Card and cash payments from a social perspective

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The modern market economy depends on the ability to make payments simply and inexpensively. Yet surprisingly little is known about the impact of these payments. In this article, we describe both the fundamental problems and costs of the use of cards and cash in Sweden from a social perspective. We estimate that the cost to society of the use of cards and cash amounts to 0.4% of GDP. Cash payments tend to be more expensive than card payments, and the results indicate that cash is over-used. The choice that the consumer makes between card and cash is largely determined by the size of the payment and the age and education of the consumer. The consumer also appears to be influenced by cost implications. A balanced use of withdrawal fees for cash and transaction fees for cards could therefore result in more efficient use of the payment system in Sweden.

One of the main reasons why money exists is that we need it as a means of payment. After all, the major part of all economic activity in a modern economy requires the buyer to pay the seller. Having inexpensive, simple methods for making payments is important for two reasons. Firstly, lower costs for executing transactions lead to an increased exchange of goods and services in the economy because of the lower cost of buying goods and services. In this way, efficient means of payment serve as a lubricant to the economy. Secondly – and this is an oft-neglected point – payment mediation is an economic activity in itself, which requires real resources. On that basis, efficient means of payment produce direct social benefits that may be substantial.

The physical handling of money, i.e. distributing and storing notes and coins, is expensive and tends to increase the cost of payment. Elec-

tronic payments, in contrast, do not involve physical handling but they do produce other costs, for example for IT networks. This applies equally to payments where buyer and seller do not meet – i.e. remote payments – and payments where the parties meet at the point of sale. In the first case, electronic transfers – such as Internet payments – are the electronic alternative to paper-based giro transfers. For payments at the point of sale, card payments can replace cash.

The fact that the costs involved in producing a payment service are not reflected in a price per payment may make it difficult to make the right – i.e. the most cost-efficient – choice of payment method when we buy something. In other markets, the production cost often determines the price of the product or service concerned, but in the market for payment services, the customer rarely incurs specific charges for the particular payment; cash withdrawals are often free, and we do not pay the bank a fee every time we use our debit or credit card. It is thus not certain that the customer will choose the lowest-cost method of payment. Therefore, it is not certain either than the payment system as a whole is used in the best way.

Despite the fact that payments occupy such a central role in all economic activity, relatively few studies exist that shed light on social costs of different types of payment, or how efficiently the payment market functions. Within the Riksbank's responsibilities for the security and efficiency of the payment system, the Riksbank has now begun to address these issues. In this article, we present some of the results from the Riksbank's research into the payment system: what is the cost of cash versus card payments from a social perspective? How does the public choose between these two payment instruments? What prevents us from using them efficiently?

Common causes of welfare losses in payment system

In the simple world of the textbook, maximum social efficiency arises when goods and services are priced on the basis of the marginal cost of producing them. However, in reality, a large number of factors also come into play, making it impossible – or undesirable – to apply this simple principle without qualification. Negative externalities (harmful environmental impact etc.) and the need to cover fixed costs mean for example that the price should be set higher than the marginal costs.[1] Similarly, in the pres-

[1] For a discussion on marginal-cost pricing in this context, see Laffont (2000).

ence of positive externalities, the price should be set *below* the marginal cost.

One particular type of positive externality is represented by "network effects". These arise when the benefit of a product to a user rises as the number of *other* users of the same product increases. For example, a certain individual's telephone becomes increasingly useful as the number of people it can be used to call increases. In the same way, certain computer programs – such as Word – become more useful as the number of people it can be used to swap files with increases. Payment systems are characterised by network effects such as these. In the case of cash, the network effects are in the main direct and so obvious that they are taken for granted: the value of notes and coins lies in the fact that they are used (accepted) by practically speaking all players in the market. This type of network effect may be referred to as *direct* or *one-sided*.

NETWORK EFFECTS VERY IMPORTANT TO CARD USE

Another type of network effect arises when two different types of players interact via a *platform* (or platform product) connecting them. This type of network effect is usually referred to as *two-sided*. In the case of debit and credit cards, network effects are mainly two-sided. Cardholders do not interact with each other and so do not enjoy any direct benefit from any increase in the number of cardholders. On the other hand, cardholders benefit from any increase in the number of merchants who accept cards. Similarly, the ability to accept card payments becomes more valuable to the merchants if the number of card users increases.

