

Report on

Entry to a Declining Market: The Case of ATMs in Finland¹

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Abstract

This report uses both qualitative analysis based on the existing literature and standard industrial organization modeling techniques to study welfare consequences of entry in the Finnish ATM market. The qualitative analysis suggests that location choices of ATMs are not likely to be a first-order welfare issue even if entry could lead to some clustering of machines. It also suggests that the short-run welfare consequences of entry on network sizes are likely to be positive but that overinvestment could be a concern in a longer run. The modeling focuses on price competition between the incumbent and the entrant(s). It turns out that that unregulated post-entry foreign and interchange fees are unambiguously too high from the welfare point of view. However, the incumbent has no incentive to use the foreign fee to foreclose the entrants. It would be more sensible to regulate the interchange fee than the foreign fee. A regulated interchange fee should be lower than the unregulated one but not too low to deter entry.

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1. Introduction

The end of the cash era has been long predicted. While the paper form of cash has turned out to be resilient, the use of cash at the daily point-of-sale transactions is clearly declining. As against this background it is surprising to observe that several new players are entering in the Finnish ATM (Automatic Teller Machine) market. The objective of this report is to understand why this entry is occurring now, what are its welfare consequences and what, if any, could constitute a reasonable regulatory response.

ATM market is a network industry of differentiated products, with primary characteristics being the location of machines. ATM technology is characterized by high fixed cost (e.g., maintenance of machines and supplying cash to them) and low marginal costs. In such circumstances the standard industrial organization theory predicts that neither free competition nor an unregulated monopoly protected from entry yields socially optimal outcome. It is hence unsurprising that, like many other related network industries such as payment cards, telecommunications, and operating systems, the ATM market poses tremendous challenges for regulators and competition authorities. The ATM industry is also of inherent interests to Central Banks given their statutory duty of ensuring smooth operation of payment systems.

This report uses both qualitative analysis based on the prevailing literature and industrial organization modeling techniques to provide insights into the emerging competition in the Finnish ATM market. The qualitative analysis focuses on network sizes, location choice and foreclosure. The existing theoretical and empirical evidence suggests that a monopoly operator chooses too small network size from the social point of view but that free market competition may yield excessive entry of ATMs, increasing the average cost per ATM transaction. The literature also indicates that while entry may yield some clustering of ATMs, location choice will not constitute a first order welfare issue.

In any market where there is a dominant incumbent, foreclosure is a serious concern. However, the report argues that this might not be an issue in the Finnish ATM market where the incumbent is a joint venture of the banks, who are multiproduct firms, and where the dimension of price competition is restricted to foreign (on-other's) and interchange fees.² It seems that ATM operation is not the most profitable business area for the banks and could even be a "loss-leader". Indeed, customers have been paying no direct fees for ATM withdrawals over the recent years. Hence, in the absence of competition, the banks might have an incentive to choose a minimum network size. For the same reasons, the banks should not have an incentive to use foreign fees to foreclose the market from the entrants.

The theoretical analysis develops a model of duopoly competition after the entry has occurred. The model takes institutional features of the Finnish ATM market as given and seeks to understand the welfare consequences of the competition as it seems to be emerging. In particular, it assumes that networks are technologically compatible, and that the incumbent network does not charge an on-us fee from withdrawals of its own ATMs nor does the entrant surcharge. While the model – like any model – abstracts from many real-world features, it yields a number of striking predictions. For example, it predicts that the entrant's equilibrium market share will settle around 1/8. Despite having a considerable higher market share the incumbent derives much less profits from ATM operations than the entrant.

The model further suggests that the foreign fee charged by the incumbent and the interchange fee received by the entrant are strategic complements but that the incumbent internalizes the effects of foreign fee on consumer usage of the entrant's network. As a

² A foreign fee, also known as an on-other's fee, is the fee charged by a cardholder's bank for the cardholder's withdrawals from an ATM belonging to a competing ATM network. An interchange fee is the fee paid by the cardholder's bank to the owner of the competing ATM for the same transaction. See Tables 1A and 1B for the taxonomy of variable ATM fees.

result, the incumbent has little incentive to foreclose the entrant, supporting the conclusions of the qualitative analysis. Unregulated competitive fees are unambiguously too high from the welfare point of view, calling for regulated lower fees. However, a blunt regulation of foreign fee alone is not recommendable. Regulation of foreign fee is reasonable if it can be made contingent on interchange fee or if it is accompanied with regulation of interchange fee. But it turns out that anything what can be achieved by regulating both fees or using contingent foreign fee can be achieved by regulating interchange fee alone. A regulated interchange fee should be lower than the unregulated one but not too low to deter entry. In short, the analysis confirms the message of the prior literature on competition in payments and telecommunications markets warranting attention to the level of interchange fee.

The rest of the report is organized as follows. In Section 2 the key characteristics of the Finnish ATM market are summarized. In Section 3 reviews the literature. In Section 4 the lessons from the literature are applied for the Finnish case. The section also summarizes the results of the theoretical model which is presented in Appendix 1 in more detail. Section 5 concludes with policy recommendations.

2. Institutional Environment³

2.1. Payment media market

The Finnish market for payment media is relatively advanced, for Finns have for some time now relied on accessing electronic payment networks at the point-of-sale (see, e.g., Amromin and Chakravorti 2007 and Leinonen 2008, for cross-country comparisons). Checks disappeared from consumer trade in the 1980s, and debit cards became

³ Most of the industry details come from the various publications of the Bank of Finland and the Federation of Finnish Financial Services

subsequently popular: In 2007, debit cards (including Visa Electron) accounted for approximately 75% of the value of all card payments.⁴

The Finnish market for payment media is concentrated, because the few main deposit banks that dominate the banking sector are the main issuers of payment media. Because the issuers of payment media are relatively homogenous the payment media, their pricing, and the ways of providing them with customers tend to be similar across the issuers, at least after controlling for the banking relationships of consumers.

From a consumer's point of view, the direct pricing of the payment media has also been quite simple (see Takala and Virén 2008a). At least one ATM or payment card is often automatically attached to a banking account as a part of a banking service package. The packages can include various payment media, whose pricing hence depends on the pricing of the banking service packages. If a payment card is not a part of the service package, an annual fee is charged. Consumers rarely face transaction fees for using a payment medium, and withdrawing cash from ATMs has been free over the recent years (with the exception of credit card withdrawals).

