Some Economics of Horizontal Integration in the Payments Industry[*]

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1- Introduction

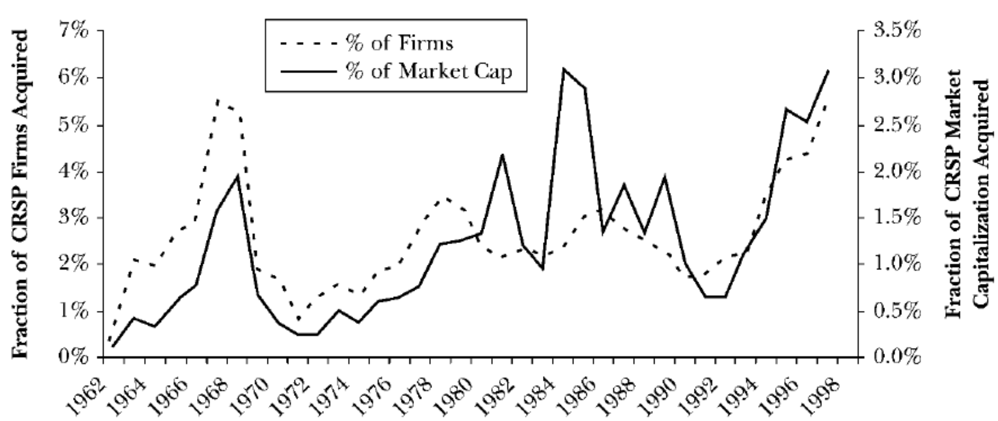
The structure of the US retail payments industry has recently experienced dramatic changes: increased concentration, entry of new firms (including nonbanks such as telecommunication and utility companies or supermarket chains), consolidation and reorganisation of IT infrastructures. This is largely due to the move to electronic payments (which now represent more than half of noncash payments in the US), but it is also clearly related to exogenous shocks of large magnitude such as financial deregulation. The on-going integration of national payments system in the Euro area, encouraged by the SEPA initiative of the European Commission, represents a shock of similar magnitude, also likely to generate a dramatic change in the retail payments landscape of continental Europe. Other regions of the world are also experiencing similar changes, as part of the consolidation and globalization of their financial services industries.[1] This article is a first pass at the economic analysis of the consequences of horizontal integration in the payments industry. We first recall the general principles of horizontal integration in other industries (Section 2). Then we study the specificities of horizontal integration within the payments industry (Section 3). Section 4 draws on the burgeoning literature on two-sided networks to try and derive some principles of horizontal integration in two-sided industries. Finally, Section 5 concludes by suggesting some policy implications.

2- Principles of Horizontal Integration

2-1 Facts

A large fraction of mergers occur in waves, as documented by Mitchell and Mulherin (1996) and Andrade et al. (2001). This is illustrated by Figure 1, taken from Andrade et al. (2001).

Figure 1: Aggregate Merger Activity



Source: Andrade et al. (2001).

[1] Claessens et al. (2003) show that networks play an increasing part in the financial services industries of many countries and argue that competition policy should be adapted accordingly.

A classical explanation of this phenomenon is that these waves of mergers are triggered by exogenous shocks such as deregulation or development of new technologies. This is confirmed by the observation that, within a wave, mergers seem to cluster by industry, as illustrated by the following table, also taken from Andrade et al. (2001).

Table 1: Top 5 Industries based on Average Annual Merger Activity

1970s	1980s	1990s
Metal Mining	Oil & Gas	Metal Mining
Real Estate	Textile	Media & Telecom.
Oil & Gas	Misc. Manufacturing	Banking
Apparel	Non-Depository Credit	Real Estate
Machinery	Food	Hotels

Source: Andrade et al. (2001).

Empirical evidence also suggests that mergers tend to discipline managers: corporate performance typically improves after a merger (Healy et al., 1992). However, Andrade et al. show that hostile takeovers have become less frequent in the recent years. In the US for example, 14.3% of takeovers were hostile in the 1980s, but the figure has fallen to 4.0% in the 1990s.

2-2 Stock market reactions

Surprisingly an horizontal merger does not seem to generate (on average) any significant change in the stock price of the acquiring firm but entails typically a significant increase for the target (Jensen and Ruback, 1983), (Andrade et al., 2001). Thus mergers increase shareholder value but this increase is mostly appropriated by the target shareholders. Another interesting empirical regularity is that the financing mode of the merger or acquisition has an impact on value creation (Loughran and Vijh, 1997). Indeed, mergers and acquisitions financed by cash seem to have no impact on acquirer shares, but lead to a large increase (18%) on target shares. By contrast, stock swaps (which amount to the combination of a cash takeover and an equity issue) seem to have a negative impact on acquirer shares, and lead to a smaller increase (11%) on target shares. A possible explanation for this is the market timing hypothesis (Shleifer and Vishny 2003, Rhodes-Kropf and Viswanathan 2004) according to which mergers and acquisitions may be triggered by overvaluation of acquirers' shares: the acquirer uses its overvalued stock to purchase the target. The overvaluation of the acquirer's shares is then corrected by the market. This may explain why stock swap mergers and acquisitions underperform cash financed ones.

