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BY RICHARD SCHMALENSEE

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I. INTRODUCTION

The press release announcing that Jean Tirole had been awarded the 2014 Nobel Prize in Economic Sciences noted that he had "made important theoretical research contributions in a number of areas."[2] One of his most important contributions was the discovery and pioneering analysis of multi-sided platforms ("MSPs") in his 2003 paper with Jean-Charles Rochet, *Platform Competition in Two-Sided Markets.*[3] According to Google Scholar, this paper has been cited over 1800 times, fourth among Jean's many papers. The Rochet &Tirole ("RT") paper has spawned an enormous literature in a very short time—over 200 papers by the end of 2012,[4] and the economics of multi-sided platforms is now a standard component of graduate courses in industrial organization. The RT paper is the first post-2000 academic paper to be deemed a classic by Competition Policy International, an honor it richly deserves.

What made this paper an instant classic is not some technical breakthrough, but rather its economic insights. In Sections 1 and 8, RT define MSPs and, through the examples in Section 1 and the "mini case studies" in Section 7, they show that these businesses are both common and economically important. The rest of the paper demonstrates that MSPs share a number of features that set them apart from the single-sided businesses that have dominated economic theory since Adam Smith. I am sure I am not the only industrial organization economist who had a Homer Simpson "D'oh!" moment upon first encountering the RT paper.I had previously studied two MSPs—computer operating systems and payment systems—and had even done some analysis of a monopoly payment system model closely related to the one in the RT paper,[5] without recognizing that these businesses and many others were members of a different genus than the firms described in standard textbooks.

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RT describe two-sided MSPs as very distinctive sorts of businesses, "characterized by the presence of two distinct sides whose ultimate benefit stems from interacting through a common platform," and they note that these businesses have "network externalities"—that is, platform users from one customer group or "side" are affected, positively or negatively, by platform users from the other side.[6] This describes a payments system that facilitates interactions between merchants and consumers; it does not describe a pharmaceutical manufacturer or a steel mill. RT further note that in MSPs, "the volume of transactions on and the profit of a platform depend not only on the total price charged to the parties to the transaction, but also on its decomposition" and stress at several points two-sided platforms' concern with "getting both sides on board."[7] Pharmaceutical manufacturers and steel mills usually have little trouble getting input suppliers "on board" if they are willing to pay competitive prices for the inputs they need, but payment systems need to get their prices to both merchants and consumers right if they are to attract a profitable mix of both.

Section II describes the formal analysis in the RT paper and relates it to some of the main papers in the subsequent literature. Section III outlines a few of the key implications for competition policy of the RT paper and the MSP literature that it launched.

II. THE ROCHET-TIROLE ANALYSIS

In Section 2 of their paper, RT model a monopoly platform with two sides, labeled buyers (**B**) and sellers (**S**). The platform is assumed to add value by facilitating transactions between buyers and sellers, with the number of transactions given by

$$T(P^B, P^S) = D^B(P^B)D^S(P^S). \quad (1)$$

Here $\mathbf{P^B}$ and $\mathbf{P^S}$ are the per-transaction prices charged by the platform to buyers and sellers, respectively, and $\mathbf{D^B}$ and $\mathbf{D^S}$ are the downward sloping functions that determine number of buyers and sellers, respectively, who are on board the platform. RT refer to $\mathbf{D^B}$ and $\mathbf{D^S}$ as "quasi-demand functions" because the actual demand for transactions depends on their product and thus on decisions on both sides of the market.[8] Given any value of $\mathbf{P^B}$, the lower is $\mathbf{P^S}$ the more sellers choose to be on board this platform seeking buyers, the more transactions then occur, and, it can be shown, the more valuable each of these transactions is to buyers. Similarly, the number of buyers on board this platform is determined by $\mathbf{P^B}$, and more buyers lead to more transactions and more value for sellers.

The network externality here is clear: sellers are better off when more buyers are on board, and buyers are better off when more sellers are on board. It is also clear that a platform's profit is affected by the mix of buyers and sellers, not just by the total level of participation. For any given total level of participation, $\mathbf{D^B+D^S}$, transaction volume is maximized when $\mathbf{D^B=D^S}$. Unless the two quasi-demand functions are identical, however, this is not likely to be the profit-maximizing mix. Given a constant per-transaction cost, **C**, the monopoly's profit is given by

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$$\Pi = (P^B + P^S - C)\, T(P^B, P^S). \quad (2)$$

RT show that the profit-maximizing value of the quantity in parentheses, the total per-transaction markup, is given by a classic Lerner formula involving the sum of the price elasticities of the two quasi-demand functions. They also show that because the platform cares about balanced participation by the two sides, its optimal prices are *directly* proportional to the corresponding quasi-demand elasticities—not inversely proportional as would be the case for an ordinary, one-sided monopoly selling two products. While both prices are necessarily positive in this model, one may be much higher than the other.