Markets with network effects – both one- and two-sided – may need to pass a certain critical point (or critical mass) for the number of users before the benefit outweighs the cost. After all, the first person to buy a telephone will have no-one to call, and a single cardholder will not be able to use his card if no shop accepts it. Consequently, in markets with direct network effects, the willingness of the first users to pay for the service of product will be low. To get the market moving, the manufacturer may need to sell the product at a loss initially before the number of users has risen to such an extent that the willingness to pay justifies a price that exceeds the costs. The need for a critical mass of users in markets with network effects carries the risk of a low degree of innovation or technology lock-in. This is very much a problem for payment markets that in some cases may be locked into inefficient technology.

SUBSIDIES CAN SOLVE THE NETWORK PROBLEM

A further complication of two-sided markets, such as the card market, is that there may also be a need long term to subsidise one side of the market. For example, a situation is conceivable where the consumers' willingness to pay falls short of the production cost but where the merchants' willingness to pay is far higher than the production cost. If in the example above marginal-cost pricing is applied to both sides separately, the consumers will not buy the card product/card services and the card systems will not be able to get established in the market. One possible solution to this problem is to allow the merchants with a high willingness to pay to subsidise the consumers in order to create a demand for cards/card services on both sides of the market. This type of logic has created the situation in which payment services exist where one side does not pay anything at all for the product, i.e. the entire cost is borne by the side where the willingness to pay is high. Cards and card payments are frequently quoted as examples of payment services of this kind, but the same kind of arrangement also exists in other markets. For example, Adobe Acrobat software is available in a simple version that only reads PDF files and is free, and as a full version – in which the user can create PDF files – that has to be bought.

As for all products, the production costs are the basis of efficient pricing of payment services, i.e. if the prices charged for a product accurately reflect its production cost, the price will contain all the information that the consumer needs to make a choice that will result in the optimal use of the resources of society. In certain cases, however, an adjustment for externalities is necessary, and in cases where positive network effects are present, the price should be set at below the production cost. In the case of negative externalities, e.g. negative external environment effects, the price should be set at above the production cost. Nevertheless, for the payment system as a whole, it may be reasonable to demand that it should cover its own costs, which in practice means that the "side" of the market that benefits most from the system should subsidise the other "side". Even if subsidies of this kind from one side of the market to the other may be socially optimum, it is very difficult to decide how large these subsidies should be.[2] Incorrect pricing may have the effect that the market does not develop quickly enough, that a relatively less efficient payment instrument is over-used and that a more efficient instrument is under-used. In the example of the card market, this may result in too few payment terminals (if merchants' fees to the banks are too high) or too

[2] Press release from European Commission, 19 December 2007, reference IP/07/1959.

few customers with cards (if transaction fees to the cardholders are too high). In that scenario, cards will be under-used and cash over-used.

AGREEMENTS ON FEES BETWEEN BANKS

Where externalities exist, there is a possibility that the market prices will not be the social optimum and that the networks will be too limited. In the card market, the banks have tried to address this problem by entering into multilateral agreements on fees between card-issuing and acquiring banks. These inter-bank mediation fees are generally often justified by the argument that the payer's bank must be compensated for the work and costs connected with the payment. Another way of expressing this is that an optimal balance of network effects is best achieved by having the card acquiring bank – and therefore, ultimately, the merchants – pay these costs, rather than having the cardholders pay them. This argument holds good if difficulties in persuading individuals to become card users justify their being subsidised by the merchants. The European Commission previously accepted this argument but recently changed its policy and decided to ban MasterCard from charging what are known as multilateral interchange fees for cross-border payments by charge and credit cards for private individuals – if it cannot demonstrate that the fees promote innovation for the benefit of all users.

Is the problem of pricing relevant to the cash and card markets in Sweden?