Eckbo (1983) documents that the announcement of horizontal mergers often has a (short term) negative impact on the shares of rival firms. However, Yan (2006) finds that longer term impacts of horizontal mergers vary according to the "clusteredness" of the merger. He argues that waves of mergers may have a prisoners' dilemma component: due to imperfect product market competition, firms may be "forced" to merge in order to exploit technological synergies, even though this leads to an increase in competition and a decrease in profit. By contrast, "off-the-wave" mergers, simply driven by fixed costs savings, generate positive externalities on rivals. More generally, there is still a controversy on the long-run impact of mergers, in part because long term effects are almost impossible to assess (due to the absence of a clear benchmark, and the difficulty to estimate long term" normal" returns).

2-3 Reasons for mergers

From a conceptual viewpoint, the reasons for mergers and acquisitions can be classified into two categories. The first include those that increase economic surplus:

- increasing technological efficiency, by exploiting scale economies or cost synergies (rationalisation of some activities),
- increasing financial efficiency by obtaining a better access to capital markets (scale economies and diversification),
- improving governance, by removing bad managers, and thus providing incentives for managerial effort.

The second category includes the mergers and acquisitions that are beneficial to shareholders or managers[2] but are detrimental to society as a whole. The objectives of these mergers and acquisitions can be:

- increasing market power by reducing competition and/or facilitating collusion,
- allowing managers to build empires and increase their power and their perks (Jensen, 1986; Gorton et al., 2005).

The challenge for antitrust laws and regulatory agencies is to find a way to prevent the second type of mergers while allowing the first type. Economic analysis is a useful guide for this.

2-4 Economic Analysis of Mergers and Acquisitions

As already mentioned, horizontal mergers can reduce competition but may also give rise to efficiency gains (by coordinating production between different production units or by exploiting synergies). Economists have thus thrived to find simple criteria for helping competition authorities or regulatory agencies decide whether or not to allow specific mergers and acquisitions. A certain number of surprising results have emerged. First Stigler (1950)

[2] A more recent literature (Moeller et al. 2005, Malmendier and Tate, 2005) relies on behavioral assumptions: overconfident managers overestimate the future gains from mergers and acquisitions.

noted that firms which do not participate in a merger may benefit more than the firms who do participate, thus reducing the private incentives for mergers. Salant, Switzer and Reynolds (1983) (henceforth SSR) went further by suggesting that mergers may in general be unprofitable to the merging firms, basing their suggestion on the remark that the profit of a firm in a Cournot oligopoly with *n* firms is typically less than the total profit of two firms in a Cournot oligopoly with $(n+1)$ firms. This tends to suggest that the actual mergers that we observe in practice may correspond to managerial empire building and be in reality detrimental to the shareholders of merged firms, as well as to consumers. However the assumptions of the SSR paper have been widely criticized. Deneckere and Davidson (1985) show for example that the existence of product differentiation can reverse the conclusion of SSR. This is because reaction functions are typically upward sloping when firms compete in prices (like in the Bertrand model with differentiated products) while they are downward sloping when firms compete in quantities (like in a Cournot model). Thus when products are differentiated, the initial price increase by the merging firms (associated with higher market power) is reinforced by the reactions of outsiders (who also increase their prices) thus making the merger profitable.

Perry and Porter (1985) also show that horizontal mergers can be profitable when marginal costs are not constant (as supposed by SSR) but increasing. Similarly, Farrell and Shapiro (1990) criticize the use of the Herfindahl index[3] as an indicator of competitiveness for an industry. Very often, Competition Authorities tend to permit mergers that maintain the Herfindahl index of the industry below a certain threshold. Farrell and Shapiro show that output (or price) changes have to be taken into account as well. They provide conditions under which any merger that does not create synergies raises price. Spector (2003) generalizes their result and shows that if marginal costs are non decreasing then any (profitable) merger that does not generate technological synergies[4] causes price to raise. This result holds true even if new firms enter after the merger and if duplication of fixed costs is avoided among merging firms.

Thus the general message provided by economic analysis is clear: in a traditional industry, mergers that do not generate cost synergies are detrimental to social welfare. We show below that this result might no be true anymore in a two-sided industry like the payments industry.

2-5 Antitrust Policy

Both economic theory and empirical evidence thus suggest that mergers may lead to price increases, unless they generate sizable cost savings. Thus candidates for mergers need to convince competition authorities (and courts of justice) that such cost synergies will be

[3] The Herfindahl index of an industry is defined as the sum of the squares of the market shares of the firms present in the industry. A low Herfindahl index indicates that concentration is small. If for example the market is shared equally between *n* firms, the Herfindahl index is $1/n$.