In this model, buyers and sellers only pay when a transaction occurs, and the level of participation of each side depends only on the per-transaction price it is charged. More generally, one can think of this platform as charging for usage only. In another canonical MSP model due to Mark Armstrong, the platform charges only

for *participation*—for being on board, not for usage—and its costs depend on participation on each side.[9] An example would be a heterosexual singles bar that has a cover charge but does not levy a per-conversation (usage) charge. In the Armstrong model the level of participation on each side depends on both the price charged to that side and (positively) on the level of participation of the other side. The optimal price to either side can be below the corresponding marginal participation cost. Thus, as is possible in the RT model and—as RT stress in Section 1—as is often observed in reality, pricing may be highly skewed, so that most or all of the profit may be earned from only one side of the platform.[10]

As RT also note, real MSPs often charge for both participation and usage. For instance, American Express charges consumers an annual membership (participation) fee and, through its rewards program, a negative usage fee. In a later paper, Rochet & Tirole present a general model with both participation and usage fees, and Weyl has provided a detailed analysis of models in which customers may value both participation and usage, and both fees may be charged.[11]

DESPITE THE PRESENCE OF NETWORK EFFECTS, MOST MSPS ARE NOT MONOPOLIES

Despite the presence of network effects, most MSPs are not monopolies, and RT devote Sections 3-6 to modeling markets with two competing platforms. This analysis is mathematically complex, but the intuition behind the main result (Proposition 3, p. 1004) is straightforward. It turns on the distinction between a situation in which customers can be members of only one platform ("single-homing") and a situation in which they can be members of two or more platforms ("multi-homing"). In the case of smart phone operating systems, for instance, most consumers single-home at any one time, while many developers multi-home by writing apps for both Android and Apple's iOS. Competition for single-homing customers is a winner-take-all struggle for all their business, while competition for multi-homing customers is competition on the margin for a larger share of their business. RT show that in their model of competition between profit-maximizing platforms, single-homing by customers on one side of the platforms tends—all else equal—to intensify price competition on that side, yielding a price structure more favorable to customers on that side.[12]

Section 4 considers the impact of "marquee" and captive buyers on the outcome of competition between for-profit platforms. A marquee buyer is defined as one whose presence makes the platform more attractive to sellers and thus shifts the sellers' quasi-demand curve out. On the other hand, the presence of a captive buyer, insensitive to price, shifts the buyers' quasi-demand curve out. For a broad class of quasi-demand functions, the presence of a marquee buyer leads to an increase in the platform's optimal price to sellers, $\mathbf{P^S}$, and a decrease in the optimal price to buyers, $\mathbf{P^B}$. Because the platform is more attractive to sellers, it is optimal to raise the price they are charged. This reduces the de facto marginal cost of providing transactions to buyers, $\mathbf{C\text{-}P^S}$, so it is optimal to reduce the price to them. Similarly, the presence of a captive buyer leads to an increase in $\mathbf{P^B}$ and a decrease in $\mathbf{P^S}$.

In a later paper, RT described these results as instances of "a simple 'seesaw principle': a factor that is conducive to a high price on one side, to the extent that is conducive to a high price on one side, to the extent

that it raises the platform's margin on that side, tends to call for a low price on the other side as attracting members on that other side becomes more profitable."[13] While this principle has a great deal of intuitive appeal, Weyl has shown that it is not a general feature of all models of MSPs.[14]

III. SOME IMPLICATIONS FOR COMPETITION POLICY

In the RT monopoly model, both prices are always positive, and there are no side-specific marginal costs to which either could be compared. Nonetheless, as they note in their introductory section and support with examples and the mini case studies in Section 7, "platforms often treat one side as a profit center and the other as a loss leader or, at best, as financially neutral."[15] This is in stark contrast with ordinary, one-sided profit-maximizing (i.e., non-predatory) firms that never set price below marginal cost and rarely continue to sell at a loss to any customer group. It complicates the antitrust economics of MSPs.[16]

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Consider, for instance, a shopping mall that provides free parking for its customers. It would be impossible correctly to evaluate a claim of predatory pricing by a nearby parking lot owner without recognizing that the mall is an MSP. It needs to attract both shoppers and stores, and, like most malls, it provides parking to its customers at a loss and earns its money from participating stores. Similarly, it would be impossible correctly to assess the welfare effects of ordering the mall to charge for pricing like the nearby parking lot without considering the impact on stores as well as on shoppers. A parking fee would directly reduce the number of customers shopping at the mall, and this would make the mall less attractive to stores. Those with long-term leases would lose profits, while others might leave. This, in turn, would make the mall even less attractive to customers, and so on.

> THE KEY POINT IS THAT ANY SOUND ANALYSIS OF WELFARE OR INJURY—OR ALMOST ANYTHING ELSE—RELATING TO AN MSP NEEDS TO CONSIDER ALL AFFECTED CUSTOMER GROUPS

The key point is that any sound analysis of welfare or injury—or almost anything else—relating to an MSP needs to consider all affected customer groups, since actions that affect one group will generally also affect the others via the network externalities that link them. Thus in assessing market power, price on one side alone is usually completely uninformative. It would make no sense to conclude that a mall lacks market power because it has to "sell" parking below cost or that it has a lot of market power because it is able to charge stores more than comparable rents downtown, where parking is scarce.

