

Social costs
of POS payments in
the Netherlands 2002–2012:
Efficiency gains from
increased debit card usage

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Central bank and prudential supervisor of financial institutions

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Social costs of POS payments in the Netherlands 2002–2012: Efficiency gains from increased debit card usage

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Abstract

The overall costs of the payment system to society are considerable. These costs depend on the relative usage of the available payment instruments, which differ in the costs that each entails to market participants in the payment chain. In the Netherlands, debit card payments have become less costly than cash payments. In 2012 an average cash payment cost EUR 0.44 whereas an average debit card payment cost EUR 0.30. Between 2002 and 2012, the number of debit card payments more than doubled to 2.5 billion, while cash usage declined to 3.75 billion payments. As a result of the changing payment behaviour of the Dutch, the total costs of cash and debit card payments to society declined by 10% from over EUR 2.6 billion in 2002 to less than EUR 2.4 billion in 2012. Relative to GDP, the social costs dropped from 0.57% to 0.40% of GDP. The costs incurred by banks for cash and debit card payments have been rather stable. Retailers, on the other hand, have achieved major cost reductions. The trend towards more card and less cash usage is expected to continue. From a cost perspective this will be beneficial for society as a whole.

Keywords: social costs, efficiency, payment instruments

JEL classification: D21, D23, D24, E42, G21

I Introduction

This paper provides estimates of the social costs in 2009 of cash and debit card payments in the Netherlands and gives an approximation of these costs for 2012. It compares these findings with the results for 2002 (Brits and Winder, 2005). Between 2002 and 2012 the payment habits of the Dutch changed considerably. Debit card usage more than doubled, whereas cash usage decreased considerably. As a result, the social costs of cash and debit card payments declined by 10% to less than EUR 2.4 billion in 2012. Relative to GDP, the social costs dropped from 0.57% to 0.40% of GDP. The term social costs refers to the costs to society, reflecting the use of resources in the production of payment services; that is the total costs of production.

Research on the social costs of payments in 2002 showed that these costs differ depending on the payment instrument (Brits and Winder, 2005). For transaction amounts above EUR 11.63, a cash transaction was more expensive to society as a whole than a debit card payment. However, the average transaction amount for debit card payments was almost four times higher, i.e. EUR 44, as the Dutch used the cards mainly for high transaction amounts. Consequently, major cost savings in the payment chain could be achieved if consumers were to use their debit cards more frequently. Therefore, retailers and banks in the Netherlands decided in 2005 to join forces in promoting debit card use. In cooperation with retail organisations, banks set up the Foundation for the Promotion of Efficient Payments (*Stichting Bevorderen Efficiënt Betalen*), which supported several projects and a campaign designed to improve safety and efficiency of payments. The campaign seemed to be successful. Since its launch in 2007, 17 years after the introduction of the debit card as a means of payment, the debit card recorded double digit growth figures again, for three years in a row (2008–10). At the same time, cash usage decreased. These developments created a demand for up-to-date information on payment behaviour and the costs associated with paying, and on how payment costs evolve over time.

This study makes several contributions to the existing literature. First of all, it is one of the few country-wide studies that provides estimates for the social costs of the point-of-sale (POS) payment system over time (see also Gresvik and Øwre, 2003 and Gresvik and Haare, 2009, for Norway or Bergman, Guibourg and Segendorf, 2007, and Segendorf and Jansson, 2012, for Sweden). It allows us to examine the magnitude

of the cost savings in the POS payment system due to changing consumer payment habits on the one hand and cost saving measures by market participants on the other hand. Secondly, the study provides evidence that within a relatively short period, huge changes can occur in what may be considered cost efficient payment behaviour.

The outcomes of this study contribute to the understanding of the development of the costs of cash and debit card payments. They are of interest to the Dutch central bank (De Nederlandsche Bank, or DNB), commercial banks, merchants and policymakers alike. Both DNB and the relevant stakeholders in the Dutch payments market have a need to keep abreast of the trends in the use and costs of cash and debit card payments in the Netherlands: DNB because of its catalyst role in promoting the efficiency of the payment system; and retailers and banks because they need information about realised and potential efficiency gains. For competition authorities the results of this study may be of interest too, as it provides information that may be valuable in the debate about the optimal setting of prices and interchange fees for card payments (see e.g. Baxter, 1983, Chakravorti, 2010, Rochet and Tirole, 2002, 2011).

The results for 2009 have been used by DNB as input for the ECB study by Schmiedel, Kostova and Ruttenberg (2012) on the social and private costs of different retail payment instruments in the European Union. In this project thirteen central banks participated voluntarily.² Some of them published their results in national studies (Ardizzi and Giucca, 2012, for Italy, Danmarks Nationalbank, 2011 for Denmark, Latvijas Banka 2013 for Latvia, Nyandoto, 2011 for Finland, Segendorg and Jansson, 2012, for Sweden and Turján, Divéki, Keszy-Harmath, Kóczán and Takács, 2011, for Hungary) while others launched cost studies in the past (Banco de Portugal, 2007).

This study proceeds as follows: section 2 presents some stylised facts about the Dutch POS payment market and provides background information needed to interpret the development of the social costs of cash and debit card payments. It describes the trend towards more card payments and less cash usage at points of sale between 2002 and 2012, it discusses the incentive structure of cash and debit card payments and it highlights modifications in the payment infrastructure of banks and retailers. In addition, Section 3 describes the conceptual framework and introduces several cost concepts, such as social and private costs and fixed and variable costs. Subsequently, it discusses several criteria for comparing social costs of cash and debit card payments borne by market participants. Section 4 presents

² The following central banks participated in the ECB-cost study: Danmarks Nationalbank, Eesti Pank, Central Bank of Ireland, Bank of Greece, Banco de España, Banca d'Italia, Latvijas Banka, Magyar Nemzeti Bank, De Nederlandsche Bank, Banco de Portugal, Banca Națională a României, Suomen Pankki and Sveriges Riksbank.

the empirical results. It discusses the development of the social costs to society as a whole between 2002 and 2009, and more particularly, the part of these costs borne by retailers and banks, as well as to their private costs. In addition, Section 4 presents the results of a scenario analysis which shows potential cost savings if consumers had used the most cost-efficient payment instrument in 2009 more frequently. Furthermore, it provides an indication of the social costs in 2012 using scenario analysis. Finally, section 5 summarises the main results and adds some concluding remarks. The annex provides details about the data we used for this cost study.

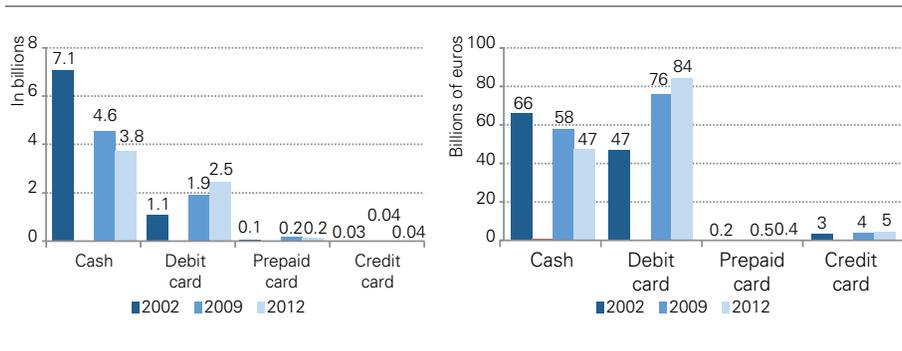
2 Pos payments and payment infrastructure in the Netherlands

2.1 Payment behaviour at the POS

The costs that market participants incur for cash and debit card payments depend both on how often people use these means of payment and on the payment infrastructure used in accepting and processing cash and debit card payments. In this section we present some stylised facts on the payment behaviour at the point-of-sale.

Although the Dutch more than doubled their usage of the debit card from 1.1 billion payments representing a sales value of EUR 47 billion in 2002 to 2.5 billion payments representing a value of EUR 84 billion in 2012, most POS payments are still made in cash (see Graph 1). The growth rate in the number of debit card payments was about 8% for both the period between 2002 and 2009 and the second observation period, 2009–2012. Exact figures on cash usage are not available as cash payments are not registered. DNB has estimated cash usage and the outcomes (Brits and Winder, 2005; Jonker, Kosse and Hernández, 2012) indicate that the number and value of cash payments dropped by 3.4 billion from 7.1 billion transactions representing a value of EUR 66 billion in 2002 to approximately 3.8 billion transactions representing a

Graph 1 Number and value of POS payments in the Netherlands, 2002 - 2012



value of EUR 47 billion in 2012.³ In terms of value, debit card payments overtook cash payments sometime between 2002 and 2009, when the value of debit card payments amounted to EUR 76 billion and that of cash payments was estimated at EUR 58 billion.

