
Costs of Card and Cash Payments in Denmark

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INTRODUCTION AND SUMMARY

When consumers buy goods in shops, the payments and related activities in e.g. banks entail costs to society as a whole. According to a recent study, these costs amounted to approximately kr. 9 billion in Denmark in 2009, cf. Danmarks Nationalbank (2012). Of this amount, nearly two thirds related to cash payments, while the rest was due to payments with the Dankort, the national debit card, or international cards such as Visa and MasterCard.

This article presents the results of a breakdown of these costs into fixed and variable costs.¹ Among other things, the analysis shows that for small payments, cash involves lower costs than other payment methods, but for amounts exceeding kr. 29 it is cheapest for society if consumers use the Dankort. In all cases, credit card payments involve higher costs than Dankort payments.

These findings are in line with the results of studies in other countries. For example, a recent Swedish study showed that cash is the cheapest payment method for amounts up to 20 Swedish kronor, while debit card payments involved lower costs for payments exceeding this amount, cf. Segendorf and Jansson (2012). A similar Dutch study concluded a few years ago that cash payments are most cost-effective for amounts up to 5 euro, cf. Bolt et al. (2008).

The analysis also makes it possible to assess the consequences of shifts between different payment methods. For example, it can be used to calculate how replacing a given number of cash payments by Dankort payments affects the social costs. The impact generally depends on the size of the payments, but for large payments, the potential savings are considerable.

¹ For a more detailed description of the analysis and the results presented in this article, see Jacobsen (2012) (in Danish only).

Likewise, it can be calculated that the amended rules for card fees which came into force last year may lead to a small decline in the total costs of payments in Denmark. The new rules permit retailers to charge fees to customers for all types of credit card payments, including for cards issued in Denmark. This could reduce the use of such cards, mainly in favour of Dankort payments.

BACKGROUND AND METHODOLOGY

In the above-mentioned report, Danmarks Nationalbank published an estimate of the social costs of paying in cash and with different types of payment cards at point of sale in Denmark. These costs include the total resources used by all parties involved – consumers, retailers, banks, etc. – but not fees between these parties. The results are summarised in Table 1, which shows the costs per payment and per krone paid for each payment method.

When interpreting these results, it should be borne in mind that payment services involve substantial fixed costs. Consequently, costs per payment depend heavily on the number of transactions. Other things being equal, payment methods that are characterised by a large number of transactions, such as cash and Dankort payments, will therefore entail lower costs per payment, as Table 1 also shows.

An alternative measure is the social costs of one additional payment, i.e. the marginal costs. However, calculating these costs requires a breakdown by fixed and variable costs, which is often a difficult distinction. Hence, some costs may be stepwise variable, which means that they are fixed until the number of payments reaches a certain level, such as a capacity limit, and then they increase.

SOCIAL COSTS OF PAYMENTS IN DENMARK, 2009

Table 1

	Payments			Costs		
	Number (millions)	Value (kr. billion)	Average value (kr.)	Total (kr. billion)	Per payment (kr.)	Per krone paid (øre)
Cash	786.3	150.5	191	5.78	7.36	3.8
Dankort	790.5	253.1	320	2.51	3.15	1.0
International debit cards .	39.9	6.8	173	0.46	11.89	6.9
International credit cards	17.4	9.3	534	0.36	21.17	4.0
Total	1,633.5	419.7	257	9.11	-	-

Note: Costs include consumer costs. International debit cards are e.g. Visa Electron and MasterCard Debit. In connection with payments of this type, the money is debited to the consumer's account as soon as the payment has been made. International credit cards are e.g. MasterCard, American Express and Diners Club. Payments with these cards are not debited to the consumer's account until some time later, typically once a month.

Source: Danmarks Nationalbank (2012).

Inspired by Brits and Winder (2005), payment costs have been broken down into three types:

- *Fixed costs*, i.e. those which are not affected by the execution of an additional payment. Examples include the banks' costs for system development, production and distribution of payment cards, collection and transport of cash, and depreciation of ATMs. For retailers, fixed costs include costs for point-of-sale equipment and time spent collecting change and depositing the day's turnover in a night safe.
- *Variable transaction-linked costs*, i.e. those that vary with the number of payments. These include the banks' costs for approving and executing payments and handling customer enquiries. For retailers, a major cost of this type is wages to cashiers for the payment time, i.e. the time elapsing from the customer is informed of the amount until the transaction has been completed.
- *Variable sales-linked costs*, i.e. those that depend on the amounts paid. For banks, this could be payroll costs for employees counting, packing and sorting cash and filling up ATMs. For retailers, costs of this type include the percentage fee payable to banks for receiving international card payments, as well as time consumption for cash reconciliation.