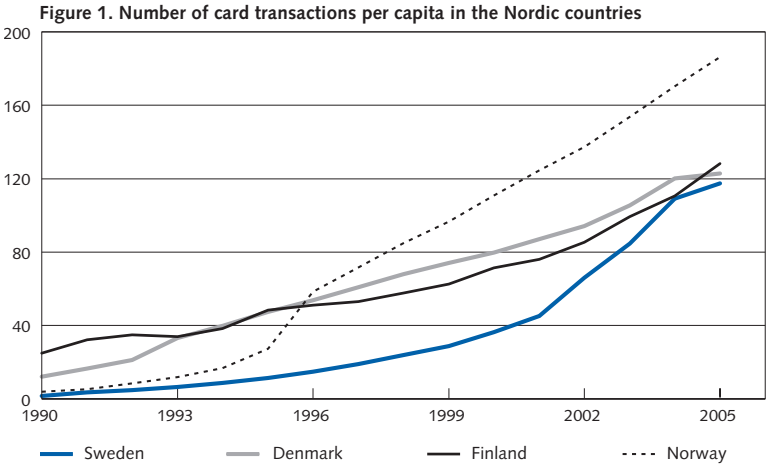
In the case of cash, network-related problems – such as for small-scale networks – are not relevant, as notes and coins issued by the Riksbank are traditionally broadly accepted as a means of payment.

On the other hand, there are examples in the card market of situations where network effects may have hampered the development of innovative products. One such situation arose in 1998 when three of Sweden's major banks jointly issued the *Cash Card* product. *Cash Card* was Sweden's first electronic cash system and was intended to be used as a substitute for physical cash. The system worked by having a prepaid value stored in a microchip on a plastic card. A digital value corresponding to the transaction amount was transferred from the microchip to another microchip in a terminal during the transaction. The launch of the new electronic cash system failed, although the three issuing banks collaborated in building up a common infrastructure and technical standards, as well as on marketing activities. Electronic cash never reached a sufficient critical mass of users, and the system was abandoned in 2004.

However, standard debit and credit card payments quickly succeeded in passing the critical mass threshold in Sweden. Both sides of the market are now well established. Not only density of terminals but also the number of cards per capita in Sweden are, from an international perspective, high. In 2006, there were 20,107 payment terminals per million inhabitants in Sweden. The corresponding figure for the average of EU countries was 15,356. The Swedish public on average holds more than 1 card per person. The number of cards issued per capita totalled 1.53 in Sweden, compared to 1.38 for the EU average. [3] If anything, these figures indicate that the acceptance of card payments is as high among individuals as among merchants.

However, a comparison with the other Nordic countries suggests that far too few card payments are made in Sweden. In terms of both the number of terminals and cards per capita, the Nordic countries are very close to each other. On the other hand, this infrastructure appears to be used less intensively in Sweden than in the rest of the Nordic region, even if the differences – above all, vis-à-vis Denmark and Finland – have narrowed considerably since 2001. The number of card transactions per capita in Sweden in 2005 – the last year for which this statistic is available for all the Nordic countries – totalled 117.[4] The corresponding figures for Denmark, Finland and Norway in the same year were 123, 128 and 186, respectively.[5] Figure 1 shows the trend of card use in the Nordic countries since the early 1990s.

Figure 1. Number of card transactions per capita in the Nordic countries

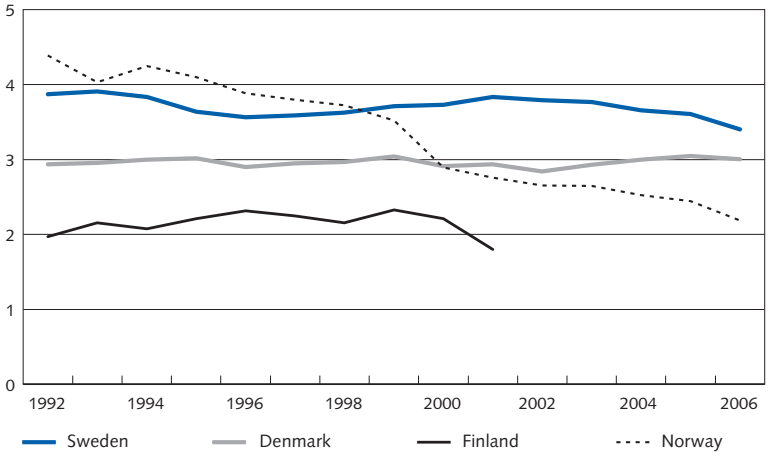


Sources: ECB and Norges Bank.

[3] Blue Book (2006), European Central Bank.
[4] Statistics on card transactions refer only to card transaction made with bank-issued cards.
[5] Sveriges Riksbank, The Swedish Financial Market in 2007.