Similarly, in merger analysis it is important to consider impacts on all customer groups. This can be hard, but it isn't always. It may be sensible to look only at store rents in the case of a mall merger, for instance, since parking prices will likely remain zero. It is important to recognize, though, that the standard quantitative tools of merger analysis can't be used mechanically when multi-sidedness is important. The traditional critical loss analysis plainly doesn't apply when one price is less than marginal cost, for instance, and available merger simulations model only one-sided firms.

There is something of a paradox here. Adapting standard quantitative tools, like the UPP measure, to handle MSPs generally produces something that is very complex and data-intensive, since connections between the platforms' sides must be described quantitatively. On the other hand, recognizing that a business is an MSP often yields very useful qualitative insights immediately. Good theory raises questions that inform empirical analysis, and the economic theory of MSPs that Rochet & Tirole pioneered is very good theory indeed. ▲

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[1] Howard W. Johnson Professor of Management and Economics Emeritus, Massachusetts Institute of Technology. It is a particular pleasure to write this introduction so soon after Jean Tirole's Nobel Prize because he first studied industrial organization at MIT with Paul Joskow and me; he was a colleague of ours from 1984 until his return to France in 1992; and we have remained in touch ever since, in part through his regular visits to MIT.

[2] *Available at* http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2014/press.html.

[3] Jean-Charles Rochet & Jean Tirole, *Platform Competition in Two-Sided Markets*, I J. Eur. Econ. Assoc. 990-1029 (2003) and reprinted in this issue of *Competition Policy International.* The phrase "two-sided market" in that paper's title is somewhat unfortunate, since it suggests that "two-sidedness" is an inherent feature of some markets rather than a characteristic of some business models. For instance, Amazon.com began as a reseller, but it now also serves as a mall or marketplace, a two-sided platform where other sellers can deal with buyers. For an interesting analysis of a firm's choice between buying and reselling—a one-sided business model—and facilitating interactions between suppliers and customers—a two-sided model—*see* A. Hagiu & J. Wright, *Marketplace or Reseller*, Mgmt. Sci. forthcoming.

[4] *See* the Appendix to David S. Evans & Richard Schmalensee, *The Antitrust Analysis of Multi-Sided Platform Businesses,* University of Chicago, Institute for Law and Economics Working Paper 623, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2185373. This paper without the Appendix will appear in Oxford Handbook of International Antitrust Economics (Roger D. Blair & D. Daniel Sokol, eds., forthcoming).

[5] *See*, for instance, D.S. Evans, A.L. Nichols, & R. Schmalensee, *An Analysis of the Government's Economic Case in U.S. v. Microsoft*, 46 Antitrust Bull. 163-251 (2001) and R. Schmalensee, *Payment Systems and Interchange Fees,* 50 J. Indus. Econ. 103-122 (2002).

[6] RT, *supra* note 3 at 990. These have come to be called *indirect* network externalities, to distinguish them from the ordinary or direct network externalities that make participation in some group (fax machine users, for example, or men in a heterosexual singles bar) more or less attractive as the group becomes larger.

[7] *Id*. at 1018.

[8] In Schmalensee (2002), *supra* note 5, I called these functions "partial demands."

[9] Mark Armstrong, *Competition in Two-Sided Markets,* 37 Rand J. Econ. 668-691 (2006). I use the term "participation" here rather than "membership," which is more common in the literature, since the latter seems to imply a durable, formal connection that need not exist.

[10] For a general discussion of skewed pricing in the RT and Armstrong monopoly models, *see* Richard Schmalensee, *Why is Platform Pricing Generally Highly Skewed?* 10 Rev. Network Econ. Article 1 (2011).

[11] Jean-Charles Rochet & Jean Tirole, *Two-Sided Markets: A Progress Report,* 37 Rand J. Econ, 645-667 (2006), and E. Glen Weyl, *A Price Theory of Two-Sided Platforms*, 100 Amer. Econ. Rev. 1642-1672 (2010).

RT consider competing platforms with both membership and usage costs in Section 6, but they allow the platforms to charge only for usage.

[12] In Section 3.4, RT model competition between two member-owned cooperative MSPs, like MasterCard and Visa before their IPOs in 2006 and 2008, respectively. As in most of the theoretical literature on payment systems, RT conclude that competition will generally not yield the socially optimal price structure—even when it is sufficiently intense to eliminate any excess profit.

[13] Rochet & Tirole, *supra* note 11 at 659.

[14] Weyl, *supra* note 11 at 1659-1661. In particular, it is not a property of the Armstrong model (*supra* note 9).

[15] RT, *supra* note 3 at 991.

[16] For a more general discussion of the antitrust economics of MSPs, *see* Evans and Schmalensee, *supra* note 4.

[17] *See*, for instance, Pauline Affeldt, Lapo Filistrucchi, & Tobias J. Klein, *Upward Pricing Pressure in Two-Sided Markets,* 123 Econ. J. F505-F523 (2013).