[4] A merger allows merging firms to reduce their costs by rationalizing production, i.e. by coordinating output decisions across production units. Technological synergies correspond to improvements in the production technology that go beyond this simple rationalization.

present if the merger is allowed. However such efficiency defences are hard to evaluate in prospect even for experts of the field. This argument is often used to suggest that it is better to leave the decision (to allow the merger or not) to a regulatory agency (that has the competent staff to assess such efficiency defences) rather than to a court of justice that would have to resort to the advice of outside experts and may have trouble interpreting this advice, unless there is direct evidence that the merger would harm competition (like in the celebrated Staples-Office Depot case[5]).

Some economists have suggested to use stock market evidence as an indicator of the impact of mergers on competition. For example if the stock price of rivals increases upon the announcement of the merger, this might indicate that the merger will reduce competition. However, mergers can have two different types of effects on competition: unilateral effects (less competition) and coordinated effects (more collusion). A merger that helps collusion will indeed lead to stock price increases for rivals, but the reverse is true if the merger increases the market power of insiders, to the detriment of outsiders (exclusionary effects). This shows that competition authorities and courts of justice have to be cautious when using stock market evidence for assessing the competitive effects of a merger. In any case, any systematic rule linking stock price changes to merger decisions would be immediately incorporated into the expectations of investors, which would very likely destroy its significance (this is a variant of the Goodhart law on monetary policy indicators).

3- Application to the Payments Industry

3-1 General Consolidation of the Financial Services Industry

The financial services industries of many countries have experienced a general consolidation movement since the 1990s (see G-10 2001).

Table 2: Financial sector mergers and acquisitions with value greater than USD 1 billion

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number	8	10	6	11	14	23	21	49	58	46
Value (USD bn)	26.5	22.1	12.4	39.7	23.7	113.0	59.0	233.0	431.0	291.0

Source: Thomson Financial, SDC Platinum, cited in G-10 (2001).

Due to deregulation, globalization and technical change, the number of financial institutions has decreased and concentration has decreased, in particular in the banking sector, the focus of the present article. This movement of consolidation has taken two forms: mergers

[5] The proposed merger of Staples and Office Depot (two of the three leading office supply superstore chains in the USA) was challenged by the FTC by showing that Staples was able to charge higher prices in regions where it competed with Office Depot. This convinced the Court that the merger would lead to a price increase in these regions, and thus harm consumers.

and acquisitions (like in other industries) and cooperative arrangements like alliances, joint ventures, and outsourcing of payment processing to jointly owned entities. Cooperative agreements of this sort have a long tradition in banking, but there is a growing tendency for banks to specialise in the "sales functions" (collecting deposits and providing payment instruments) while outsourcing the "production function" (processing of payments) to specialized entities. Similarly, mergers and acquisitions in the banking sector have often been followed by internal reorganisation and consolidation of IT infrastructures payment functions and accounting systems. In any case consolidation does not necessarily reduce competition in a network industry. For example, in ATM networks, consolidation may enhance competition for retail deposits by allowing small banks and large banks equal access to a large number of ATM locations. By contrast, competition might be hindered if ATM networks foreclose new entrants.[6] Therefore it is not consolidation per se that matters, but the governance structure and the criteria of access to the interbank cooperative entities that are necessary for payments activities to be undertaken efficiently.

Whereas deregulation was the main driver of consolidation in the US banking industry, the creation of Euro is likely to have similar consequences in continental Europe, but probably with some delay. Anxious to stimulate competition for payment services, the European Commission has launched the SEPA (Single European Payments Area) initiative. SEPA aims to create a single market for payments throughout the Euro area. The idea is to integrate national payment systems, with the objective of generating economies of scale and making cross-border competition feasible.

3-2 Nonbanks in the Payment System

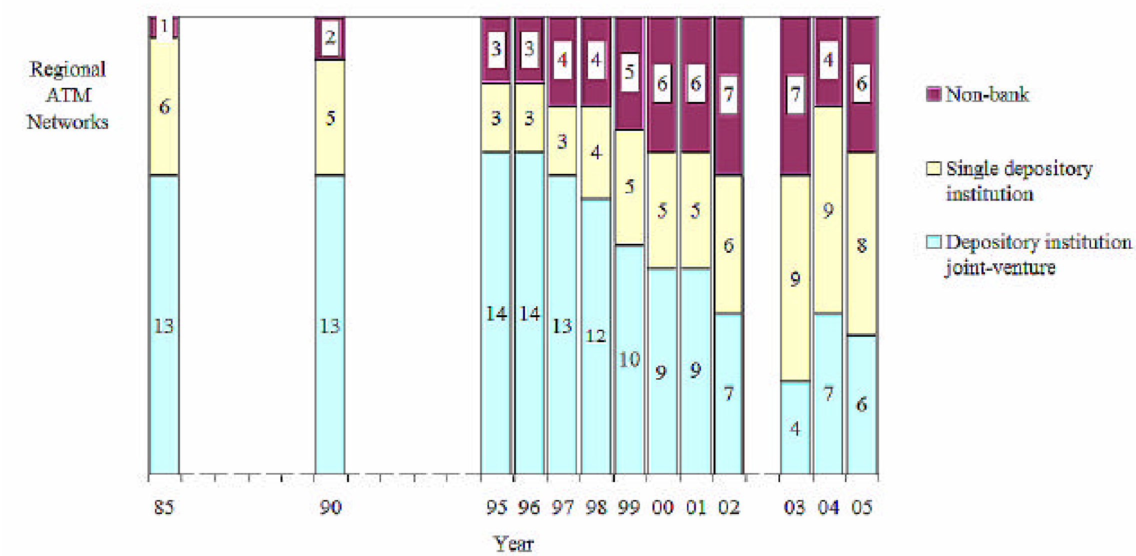
A recent book by Bradford, Davies and Weiner (2003) (henceforth, BDW) shows that, although nonbank participation in the US payments system has always existed, it has increased dramatically in the recent years. This goes hand in hand with the development of electronic payments and the consolidation in the banking industry. Roughly speaking, BDW classify payment activities in three categories: authorization, processing and instrument provision. Processing activities tend to be dominated by nonbanks. A good example is First Data, who controlled 300 million card accounts (in 2003) in the card-issuer processing business (another big player in TSYS, who controlled 250 million card accounts in 2003) and simultaneously controlled almost of the market for processing card transactions on the merchant side.[7] By contrast, card networks are largely controlled by banks or bank-owned nonbanks (but this could change if proprietary networks or merchant-controlled networks gained market share).