Because card and cash payments are interchangeable, the lower level of card use by Swedes reflects, at the same time, a more widespread use of cash. In 2001, the last year for which Finland reported its own money supply figure (before joining the euro), its cash use, measured as the ratio of cash in circulation to GDP, was 1.8%. In Denmark and Norway, cash use by this measure totalled 2.9% and 2.8%, respectively. The corresponding figure in Sweden was 3.8%. The difference vis-à-vis Denmark has narrowed in recent years, but has remained stable or has even risen slightly vis-à-vis Norway. Figure 2 illustrates cash use in the Nordic countries since the start of the 1990s.

Figure 2. Cash use, measured as ratio of cash in circulation to GDP in the Nordic countries
Per cent



Sources: ECB and Norges Bank.

As we explained in the introduction, handling cash is expensive. The fact that cash is used more in Sweden than in the other Nordic countries could therefore indicate that the Swedish payment system is being used less efficiently. Logically, the next question is, in that case, why is cash overused in Sweden? Experience from both Sweden and Norway indicates that the demand for payment services is price-sensitive, i.e. the fees that above all banks but also in some cases merchants charge for a payment considerably influence the consumer's choice of payment method – see Humphrey et al. (2001) and Nyberg and Guibourg (2003).[6] In Norway, the number of electronic payments – including card payments – rose very

[6] Cash is the most common means of payment in the shadow economy. If Sweden were to have a more extensive shadow economy than the other Nordic countries, the demand for cash in Sweden would be higher than in the other Nordic countries. However, there is nothing to suggest that this is the case. On the contrary, the shadow economy appears to be roughly equal in the Nordic countries. Therefore, the explanation for the different level of demand for cash in the different countries is probably to be found elsewhere. For more information on the correlation between the shadow economy and the demand for cash, see Guibourg and Segendorf (2007b).

sharply when the banks increasingly started using cost-based transaction charges. Previously, the Norwegian banks had financed their payment services via cross-subsidisation, net interest and float income.[7] This raises the question as to whether incorrect pricing for card and cash payments may lie behind the less efficient use of the payments instruments in Sweden.[8]

How are card and cash payments priced in Sweden?

Guibourg and Segendorf (2007a) analyse the Swedish banks' costs for various payment services, and demonstrate that the difference in costs are only to a minor extent reflected in the fees paid by businesses and private individuals for various services.[9] In the case of card and cash payments, it appears that the banks almost exclusively charge fees to retailers. With few exceptions, the Swedish public do not pay charges to the banks for cash withdrawals and only pay an annual fee for their cards. Instead, the banks cover their card and cash payment costs via fees to retailers for daily takings (cash takings) and transaction fees for card payments. In some cases, cardholders also receive a bonus on the purchase amount, and in the case of charge and credit card transactions consumers regularly benefit from an interest-free credit period of around a month. Both the non-charging of fees and the provision of a bonus mean that the bank subsidises the consumer's card transactions. As we explained above, a subsidy of this kind on only one side of the market may be justified if (two-sided) network effects exist.

CASH IS MORE EXPENSIVE

The costs to Swedish banks – both variable and unit – of cash withdrawals exceed their costs for card payments. If we look at the revenue side, we find that in 2002 an average large Swedish banking enterprise made an annual profit in the card market (SEK 460 million) equal to the loss it incurred on its cash distribution operation (SEK 466 million). It may thus be concluded that cash distribution is being subsidised by the profits made in the card market.

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[7] According to information from Norges Bank, the rapid growth was attributable to a combination of successful pricing and merging of different card systems. "Net interest" refers to the difference in borrowing and lending interest rates. "Float income" is the interest income the bank earns on money "in transit" between different accounts. If it takes more than 24 hours from when the account of the paying party is debited and the account of the beneficiary party is credited, the bank can invest the money and earn interest on it.

[8] Guibourg & Segendorf (2007a).

[9] Ibid.

So retailers pay fees to the banks for both cash and card payment services, but do not price these services explicitly vis-à-vis their own customers.[10] The costs that retailers incur are instead passed on to the consumers in the form of general mark-ups on the prices of goods. In this way, retailers do not, either, send signals to their consumers about the costs of one method of payment or another

THE CUSTOMER CHOOSES

In the transaction, it is the customer who decides which means of payment he or she wishes to use. Since the customer rarely meets any explicit pricing signals, either from the bank or from the merchant, he or she can be expected to decide on the basis of non-monetary costs, such as the time and trouble involved.

