; that in turn would reduce the value of debit cards to cardholders; and so forth.[211]

Conclusion

Platform markets arise in many economically significant industries from media to payment systems to software. Some platform businesses are small—like the dating club with which we began. Others are enormous—like the MasterCard and Visa cooperatives that serve millions of merchants and cardholders around the world. Multi-sided platforms include several widely recognized brands: American Express, Bloomberg, Century 21, eBay, Microsoft, Sony, and Visa. Platforms have been part of the economic landscape for a long time: the village matchmaker from millennia past, Diners Club in the early 1950s, and Multiple Listing Services in real estate in the early 1970s.[212] Multi-sided platforms are likely to become more important parts of the economy as the information-technology revolution continues. For example, although irrational exuberance may have given dot-coms a bad name, Internet-based businesses will likely flourish over time and many of these will be multi-sided platforms.

Multi-sided platform businesses compete in ways that seem surprising from the vantage point of traditional industries but seem obvious once one understands the business problems they must solve. "Getting both sides on board," "the chicken-and-egg problem"—these are the mantras one hears from the entrepreneurs in these industries, the trade press that covers them, business gurus, and journalists. They contain important economic truths. Multi-sided platforms 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 a harder problem for multi-sided firms. Different multi-sided 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:[213] Visa, with a different pricing structure, surpassed the seemingly

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211 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 Visa Check/MasterMoney*, 280 F.3d at 154-55.

212 *See* EVANS & SCHMALENSEE, *supra* note 36, at 62-65; Joe Frey, *The Dawning of the Age of IDX*, REALTOR.ORG, Nov. 14, 2002, *at* http://www.realtor.org/realtororg.nsf/pages/dawnofIDX?OpenDocument (last visited Mar. 8, 2003).

213 Between the mid-1980s and 1996 the American Express charge and credit card share dropped from more than twenty-four percent to sixteen percent. By the mid-1990s American Express

indomitable American Express.[214] Microsoft bet on a price structure that catered to software developers. Apple did not. Bloomberg bet on a simple formula for its data terminals—a flat fee for subscribers and few charges for content providers. Despite following a similar price structure, Reuters has not come close to Bloomberg's level of success.

Business platforms provide enormous social value by internalizing externalities among different customer groups and, in some cases, by creating products and services that could not exist without this intermediation. Antitrust, regulatory, and other government policies that hinder entrepreneurs from creating and maintaining platforms come at significant cost. Of particular concern are policies that seek to prevent firms from leveraging their success in one market to other markets—line-of-business restrictions and prohibitions of tying and other cross-market practices are primary examples. This problem appears acute in telecommunications, where a web of regulations and antitrust decisions limit tying, bundling, and integrating various kinds of services.[215]

I do not mean to suggest that antitrust and regulatory scrutiny of multi-sided platforms is unwarranted. These businesses, like all businesses, may engage in strategies, from price fixing to exclusive contracts, that reduce consumer welfare. However, society needs to consider the overall effects of regulatory and antitrust intervention on consumer welfare. Does government intervention increase consumer welfare in a particular case after taking into account the role of the platform in harnessing indirect network effects? And can government scrutiny distinguish between pro-competitive and anti-competitive practices with sufficient precision that the cost of "false convictions" does not exceed the cost of "false acquittals?"[216] It is doubtful that the courts can accurately distinguish "low prices" that are anti-competitive from those that are pro-competitive in multi-sided platform markets. Indeed, the fact that low and negative prices are common and sustainable over the long run in multi-sided platform markets suggests that low and negative prices should be presumed pro-competitive in these markets. One can make the same kinds of arguments in single-sided markets; however, they have greater force for multi-sided platform markets where practices that are

realized the necessity of adopting a new business model. *See* EVANS & SCHMALENSEE, *supra* note 36, at 185-93.

214 By 1996 Visa charge and credit card share was more than forty-five percent compared to sixteen percent held by American Express. *Id.* at 174, 187.

215 *See* Alfred E. Kahn, *Thoughts on the Past, Present, and Future of Telecommunications Regulation, in* TELECOMMUNICATIONS DEREGULATION: MARKET POWER AND COST ALLOCATION ISSUES 259, 263 (John R. Allison & Dennis L. Thomas, eds., 1990); *see also* David Teece, *Telecommunications in Transition: Unbundling, Reintegration, and Competition*, 1 MICH. TELECOMM. TECH. L. REV. 47 (1995), *available at* http://www.mttlr.org/volone/teece_art.html.

216 For a discussion of this error-cost framework, see *Hylton & Salinger*, *supra* note 174.

sometimes suspect help internalize indirect network effects and where complexity makes it harder for courts to distinguish pro-competitive from anti-competitive strategies.