[6] Matutes and Padilla (1994) provide a strategic analysis of cooperation between competing banks within ATM networks. They show that full cooperation (the socially optimal outcome) is never spontaneously chosen by competing banks.

[7] Since its merger with Concord EFS, First Data also controls a large ATM network.

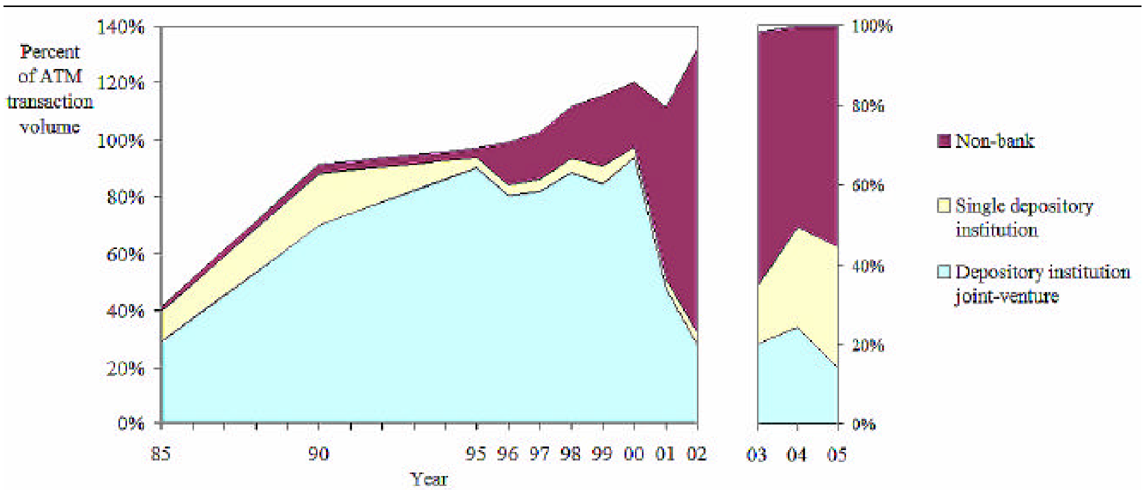
Figure 2: Ownership of Top 20 Regional ATM Networks

United States, 1985-2005



Source: EFT Network Data Book (various years), cited by Sullivan (2006).

Figure 3: Share of ATM Transaction Volume by Ownership of ATM Network



Notes: The break at 2002-2003 is due to different methods of calculating transaction volume. Prior to 2003, many ATM transactions were counted by more than one ATM network. As a result, measures of aggregate market share could be above 100 percent. Much of the double counting was eliminated for 2003 to 2005.

Source: EFT Network Data Book (various years), cited by Sullivan (2006).

In any case the increasing role of nonbanks in the payment industry seems to be essentially important from the point of view systemic (or "system-wide") risk, which is outside the scope of this paper.[8] Given our focus on competition issues, what matters for us is the governance

[8] This aspect is discussed in Sullivan (2006).

structure of an access rules to payment networks, and not so much whether they are owned or controlled by banks or nonbanks.

4- Horizontal Integration in Two-Sided Networks

By the very nature of the payment activity, any means of payment provides a **joint** service to two distinct users, the payor and the payee, whom we will call for simplicity the buyer and the seller. Except when they can perfectly bargain ex-ante on the sharing of transaction fees (the cardholder fee and the merchant service charge in the case of card payments) the structure of prices (i.e. the relative contributions of the buyer and the seller to the total cost of the payment) and not only the total price (i.e. the sum of the fees paid by the buyer and the seller) matters. Thus the payments industry is two-sided[9] (see Rochet and Tirole 2006 for a more formal definition). This section surveys briefly some economics of two-sided networks and shows how traditional antitrust analysis has to be amended to take care of this "two-sidedness" of the payments industry.