The decline in cash usage is supported by data on the number and value of cash withdrawals and cash deposits at ATMs and banks (see Table 1). The figures refer to cash withdrawals by both consumers and businesses. From 2006, people began to withdraw less cash from their current accounts (at ATMs or local banks). Between 2006 and 2008 the reduction in the number of cash withdrawals remained fairly modest, but between 2008 and 2012 the number of cash withdrawals dropped by 11%. From 2007 onwards the value of the cash withdrawals also decreased, from EUR 72 billion to EUR 55 billion in 2012.

Debit cards are by far the most-used form of ‘plastic’ money. Other payment cards such as the prepaid card or credit card are infrequently used to settle POS payments. Cheques are no longer used in the Netherlands. Note that the total number of POS payments is declining. There are several reasons that may explain this trend. First of all, consumers tend to buy more purchases at one point-of-sale instead of visiting multiple points-of-sale. Consequently, they make fewer payments. Secondly,

Table 1 ATM and counter cash withdrawals by consumers, 2002 - 2012^a

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Transactions (in millions)											
ATM withdrawal	493	494	484	471	475	469	473	455	434	437	425
Counter withdrawal				16	14	13	12	10	7	6	5
Total cash withdrawals	493	494	484	487	489	482	485	465	441	443	430
Value (in EUR billions)											
ATM withdrawal	53	51	51	55	55	56	55	54	52	52	50
Counter withdrawal				16	15	16	16	11	6	5	5
Total cash withdrawals	53	51	51	71	70	72	71	65	58	57	55

Source: Report of the National Forum on the Payment System 2011, DNB Statistical Bulletin Table 5.12 and Currence.

a 2012 figures were estimated using information from 2011:Q4 – 2012:Q3

³ Cash estimates for 2012 are preliminary.

people buy more products on-line. Dutch consumers made about 80 million online payments in 2012, with a total value of approximately EUR 10 billion (Thuiswinkel.org, 2012). An increasing part of these payments substitutes for POS payments. And thirdly, the economic crisis has reduced consumer expenditures.

2.2 Development of the payment infrastructure

The development of the social cost of cash and debit card payments depends not only on how often consumers use these payment instruments, but also on the payment infrastructure used by banks and merchants facilitating the use of these payment instruments. Almost all adult Dutch citizens have a current account with a debit card. The debit card can be used to withdraw cash from automatic teller machines (ATMs) and to make debit card payments at points of sale.

Traditionally, banks primarily used branches to offer payment services to their customers. People went to their local bank to withdraw cash from their current account or to deposit it to it. Such cash services were costly for the banks, as they required many manual operations by bank employees. After the introduction of ATMs and debit cards, from the mid-1980s onwards, the payment infrastructure offered by banks underwent dramatic changes (see Table 2). On the one hand, banks installed more and more ATMs, which also became increasingly sophisticated, but on the other hand they also rationalised their branch and cash point networks. This process has been going on so since the 1990s (MOB, 2004). During 2002–2012, the number of bank branches continued to decline (by an average 4.5% per year) to under 2,500 by 2012. Offsetting this decline in bank offices was the growth in the number of cash points, and cash acceptance machines (CAM). However, from 2008 onwards banks also started to weed out these networks.

Table 2 Supply of bank payment services, 2002 - 2012^a

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of bank branches, bank offices and cash points	4611	4494	4348	4259	4129	4106	4351	3996	4017	3087	2921
Automatic teller machines (ATMs)	7530	7556	7889	7446	8114	8546	8654	8506	7919	7799	7607
Cash acceptance machines (CAMs)				1773	1960	2037	2178	2320	2297	2264	2178

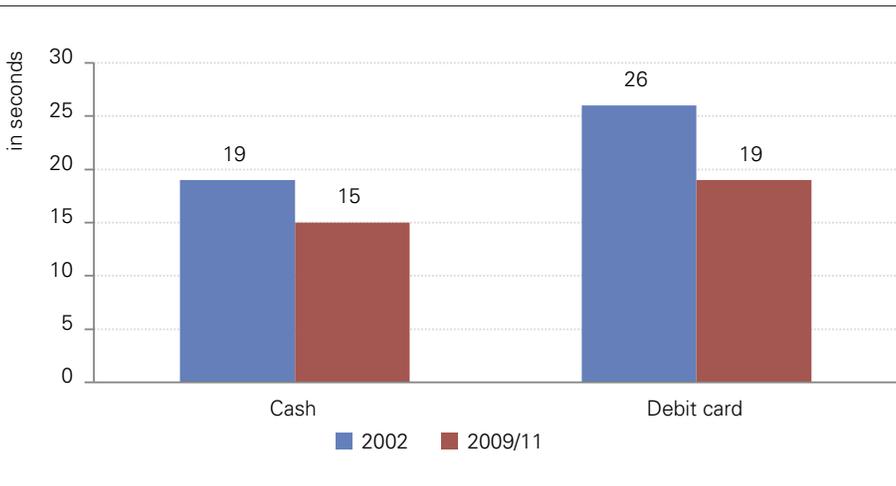
Source: Report of the National Forum on the Payment System 2011, DNB Statistical Bulletin Table 5.12 and Currence.

a 2012 figures refer to 2012:Q3

The payment infrastructure used by retailers also changed considerably. Since the 1990s increasing numbers of retailers decided to accept card payments and installed POS terminals (see Jonker and Lammertsma, 2010). Whereas in 2002, there were 177 thousand terminals, by 2012 the number had increased to 279 thousand terminals, which corresponds to an annual growth rate of about 4.5%. The first to accept debit card payments were, by and large, fuel stations, large retail chains and high-end retailers. Later on, smaller retailers, entrepreneurs in the catering industry and street traders also began to accept debit card payments. In 2011 all fuel stations and large retail chains accepted the debit card, as well as more than 90% of the small and medium sized merchants. In the catering industry, about two-thirds of businesses accepted the cards alongside cash, while one in three street traders did so (EIM, 2011, HBD 2012).

Innovations such as cable or broadband internet that have considerably sped up data communication, have enabled retailers to reduce their front office costs. Front office time refers to the time needed by a cashier to process a checkout payment. It starts the moment the cashier mentions the sales amount to the customer and it ends when the cashier hands over the receipt to the customer, indicating that the purchase is complete. When consumers use their debit card to settle a payment, the POS terminal seeks connection with the bank of the consumer in order to check the account balance and the 4-digit PIN code. Many retailers have opted for faster data communication than the traditional relatively slow dial-in connection and need less time now to process payments than they used to. Graph 2 shows the influence of these innovations on the amount of time cashiers needed to process a cash or a debit card payment (HBD, 2002, EIM, 2011). In 2011, cashiers needed less time to

Graph 2 Median front-office time, 2002 - 2011



process either kind of payment than they needed in 2002, but the time reduction for debit card payments was twice the reduction for cash payments.⁴

2.3 Fees in POS payments

A purchase can only be paid by debit card if 1) the retailer chooses to accept debit card payments, and 2) the consumer chooses the debit card over other means of payment. These choices are influenced by several factors, one of which concerns fees (Bolt, Jonker and Van Renselaar, 2010; Jonker, 2011). In the Netherlands several changes in the incentive structure have made debit card use more attractive for both consumers and retailers.

The first such change related to accountholder fees charged by banks. Banks apply different fee structures for consumers and businesses (Bolt, 2006). Until the beginning of the 21st century banks did not charge consumers any fees related to their current account or their payment behaviour. However, in order to recover part of the costs associated with retail payments, banks introduced fixed, periodical fees for consumers, which they gradually increased. At first, these were called card fees, which suggested to consumers that debit card payments were more expensive than cash (Jonker, 2007). This view was supported by the fact that some merchants surcharged consumers for debit card use. Nowadays, the banks call these fees payment package fees. The fees are linked to a payment package including the use of a current account, access to internet banking and a debit card which consumers can use for making debit card payments or to use ATMs. Credit cards are provided optionally at extra cost. Consumers do not pay any transaction fees for card payments, cash withdrawals or cash deposits at the ATM, nor do they receive any tangible rewards. Thus banks in the Netherlands tend not to make consumers directly aware of the costs associated with their payment behaviour or to provide any incentives towards more cost efficient payment behaviour.

In contrast, bank fees for retailers and businesses are directly linked to the use of payment instruments through a differentiated system of fixed fees for payment packages and transaction fees depending on the number of payment transactions made by themselves or their customers and the number and value of cash withdrawals and deposits. Debit card payments have gained attractiveness in the eyes of retailers, because acquiring fees charged by banks have declined steadily from 2003 onwards (NMa, 2006). In 2010, they averaged 4 eurocents (NMa, 2010),

4 There are several reasons for the reduction in front office time needed to process a cash payment. First of all, 2002 was the year of the euro cash changeover. Both consumers and cashiers needed to get use to this new currency; once that happened front-office time reduced. And secondly, as a result of the recommendation issued by National Forum on the Payment System in September 2004 most retailers decided to round cash payments to the nearest 5 eurocent, which reduced the front-office time as cashiers needed less coins as exchange.

which is already low in comparison with acquiring fees applying elsewhere in Europe (Börestam and Schmiedel, 2011). On the other hand, increased fees for cash withdrawals and cash depositions have made cash more expensive for retailers.