It is clear from the above-mentioned studies that the banks would gain from increased use of cards by their customers, at the expense of cash. However, this does not automatically imply that society as a whole would benefit from a trend of this kind. To ascertain what is good for society, we should instead consider the social costs that arise as a result of card and cash payments.

Cost to society of card and cash payments

What distinguishes a cash payment from other types of payment is that no intermediaries are involved in the transaction itself. The payment is concluded immediately when notes and coins are handed over. A card payment on the other hand is not concluded immediately when the buyer hands his card to the seller. When a card is inserted into a terminal, information is transferred from the buyer's card to the terminal and onward to the shop's (the merchant's) bank. This starts a relatively complex process in which information and payments are transferred in several stages, with several intermediaries being involved. Ultimately, the transfer of information results in money being moved from the paying party's bank account to the beneficiary's account. The payment is not considered as finalised until the banks have debited and credited the accounts of the respective parties.

[10] The agreements that retailers enter into with the card issuer prohibit them from "discriminating" between different types of card, such as credit card and debit card, or between cards and cash. "Discrimination" here refers to retailers charging a special fee for card payments or charging customers different prices depending on their choice of means of payment. Nevertheless, there are individual merchants who charge a fee for card payments below a certain amount. Under a decision by the Swedish Competition Authority "discrimination" was permitted until the beginning of the 2000s, but this option was rarely used and the Authority then changed its decision after the EU Commission declared in 2001 that card issuers were entitled to prohibit "discrimination".

Card payments require an infrastructure of terminals and systems for transferring information about the payment. An infrastructure of this kind generally represents a major fixed cost. On the other hand, the cost that is directly attributable to an individual card payment is minor and arises when the payment information is processed and transferred in the system.

Cash payments do not need any infrastructure for the payment itself to be executed. On the other hand, handling cash requires an infrastructure for transport of cash between banks, post offices, retailers and users. This, too, involves fixed costs as well as costs attributable to an individual payment that arise before, during and after the actual handing over of the cash. What is common to both cards and cash is that several parties are involved in the production of both types of payment.[11]

An analysis of costs within a particular market should distinguish between private costs for the parties involved and social costs. The latter consist of the total costs to society, and reflect the real use of resources in the production of payment services. When a good or service is produced in a production chain, the social costs cannot be estimated simply by adding up the private costs of the parties involved. This is partly because, at a certain stage of production, private costs include fees to cover costs at an earlier stage of the production process.[12] For example, part of the fees paid by the business proprietor for transport of cash covers the transport company's production costs. Simply adding up these costs would result in double counting. The social costs comprise only the real costs of production, that arise at every stage of production, i.e. the added value of the production stage (assuming that the economic profit is zero).

COSTS OF CASH PAYMENTS

Handling cash demands an extensive infrastructure that entails substantial costs and the involvement of many intermediaries. The Riksbank's costs arise mainly when notes are issued, i.e. printing costs, storage costs etc. The banks buy the notes and coins they need from the Riksbank. These notes and coins are then handled by various private operators. In the case of the cash deposits – where the cash surpluses of the banks are stored – costs include rent of premises, insurance, security, machinery, personnel and IT systems. Transport companies move and distribute the cash, and

[11] For a more detailed account of the card and cash market, see Bergman, Guibourg and Segendorf (2007) and The Swedish Financial Market, Sveriges Riksbank (2007).

[12] In the case of cash, the calculation of private financial costs also include seigniorage costs – the interest income that banks, retailers and the public lose via their holdings of cash. However, these costs are deducted in the estimation of social costs, since seigniorage consists only of transfers that are made from banks, retailers and the public to the central bank.

their costs include, alongside personnel and transport costs, the costs of logistics and security.

Private costs

Cash handling at bank branches includes both the withdrawal and depositing of cash by customers.[13] These transactions involve costs relating to premises and personnel, i.e. costs that are mostly fixed relative to the number of cash withdrawals. ATMs also involve high fixed costs, but there are also substantial variable costs, in particular for filling the machines and for the fees known as interchange fees[14] paid by the banks to each other. Banks also incur costs for cash takings, in terms of foregone interest and administration, as well as for transport of cash between bank branches and cash deposits.