4-1 Horizontal Integration in a Network Industry

Before delving into the specificities of two sided industries, let us contrast the impact of horizontal integration in a traditional industry and in a network industry. In a traditional industry, when two or several (identical) firms with constant marginal cost compete in prices (Bertrand competition), competition drives these prices down to the (common) marginal cost of the competing firms, and thus leads to a situation that maximizes social welfare, defined as the sum of consumer surplus and industry profit (see Appendix 1 for a formal analysis). By contrast, if these firms merge and form a monopoly, the price will increase up to the (monopoly) price that equalizes the Lerner index (price minus marginal cost divided by price) with the inverse elasticity of demand. This is the main reason why mergers are often viewed as detrimental to social welfare.

Of course, we have seen that this simple reasoning may not hold anymore in some cases (differentiated products or decreasing marginal costs) but in essentially all other situations, mergers tend to be detrimental to social welfare, unless they generate technological synergies.

Appendix 2 shows that in a network industry this fundamental result does not hold, even in the simplest possible set-up: two identical firms with constant marginal costs. This is because of the network externality: consumers get a higher utility from a bigger network, therefore a greater scale of operation generates a higher economic surplus. Network externalities are thus similar to increasing returns to scale.[10]

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[9] There are many other examples of two-sided (or multi-sided) industries, like media, software, intermediaries,… See for example Evans (2002).

[10] For an economic analysis of network externalities, see for example Economides (1996) and Katz and Shapiro (1985). McAndrews (1997) discusses network issues in payment systems.

4-2 Measuring Market Power

The usual reference for reviewing mergers between horizontal competitors is the Horizontal Merger Guidelines issued jointly by the U.S. Department of Justice and the F.T.C. The main message of these Guidelines is that "mergers should not be permitted to create or enhance market power… [defined as] the ability profitably to maintain prices above competitive levels for a significant period of time.[11]" The associated test is called the SSNIP test, and aims at determining whether an hypothetical profit-maximizing monopolist would profitably impose (at least) a small but significant and non-transitory increase in price.

The SSNIP test is relatively straightforward to apply in a traditional (one-sided) industry by comparing the **actual loss** that the monopoly would make, due to decreased sales (consequently for the price increase) to the **critical loss** that the monopoly could afford, and equal to the gain on inframarginal sales. If demand elasticity is big enough, the actual loss is greater than the critical loss and the SSNIP (small but significant nontransitory increase in price) would not be profitable for the hypothetical monopoly.

However in a two-sided industry like the payment industry there are two distinct sides (the buyers' and the sellers') and thus two distinct prices, the price p_B paid by the buyer (cardholder fee in the case of a payment card network) and the price p_S paid by the seller (merchant service charge in the case of a payment card network). Thus it is not clear a priori if the SSNIP test should be applied to one side (and the corresponding price) or the other. However, Rochet and Tirole (2003) have studied the optimal pricing for a monopolist in a two-sided network such as a payment card network and shown that the pricing decision could be separated into two steps: choosing the price structure (p_B, p_S) that maximizes the volume of payments for a given total price $p_B + p_S \equiv p$; Then finding the total price p that maximizes the total profit of the monopoly network.

Therefore, as explained in more detail by Emch and Scott Thompson (2006), the SSNIP test can be extended to the payment industry[12] by using the total price cost margin (sum of price cost margins on the buyer and the seller side) as a measure of profitability (thus determining the critical loss of a hypothetical monopoly) and the elasticity of the payment volume (once price structure has been optimised) as a measure of substitutability with other payment instruments (thus determining the actual loss of a hypothetical monopoly). According to Emch and Scott-Thompson (2006), this methodology has been used in the recent merger case U.S. vs First Data Corporation and Concord EFS.[13] However, it is far from

[11] See US DOJ (1997), Section 0.1.

[12] Rochet and Tirole (2006) suggest a possible way to extend this methodology to other two-sided industries by defining the notion of "per-interaction prices" p_B and p_S (roughly speaking, this is done by aggregating fixed and variable fees on each side and dividing these aggregate prices by the number of "interactions"), "total price" $p = p_B + p_S$ and usage volume *V*. However there are important measurability issues ("usage volume" is not easy to measure) and the approach does not generalize well to the case of several firms.

[13] In 2003, the US government sued to block the merger of two large debit card networks (NYCE and STAR). The case was settled before the trial, the parties agreeing to divest the NYCE network.

clear that this aggregate measure of market power is a good indicator of social welfare changes, as we explain now.

4-3 Some Caveats

Even if the SSNIP test can be adapted to the payments industry, by looking at the total price of the payments service paid by the two users, the economic rationale behind it does not necessarily adapt to two-sided markets. In Appendix 4, we provide a formal analysis of the impact of a horizontal merger between two payment card networks. We show that even if the merger raises total price, it may surprisingly increase social welfare! This happens when buyers hold a single card (single-homing) so that competition does not lead to the socially optimal price structure and tilts the price structure towards sellers. By contrast, even if a monopoly platform chooses a higher price level (or total price), the monopolistic price structure may be socially optimal.