The reduction of acquiring fees for debit card payments had the dual effect of increasing the number of retailers that accept the debit card and reducing the number of retailers surcharging customers for use of the card from 22% in 2006 to less than 2% in 2011 (Bolt et al., 2010; HBD, 2011). This encouraged consumers to use the card more frequently. For them, too, the costs of a debit card payment were no longer higher than for a cash payment.

3 Conceptual framework of social and private costs⁵

3.1 Conceptual difference social and private costs and revenues

The social cost perspective chosen in this report focuses on the resource costs to the economy of enabling and processing all POS transactions and is similar to the approach adopted by De Grauwe, Buyst and Rinaldi (2000). We focus on the costs incurred by the central bank, retailers and the banking industry for cash and debit card payments. These costs include the costs for value added services provided by these market participants, the so-called internal costs and transfers to other market participants related to cash or debit card payments, as a proxy for those parties' internal costs. These other parties include, for instance, the automatic clearing house (ACH) which processes the electronic payment transactions, cash-in-transit companies which transport and collect cash between banks, ATMs, retailers and DNB, and the telecom companies providing the internet connections for payment terminals. Transfers between DNB, banks and retailers sort out in the social cost concept and are therefore excluded.

Although for society as a whole the social costs associated with a cash and a debit card payment determine which payment instrument is most cost efficient, for a bank or retailer it is their private costs that matter. These costs include not only the costs incurred by these agents themselves (internal costs), but also the external costs and revenues they face. External costs for one party in the payment chain often constitute revenues for another, such as the annual fee or acquiring fee paid by a retailer to its bank. In addition, external costs include the opportunity costs of holding cash or non-interest bearing transaction balances, which can also be considered as implicit transfers.

Following Brits and Winder (2005), we use the following definitions for the costs and revenues for a particular means of payment for each party in the payment chain:

- External costs (C_{ext}) = transfers (fees/tariffs, etc.) to other agents in the payment chain

⁵ This section borrows heavily from Section 3 in Brits and Winder (2005).

- Internal costs (C_{int}) = all other costs, roughly the costs of value added payment services ⁶
- Total costs (TC) = $C_{int} + C_{ext}$
- Revenues (R) = transfers (fees/tariffs, etc.) from other agents in the payment chain
- Private costs (PC) = total costs minus total revenues from other agents in the payment chain
- Social costs (SC) = sum of internal costs of all agents in the payment chain.

Table 3 summarises these relationships. $T_{i \rightarrow j}$ denotes a transfer of size T from sector i to sector j . The revenues of the central bank indicate a specific transfer, namely seigniorage. Central banks issue banknotes, but do not pay interest on these debt instruments. Hence all participants holding cash bear opportunity costs. Seigniorage constitutes an implicit transfer from banks, retailers and consumers to the central bank. Sector c refers to consumers. We assume that consumers do not make internal costs in order to make payments possible. However, they face external costs, because other participants receive revenues from them.

The payment instrument that is most attractive for society as a whole, may in practice not become successful. This can be understood when we consider the private costs of groups of agents. If in one or more groups the private costs associated with a particular payment instrument are high, agents in that group may not promote the use of that instrument. It is after all the banks that decide about the development and the introduction of a payment instrument. Next, retailers are in the position to withhold the use of a particular payment instrument from their customers. They may, for instance, decide not to accept debit card payments. Both external cost items, for instance fees levied by acquirers, and internal cost items, e.g. employee education, may be prohibitive in this respect.

Table 3 External costs and revenues by group of agents

	Internal costs	External costs	Revenues	Private costs
Central bank	$C_{cb,int}$	-	$R_{cb} = T_{b \rightarrow cb} + T_{r \rightarrow cb} + T_{c \rightarrow cb}$	$C_{cb,int} - R_{cb}$
Banks	$C_{b,int}$	$C_{b,ext} = T_{b \rightarrow cb} + T_{b \rightarrow r}$	$R_b = T_{r \rightarrow b} + T_{c \rightarrow b}$	$C_{b,int} + C_{b,ext} - R_b$
Retailers	$C_{r,int}$	$C_{r,ext} = T_{r \rightarrow b} + T_{r \rightarrow cb}$	$R_r = T_{b \rightarrow r} + T_{c \rightarrow r}$	$C_{r,int} + C_{r,ext} - R_r$

⁶ Payments to third parties, (e.g. telecom companies, cash-in transit companies, insurance companies, printers (e.g. for banknotes), etc.) are considered as internal costs. In the cost calculations, the actual price paid is used for these items. This may lead to some bias in the outcomes, unless the profit margin on the services provided by these third parties is nil.

3.2 General description of roles, activities, cost items and transfers

In the Netherlands, the Dutch *central bank* (DNB) has the statutory duty to provide for the circulation of banknotes, while the Dutch treasury has this responsibility for coins. In this respect, cost items include costs of printing banknotes and producing coins, distribution costs, costs pertaining to departments organising and managing logistical processes, costs of product development (technical requirements for banknotes, counterfeit detection equipment, etc.), costs of checking banknotes for authenticity and fitness for recirculation (including audit & control departments, transportation logistics), and banknote storage and security costs (vault costs). All the listed cost items are internal costs. In the remainder of this study we include the costs of the Dutch treasury in DNB's costs.

The banks have to pay for specific services provided by the central bank (in the Netherlands for the provision of banknotes, for instance). These transfers are external costs for the banks and revenues for DNB. Seigniorage constitutes a less visible transfer from the banks and the public (both retailers and consumers) to DNB.

The *banking sector* has a pivotal role in the distribution of cash money. ATMs and local branch offices are important distribution channels for both consumers and retailers. Periodically, surplus cash money is deposited at the bank by retailers. This requires the presence of various facilities: night safes, seal bag deposit boxes, etc. These services also involve staff costs, e.g. for handling and processing sealed bags or for administrative activities. The transactions have to be entered in the accounting systems and customers must be informed via account statements. The Netherlands' large commercial banks operate cash centres, where banknotes deposited at bank branches are collected and counted, checked for authenticity and packaged before they are transported to the central bank or recirculated through bank branches or ATMs. The associated costs are allocated to the cash system. Banks' activities relating to debit card payments, concern the operation of the interbank network to process the electronic transactions, the production and distribution of the cards, product development including the measures to guarantee safety, administrative activities (including auditing & control departments, customer service, etc.). The costs of all these activities are internal costs. Transfers from the banks to ACHs or cash-in-transit companies are also considered as internal costs for banks.

The external costs of the banks relate to the above-mentioned transfers to the central bank. Banks derive revenues from cash and debit card payments too. These revenues, defined as those revenues directly related to payment system activities, are fixed periodic contributions e.g. for the payment package and per transaction fees, whether in the form of a fixed amount per transaction (e.g. for a debit card transaction) or as a percentage of the transaction amount (often charged for cash withdrawals or cash depositions). The fee revenues are visible costs to the customer,

who is informed by the bank about the amounts involved. By contrast, there are also invisible costs, such as float.⁷ Revenues from float arise when, in case of a transfer between two customers, the dates of debiting and crediting their accounts do not match.

For the *retail sector*, the internal costs refer to all the activities necessary to facilitate and receive cash and debit card payments. Investments in technical facilities such as POS terminals and cash registers are important in this respect. Another important cost item concerns front office time, i.e. the length of time, expressed in terms of staffing costs, involved in processing the payment of the transaction (Garcia Swartz, Hahn and Layne-Farrar, 2006). The time needed by the cashier to ring up individual items is not counted, since this is not a payment activity. On the other hand, the activities involved in depositing surplus cash periodically at the bank constitute internal costs for the retailer, including the time necessary for counting banknotes and coins, packaging (e.g. in sealed bags) and transporting them to the bank.

The external costs for the retailers concern their payments to the banks for the services rendered (see above). Retailers' revenues from the payment services they provide to consumers include the fees levied on low-value debit card payments. In reality, however, the revenues from surcharging have become negligible (EIM, 2011). In practice, the surcharges have mainly acted as a steering device.