Swedish users do not pay fees for cash withdrawals. The only explicit costs to the public are the fixed annual fees that are charged for cards that may be used for withdrawals from ATMs. Nevertheless, the user incurs implicit costs, namely foregone interest income on his average cash holding, plus the time cost for the withdrawals. Cash users also incur a cost in the form of the time taken to carry out a cash payment (time of queuing at the shop's cash register etc.).

Retailers incur costs, including personnel time costs for cash payments at the cash register, as well as the extra time taken for other administration of cash, such as counting, sorting notes and coins, helping with daily takings and ordering cash. Retailers also pay fees to both banks and transport companies for depositing and transporting daily takings.

The total private cost of handling cash is the total of the costs that arise in all these stages. Bergman, Guibourg and Segendorf (2007) estimated that the total private cost connected with handling cash in 2002 was SEK 10.8 billion, corresponding to 0.5 per cent of GDP in that year. Just over 70 per cent of gross private costs arise at banks and retailers, and are fairly evenly shared among them.[15]

Social costs

The social costs only take account of the value added in each production stage, and are calculated as the total of private costs in each production stage, less the fees paid to the previous production stage. By this

[13] After this point, any reference to the banks' costs includes the costs incurred by Svensk Kassaservice (the Swedish Cashier Service).

[14] The bank of which the cardholder (the person making the withdrawal) is a customer pays a fee – an interchange fee – to the bank that owns the ATM, unless the first-mentioned bank itself owns the ATM. Interchange fees will be dealt with in more detail later.

[15] M.Bergman, Guibourg G. and Segendorf B., (2007).

measure, the social costs amounted to SEK 6.6 billion, 0.3 per cent of GDP. Nearly half of the social costs arose on the banking side. Roughly the same proportion was incurred in all by retailers, transport companies and the public, distributed fairly evenly across the three categories. The respective shares of total social costs accruing to the Riksbank and the cash deposits are minor.[16] According to the above-mentioned study, the number of payments made with cash totalled 1.4 billion per year. As a result, it is calculated that a cash payment cost society on average SEK 4.6 in 2002.

COSTS OF CARD PAYMENTS

The costs of card payments vary from user to user and bank to bank, depending on the type of card used. Credit card payments are more expensive to both issuing banks and users.[17] The card issuers have to pay higher costs for credit card payments because they allow the users credit for a period that the banks themselves have to finance.[18] As a result, the banks charge higher fees to the sellers (the merchants) for credit card payments. To the cardholders, the picture is more ambiguous. Annual fees for credit cards may be higher than for debit cards, but generally fees are not charged per transaction, neither for debit nor credit cards. In addition, those who pay by credit card sometimes receive a bonus on the purchase price and it is fairly common for no fee to be charged for at least the first year.

In addition to fees to the banks, retailers also have to bear the costs of terminals and personnel. As for cash payments, personnel costs are a function of the average time taken for a card payment to be performed. Customers who pay by card also have to pay a cost for the time at the cash register. The cost is the same for credit and debit card payments, as they both use the same technology. Otherwise, card payments generate costs for the transfer of information on payments between the card-issuing bank and the merchant's bank, plus costs relating to settlement and clearance of payments between the banks involved.

In the above-mentioned study, the social costs for payments by card were estimated at SEK 1.9 billion, corresponding to 0.1 per cent of GDP in 2002. The gross private costs totalled SEK 4.3 billion, or 0.2 per cent of

16 Bergman, Guibourg and Segendorf (2007).

17 All cost data is from Bergman, Guibourg and Segendorf (2007)

18 There are two types of credit card: pure credit cards, where the cardholder pays either the whole amount or part of the debt after 30 days and pays interest on the remaining balance of the debt, and "charge cards", where the entire debt is paid after 30 days without any interest charge to the cardholder. Charge cards are the type of card that is used most frequently in Sweden. Debit card payments are most common in Sweden. With these, the transaction amount is deducted immediately from the cardholder's account at the time of the transaction.

GDP. Nearly half of total social costs arose at the banks, while the share accruing to retailers was approximately a third.