2.2. Cash use and the development of ATM network

It is likely to that cash usage has decreased in Finland although it is not clear how much. On the one hand, between 1999 and 2008, the use of cash as the most typical way of paying for daily consumer goods and services decreased by 49% (34 percentage points, to 37%). On the other hand, the ratio of currency in circulation to GDP has been increasing

⁴ Survey evidence suggests that between 1999 and 2008 the use of debit cards (including Visa Electron) as the most common way of paying for daily consumer goods and services increased from 17% to 57%.

over the euro era (from 1.8% in 2002 to 4.4% in 2007).⁵ A special feature of the Finnish market is that the use of cash is often preceded by the use of an ATM. For example, getting “cash back” when paying with a card (say, at a retail store) is rare. The use of cash without first accessing one’s bank account via an ATM is a habit that is restricted to the shrinking population of senior citizens that have never learned to use ATMs and to those who seek to use the euro value notes that are not available from ATMs. For the rest, using ATMs is easy, since virtually everyone has a banking account where incomes are credited directly and an ATM (compatible) card.

The first ATMs were introduced in 1971. The first network was operated jointly by the banks. ATMs remained a curiosity in the 1970s but their number started to rapidly increase in the 1980s following the introduction of bank cards in 1981. At this stage banking groups operated their own networks, which were not compatible with each others. Because deposit and loan rates were regulated, the banking groups competed by the scope of their service network. The last phase of the service competition was the expansion of ATM networks.

ATM networks were remade compatible in 1990 in the aftermath of deregulation of banking sector. The subsequent banking crisis of the early 1990s initially expanded the coverage of ATM networks, because the banks replaced their branches by ATMs to cut down costs. Eventually cost saving hunt reached the ATM networks, and the major Finnish banks formed a joint venture, Automatia, to co-operate their ATM networks in 1994. The shared ATM network was labelled as “Otto.” In the early 2000s Automatia expanded its operations to the supply of currency to bank branches. In 2001 the most of the smaller banks that have remained outside the joint venture joined in it, and since 2004 Automatia

⁵ It is however likely that a significant fraction of the euros issued from Finland migrate abroad due to tourism, large import purchases (e.g. wood and used cars) and both legal and illegal migrant workers’ salaries. Takala and Virén (2008b) estimate that the residents’ total cash holdings are some 2 billion euros smaller than the entire currency in circulation (7.8 billion euros) in 2007. But even the ratio of currency in active circulation to GDP has probably increased recently.

has owned all ATMs in Finland.

As Figures 1 shows, Automatia has been cutting back the coverage of the ATM network over its entire existence, but the amount of cash withdrawn from ATMs rose up to the launch of euro notes and has since then decreased only slightly (Figure 2).

INSERT FIGURES 1 AND 2 HERE

2.3. Entrants

Up to 2008 Automatia practically operated as a monopoly, but in 2008 three new deployers are entering to the Finnish ATM market: i) Eurocash Finland, which has already introduced ATMs in the R-kiosk outlets. Eurocash Finland is a subsidiary of Kontanten, which is an independent Swedish ATM deployer. Eurocash Finland's network is labeled as "Nosto". ii) Suomen Käteisnosto, which has announced a launch of an independent ATM network, named as "Anna", by the end of 2008. Suomen Käteisnosto is owned by a group of Finnish businessmen and co-operates with First Data, a major player in retail payment infrastructure and data processing market in the US. The introduction of the Anna network has been delayed several times. iii) The delays and other disputes in the management of Suomen Käteisnosto prompted its managing director to exit and announce an introduction of his own ATM network. As the business model of this last potential entrant is virtually the same as the Anna network, in what follows the discussion is restricted to two entrants, Nosto/Eurocash Finland and Anna/Suomen Käteisnosto.

2.4. Incumbent's and entrants' business models and strategies

The entrants' stated objectives are to give the consumers easy and secure access to cash and to be present in high traffic locations in Finland. The underlying presumption is that

there are too few ATMs in Finland. As Figures 1 and 2 indicate, the number of ATMs has been declining while the amount withdrawn from ATMs is not.⁶ A slight difference between the entrants' strategies might be that the introduction of the Nosto network is at least at the first stage based on the close cooperation with R-kiosk chain. R-kiosks calculate that having an ATM in a store will increase sales and may be willing to cross-subsidize ATMs. As the location of the R-Kiosks are fixed, the location choice is less of an issue for the Nosto network than for the Anna network in the first stage.

The differences between the entrants and the incumbent are multitude. The Otto. network has enjoyed many years of incumbency over which it should have been able to optimize the location of ATMs. As the Otto. network is owned by the banks who also issue other payment media besides cash, the goal of the Otto. network is not necessarily to maximize the profits from the ATM use. Indeed, the usage of the Otto. network's ATMs has been subject to no direct fees so far. The banks' representatives have also publicly expressed that from the banks' point of view, payment cards are preferred to cash as a means of payment. In contrast, Nosto and Anna networks are supplying only cash to consumers and are not involved in issuing other payment media.

The pricing strategies currently used are relatively simple but not necessarily transparent to consumers. The banks do not charge their cardholders for the use of Otto. ATMs, i.e., the on-us fee is zero. The entrants do not have members of their own but are nonetheless not charging customers for the use of their ATMs, i.e., the entrants do not surcharge. The banks set account fees for most of their customers and charge them for using entrants' ATM networks, i.e., there is a positive foreign (on-other's) fee. The entrants resort to an interchange fee, i.e., they received payments from cardholders' banks

⁶ The evidence from a consumer survey conducted by the Bank of Finland (February 2007) also suggests that consumers are not entirely satisfied with the coverage of ATM network (25% of the respondents regarded it too small).

according to ATM use by the cardholders.⁷ The entrants may also get a cross-subsidy from the outlets in which their ATM machine is installed. This cross subsidy could, e.g., be a negative rent paid by the outlet to the ATM owner or it could be tied to the amount of transactions.

Tables 1A and B summarize the taxonomy of variable ATM fees. Table 1A presents the full scale of variable ATM fees that could be used and makes a distinction between the ATM network organization, ATM owners, and cardholder's bank. As the Finnish banks own the incumbent network (Automatia) and the entrants own their networks, Table 1B simplifies the organization of ATM industry and pricing strategies to the purposes of the subsequent analysis.

INSERT TABLES 1A,B HERE

3. Key Insights from the Academic Literature

3.1. Location choice

Starting from the classic work of Hotelling (1929) there is a huge literature on location choice of firms using the spatial competition framework. The basic results suggest that the firms tend to cluster when location is the sole decision variable. In the case of a duopoly, for example, given the location of a rival, the best reply of a firm is to locate as closely as possible to the position of its rival. Realizing this decision rule, the rival cannot do better than locate in the market center. In this case there is too little differentiation from the social point of view.