3.3 Fixed versus variable costs

The different cost items that constitute internal costs can be divided into fixed and variable costs. This distinction is relevant for several reasons. First, it contributes to the understanding of the decisions made by individual agents. And second, it is relevant for assessing which payment instrument is most cost effective for which transaction amount. Fixed costs relate to the cost items that are not affected by the performance of a specific transaction or by the sales amounts generated by a specific means of payment. An example of such a fixed cost item is the production costs of banks for debit card payments. Variable costs do have such a relation. Some of these costs depend only on whether the transaction is carried out or not (e.g. telecommunication costs of a debit card payment), while others are related to the transaction amount involved. In the case of cash, the variable costs increase with the transaction amount (counting bank notes and mints, etc.), whereas the costs for

⁷ With the implementation of the Payment Services Directive in 2009 another source of invisible costs, the so called value-dating, has been banned. Revenues from value-dating arose when the interest-bearing date differed from the date of entry of the account. A second source of invisible costs for consumers and revenues for the banks concerns revenues derived by banks from current account balances. However, these costs do not depend on the usage of specific means of payment and are therefore not relevant to this study.

debit card payments mainly depend on whether the transaction is carried out or not. In this study we use the macro view to classify the nature of the costs.⁸

Formally, we split social costs SC in fixed costs F, and variable costs V, which can be transaction-linked or sales-linked (respectively V_{tr} and V_s). For each payment product j, social costs equal the sum of these three types of costs:

$$SC_j = F_j + V_{j,tr} + V_{j,s}.$$

If N_j denotes the number of transactions made with payment instrument j and α_j denotes the average transaction-linked variable costs per transaction made with payment instrument j, then the total variable transaction-linked costs with payment instrument j equal $V_{j,tr} = \alpha_j N_j$. If we define S_j as the sales realised through payment instrument j and β_j represents the average sales-linked variable costs per euro in sales paid with payment instrument j then the total variable sales-linked costs with payment instrument j equal $V_{j,s} = \beta_j S_j$. In this study we used a time horizon of 3–5 years for the classification of the nature of costs. This horizon corresponds to the investment horizon of businesses.

3.4 Introducing criteria for cost comparing

In general, the social costs of cash payments cannot be directly compared to the social costs of debit card payments, as they differ in the number and the value of the transaction carried out. In order to compare costs, we need to scale them somehow and take usage differences into account. There are two options for scaling social costs, viz. total number of transactions and total amount of sales. An alternative is to look at the costs of one additional transaction of a predetermined size s. Therefore, following Brits and Winder (2005), we have three criteria to make compare costs:

Criterion 1 Social costs per transaction: $SC_j/N_j = F_j/N_j + \alpha_j + \beta_j S_j/N_j$
with S_j/N_j representing the average value of a transaction generated with instrument j.

Criterion 2 Social costs per euro of sales: $SC_j/S_j = F_j/S_j + \alpha_j N_j/S_j + \beta_j$
with SC_j/S_j (F_j/S_j) as the total costs (fixed costs) of each euro in sales, and N_j/S_j representing the number of transactions needed to generate EUR 1 in sales.

⁸ For individual agents, the classification of cost items into fixed, variable transaction-related or variable sales-related may differ from the classification on macro level. For instance, for an individual retailer the costs for a payment terminal may be mainly fixed, whereas at the macro level part of these costs are variable, because they vary with the number of retailers who accept debit card payments.

Criterion 3 The costs of one single additional transaction of size s : $\alpha_j + \beta_j s$

Criterion 3 focuses on the variable costs of a transaction, consisting of a component that depends on the fact that the transaction is carried out and a component that depends on the transaction value. Criterion 3 is most appropriate for discussions on the efficiency of the individual payment instruments. The distinction between the variable costs related to the mere fact of carrying out the transaction and those related to its size opens up the possibility to calculate the so called break-even transaction amount, i.e. the amount for which the costs of the two products are equal (Ten Raa and Shestalova, 2004). For each pair of payment instruments i and j , the 'break-even' transaction amount follows from the equation $\alpha_j + \beta_j s = \alpha_i + \beta_i s$. The resulting value of s represents the transaction amount for which the costs involved in paying with product j are equal to the costs of using product i . If a smaller amount is paid, the one payment instrument will be more economical, while the other will be preferred for larger transaction amounts. Therefore, criterion 3 does justice to the fact that for some transaction amounts one payment instrument will be most cost efficient from a social point of view, while for other amounts another instrument may be most economical. Because of this quality, this cost criterion can also easily be used to quantify the possible cost savings achieved by substituting transactions which are paid with a high-cost instrument for an alternative, low-cost payment instrument.

4 Empirical results

4.1 Social costs of cash and debit card payments 2002–2009

The move from cash to debit card payments, the innovations in the payment infrastructure and the rationalisation of the network of bank branches and ATMs have resulted in substantial cost savings for Dutch society as a whole. Table 4 shows the social costs borne by the central bank, the banking sector and retailers together for cash and debit card payments for the years 2002 and 2009. An approximation of the social costs for 2012 is presented in section 4.3.

Between 2002 and 2009, the social costs for cash and debit card payments dropped by EUR 237 million from EUR 2,642 million in 2002 to EUR 2,405 million in 2009, i.e. costs declined by about 1% a year. Between 2009 and 2002 costs for cash fell by EUR 334 million to EUR 1,788 million in 2009. Both retailers and banks reduced their costs, although retailers realised larger cost savings than banks. The costs for DNB increased slightly between 2002 and 2009, but they made up only a small portion of the total costs. In line with the increased usage of the debit card the social costs of debit card payments rose. Between 2002 and 2009 costs went up by EUR 97 million to EUR 617 million.

Next to cost figures Table 4 also includes two indicators which put the amount spent on payments into perspective. The first indicator relates the social costs to the number of households in the Netherlands and the second indicator relates the social costs to the nominal level of Dutch GDP. The latter indicator also takes price developments into account and provides a more accurate picture of the realised cost savings than nominal costs.

The total costs for cash and debit card payments together per household per annum amounted to about EUR 380 in 2002 and to about EUR 330 in 2009. So between 2002 and 2009, the nominal costs per household fell by approximately EUR 50. Under perfect competition in the retail sector and the banking sector such a reduction in costs will eventually translate itself into lower prices for consumer products and bank services. The extent to which agents made use of scarce production factors to facilitate cash and debit card payments also decreased considerably, as evidenced by the reduction in the cost relative to the Dutch GDP. In 2002 social costs of all

cash and debit card payments was equal to 0.57% of GDP, whereas by 2009 it had dropped to 0.42% of GDP.

Table 4 Social costs of cash and debit card payments, 2002 - 2009

In EUR millions, unless otherwise indicated

	2002		2009	
	Cash	Debit card	Cash	Debit card
Total no. of transactions (millions)	7,066	1,069	4,579	1,946
Aggregate amounts (EUR billions)	66.3	47.2	58.1	76.1
Average transaction amount (EUR)	9.37	44.13	12.69 ^a	39.07
Social costs incurred by agents				
Costs to DNB	70	-	73	-
- Fixed costs	30	-	32	-
- Variable costs	40	-	41	-
Costs to banks	895	268	865	322
- Fixed costs	351	211	420	239
- Variable costs	544	57	445	83
Costs to retailers^b	1,157	252	850	295
- Fixed costs	497	99	192	48
- Variable transaction-linked costs	417	153	321	247
- Variable sales-linked costs	243	0	337	0
Total costs	2,122	520	1,788	617
- Fixed costs	878	310	644	287
- Variable costs	1,244	210	1,144	330
Total costs of cash and debit cards	2,642		2,405	
Total annual costs per household (in EUR)	380		330	
% of GDP	0.57% GDP		0.42% GDP	

a The increase of the average value of cash payments can be explained by the fact that consumers tend to buy more purchases at one point-of-sale instead of visiting multiple points-of-sale. Consequently, they make less payments with an on average higher transaction value. In addition, inflation exercised upward pressure on the average value of a cash transaction.

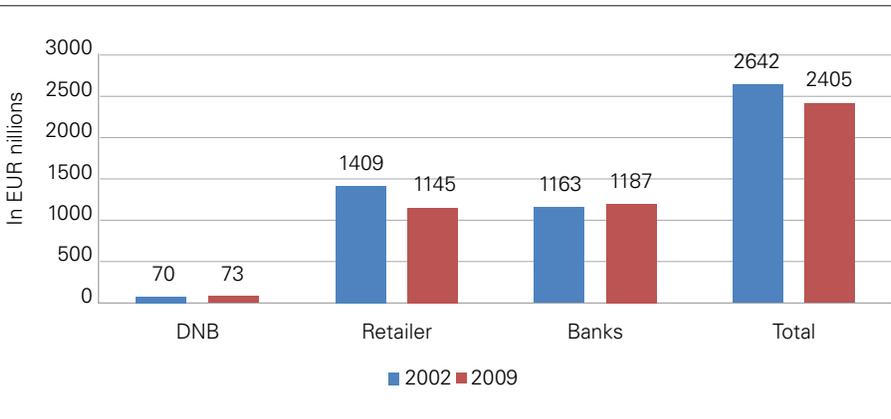
b Variable costs to retailers are split into costs that vary with the number of payments made, the so called variable transaction-linked costs and costs that vary with the sales generated with the payment instrument, the so called variable sales-linked costs. We could not make such a breakdown for banks' costs.