Thus the correct measurement of market power in a two-sided network may be more complex than it seems. Even if the total volume and the total price of card transactions give a first indication of the economic surplus generated by the network, relative prices also matter. This is similar to the "competitive bottleneck" situation identified by Armstrong (2006) in other types of two-sided industries, such as media or mobile telephones. Suppose indeed that two identical card networks compete for customers on both sides of the market (buyers and sellers) but that, for some unspecified reason, buyers find it inconvenient to hold more than one (they single-home). In this situation, a seller that decides to reject one of the cards (say card 1) loses the card transactions (and possibly the clientele) of all the buyers who hold card 1. It is as if network 1 had a de facto monopoly power (vis-à-vis sellers) on its own cardholders. Thus network 1 can charge relatively high merchant discounts, independently of its market share, whether this market share is measured on the buyer side, on the seller side, or on the total volume of card payments.

5- Some Policy Implications

As already acknowledged in the academic literature, horizontal mergers have a totally different impact in a network industry than in a traditional industry: Mergers can benefit simultaneously firms and consumers. This is because positive network externalities increase with the side of the network, and play on the demand side a role similar to increasing returns on the supply side. In a two-sided network like the payment card industry, the analysis of horizontal mergers is more complex, because the structure of prices across the two sides of the market also matters. It is true that some tools of classical antitrust analysis (such as the SSNIP test used for defining markets and measuring market power) can be adapted, by looking at the total volume and the total price of card transactions.[14] But the relation between these measures of market power and social welfare is far from clear. Moreover, as shown by Wright (2004a) using one-side logic in a two-sided context can lead to important errors of judgment. In particular, market power is not only associated with market shares (when properly defined, i.e. as fractions of total volume of card payments) but also with consumer loyalty and the extent of single-homing. The development on nonbanks control over payment networks may be problematic in terms of risks but as far as competition policy is concerned, the only thing that matters is the governance structure of the different networks and their access criteria and pricing rules. Finally, the balance between regulation and competition policy is probably even more difficult to find in two-sided networks than in classical industries.

[14] We are obviously focusing here on the payment activity: Credit functionalities, cash withdrawals and other services are left aside.

Appendix 1: Horizontal Mergers in a Traditional Industry

Consider two identical firms with constant marginal cost *c*, in a traditional industry characterized by a demand function $D(p)$. If the two firms compete in prices, the only competitive equilibrium is such that $p = c$ (the two firms charge a price equal to the marginal cost). This outcome maximizes social welfare *W*, defined as the sum of consumer surplus *CS* and industry profit π:

$$CS(p) = \int_p^\infty D(x)dx,$$
$$\pi(p) = (p - c)D(p).$$

Thus

$$W(p) = \int_p^\infty D(x)dx + (p-c)D(p)$$

is indeed maximum when

$$W'(p) = -D(p) + D(p) + (p-c)D'(p) = 0,$$

i.e. for $p = c$.

Now if the two firms merge, the newly formed monopoly will charge the price p^m that maximizes its total profit:

$$\pi(p) = (p-c)D(p).$$

p^m is characterized by the classical Lerner formula:

$$\pi'(p^m) = D(p^m) + (p^m - c)D'(p^m) = 0,$$

or

$$\frac{p^m - c}{p^m} = \frac{1}{\varepsilon} > 0.$$

where $\varepsilon = -\frac{p^m D'(p^m)}{D(p^m)}$ denotes the elasticity of demand.

Clearly here, the merger increases the industry profit π but reduces social welfare *W*.

Appendix 2: Horizontal Mergers in a Network Industry

Consider now a model where two identical networks indexed $i = 1, 2$ compete for a unit mass of consumers that are located on a Hotelling line (see Figure A.1).

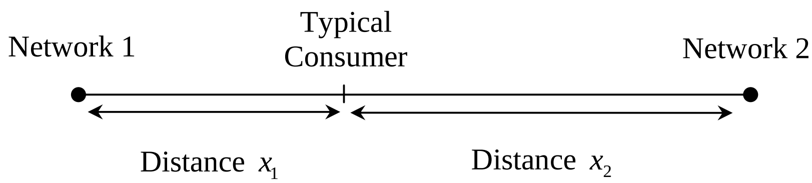

Figure A.1: Two competing networks.