The Appendix to this article elaborates on this breakdown for each of the parties involved in a payment transaction.

FINDINGS AND INTERPRETATION

Table 2 shows the aggregate result of a breakdown of the costs in Danmarks Nationalbank (2012) as described above. For each payment method, the variable transaction-linked costs per payment and the variable sales-linked costs per krone paid are also shown. The results in the Table can be used for various types of analysis.

Size of amount

A breakdown such as that performed in Table 2 can be used to illustrate how the social costs of one additional payment using a given method depend on the amount paid. This has been done in Chart 1 for the payment methods comprised by the analysis, i.e. cash, Dankort and international cards. The Chart does not include fixed costs, which do not affect the costs for one additional payment.

For each payment method, costs on the Chart's vertical axis start at the calculated transaction-linked costs per payment. These indicate the total costs of executing one additional payment of a hypothetical amount of

BREAKDOWN OF COSTS FOR PAYMENTS IN DENMARK, 2009

Table 2

Kr. million	Cash	Dankort	Int. debit cards	Int. credit cards
Total costs	4,817.5	2,223.5	528.5	464.2
Of which fees and other transfers	382.0	375.6	93.0	110.2
Social costs	4,435.5	1,847.8	435.5	354.0
Fixed costs	2,720.4	905.3	368.6	310.6
Variable transaction-linked costs	769.3	916.5	66.0	42.8
Per payment (kr.)	0.98	1.16	1.68	2.46
Variable sales-linked costs	945.8	26.1	0.9	0.6
Per krone paid (øre)	0.63	0.01	0.01	0.01

Note: Total costs are the sum of the costs for all parties except consumers, while social costs are the total costs less fees and other transfers.

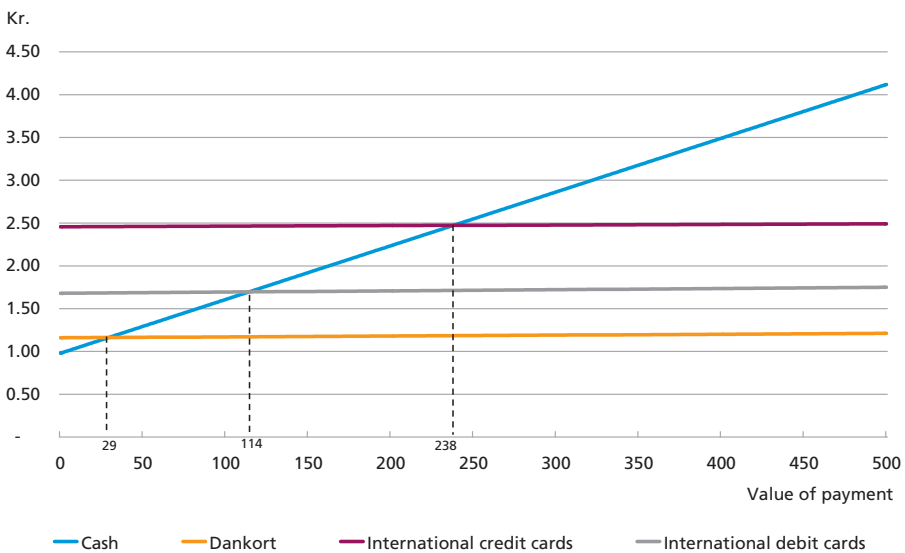
Source: Jacobsen (2012).

kr. 0. The costs then rise with the slope of the straight line, which – for each payment method – corresponds to the calculated sales-linked costs per krone paid.

In practice, the social costs rise with the value of the payment in connection with cash payments only, cf. Chart 1. The reason is that larger cash payments entail increased time consumption for cash handling by banks and retailers. For card payments, on the other hand, the parties' time consumption is independent of the amount as such payments are electronic and do not usually involve any use of labour time.