Cost savings realised between 2002 and 2009 were not equally distributed among the three different sectors. In fact, all nominal cost reductions were achieved in the retail sector. There, costs for cash and debit card payments together dropped by EUR 264 million (see Graph 3). Several factors contributed to the cost decrease, such as the substitution of cash by the debit card, cheaper payment terminals and cheaper and faster online connections which resulted in savings in the front office. However, although the costs incurred by banks and DNB remained relatively stable between 2002 and 2009, they too realised efficiency gains – for example through the optimisation of the cash cycle and economies of scale in the processing of debit card transactions. These efficiency gains compensated for cost increasing factors such as wage increases, but did not outweigh them as in the retail sector.

The results raise the question why retailers were able to realise relatively large efficiency gains compared to the banking sector and DNB. One of the reasons is that a relatively large part of the costs in the banking sector is fixed, whereas variable costs are dominant in the retail sector (see Graph 4). As a consequence, changes in consumer payment behaviour have a relatively heavy impact on retailers' costs compared to banks' costs. Another reason may be that for a bank, optimising or adjusting payment processes is much more complex and time-consuming than it is for retailers. This raises the question whether the chosen time horizon of 3–5 years for investments is appropriate for banks.

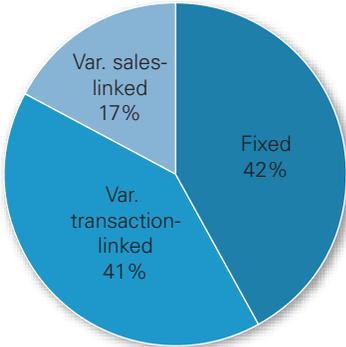
For retailers, the share of fixed costs decreased considerably between 2002 and 2009. This is not only due to changes in consumer payment behaviour or a decline in fixed costs. The classification of the nature of costs (fixed or variable) also changed for some cost items. For example, the back office costs for cash and debit card payments were classified as fixed in 2002 but were later reallocated to mainly)

Graph 3 Social costs cash and debit card payments, 2002 - 2009

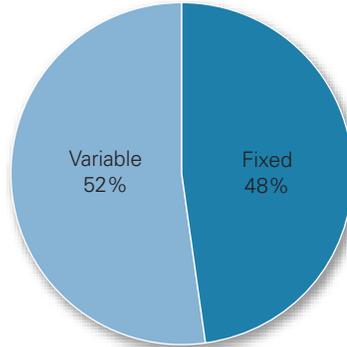


Graph 4 Breakdown of costs into fixed and variable, 2002 - 2009

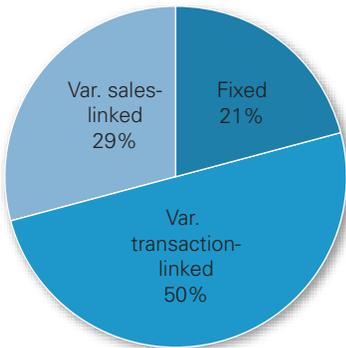
Retailers 2002



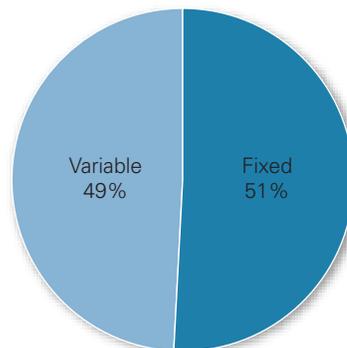
Banks 2002



Retailers 2009



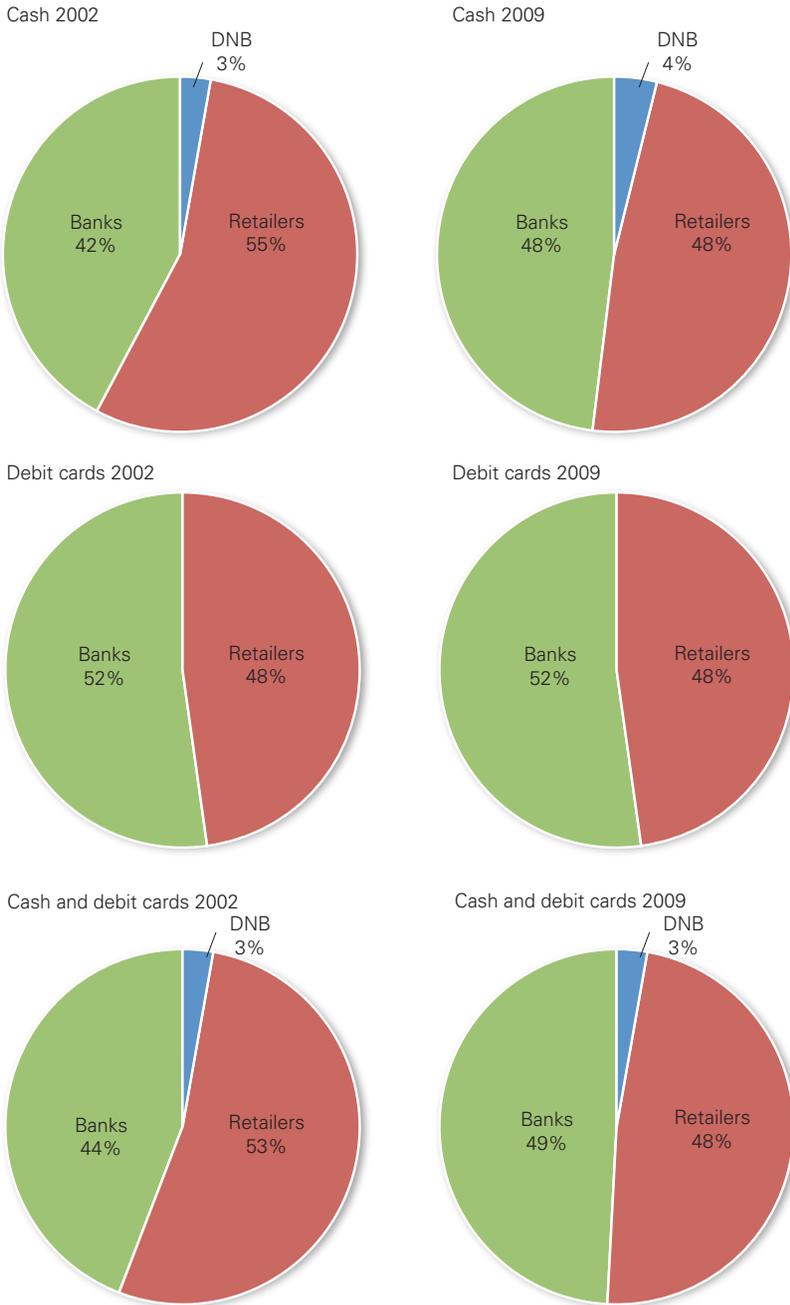
Banks 2009



variable (EIM, 2011). On the other hand, the costs for own cash transport to the banks were reallocated from variable costs to fixed costs.

The relatively large cost reduction in the retail sector led to a shift in the shares of cash-related social costs borne by different groups of agents (see Graph 5): in 2002 retailers bore 55%, banks 42% and DNB about 3%, whereas in 2009 retailers and banks each bore 48% of the costs and DNB about 4%. Unlike the distribution in the costs for cash payments, the distribution of costs associated with debit card payments did not change: 48% was borne by the retail sector and 52% by the banking sector. The share of the banks in the total costs for cash and debit card payments rose from 44% to 49%, whereas the corresponding share for retailers declined from 53% to 48%. Thus contrary to the situation in 2002 the largest share of the social costs was borne by banks in 2009. The share of DNB remained fairly stable at 3%.

Graph 5 Part of the social costs borne by different agents, 2002 - 2009



4.2 Cost efficiency of cash and debit card

Section 2 showed that between 2002 and 2009 cash usage declined considerably, whereas debit card usage more than doubled. In addition, developments in IT and austerity measures had been taken by DNB, retailers and banks to cut down expenses related to the cash cycle and to debit card payments. Table 5 shows the impact of these developments in the associated social costs, scaled by the usage of the payment instrument. It presents the results for the three cost criteria which we introduced in section 3.4, that is, the total social costs per transaction, the total social costs per euro in sales, and the social costs of a single additional transaction of size $s: \alpha_j + \beta_j s$, as well as the break-even point. The break-even point indicates the threshold level below which cash payments are most cost effective and above which debit card payments incur least costs to society. Subsequently, we present possible cost savings for 2009 if consumers had opted more often for the most cost effective mode of payment, as well as an approximation of social costs in 2012.