Such clustering is not robust to price competition and specification of “transportation” costs: under plausible assumptions the simultaneous price and location

⁷ A similar interchange fee applies to all credit card withdrawals of cash.

choice leads to *the principle of maximum differentiation* (d'Aspremont et al. 1979). If pricing is a decision variable, locating as closely as possible to the rival results in intense price competition. Price competition can be softened by locating further away from the rival's location, and the rivals' local market powers are maximal when they locate as far away as possible from each others. In that case there is too much differentiation from the social point of view.

As we do observe competing firms gathering in the same locations, there has been extensive research to isolate circumstances in which the principle of maximum differentiation fails. The reasons for such a failure include ability to collude, capacity constraints and consumer search costs (see, e.g., Kultti 2007).

3.2. Entry and its deterrence

In the seminal paper on sequential entry in spatial competition framework, Prescott and Visscher (1979) show that in the absence of price competition, clustering occurs but only in the case of a duopoly. If there are more firms, however, clustering is avoided even if the pricing is not a decision variable (see also Ireland 1987).

Building on Prescott and Visscher (1979), Bonanno (1985) considers whether entry deterrence is best done via product proliferation (opening more stores than without entry threat) or location choice (choosing different locations of stores than without entry threat). It turns out that product proliferation is not always used: Sometimes the incumbent would not open more stores than a monopoly protected from entry but would rather store locations differently. Irrespective of whether incumbent uses product proliferation or location choice, the incumbent wants to spread its stores across the market. As pointed out by Kultti (2007) such dispersion is likely to worsen consumers' miscoordination, which in

turn is identified in modern competition policy theory (e.g., Fumagalli and Motta 2007) as a crucial ingredient of a successful entry deterrence strategy by a less efficient incumbent.

Even if the entry is not deterred, the literature (e.g., Shaked and Sutton 1990) generally suggests a negative correlation between existence of a rival store and entry to the same location, i.e., that there is no clustering. However, exploiting the theory of real options, Caplin and Leahy (1998) advocate the view that firms may face considerable uncertainty as to the profitability of a given location. In such circumstances, the location of a rival may lead an entrant to update its beliefs about the profitability of the location and enter to the same location. Toivanen and Waterson (2005) confirm that this pattern of entry holds in the fast food market.

Real option theory has been also used to study the timing of entry over industry lifecycle. While most of the literature focuses on entry on a growing industry, Dixit (1989) identifies circumstances in which entry to a declining industry may happen. This is possible if there has been previously too much exit and the demand is temporarily high.

3.3. ATM competition: compatibility, network sizes and pricing

The existing theory work on ATM competition largely builds on the aforementioned spatial models. It is closely related to the vast literature on regulation and competition on telecommunications market (see, e.g., Laffont and Tirole 1998 and Armstrong 2002). Some key additions on the top of the standard spatial competition model are network externality, compatibility choice, and richer pricing strategies. Early literature was developed in circumstances in which the direct pricing of ATM usage was not an issue. As a result, much of the early literature focuses on the sizes of ATM networks and compatibility choice (see, e.g., Economides and Salop 1992, Matutes and Padilla 1994, McAndrews and Rob 1996, and Shy 2001, chapter 8.2). As the (technological)

compatibility is now an industry standard, this literature is relevant today to the extent it studies network sizes and consolidation. The basic tradeoffs are clearly articulated by Snellman and Virén (2006) who show that the number of ATMs is increasing in the number of competing ATM deployers and that a monopoly ATM deployer chooses a minimum network size. A monopoly deployer can also foreclose entrants (Matutes and Padilla 1994). As argued by McAndrews and Rob (1996) and Rochet (2007), however, consolidation of ATM networks may be good for welfare as it generates larger network externalities and may intensify competition over deposits.

Following the introduction of direct fees for ATM usage in the US in 1996, the pricing of ATM services has attracted more research attention (see McAndrews 2003, for a survey of the seminal papers). As Tables 1A shows, competitors in an ATM market can use rich pricing strategies that make it hard to fully analyze price competition in the market. As a result, most of the studies focus on one or two pricing dimensions and ignore the rest. Matutes and Padilla (1994) make an early attempt to investigate the consequences of an interchange fee. The role of the interchange fee is also highlighted by Donze and Dubec (2006) who study the deployment of shared ATMs when an interchange system compensates for processing non-customers' withdrawals. As in Matutes and Padilla (1994), a higher interchange fee softens competition over deposits but increases competition to process withdrawals. Both Matutes and Padilla (1994) and Donze and Dubec (2006) abstract from surcharges and foreign fees. Massoud and Bernhardt (2002) study account fees, on-us fees and surcharges but abstract from interchange fees and foreign fees. They find that banks optimally choose high account fees and surcharges but do not charge their customers for the use of their own ATMs.

The most comprehensive model in terms of pricing strategies employed by ATM operators is Croft and Spencer (2004). They study determination of interchange, foreign

and account fees as well as surcharges, and allowing for competition between banks and non-bank ATM networks. They assume that on-us fees are set at marginal costs. They find that banks would prefer no-surcharging and no-interchange fee agreements but non-banks would always like to surcharge. If surcharging fees are set non-cooperatively, they are higher than in a joint-profit maximizing level. The interchange fee should be sufficiently high to make entry possible.

Generally, the theoretical literature suggests that, on one hand, a monopoly deployer that is protected from entry chooses too small network size from the social point of view. On the other hand, free completion may not yield socially optimal outcome either. Since the technology of ATMs is characterized by high fixed costs and low marginal costs, free market competition may yield excessive entry of ATMs thanks to “business stealing” effect (Mankiw and Whinston 1986). This may require higher prices per ATM transaction to support free-entry equilibrium. However, since the ATMs are spatially differentiated, the increased number of ATMs economizes consumer transportation costs, which may compensate the effects of higher usage fees. It is thus ultimately empirical question of whether entry or ATM price regulation increases or decreases welfare.

3.4. Empirical evidence on ATM competition and entry

Assessing empirically the welfare consequences of entry in a network industry is difficult. Fortunately, following the introduction of direct fees for ATM usage in the US in 1996, an impressive empirical literature on ATM competition has emerged. In particular, Ishii (2005), Gowrisankaran and Krainer (2007) and Ferrari et al. (2007) use the methods of structural industrial organization, enabling welfare analysis of ATM competition and

entry.⁸ Gowrisankaran and Krainer (2007) exploit the US quasi-experiment where some states (e.g., Iowa) have banned surcharge fees whereas most states (e.g., Minnesota) allow them. They find that free market competition may yield overinvestment. Banning surcharges decreases ATM operators' profits and hence their entry, but increases nonetheless consumer welfare. While such regulation would have significant distributional effects, the net effect on the welfare is likely to be insignificant. Ishii's (2005) results using data from Massachusetts broadly speaking echo these findings.