The utility of a typical consumer who patronizes network *i* is:

$$u_i = u_0 + vN_i - tx_i - p_i,$$

where u_0 denotes the fixed utility obtained by joining a network, *v* represents the (marginal) utility received by each consumer each time a new member joins his network (the network externality term), N_i denotes the number (mass) of customers belonging to network *i*, $t > 2v$ is the unit transport cost, x_i is the distance between the consumer's location and network *i*, and p_i is the (fixed) price charged by network *i*. In the case where all the market is served $(N_1 + N_2 = 1)$, the marginal consumer is indifferent between the two networks:

$$u_0 + vN_1 - tx_1 - p_1 = u_0 + vN_2 - tx_2 - p_2.$$

Assuming for simplicity that consumers are uniformly distributed on the line, we have that $x_1 = N_1$ and $x_2 = N_2 = 1 - N_1$. Therefore the above conditions simplify:

$$(v - t)N_1 - p_1 = (v - t)(1 - N_1) - p_2,$$

which allows to express the demand function of network 1:

$$N_1(p_1, p_2) = \frac{1}{2} + \frac{p_2 - p_1}{2(t - v)}.$$

The demand function of network 2 is given by the symmetric expression:

$$N_2(p_1, p_2) = \frac{1}{2} + \frac{p_1 - p_2}{2(t - v)}.$$

Denoting by $c < v$ the cost of connecting a consumer to a network (other costs are neglected), we can write the profits of the two networks as:

$$\pi_1 = (p_1 - c)N_1(p_1, p_2),$$

and

$$\pi_2 = (p_2 - c)N_2(p_1, p_2),$$

The (Bertrand) equilibrium of this model is symmetric $(p_1 = p_2 = p)$, and p is given by

$$\frac{\partial \pi_i}{\partial p_i}(p, p) = N_i(p, p) + (p - c)\frac{\partial \pi_i}{\partial p_i} = 0.$$

Since $N_i(p, p) = \frac{1}{2}$ and $\frac{\partial N_i}{\partial p_i} = \frac{-1}{2(t-v)}$, we obtain:

$$p = p^c \equiv c + t - v.$$

Thus the competitive price in a differentiated network industry equals the sum of the marginal cost c and an additional term $(t - v)$, equal to the difference between the differentiation parameter t (transport cost) and the externality term v.

Social welfare is equal to the difference between the total utility of each consumer $u_0 + \frac{v}{2}$ and the sum of the connection cost c and the average transaction cost $\frac{t}{4}$:

$$W^c = u_0 + \frac{v}{2} - c - \frac{t}{4}.$$

Since total demand is 1, the industry profit π^c (where index c stands for "competitive") is equal to the price cost margin:

$$\pi^c = t - v > 0.$$

Suppose now that the two networks merge and become interconnected. The utility of a typical consumer becomes:

$$u = u_0 + vN - tx - p.$$

The marginal consumer $(x = \frac{N}{2})$ is indifferent between connecting to the network or not

$$u_0 + vN - t\frac{N}{2} - p = 0.$$

Since N cannot exceed 1 (total size of the market) the demand function of the (monopoly) network is given by

$$N(p) = \min\left(\frac{2(u_0 - p)}{t - 2v}, 1\right).$$

The profit function of the monopoly is

$$N(p) = (p - c)N(p).$$

When $u_0 > c + t - v, \pi$ is maximum for $N = 1$ and $p = p^m \equiv u_0 - \frac{t}{2} + v.$

In this case, the merger has unambiguously increased social welfare:

$$W^m = u_0 + v - c - \frac{t}{4} > W^c.$$

This is because the size of the network has increased, benefiting all consumers, while not increasing costs. It is true that a monopoly network charges higher prices but this is compensated by a higher utility for consumers.

When $u_0 > c + \frac{3t}{2} - 2v$, the merger is also profitable for the monopoly, since the industry profit is also increased:

$$\pi^m = u_0 - c - (\frac{t}{2} - v) > (t - v) = \pi^c.$$

Thus in a network industry with constant marginal cost, a profitable merger can increase social welfare. In fact network externalities are analogous to increasing returns to scale: a greater scale of operation generates a higher economic surplus.

Appendix 3: Measuring Market Power in the Payment Industry

Consider a monopoly card network that wants to select prices for the two categories of users: p_B for buyers and p_S for sellers.

For simplicity, we assume here that the two prices are per-transaction fees and that fixed fees are zero on both sides (for an analysis of two-sided industries with two part tariffs, see Rochet and Tirole 2006), and we consider only a proprietary (or three-party) payment card network. In this case the profit of a monopoly network can be written:

$$\pi = \left(p_B + p_S - c) D(p_B, p_S \right),$$

where $D(p_B, p_S)$ denotes the volume of card payments. D is the analogous of the demand function for a one-sided industry. Rochet and Tirole (2003) study the optimal pricing for a monopolist in such a context, and show that the total price chosen by the monopolist:

$$p^m \equiv p_B^m + p_S^m$$

is given by a generalized Lerner formula:

$$\frac{p^m - c}{p^m} = \frac{1}{\varepsilon},$$

where $\varepsilon = -\frac{p^m V'(p^m)}{V(p^m)}$ denotes the elasticity of the volume of card payment to a change in the total price, assuming that the monopolist selects the optimal price structure:

$$V(p) = \max_{p_B} D\left(p_B, p - p_B \right).$$

Since this volume V of card payments and the total price of payment services can be observed empirically, there is no difficulty in extending the SSNIP test to the payment industry (see Emch and Scott Thompson 2006 for details). However this test does not take into account the price structure. As shown in Appendix 4, the competitive price structure is not necessarily socially optimal.