Table 5 Cost measures for cash and debit card transactions, 2002 - 2009

In EUR

	2002		2009	
	Cash	Debit card	Cash	Debit card
Social costs per transaction				
DNB/KNM	0.01	-	0.02	-
Banks	0.13	0.25	0.19	0.17
Retailers	0.16	0.24	0.19	0.15
Total	0.30	0.49	0.39^a	0.32
Social costs per EUR in sales				
DNB/KNM	0.001	-	0.001	-
Banks	0.014	0.006	0.015	0.004
Retailers	0.018	0.005	0.015	0.004
Total	0.032	0.011	0.031	0.008
Variable social costs per average transaction^b				
Costs of 1 additional transaction (α),	0.1117	0.1903	0.1376	0.1643
Costs for EUR 1 in additional sales (β , %/100)	0.0069	0.00014	0.0089	0.00013
Break-even point	11.63		3.06	

a Due to rounding errors the figures do not add up.

b $\alpha + \beta s$, where s is the average transaction amount, viz EUR 9.37 (cash 2002), EUR 44.13 (debit card 2002), EUR 12.69 (cash 2009), EUR 39.07 (debit card 2009).

In 2002 the average social costs for a cash payment were EUR 0.30, or about 19 eurocents less than for a debit card payment. Between 2002 and 2009, average social costs per debit card payment dropped from EUR 0.49 to EUR 0.32, as a result of economies of scale, IT developments and other cost saving measures.⁹ With respect to cash payments, the efficiency measures taken by DNB, the banking sector and retailers did not outweigh the effects of diseconomies of scale and rising cost factors such as labour costs; the average social costs per cash payment grew from EUR 0.30 to EUR 0.39. As a result, in 2009, a debit card payment cost 7 eurocents less, in terms of average social costs, than a cash payment.

For both 2002 and 2009, the social costs per euro in sales were about 3 to 4 times lower for debit card payments than for cash payments. Overall, the social costs-sales ratio declined moderately between 2002 and 2009. The costs per extra euro in sales for cash payments amounted to EUR 0.032 in 2002 and EUR 0.031 in 2009, while the social costs per extra euro in sales for debit card payments fell from EUR 0.011 to EUR 0.008. With respect to debit card payments, the drop in costs holds for both retailers and banks, but for cash payments it was restricted to the retail sector.

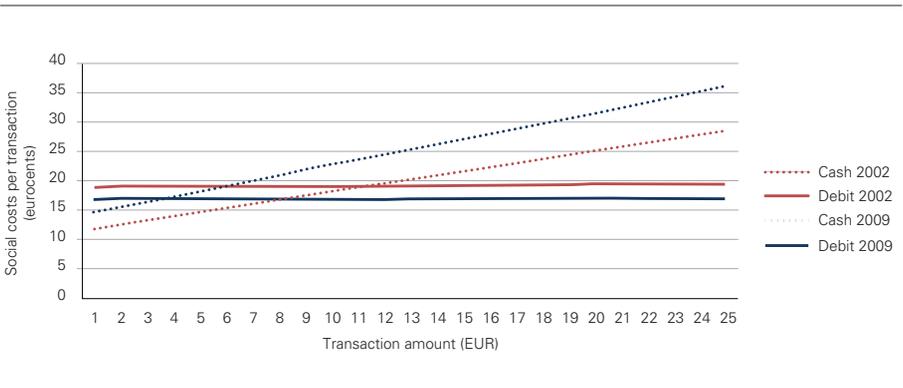
The only way social costs can be reduced in the short run is by lowering variable social costs through changing payment behaviour. In order to calculate these costs for a specific purchase it is necessary to take the transaction amount into account, as variable costs break down into transaction-linked (α) and sales-linked variable costs, depending on the transaction amount s (sales-linked costs = $\beta*s$, with β indicating the change in variable costs associated with a 1 euro increase in transaction amount and s denoting the transaction size). Following Brits and Winder (2005) we specify the variable social costs for the average cash transaction and for the average debit card transaction in Table 5. We also present estimated values for α and β for 2002 and 2009 as well as the break-even transaction amounts.¹⁰

9 Scale economies (SCE) equal marginal costs divided by average costs per payment. An SCE below 1 indicates that if payment volume doubles, costs will less than double. Following Bolt and Humphrey (2007) we approximated marginal costs with variable costs. As marginal costs lie below variable costs SCEs approximated this way should be considered as upper bounds. Using the cost information in Table 5 we found SCEs for cash payments of 0.6 in 2002 and 0.67 in 2009. For debit card payments they were 0.41 in 2002 and 0.53 in 2009. For both years, economies of scale were larger for debit card payments than for cash payments. Scale effects for debit card payments declined because the average costs per debit card payment decreased. This was mainly due to the fact that fixed costs were spread over a larger number of payments. Bolt and Humphrey report SCEs for debit card payments for Belgium in 2003 and Norway in 2001 which are similar to ours, but a lower SCE for cash payments in Belgium in 2003.

10 We could not distinguish between variable transaction-linked cost and variable sales linked cost of the banking sector and DNB. Therefore, we constructed a proxies for the transaction-linked cost and the sales-linked cost by assuming that the share of transaction linked-cost on variable cost and the share of sales-linked cost on variable cost in 2009 was the same as in 2002.

Graph 6 illustrates the variable social costs curves for a range of transaction amounts and the break-even amounts for both 2002 and 2009. It turns out that the average variable social costs for cash payments increased from EUR 0.18 to EUR 0.26 between 2002 and 2009, whereas the average variable social costs for a debit card payment fell slightly from EUR 0.20 to EUR 0.17. Moreover, the results reveal that in 2009 the variable social costs for an additional cash payment exceeded the variable social costs for an additional debit card payment for transaction sizes above EUR 3.06. In 2002 the break-even point below which cash was more economical than the debit card was much higher, i.e. EUR 11.63 (Brits and Winder, 2005). The downward shift of the break-even point is the result of both the increase in the variable social costs per cash payment and the decrease in the variable social costs per debit card payment. It seems likely that the actual break-even point was even lower than EUR 3.06.¹¹ The variable social costs for banks and retailers include fees paid to other companies, such as to the ACH, telecom companies, terminal providers for debit card payments and cash-in-transit companies for cash payments. These companies fees are intended to cover both their fixed and variable costs. Furthermore, these fees probably also included a profit margin. Therefore, in reality, the variable costs of the services incurred by these companies were probably lower than the sum of their fees. Especially for debit card payments, because fees make up a larger share of the variable costs for debit card than for cash payments. In addition, it is likely that the break-even point has continued its decline since 2009, as IT developments have made debit card payment processing even more efficient.

Graph 6 Variable costs of cash and debit card payments, 2002 - 2009



¹¹ About 30% of all POS payments in 2009 had a transaction value of EUR 3.06 or less. It would have been socially optimal if consumers would have used the debit card for all payments above EUR 3.06 and cash for all payments lower than EUR 3.06. Retailers may use incentives to steer consumers towards cost efficient payment behaviour, see. e.g. Bolt et al. (2010).

Our findings for the Netherlands correspond very well with recent findings for Denmark and Sweden. Kaas Jacobsen and Mølgaard Pedersen (2012) report EUR 3.90 in Denmark in 2009 as the break-even point between payments in cash and by domestic Dankort debit card, which closely matches our EUR 3.06. And also Sweden shows a considerable decline of the break-even point between cash and debit card payments between 2002 and 2009, from SEK 72/EUR 7.80 in 2002 (Bergman et al, 2007) to SEK 20/EUR 1.88 in 2009 (Segendorf and Jansson, 2012).

Scenario analyses

The above analysis shows that further cost savings could be achieved if consumers used the debit card more often, in preference to cash. In order to get a rough indication about the extent of possible savings we carried out scenario analyses. We assumed that the cost structure for 2009 as presented in Table 5 would still apply.

Scenario 1: Increased cash by card substitution in 2009.

In this scenario we assumed that half of all payments had been paid with debit cards and the other half with cash. This means substitution of 1.3 billion cash payments by debit card payments. In addition, we assumed that the substitution would result in a decline of the average value of a cash payment from EUR 12.69 to EUR 10, since for most consumers, cash is the most convenient payment instrument for small amounts (Jonker, 2007). Furthermore, consumers tend to think that merchants prefer cash for low amounts (unpublished results of earlier DNB research). In addition, it is relatively common for merchants selling mainly low-value products to accept only cash and/or to surcharge for debit card payments (Jonker, 2011). Therefore, it seems reasonable to assume that, in 2009, card-for-cash substitution would have taken place in the medium and higher transaction brackets.¹²

According to this scenario the social costs would amount EUR 2,219 million in 2009 instead of EUR 2,405 million, implying a cost reduction of EUR 186 million or 8% (Table 6). Agents would incur EUR 1,382 billion in costs for cash payments (-23%), whereas costs incurred for debit card payments would amount to EUR 837 million (+36%).