Our discussion has so far centred on where the costs arise. If we also take payments between the operators into account, such as fees for services, we gain an idea of the proportions in which they ultimately bear these costs. We can then see that retailers bear nearly half of the costs, while the banks' share is less than a quarter. Retailers pay high transactions fees to the banks for card payments, fees that are in turn decided by the fees that the banks involved pay to each other.

In 2002, the number of card payments amounted to 589 million.[19] The cost to society of each card payment thus totalled on average SEK 3,0 about 35 per cent less than the corresponding cost of a cash payment. Table 1 summarises the social costs, in total and per transaction, for both payment instruments.

Table 1. Social costs, in total and per transaction, of card and cash in 2002

	Total social costs *SEK million*	Volume *million transactions*	Unit cost social *SEK*
Cash	6 560	1 424	4.6
Cards	1 780	589	3.0
– of which			
– Debit cards	1 540	509	3.0
– Credit cards	240	80	3.0
Total	**8 340**	**1 989**	

Source: Bergman, Guibourg and Segendorf, 2007.

Cost-efficiency in the choice between cards and cash

What does this say about the socially optimal use of cards and cash, respectively? At first glance, card payments – with a social unit cost 35% lower than that for cash payments – ought to replace cash totally. But it is not quite so simple, because there are major differences in the production technologies used by the two payment instruments. Card payments require an extensive infrastructure of terminals, computers and lines of communication, which involves a high proportion of fixed costs. A cost is also associated with processing payments, but this cost is constant, irrespective of the transaction amount – meaning that the cost of the payment is the same whether the card is used to pay for a purchase amounting to SEK 50 or 50,000.

In the case of cash payments, the conditions are partly reversed. Cash payments involve a good deal of physical handling – transport,

[19] The Swedish Financial Market (2007), Sveriges Riksbank

counting, storage of notes etc. The larger the transaction amount, the more expensive the actual cash payment is, as a larger transaction amount will require a larger amount of handling. In payments of small amounts, the "variable" cost is lower for cash than for card payments. As a result, from the social viewpoint, cash may be preferable for small payments. But what does this mean in practice, from the perspective of the socially optimal use of cash?

Bergman, Guibourg and Segendorf (2007) calculate a "social break-even value", which is the transaction amount below which cash payments are the socially most efficient option. The calculation is performed by expressing the cost to society of a cash and card payment, respectively, as functions of the transaction amount. In payments of very small amounts, the fixed unit cost dominates. Because this is higher for card payments than for cash payments, paying by cash is (on average) socially the most efficient option for small payments. As the transaction amount rises, so too does the total unit cost for cash payments, while the cost of a card payment on the other hand is not affected by the amount. Therefore, the social break-even point is found at the transaction size where the total social unit costs are equal for both payment methods. The result of the calculation indicates a break-even point of SEK 69.[20] This means that, according to the costs that prevailed in 2002, the socially optimal option typically was to use cash for purchases up to a value of SEK 69. Above that amount, card payments were generally preferable, even though the actual costs for the two payment methods may of course vary considerably from one specific payment to another.

Costs to consumers of card and cash payments

In Sweden, a high proportion of the merchants accept both cash and card payments. It is therefore primarily the consumer who chooses the instrument of payment. Demand for payment instruments is determined in the same way as demand for other goods and services, in other words by the consumers' preferences and their private incentives, i.e., the costs that arise from the consumer's choice.

Both card payments and ATM cash withdrawals require the customer to have a card, and an annual fee is normally charged to the customer for such cards. However, when making the transaction, the customer will already have borne the annual card fee. This is, thus, a sunk cost and, consequently, should not affect the choice between cash and card. Other-

[20] For a more detailed description of the method of estimation, see Bergman, Guibourg and Segendorf (2007).

wise, a Swedish consumer does not incur any explicit variable costs, either from the bank or the merchant. On the other hand, costs arise in the form of queuing time at the cash register and implicitly a cost in time for future ATM cash withdrawals when the person draws on his cash balance.

Bergman, Guibourg and Segendorf (2007) also calculated the private costs to consumers of paying by card and cash, respectively, using the figures for 2002. As for the social costs, these costs are also expressed as functions of the transaction amount. As before, the calculation is based on specific assumptions and therefore may be assumed at best to apply to a "typical" transaction. Depending on the circumstances, the costs, and so the break-even point, vary for every individual payment.