Ferrari et al. (2007) study the investment and usage in a share ATM network in Belgium where the organization of the ATM industry is close to the one that prevailed in Finland prior to entry. They find that banks substantially underinvest in shared network and that consumers use ATMs too little.

These results are in line with theory according to which a monopoly deployer provides too small network but free market competition yields excessive entry of ATMs.

4. Application to the Finnish Case

In this section the insights from the literature are applied to analyze the Finnish ATM market. As pointed out in Section 2, all entrants in the Finnish case are non-banks and all ATM cards are issued by incumbent banks. This means that the entrants cannot set on-us fees or foreign fees, nor cannot the incumbent network surcharge. In other words, the incumbent's potential pricing variables consist of on-us and foreign fees as well as account fees. Surcharges and interchange fees are available to the entrants.

In what follows the discussion is simplified by assuming that a single incumbent ATM network faces entry and competition by a single non-bank ATM network. The

⁸ There are a number of other recent empirical contributions on ATM competition such as Snellman and Virén (2006), Hannan and Borzekowski (2007) and Knittel and Stango (2007). In particular, Snellman and Virén (2006), using cross-country data, find a positive relationship between the number of competing ATM networks and the number of ATMs.

discussion also focuses on the case where the entrant's revenues come from consumers or card issuers and do not take account the possibility that the entrant would receive a cross-subsidy from the stores their ATMs are attached.

The issue of entry deterrence and foreclosure is discussed first. Given that entry has occurred, however, more attention is paid to its welfare consequences. The principal determinants of welfare implications of entry are the total network size, locations of ATMs and prices that prevail in the post-entry market equilibrium.

4.1. Entry and its deterrence

The Finnish evidence suggests that the incumbent has not used a product proliferation as an entry deterrence strategy. In theory, it could be possible that strategic entry deterrence based on location choice has been used instead. As a matter of fact, however, entry has been possible. There are number of potential reasons for that. The first is that the incumbent underestimated the probability of entry to a declining market, i.e., the incumbent has acted like a monopoly protected from entry threat and has been cutting back the network too fast. A more rational explanation is that deterring entry would have been too costly or that demand for cash has been higher than expected.

Since the incumbent is a multiproduct firm and it appears that ATM business is not profitable for the incumbent, it is also possible that the incumbent has been cutting back the ATM network so as to encourage the use of other payment media. It has rationally taken into account that this may open room for entry, but since ATM is a loss making business for the incumbent such entry would not be dramatic.

It is also possible that the incumbent has been calculating consumer miscoordination could help to deter entry even by a more efficient entrant. This is plausible given that the customers of ATMs are very fragmented and dispersed. If this is the case,

however, it appears that the entrant has been able to solve the miscoordination problem by striking deals with a chain of stores such as R-kiosks, and thereby ensuring a minimum viable market share.

4.2. Location choice and network sizes

Welfare consequences of entry partially depend on the total size of the incumbent's and entrant's ATM network and the locations of their ATMs that prevail in the post-entry equilibrium.

Not surprisingly, the literature does not provide clear guidance about the location choice. Some relevant reasons that support clustering (entrants will locate close to existing ATMs) are

- 1) Absence of full price competition. The literature suggests that if pricing is not transparently used as a strategic variable, clustering will occur.
- 2) Learning spillovers. The incumbent has been able to optimize the ATM locations over the years, and the entrant will optimally locate their ATMs to these most profitable locations.
- 3) Capacity constraints. The principle of maximum differentiation can fail if there are capacity constraints. ATMs can serve only one customer in time. Hence in high traffic locations clustering does not necessarily lead to such fierce price competition as it would lead in the locations where demand is less than supply.

Similarly, reasons that support dispersions include

- 1) Price competition. While there is no full scale price competition, the incumbent has set a foreign fee. To soften the effects of foreign fees, the entrant will not

want to locate close to existing ATMs, at least whenever they are in locations where capacity constraints are not likely to bind.

- 2) Demand uncertainty. If the incumbent has underestimated the demand for ATM services in some locations, the entrant may find it profitable to fill the gaps. The entrant can also be more efficient and profitable operate in locations which the incumbent is overlooking.

It is likely that both dispersion and clustering will be observed. Especially if the price competition becomes more extensive and transparent in the future, it will create more dispersion except for high-traffic locations where capacity constraints are binding. Since intermediate dispersion is socially optimal and some amount of dispersion is also always good for consumer welfare to economize transportation costs, it is hard to argue that entry would generate too much dispersion. Even if entry does lead to clustering to high-traffic locations, this will mitigate capacity constraints causing queues and other welfare losses to consumers. If the incumbent has been misestimating demand and reduced the network overly much, entry filling free locations should merely be welfare-improving. The location choice does not appear to be a first-order welfare issue.

Given that ATM is a network industry of high fixed costs and low marginal costs, it is possible that free competition yields too large network sizes. If the pre-entry size of the incumbent's network was too small, some amount of entry is again merely welfare improving. It is thus likely that the network size is not a welfare issue in the short run. But the long run consequences of entry on network size should not be ignored. In particular, if the ATM usage is charged more extensively in the future, entry could generate large networks, high average costs of transactions and high prices to support such competitive equilibrium. Since from a consumer's point of view higher prices are compensated by

easier access to ATMs, however, even the long-run effects of entry on network size could be negligible from the welfare point of view.⁹

4.3. ATM price competition

This section uses principal ingredients from the literature (in particular from Croft and Spencer 2004) to develop a simple model of ATM price competition where an incumbent ATM deployer (or its owners) issues all ATM cards and competes against a non-bank ATM deployer entrant which does not issue ATM cards. The formal analysis is presented in Appendix 1 and Table 1B summarizes potential pricing strategies that the entrant (ATM owner) and the incumbent (cardholder's bank) could use.

The model takes the institutional features of the Finnish ATM market as given and seeks to understand the consequences of competition as it seems to be emerging. It assumes that networks are technologically compatible, and that the incumbent network does not charge an on-us fee from withdrawals of its own ATM machines nor does the entrant surcharge. As a result, the sole ATM related pricing variable used by the incumbent is a foreign fee, i.e., the price the incumbent charges for the use of the entrant's ATMs by its cardholders. Since the entrant does not surcharge, it can only resort to an interchange fee to obtain revenues from the cardholders' banks for the access of its ATMs. The assumptions imply that the incumbent makes losses from ATM withdrawals from its machines and may have some unmodelled motivation to offer a (minimum) service.¹⁰ That is, the model predicts that if the incumbent were protected from entry, it would choose a

⁹ A caveat should be borne in mind: If some alternative, digital payment medium will clearly become superior to ATM technology and cash from the welfare point of view, a large ATM network may hamper the adoption of the superior payment medium and encourage excessive use of cash.