Scenario 2: 2012

In a second scenario, we made a first attempt to approximate the social costs for 2012. In 2012 there were 2,474 million debit card payments, for a total value of EUR 84 billion, and about 3.75 billion cash payments for a total value of about EUR 47 billion. The total number of cash payments is not only lower because of

¹² Between 2002 and 2009 the average value for cash payments increased from EUR 9.37 to EUR 12.69. The reason for the increased transaction value stems from the fact that Dutch consumers went to less points of sale to buy their purchases, which exercised upward pressure on the average transaction amount. The number of POS payments decreased from 8.3 billion to 6.7 billion.

Table 6 Social costs of cash and debit card payments, 2009 and under alternative scenario

2009	Cash	Debit card	Total
No. of transactions (millions)	4,579	1,946	6,525
Aggregate amount (EUR millions)	58.1	76.1	134.2
Average transaction amount (EUR)	12.69	39.11	20.57
Social costs (EUR millions)	1,788	617	2,405
Scenario 1: 2009 – alternative scenario			
No. of transactions (millions)	3,2625	3,2625	6,525
Aggregate amount (EUR millions)	32.6	101.6	134.2
Average transaction amount (EUR)	10.00	31.13	20.57
Social costs (EUR millions)	1,382	837	2,219
Social cost difference (alternative vs. actual)	-406	220	-186
Scenario 2: 2012–using 2009 cost structure, with 4.5% cost price correction			
No. of transactions (millions)	3,750	2,474	6,224
Aggregate amount (EUR millions)	47.2	84.3	131.5
Average transaction amount (EUR)	12.58	34.08	21.12
Social costs without cost price correction (EUR millions)	1,578	705	2,283
Social costs with cost price correction (EUR millions)	1,649	737	2,386
Social cost difference (2012 vs. 2009)	-139	120	-19

a Due to rounding errors the figures do not add up.

b $\alpha + \beta s$, where s is the average transaction amount, viz EUR 9.37 (cash 2002), EUR 44.13 (debit card 2002), EUR 12.69 (cash 2009), EUR 39.07 (debit card 2009).

the substitution of cash by debit card payments, but also because of an overall reduction in the number of POS payments. We assumed that the cost structure for 2009 would still apply, but we adjusted the social costs for the development of cost prices between 2009 and 2012 as proxied by the wage development in that period (+4.5%).¹³

For cash and debit card payments together, social costs would amount to EUR 2,386 million in 2012, EUR 19 million less than in 2009. This estimation suggests that the extent to which agents used scarce production factors to facilitate cash and debit card payments continued to go down. The estimates suggest a further reduction

¹³ Labour costs constitute an important part of the social costs for cash and debit card payments. It was more appropriate to use wages (+4.5%) as a proxy for cost price than general inflation (+6%), because other factors that influenced cost price, such as IT or real estate, exercised downward pressure on cost price between 2009 – 2012.

of the costs-to-GDP ratio from 0.42% to 0.40%. They also indicate that in 2012 a cash payment cost society about EUR 0.44 (2009: EUR 0.39) whereas a debit card payment cost EUR 0.30 (2009: EUR 0.32).

Note that the above calculations merely serve as an illustration of possible cost savings. They only show first-order effects on costs, i.e. on the costs that are considered as variable within a medium term horizon of about 3–5 years. Any second-order effects have not been taken into account.

However, it is quite conceivable that if consumers did indeed change their payment behaviour so radically, agents might adjust their payment infrastructure and payment processes accordingly. So, in the longer run, fixed costs might be affected as well. For instance, while on the one hand, banks might need to expand the payment infrastructure for electronic debit card payments, on the other hand, they might decide to scale down the infrastructure needed for cash handling and recirculation. It seems likely that if such infrastructural changes occurred, even larger cost savings could be achieved. However, they will only be realised if cost savings from the further rationalization of the cash cycle will outweigh the investments aimed at expanding the necessary capacity of the electronic payment infrastructure.

4.3 Social costs versus private costs

Although from a social point of view it is the social costs associated with a cash and a debit card payment that determine which payment instrument is most cost efficient, for a bank or a retailer it is private costs that matter. Private costs include not only the expenses of making a payment with a particular payment instrument possible (i.e. internal costs), but also the implied external costs and revenues.¹⁴ External costs for one party in the payment chain often constitute revenues for another, such as annual fees or acquiring fees paid by retailers to acquiring banks. In addition, external costs also include the opportunity costs of holding cash. The payment instrument that involves lowest private costs will for individual agents be most attractive from a cost perspective. However, banks and retailers may differ in the private costs they face, and may therefore favour different payment instruments. This section examines private costs for all payments together, as well as scaled by the number of transactions.

Graph 7 shows that for both banks and retailers, private costs for cash were much higher than those for debit card payments. Between 2002 and 2009 private costs for retailers and banks declined. Retailers also realised a reduction in internal costs,

¹⁴ The social costs equal the sum of the internal costs of the central bank, the banking sector and the retailers. See section 3.1 for an introduction to the definitions of social costs, internal costs, external costs, revenues and private costs.

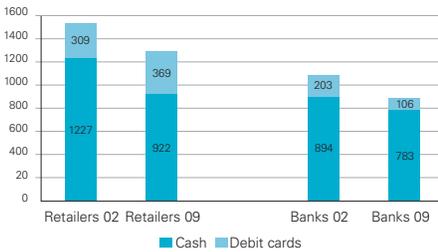
whereas banks faced a slight increase. Due to transfers from the retail sector to the banking sector, external costs for retailers were positive, whereas they were negative for the banking sector. Note that the decline in external costs for banks between 2002 and 2009 was smaller than the increase in external costs for retailers. Due to the huge fall in interest rates between 2002 and 2009 the opportunity costs for holding cash dropped, which especially affected banks' external costs. Increasing revenues from debit card payments also contributed to the drop in external costs for banks. Banks not only received higher revenues from retailers, but they also started to receive revenues from consumers.¹⁵

Private and social costs scaled by the number of payments provide insight into whether private interest of banks and retailers correspond with the social interest. After all, the payment instrument which incurs lowest costs to society as a whole

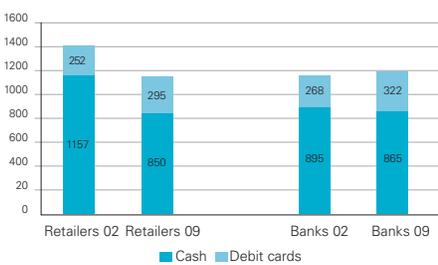
Graph 7 Private, internal and external costs for retailers and banks, 2002 - 2009

In EUR millions

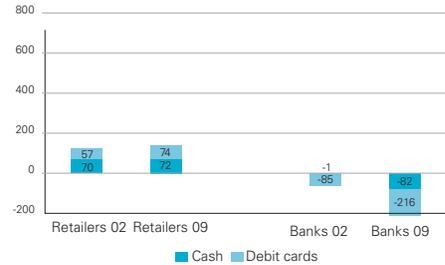
Private costs for cash and debit card payments



Internal costs for cash and debit card payments



External costs for cash and debit card payments



¹⁵ After 2002, banks introduced fixed periodical fees for consumers for having a current account. The payment package included having a current account, access to online banking and a debit card which can be used for ATM withdrawals and debit card payments. The fees were allocated to different payment services delivered by banks to consumers. A relative large part of these fees were allocated to the debit card, because of the high usage of this type of card.

may turn out to be relatively expensive for individual agents. Table 7 shows both the average private costs and the average variable private costs per payment in 2002 and 2009. In general, for each group of agents the average private costs associated with a payment by a particular payment instrument differ from the average social costs (compare Table 5 and Table 7). Between 2002 and 2009 the average overall private costs of debit card payments to banks plummeted, whereas their average variable private costs rose. The drop in average private costs is mainly due to increasing revenues from consumers which were allocated to debit card payments. The moderate increase of the variable private costs is partly due to the reduction of the acquiring fees that retailers paid for each incoming debit card payment. Table 7 also reveals that even in 2002 a bank's variable private costs for a debit card payment were already lower than those for a cash payment. In fact, the variable private costs per debit card payment were nil, indicating that the acquiring fee banks received per debit card payment covered their variable internal costs per debit card payment. This is not surprising as the variable costs per debit card payment are intrinsically low. For banks, the costs of debit card payments is mainly due to the high fixed costs associated with the electronic payment infrastructure needed to support card payments.