For an average payment, it was calculated that the private break-even point for consumers was around SEK 125. Below this point, it is in private terms cheaper to use cash, while above it, using a card is cheaper. It should be noted that the private break-even point is nearly double that of its social equivalent. As a result, if consumers chose between card and cash on the basis of their private incentives, this would lead to over-use of cash and thus to a welfare loss.

How do Swedish consumers choose between card and cash payments?

In order to study how the consumers choose the method of payment, the Riksbank conducted a questionnaire-based survey *inter alia* of how consumers chose between card and cash in their most recent transaction.[21] As well as being asked about their actual choice of means of payment, individuals were questioned on the size of the purchase. Other background variables taken into account in the survey were age, education, income and gender. By comparing consumers' actual choices with the break-even points calculated, it is possible to start discussing the efficiency of the payment system in Sweden.

Bergman, Guibourg and Segendorf (2007) used data from this survey to estimate the actual break-even point in the choice between card and cash payments. To be more precise, the transaction amount at which it was equally likely that an individual would choose a card or a cash payment was estimated. The results indicated that a typical consumer does not choose to use a card until the purchase amount exceeds SEK 123.[22] This is very near the private break-even point. Against that background, it appears that a typical consumer makes the choice on the basis of his

[21] Synovate Temo 2006.

[22] The typical consumer is defined as a 41-year-old man with upper secondary education and with an annual household income of SEK 350,000–400,000, living in a two-person household.

private incentives and, so, deviates from the social optimum. This results in over-use of cash. However, certain background variables – such as level of education and, above all, age – considerably affect the outcome. The break-even point at which a 60-year-old individual chooses card ahead of cash does not arise until purchases of SEK 179, while the corresponding break-even point for a 20-year-old consumer occurs at transaction amounts as low as SEK 60. The choice of young people thus appears to be very close to what is the social optimum.

Private incentives can deliver more cost-efficient payments

The Riksbank's studies of the card and cash market suggest that there is an over-use of cash and a corresponding under-use of cards, from a social perspective. Welfare losses therefore arise in these markets. Because developments in technology have made card transactions more efficient and because the study is based on conditions in 2002, it is probable that the break-even point prevailing today is lower than the estimated one, which implies even greater welfare losses.

On the other hand, the choice of payment instrument by Swedish consumers appears to follow from their private incentives. The problem is that these incentives are not compatible with what is the social optimum. However, the behaviour of the consumers could be changed by structuring private incentives so as to coincide with what is socially efficient. This could be achieved for example by introducing fees on cash withdrawals. An illustrative calculation based on 2002 figures indicates that quite small withdrawal fees – in the order of SEK 0.15 per SEK 100 withdrawn – would be sufficient. In order not to encourage small withdrawals, a fixed fee may be justified, for example SEK 1.5 if a normal withdrawal is around SEK 1,000.[23]

To prevent this from providing excessive incentives for using cards for small payments, consideration could also be paid to the possibility of introducing a fixed transaction fee of, for example, SEK 0.25 – 0.50 per card payment. However, higher fees for card payments alter the private break-even point, and so such fees must be offset by higher withdrawal fees. On that basis, card fees at the above-mentioned level require withdrawal fees of SEK 5–8.5 per withdrawal for the break-even point to remain at the optimal level of around SEK 70. For a typical customer, the annual cost would rise by SEK 300–500. If competition is operating

[23] In 2006, the average withdrawal was just under SEK 900, but a withdrawal fee would probably lead to an increase in this average.

effectively, however, higher transaction fees ought to give the consumers offsetting revenues via higher interest on transaction accounts or, alternatively, reduce other fees, such as annual card fees, so that the consumers' total costs remain stable..

Of course, it is up to the market operators themselves to decide how to price their services. There may be commercial and other issues to be considered, and so the above-mentioned calculations should only be regarded as illustrative. Transaction-based fees also involve costs in themselves, which speaks against their introduction. In addition, the use of cards as an instrument of payment is age-related, in that the choice of the young generation is very close to the optimum. This may be interpreted as indicating that – all else being equal – time itself may play a part in reducing welfare losses. If, on the other hand, the desire is to create a more efficient payment system quickly, transaction fees may be a way of aligning the private incentives to better match the social costs involved in the production of the two payment services.

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