¹⁰ In the jargon of corporate strategy ATM service may act as a loss-leader for the incumbent. For example, offering ATM service as a part of the banking service package is necessary for a bank to attract customers. The losses made from the ATM business are covered by account fees or fees from other banking services. Also regulation could warrant the incumbent banks to maintain a minimum ATM service as a part of their banking license.

minimum ATM network size (Snellman and Virén 2006 establish the same result in a different set up).

In a departure from most of the literature, the model allows the networks' ATMs be vertically differentiated besides the standard spatial differentiation. First, a consumer may receive a different incremental utility depending on whether the consumer withdraws cash from the incumbent's or entrant's ATM machine. For example, in the Finnish case the smallest nominal value of a note withdrawn from the entrant's ATMs is 10 EUR whereas it is 20 EUR for the incumbent's ATMs, suggesting a higher incremental utility from using the entrant's machine. Second, the processing costs of a consumer's cash withdrawals can differ between the networks. For example the above mentioned difference in the minimum note value can lead to higher processing costs of the entrant's machines. We say that a deployer's ATMs are more "efficient" than its rival's ATMs if its ATMs create a larger difference between the incremental utility and costs than its rival's ATMs.

While the model is very simple, it offers some interesting predictions about the competition in the Finnish ATM market. The model suggests that foreign and interchange fees are strategic complements. The entrant has an incentive to set a high interchange fee, since this will not affect consumers' choices directly. However, a high interchange fee prompts the incumbent to raise its foreign fee. As a result, in a competitive equilibrium, the fees are relatively high. This implies that although the incumbent only makes profits from the withdrawals of the entrant's ATMs, the incumbent's equilibrium market share is high.

The model predicts that the incumbent enjoys approximately $7/8$ market share whereas the entrant is left with $1/8$. The incumbent's market share is somewhat above (below) this benchmark if its ATMs are more (less) efficient than the entrant's ATMs. Despite capturing a much larger market share, the incumbent's profits are less than a half of the entrant's profits. Since the incumbent protected from the entry threat would choose a

minimum network size, competition induces the incumbent to maintain a considerable larger network than it would otherwise do.

The model can also be used to study the regulation of ATM fees. It turns out that the incumbent internalizes the effects of foreign fee on the consumer usage of the entrant's network and, as a result, has no incentive to foreclose the entrant. The model also shows that interchange and foreign fees affect welfare only to the extent they affect market shares. If the networks' ATMs were equally efficient, a benevolent regulator would like to minimize consumer traveling costs, implying equal market shares. Since higher foreign fees increase the incumbent's market share and since the foreign and interchange fees are strategic complements, it is easy to see that the unregulated fees tend to be too high. The socially optimal foreign fee should be positive only if the entrant's ATMs are more costly than the incumbent's ATMs. The socially optimal interchange fee should be above the marginal costs of the entrant's ATMs only if the fee is too low in the first place. But it transpires that if a profitable entry is feasible with competitive foreign and interchange fees, the competitive fees are unambiguously too high from the welfare point of view.

A conclusion of the model is that regulating foreign fee alone at some fixed level does not make sense. Such regulation would leave the entrant free to set a very high interchange fee as the entrant no longer needs to take account the response of the incumbent. Joint regulation of both fees or implementing a foreign fee that is contingent on interchange fee would be preferable. However, anything what can be achieved by regulation of both fees or implementation of a contingent foreign fee can be achieved by regulating the interchange fee alone. If the interchange fee is regulated at optimal level, the incumbent will automatically choose a socially optimal foreign fee.¹¹

¹¹ The socially optimal fees here are unconstrained and do not necessarily guarantee profitability of the ATM operators. In particular, the regulated interchange fee should not be too high to deter entry. Clearly, the Ramsey pricing should be considered in the future work.

5. Conclusions with Policy Implications

This report aims at understanding the welfare consequences of entry in the Finnish ATM market and the role the regulators might play to promote efficiency in the market. It uses both qualitative analysis based on the existing literature and a theoretical model of industrial organization to isolate key issues.

ATM is a network industry, characterized by spatial product differentiation, high fixed costs and low marginal costs. Both theoretical and empirical literature suggests that in such circumstances neither unregulated competition nor a protected monopoly yields socially efficient outcome. It is, however, difficult to regulate such an industry. For example, the standard regulatory guidance based on marginal cost pricing does not generally work – even if such marginal costs were known.

It appears that the entry is a consequence of the incumbent's underinvestment in the network. Hence the short-run effects of the entry on the network size are likely to be positive. In the long run, however, the risk of overinvestment in the network coverage is real, especially if advances in other payment media render them superior to cash. The entry is not likely to lead to too much dispersion of ATMs but may lead to some clustering. As such clustering of ATMs is likely to occur in high-traffic locations where clustering may mitigate queues, location of ATM machines is hardly a first-order welfare issue.

The theoretical analysis develops a model of duopoly competition after the entry has occurred. The model predicts that the entrant's equilibrium market share will settle around 1/8. Despite having a considerable higher market share the incumbent derives much less profits from ATM operations than the entrant. The model also suggests that the foreign fee charged by the incumbent and the interchange fee received by the entrant are strategic complements. Hence the fees are likely to be too high in unregulated competition.

A key policy implication of the model is that the incumbent internalizes the effects of foreign fee on the consumer usage of the entrant's network and, as a result, has little incentive to foreclose the entrant. A blunt regulation of foreign fee alone is not recommendable. Regulating foreign fee is reasonable if it can be made contingent on interchange fee or if it is accompanied with regulation of interchange fee. However, it turns out that anything that can be achieved by regulating both fees or using contingent foreign fee can be achieved by regulating interchange fee alone. But even regulation of interchange fee is not simple: although the unregulated interchange fee is too high from the welfare point of view, the regulated one should not be too low to deter entry. In short, the analysis confirms the message of the prior literature on competition and regulation of payments and telecommunications markets calling for attention to the level of interchange fee.

There are a number of issues the report does not consider. It does not take into account that the possibility that entry could be invited by a store, i.e., the ATM owner would receive a cross-subsidy from an outlet's in which the ATM are attached. Such a scenario could be feasible since there is evidence that ATMs increase the sales of outlets in which they are attached. This could suggest that ATM industry should be considered as a two-sided market like other payment media (see, e.g., Rochet and Tirole 2006), with ATM deployers competing as platforms for consumer withdrawals and merchant acceptance of ATMs in their locations.¹²

Nor does the report take into account the incentives to invest in new payment media or new ATM technologies. Incorporation of such investment incentives into optimal regulation of network industries is a challenging but an important task and may modify the received wisdom derived from static models (Kotakorpi, Puhakka and Takalo 2004).