Table 7 Breakdown of the average social, private and variable private costs per cash and debit card payment, 2002-2009

In EUR

	2002		2009	
	Cash	Debit card	Cash	Debit card
Average social costs per payment	0.30	0.49	0.39	0.32
Average variable social costs per payment	0.18	0.20	0.25	0.17
Average private costs per payment				
DNB	0.01	0.00	0.02	0.00
Banks	0.13	0.19	0.17	0.05
Retailers	0.17	0.29	0.20	0.19
Total	0.31	0.48	0.39	0.24
Average variable private costs per payment				
DNB	0.01	0.00	0.01	0.00
Banks	0.08	0.00	0.10	0.01
Retailers	0.10	0.19	0.16	0.16
Total	0.19	0.19	0.27	0.17

For retailers debit card payments were more costly than cash payments in 2002, but in 2009 they turned out to be as costly as cash payments. So, accepting debit card payments instead of cash did not affect variable private costs in 2009. Decreasing acquiring fees and faster online connections, which reduced front office time, both contributed to the increasing attractiveness of the debit card for retailers. Consequently, debit card acceptance rose, also among the smaller retailers and those selling low-value products.

5 Concluding remarks

In this study we present new estimates for the social costs associated with cash and debit card payments for the Netherlands for the year 2009. In addition, we provide an approximation of the costs for the year 2012 using scenario analysis. Social costs refer to the costs to society, reflecting the use of resources in the production of payment services; that is the total costs of production. We focus on the costs incurred by the central bank, retailers and the banking industry.

The key findings can be summarised as follows: the social costs of cash and debit card payments declined considerably between 2002 and 2012, from EUR 2,642 million in 2002 to EUR 2,405 million in 2009 and EUR 2,386 million in 2012, i.e. from 0.57% of GDP in 2002 to 0.42% of GDP in 2009 and 0.40% of GDP in 2012. If we separate the costs of cash payments from those of debit card payments, we see that the former declined from EUR 2,122 million in 2002 to EUR 1,788 million in 2009 and EUR 1,649 million in 2012, whereas the latter rose from EUR 520 million in 2002 to EUR 617 million in 2009 and EUR 737 million in 2012. An important part of the drop in social costs of cash and debit card payments is due to increased popularity of the debit card in the Netherlands. Between 2002 and 2012 its usage more than doubled at the expense of mainly cash. The resulting economies of scale in debit card usage reduced considerably the social costs of both cash and debit card payments.

The efficiency gains in the payment chain were for the best part achieved on the retailers' side. However, although the costs incurred by banks and the Dutch central bank remained relatively stable, they too realised efficiency gains – for example through the optimisation of the cash cycle and economies of scale in the processing of debit card transactions. These efficiency gains, while compensating for cost increasing factors such as wages, did not outweigh them as they did in the retail sector. Because of the relatively large cost reduction on the retailers' side, the part of the total costs borne by retailers went down from 53% in 2002 to 48% in 2009, whereas the part of the costs incurred by banks rose from 44% to 49%. The part of the social costs incurred by DNB was 3% in both 2002 and 2009.

Turning from total costs for all payments to costs per payment, we found that between 2002 and 2009 the average social costs per cash payment rose from EUR 0.30

to EUR 0.39, whereas the average social costs per debit card payment dropped from EUR 0.49 to EUR 0.32. So, on average, debit card payments have become much cheaper than cash payments. The break-even amount at which a cash payment cost as much as a debit card payment dropped from EUR 11.63 in 2002 to EUR 3.06 in 2009. So in 2009, only for amounts below EUR 3.06 did a cash payment involve less costs to society than a debit card payment. This finding stresses that debit card payments have become more cost-efficient than cash payments for almost any transaction amount. A scenario analysis, assuming that half of all POS payments had been paid with debit cards and the other half with cash, revealed that major cost savings could have been achieved if consumers had used the debit card more often in 2009. The cost savings would have amounted to EUR 186 million, corresponding to a reduction of realised costs by 8%.

The substitution of cash by debit card payments from 2002 onwards has been supported by changes in the incentive structure. For consumers and many small retailers alike, debit card payments used to be relatively costly compared to cash payments. However, the lowering of debit card acquiring fees made debit card payments more attractive for retailers, whereas the disappearance of debit card surcharges by retailers reduced the costs of debit card payments for consumers relative to cash payments, that is, both are now free of charge. As a result, card acceptance increased and card usage by consumers intensified. These developments clearly illustrate the importance of transaction fees that reflect cost differentials between different payment instruments. This holds for both consumers and retailers.

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Annex A. Data

A.1 Data banks

For this study we used data from several sources. Information about the internal costs incurred by banks 2002 were taken from Brits and Winder (2005). Additional information about the revenues of banks for 2002 were based on information about bank fee levels published in HBD (2002) and NMa (2006). We estimated the opportunity costs of holding cash for 2002.

For the costs incurred by banks for debit card payments in 2009 we used information from a survey by McKinsey & Company inc. (2006) about the costs and revenues for retail payment services for banks in 2005. This study covers all retail payment instruments and the current account. Five of the largest banks in the Netherlands participated in it. They covered more than 98% of the retail payments market. In order to provide an estimate for the operating costs of the entire banking sector costs were scaled up by a factor of 1.3%. McKinsey & Company inc. used the so called “Activity-Based Cost” allocation model to allocate costs that are directly or indirectly linked to payment services and to specific payment instruments. It collected information about transaction costs, maintenance costs and overhead, as well as transaction revenues, subscription revenues and balance-related revenues.

With respect to banks’ costs for cash payments we used confidential data from a survey about the cost of cash services for banks in 2007 and information about indirect costs from the McKinsey study (2006). The former survey focused on the costs directly linked to the cash cycle incurred by three major banks in the Netherlands. These three banks represent about 85% of the banks that offer cash-related services to households and businesses. Their costs have been scaled up in order to provide an estimate for the costs for all banks that were active in the cash cycle.

We extrapolated the results of the aforementioned surveys to 2009 by taking into account changes in the cost drivers for cash, changes in the payment habits of consumers, changes in the organisational structure of banks, changes in short-term interest rate, increases in labour costs as well as inflation.

A.2 Dutch central bank data

DNB provided the cost figures on its own activities related to cash payments for 2002 and 2009 and reported data for the Royal Dutch Mint (Koninklijke Nederlandse Munt, or KNM), which produces euro coins. Cost figures for 2002 were also published in Brits and Winder (2005).

DNB distinguished between direct and indirect costs for cash. Major cost drivers for DNB were the printing of banknotes and the issuance, processing, recirculation and destruction of banknotes. Other drivers of direct costs were: the design and quality control of banknotes, counterfeiting, the minting of coins and third-party cash handling.

A.3 Retailer data

For this study we used data from several sources. Information about the social costs for retailers in 2002 were taken from Brits and Winder (2005). Additional information about the private costs for retailers 2002 were based on information about acquiring fees published by HBD (2002) and NMa (2006).

For 2009 we used cost information on cash and debit card payments for retailers from EIM (2011). The questionnaire used by EIM is similar to the one used for the ECB cost study on cash and debit card payments. Additional information about banks' fees were taken from NMa (2010). Research institute EIM interviewed 29 (very) large retail trade chains in the Netherlands. They received a written questionnaire with questions at the organisation level. EIM also conducted interviews by telephone with a representative sample of 979 small and medium-sized retailers from the following sectors: retail trade, street trade, catering industry and fuel stations. They were asked questions at branch level.

EIM extrapolated the results for the sample of retailers to the population of retailers active in the four abovementioned four sectors. We extrapolated these results to the entire Dutch POS market in 2009.

Table A.1 provides an overview of the composition of the internal costs and external costs incurred for cash and debit card payments by the retailers in 2002 and 2009.

Table A.1 Key figures cash and debit card payments for retailers, 2002 - 2009

	2002		2009	
	Cash	Debit card	Cash	Debit card
<i>Key statistics</i>				
Total no. of transactions (millions)	7066	1069	4579	1946
Aggregate amounts (EUR billions)	66.3	47.2	58.1	76.1
<i>Cost items (EUR million)</i>				
Back-office	497	35	306	28
Front-office	417	88	286	152
Telecommunication	0	54	0	58
Cash Transport	169	0	180	0
POS terminals	0	75	0	57
Other	74	0	78	0
Total internal costs	1157	252	850	295
<i>Break down internal costs</i>				
Fixed	497	99	192	48
Variable transaction-linked	417	153	321	247
Variable sales-linked	243	0	337	0
Opportunity costs, bank fees	70	66	72	77
Total private costs	1227	318	922	369
<i>Average retailer's costs per payment (in EUR)</i>				
Internal costs per payment	0.16	0.24	0.19	0.15
Private costs per payment	0.17	0.29	0.20	0.19
Variable private costs per payment	0.10	0.19	0.16	0.16

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