Appendix 4: Horizontal Mergers in the Payment Card Industry

Consider the simplest possible model of the payment card industry[15] where buyers and sellers can settle transactions either by card or by an alternative payment means (cash or check). The economic surplus generated by a card payment is:

$$b_B + b_S - c,$$

where b_B (resp. b_S) denotes the buyer's (resp. seller's) convenience benefit of using the card rather than the alternative means of payment and c is the total processing cost (also measured with respect to the cost of the alternative payment means). For simplicity it is assumed that b_S is constant but b_B varies from one transaction to the other. The (per transaction) prices paid by the two users are denoted p_B (for the buyer) and p_S (for the seller). There is an asymmetry between the two sides of the market, since the seller has to decide ex-ante whether or not to accept card payments, whereas the buyer can decide at the last moment whether or not to pay by card.[16] It will be in her interest to pay by card exactly when $b_B > p_B$. The proportion of transactions settled by card is thus:

$$\Pr\left(b_B \geq p_B\right) \equiv D(p_B).$$

Assuming that p_S is low enough so that all merchants accept cards, social welfare is equal to the sum (integral) of the economic surpluses $(b_B + b_S - c)$ generated by all card payments (which occur when $b_B \geq p_B$). *W* can also be written as the sum of consumer surplus *CS*, retailer surplus *RS* and network profit π:

$$W = CS + MS + \pi,$$

where

$$\begin{aligned} CS &= \int_{p_B}^{\infty} D(x)dx, \\ RS &= (b_S - p_S)D(p_B), \\ \pi &= (p_B + p_S - c)D(p_B). \end{aligned}$$

Thus:

$$W(p_B) = \int_{p_B}^{\infty} D(x)dx + \left(b_S + p_B - c\right)D(p_B).$$

Social welfare is maximum when

$$0 = W'(p_B) = -D(p_B) + D(p_B) + \left(b_S + p_B - c\right)D'(p_B),$$

i.e. when $p_B = c - b_S$.

[15] See Rochet and Tirole (2002), Wright (2004a) and Guthrie and Wright (2005).

[16] Since there are no fixed fees, we can assume that all consumers have a card. However they need not want to use it.

Since retailer demand is inelastic, the seller price p_S does not have any impact on social welfare as long as it is not too high (so that retailers do not reject cards). For example $p_S = b_S$ is acceptable to retailers and allows the platform to break even: $p_B + p_S = c$.

If two identical card networks compete by offering perfectly substitutable cards (perfect competition) the outcome will depend on the extent of buyer multhoming.[17] If all buyers hold the two cards (complete multihoming *MH*) sellers will only accept the card that gives the highest total user surplus *TUS* (see Rochet and Tirole 2007 for details):

$$TUS \equiv CS + RS = \int_{p_B}^{\infty} D(x)dx + (b_S - p_S)D(p_B).$$

This is because sellers can reject the card that gives the lower *TUS*, knowing that all buyers also hold the other card. Given that perfect competition drives total price $p_B + p_S$ down to total cost *c*, *TUS* equals social welfare and the equilibrium outcome also maximizes social welfare:[18]

$$p_B^{MH} = c - b_S, \quad p_S^{MH} = b_S.$$

Consider now the polar case where all buyers only hold a single card (singlehoming *SH*). Sellers' resistance is now severely weakened: they are ready to accept any card that gives a positive *TUS*, since they do not want to lose profitable card transactions.

The competitive equilibrium is thus characterized by two conditions:

$$p_B + p_S - c = 0 \qquad \text{(zero profit for networks)}$$
$$TUS = 0 \qquad \text{(zero surplus for users).}$$

The competitive price structure is thus tilted towards cardholders:

$$p_B^{SH} = c - b_S - v_B < c - b_S, \quad p_S^{SH} = b_S + v_B,$$

where $v_B \equiv \dfrac{\int_{p_B}^{\infty} D(x)dx}{D(p_B)}$ denotes the option value of the card for a buyer.

Interestingly, a monopoly platform that maximizes its profit would choose the same price for sellers, but the socially optimal price for buyers:

$$p_B^m = v - b_S, \quad p_S^m = b_S + v_B.$$

Thus in the case of buyers' singlehoming, a horizontal merger would increase social welfare by restoring the "correct" price for buyers. Of course the total price $p = p_B + p_S$ would increase, but this is immaterial for social welfare. If competition authorities use consumer surplus as the criterion for allowing the merger or net, the decision would depend on a trade-off between total price and price structure: the merger increases total price but restores the correct price signal for buyers.

[17] The word multihoming belongs to the Internet jargon. Following Rochet and Tirole (2003), we say that a buyer multihomes if she owns both cards.
[18] This is not the case anymore if downstream markets are imperfect: see Rochet and Tirole (2007) for details.

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