¹² Interestingly, in the ATM market the interchange fee has a reverse direction than in the payment card industry (i.e., it is paid from issuers to acquirers rather than from acquires to issuers).

The model also abstracts from the competition between banks and does not explain why the banks want to maintain a free ATM service. It is hence a little awkward to study the standard Ramsey pricing in this simple set up. This and other important policy issues must wait for future research.

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Appendix 1. Bank v. non-bank network competition in an ATM market

In this appendix I present a simplified version of the model of ATM competition put forward by Croft and Spencer (2004), tailoring it to the institutional features of the Finnish ATM market. Compared with Croft and Spencer (2004) the model abstracts from surcharges (which are not used in Finland) and account fees but allows for vertical differentiation of ATMs and analysis of optimal regulation of foreign and interchange fees.

Consider two networks indexed $i = O, N$ that compete for a unit mass of consumers that are uniformly distributed on a Hotelling line (see Figure A.1).

INSERT FIGURE A.1. HERE

The networks are technologically compatible but network O is the sole issuer of ATM cards. Following the market practice, I assume that network O does not charge an on-us

fee.¹³ As a result, the sole pricing variable used by network O is the foreign fee, i.e., the price network O charges for the use of ATMs by network N. Similarly, it is assumed that network N does not surcharge, so network N can only obtain revenues by receiving interchange fee payments from network O for the access of its ATM machines. Note that because network O issues all cards, surcharges by network O and on-us and foreign fees by network N are immaterial. Table 1B summarizes potential pricing strategies that the entrant (ATM owner) and the incumbent (cardholder's bank) could use.

For simplicity, it is assumed that each consumer makes just one withdrawal and hence the number of consumers is a proxy for the number of transactions. The utility of a typical consumer who obtains cash from an ATM operated by network O is then

$$u_O = M_O - tx_O$$

where M_O denotes the incremental utility received by each consumer from using an ATM of network O, t is the unit travelling cost (disutility of not getting cash immediately) and x_O is the distance from a consumer's location to the nearest ATM of network O. Correspondingly, the utility of a consumer who withdraws cash from an ATM owned by network N is

$$u_N = M_N - f - tx_N$$

where f is the foreign fee charged by network O.

It is assumed that M_i , $i \in \{O, N\}$, is sufficiently large so that in equilibrium all consumers have an ATM (compatible) card. In this case the marginal consumer is indifferent between the two networks:

$$M_O - tx_O = M_N - f - tx_N.$$

Since consumers are uniformly distributed on the line, we have that $x_O = 1 - x_N$. Therefore the above expression can be rewritten as

¹³ Croft and Spencer (2004) exogenously assign on-us fees equal to marginal costs. Here it is assumed that the on-us fee is set below marginal costs.

$$X_O(f) = \frac{1}{2} + \frac{f + \Delta M}{2t},$$

where $\Delta M \equiv M_O - M_N$ captures the difference between the service quality of network O's and N's ATMs. Note that the quality difference can be either positive or negative. This equation shows the market share of network O as a function of the foreign fee. The market share of network N is then

$$X_N(f) = 1 - X_O(f) = \frac{1}{2} - \frac{f - \Delta M}{2t}.$$

Let c_i denote the cost an ATM withdrawal causes to network $i \in \{O, N\}$ and let a denote the interchange (access) fee paid by network O to network N. The profit function of network O can then be written as

$$\pi_O = -c_O X_O(f) + X_N(f)(f - a).$$

In the equation for π_O the first term captures the losses caused to network O by the use of its own ATM machines. Recall that because network O does not charge an on-us fee by assumption, operating an own ATM network represents only costs to the owners of the network (like in the monopoly network case of Snellman and Virén 2006). The second term comes from the profits (assuming that $f > a$) derived from cash withdrawals of its cardholders from the rival's network.

The profit function of network N is given by

$$\pi_N = X_N(f)(a - c_N).$$

Following the literature (e.g., Laffont, Rey and Tirole 1998, Croft and Spencer 2004, and Donze and Dubec 2006) I consider a two-stage game where an interchange fee is set first and then usage fees are chosen. So network N first chooses the interchange fee and then network O sets its foreign fee. From a practical point of view, such timing could be motivated, e.g., by international Visa and MasterCard fall-back rules that are more difficult to change than networks' usage charges. As usual, the game is solved backwards.

In stage two, networks O chooses foreign fee f to maximize its profits π_O , taking as given the interchange fee a . The first-order condition is given by

$$\frac{\partial \pi_O}{\partial f} = -\frac{\partial X_O}{\partial f} c_O - \frac{\partial X_O}{\partial f} (f - a) + 1 - X_O = 0.$$

Since $\frac{\partial X_O}{\partial f} > 0$, the first-order condition shows how an increase in the foreign fee increases the market share of network O but the increase in the market share is only costly from the network O's point of view. The first term captures the costs of increased withdrawals from its own machines. The second term captures the normal demand response for the price increase, i.e., network N's market share shrinks. As the use of network N's ATMs generates profits to network O, the shrinkage of network N's share is also costly from network O's point of view. The last term depicts marginal revenues of the increased foreign fee. In effect, the first-order condition is just the standard monopolist's pricing equation, where marginal revenues from a price increase must equal its marginal costs, taking into account the demand response. The equation shows that network O internalizes the effects of the foreign fee on the consumer usage of network N and, as a result, network O never has an incentive to use foreign fee to foreclose network N.

Solving the first-order condition for f yields

$$f = \frac{a+t-\Delta M-c_O}{2}.$$

This pricing rule shows that the foreign fee optimally charged by network O is increasing in the interchange fee – the fees of the two networks are strategic complements. As usually, it is increasing in the cost of transportation. The fee is decreasing in the own costs and the service quality difference. If the use of network O's machines becomes more costly, network O lowers the foreign fee to discourage such use. Similarly, if ΔM is negative, consumers are more inclined to use network N's ATMs, and network O can hence raise the foreign fee.

In stage one, network N chooses interchange fee a so as to maximize its profits π_N , taking into account the above pricing rule for foreign fee f . The first-order condition reads as

$$\frac{d\pi_N}{da} = \frac{\partial\pi_N}{\partial f} \frac{df}{da} + \frac{\partial\pi_N}{\partial a} = \frac{\partial X_N}{\partial f} \frac{(a - c_N)}{2} + X_N = 0.$$

Here the first term is negative, since an increase in the interchange fee prompts network O to raise its foreign fee due to strategic complementarity, which decreases the market share of network N. Term $\frac{\partial\pi_N}{\partial f} \frac{\partial X_N}{\partial f} (a - c_N) = -\frac{a - c_N}{2t}$ captures the negative profit effect of the declined market share. The second term captures the marginal revenues of the increased fee. Using network O's pricing rule for foreign fee to solve the first-order condition gives

$$a = a^c \equiv \frac{t - \Delta M + c_O + c_N}{2}.$$

Substituting this for the pricing rule for f yields

$$f = f^c \equiv \frac{3(t - \Delta M) - \Delta c}{4},$$

where $\Delta c \equiv c_O - c_N$ depicts the marginal cost difference between network O's and network N's machines. Like the service quality difference ΔM , the cost difference can be either positive or negative.

The equations for a^c and f^c show that both competitive (unregulated) equilibrium ATM prices depend on travelling costs, service quality difference, and the marginal costs of ATM withdrawals as one could expect. Note that while competitive interchange fee a^c is increasing in the costs of ATM withdrawals irrespective of the network, competitive foreign fee f^c is increasing only in the cost difference between network N's and network O's machines.

Substituting equilibrium foreign fee f^c for the market share equations X_O and X_N yields

$$X_O = \frac{7}{8} + \frac{\Delta M - \Delta c}{8t}$$

and

$$X_N = \frac{1}{8} - \frac{\Delta M - \Delta c}{8t}.$$

Since $\Delta M - \Delta c = M_O - c_O - (M_N - c_N)$, $\Delta M - \Delta c$ can be thought of capturing relative efficiency of network O's and N's ATMs. As a result, the equilibrium market share equations show that if the networks' ATMs are approximately equally efficient in the sense that service qualities and marginal costs of withdrawals cancel out each other or are roughly the same irrespective of the network, in unregulated equilibrium network O captures approximately 7/8 of the market and network N is left with 1/8 of the market. The market share of network O is higher (lower) than this benchmark if its ATMs are more (less) efficient than the ATMs of network N.

By substituting the equilibrium market shares and prices for the profit functions of the networks, competitive equilibrium profits can be written as

$$\pi_N = \frac{(t + \Delta c - \Delta M)^2}{16t}$$

and

$$\pi_O = \frac{(t + \Delta c - \Delta M)^2}{32t} - c_O = \frac{\pi_N}{2} - c_O.$$

In words, the profit of network N is increasing in the cost difference and decreasing in the service quality difference as one could expect. The profits of network O behave more unusually, being decreasing in the service quality difference and the marginal costs of withdrawals of network N. But the result becomes intuitive upon recalling that the network O only derives profits from the use of network N's ATMs. More usually, one can show that the profits of the network O are decreasing in its own cost. Even if network O is enjoying a high market share its profits are much smaller than the profits of network N.

This is not surprising given that network O is not charging an on-us fee and hence it makes losses from cash withdrawals from its own machines.

Social welfare is given by

$$W = \int_0^{X_O} (M_O - tx)dx - c_O \int_0^{X_O} dx + \int_{X_O}^1 (f - a)dx + \int_{X_O}^1 (M_N - f - (1 - x)t)dx + \int_{X_O}^1 (a - c_N)dx,$$

which simplifies to

$$W = M_O \int_0^{X_O} dx + M_N \int_{X_O}^1 dx - \int_0^{X_O} (c_O + tx)dx - \int_{X_O}^1 [c_N + (1 - x)t]dx.$$

The first and second term depict the gross utility consumers get from cash withdrawals from network O's and N's ATMs, respectively, and the third and fourth term capture the costs associated with ATM use (consumers' travelling costs to the nearest ATM and the marginal costs of withdrawals incurred by networks O and N).

As the equation for W shows, welfare does not directly depend on the foreign and interchange fees, since they merely represent transfers between the networks. Welfare, however, indirectly depends on the fees as they affect how the market is split between the networks, i.e., the fees affect X_O (recall that X_O is increasing in f which in turn is increasing in a). Because the networks are asymmetric in terms of their efficiency and pricing strategies, there are tariff-mediated externalities, and unregulated market competition will hardly yield socially optimal outcome.

Let us now consider a socially optimal foreign fee. Maximizing W with respect to f by using Leibnitz's rule yields

$$\frac{dW}{df} = \frac{dX_O}{df} [t(1 - 2X_O) + \Delta M - \Delta c] = 0.$$

Solving this first-order condition for f gives

$$f = f^* \equiv -\Delta c.$$

The socially optimal foreign fee should be positive only if the marginal cost difference is negative, i.e., only if network O's machines are more cost efficient than network N's machines.

Using an analogous procedure, the socially optimal interchange fee can be written as

$$a = a^* \equiv \Delta M - \Delta c + c_N - t .$$

The rule for the socially optimal interchange fee is somewhat more complicated but makes sense. As the interchange fee discourages the use of network N due to the strategic complementarity of the fees, the interchange fee should be high, if withdrawing from network O's machines yields more utility to consumers or if operating O's machines is less costlier. The optimal interchange fee is also decreasing in the transportation costs, again thanks to the strategic complementarity of the fees.

Comparing now competitive fees f^c and a^c to the socially optimal fees f^* and a^* shows that the unregulated fees are too high (small) if

$$t > (<) \Delta M - \Delta c .$$

That is, if the networks' machines are approximately equally efficient or network O's machines are less efficient, competitive fees are too high. Equilibrium market share and profit equations imply that $t > \Delta M - \Delta c$ is a necessary and sufficient condition for network N to have a positive market share and profit in equilibrium. In other words, if $t < \Delta M - \Delta c$, entry does not occur in equilibrium. Consequently, competitive post-entry fees are too high from the welfare point of view. Note that the result applies to both fees.

Let us now consider the regulation of the fees. In principle the policy maker could regulate either foreign fee or interchange fee or both. While the rule for the optimal foreign fee is appealingly simple, the model suggests that there is little rationale to regulate the foreign fee alone without regulating the interchange fee simultaneously. To see this, note

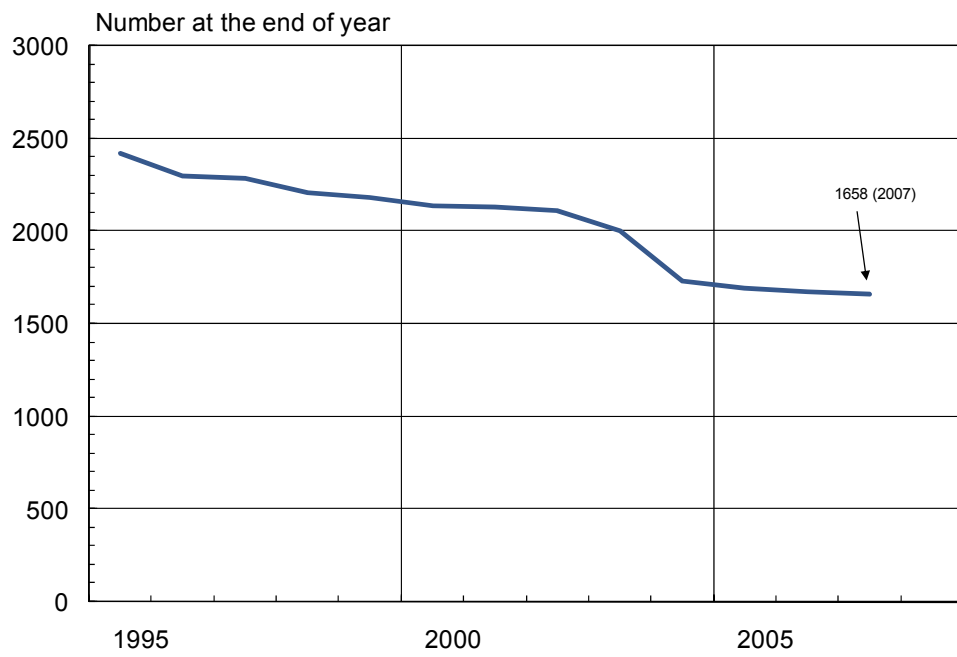
that if the foreign fee is regulated at some fixed and finite level but network N can choose the interchange fee freely, the interchange fee will be “as high as possible”: when choosing its interchange fee network N does no longer need to take into account the response of network O. As a result, the interchange fee would be too high from the welfare point of view, network O would make losses and would have an incentive to shut down its ATM operations.¹⁴ Only if the regulated foreign fee is made contingent on the interchange fee would the regulation of foreign fee alone make sense, but in this case the regulation of foreign fee would not be so straightforward.

Regulating both fees is feasible and yields socially optimal outcome if the fees are set to a^* and f^* . However, the model suggests that everything what can be achieved by regulating foreign and interchange fee jointly can be achieved by regulating interchange fee only. If the interchange fee is set to the optimal level a^* , network O would choose the socially optimal foreign fee f^* automatically.

In assessing the reliability of observations here, a caveat should be borne in mind: With the optimal fees the operators would not balance their budgets. Clearly regulation based on the Ramsey pricing should be considered in the future work, but this is less meaningful in the current set-up where the incumbent makes losses from its ATM business. Here it can only be concluded that dW/da is negative when evaluated at $a=a^c$, implying that a regulated interchange fee should be lower than the unregulated one but not too low to deter entry.

¹⁴ The model predicts that network N chooses as high interchange fee as possible but it is a bit awkward to use the model to study how high fee is possible. For high enough interchange fees network O would make losses so network O’s zero-profit condition could set an upper bound for the interchange fee. However, the model assumes that in the absence of competition, network O would make losses in any case.

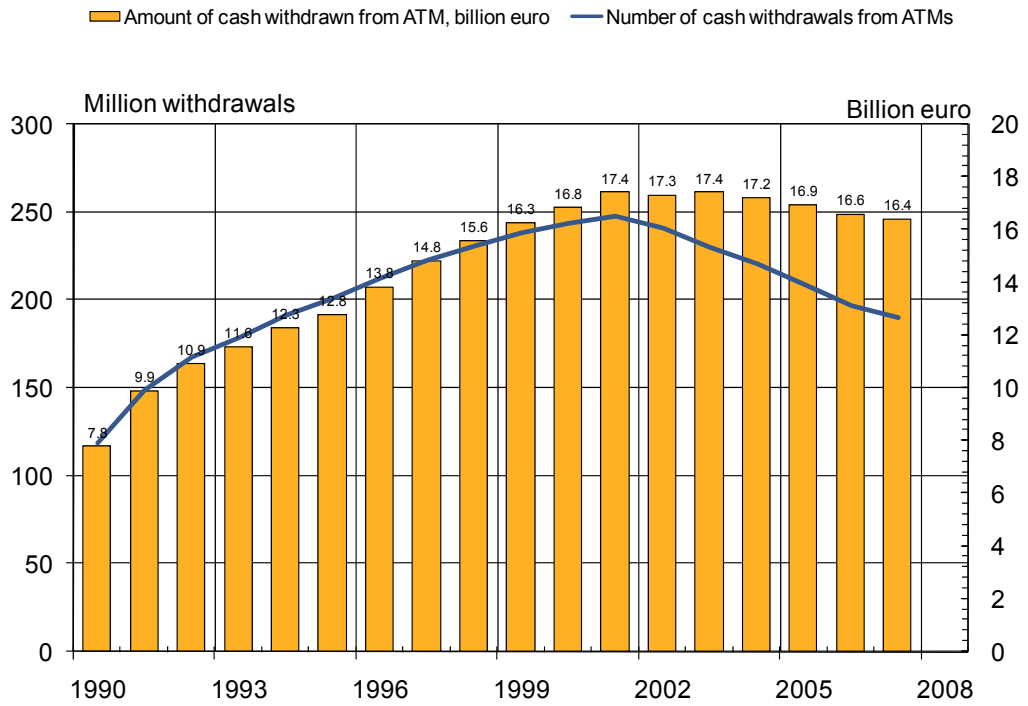
Number of ATMs in Finland, 1995 - 2007



Source: Federation of Financial Services and Automatia.

FIGURE 1.

Cash withdrawals in ATMs by number and value in Finland



Source: Automatia Ltd.

FIGURE 2.

Fee set by	Fee received by	Fee received by	Fee received by
	ATM owner	cardholder's bank	network
ATM owner	Surcharge, paid by cardholder.		
Cardholder's bank		Foreign fee, paid by cardholder.	On-us fee, paid by cardholder.
Network	Interchange fee, paid by cardholder's bank.		Switch fee, paid by cardholder's bank.

TABLE 1A: Variable ATM fees, modified from McAndrews (2003)

	Fee received by ATM owner	Fee received by cardholder's bank
Fee set by ATM owner	<ul style="list-style-type: none"> • Interchange fee, paid by cardholder's bank. • (Surcharge, paid by cardholder. Currently not used in Finland.) 	
Fee set cardholder's bank		<ul style="list-style-type: none"> • Foreign fee, paid by cardholder. • (On-us fee, paid by cardholder. Currently not used in Finland.)

TABLE 1B: Simplified pricing strategies, modified from TABLE 1A.