SOCIAL COSTS OF ONE ADDITIONAL PAYMENT USING DIFFERENT PAYMENT METHODS, 2009

Chart 1

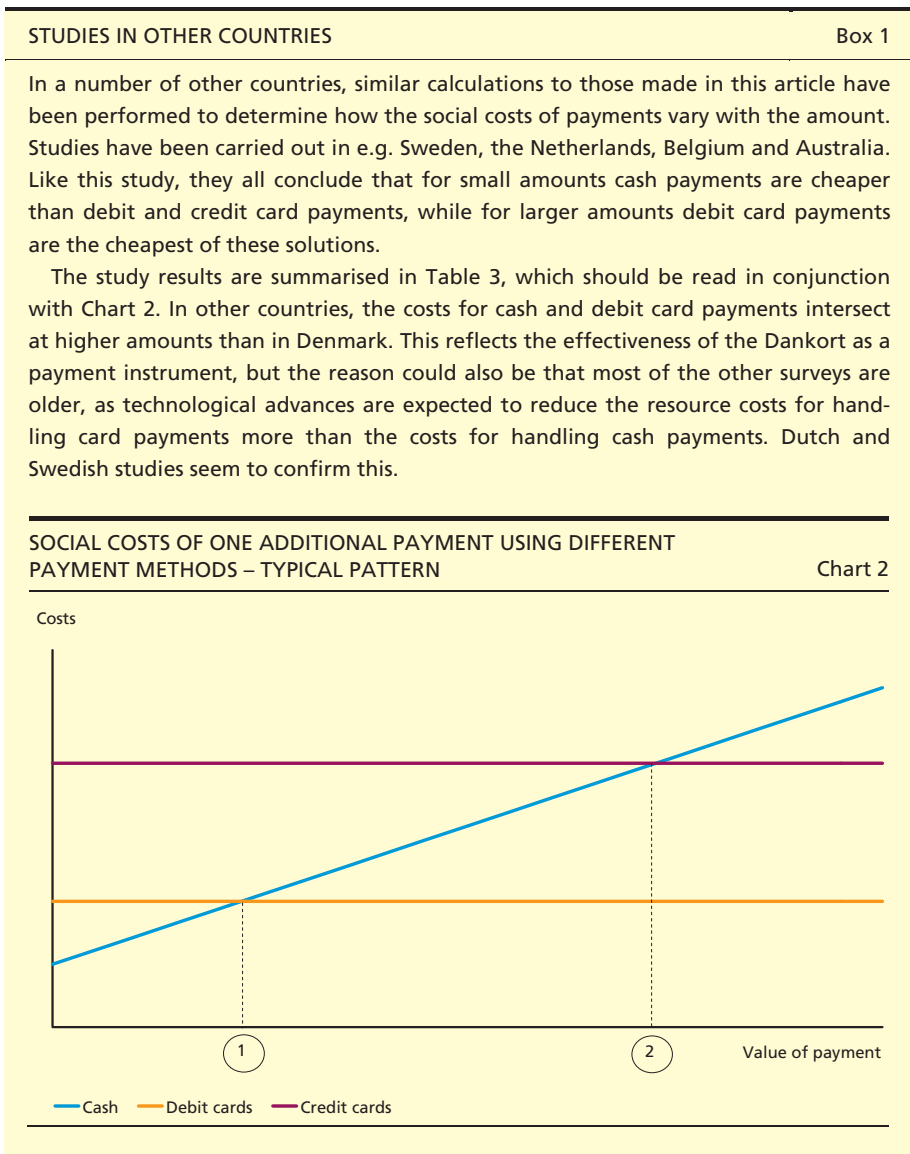


Note: The social costs have been calculated exclusive of consumer costs. For each payment method, the intersection on the vertical axis corresponds to the transaction-linked costs per payment, while the slope is equal to the sales-linked costs per krone paid, cf. Table 2.

Source: Jacobsen (2012).

Chart 1 shows that for small payments – up to kr. 29 according to the calculations – cash is the cheapest solution for society as a whole. For all larger amounts, the costs are lower for Dankort payments than for other payment methods. Compared with international debit and credit card payments, cash payments are cheaper for amounts up to kr. 114 and 238, respectively.

There are several reasons why payments with international cards are always more expensive for society than Dankort payments. First of all, the large number of Dankort payments entails economies of scale so that for some activities the transaction-linked costs per payment are



CONTINUED		Box 1
INTERSECTIONS OF SOCIAL COSTS ACCORDING TO VARIOUS STUDIES		Table 3
Danish kroner	1	2
Denmark (2009)	29	238
Sweden (2002)	58	127
Sweden (2009)	14	316
Netherlands (2002)	86	1,159
Netherlands (2006)	37	-
Belgium (2003)	76	452
Australia (2006)	224	> 2,000
<p>Note: The Table shows where the social costs of cash payments intersect the corresponding costs for payments by (1) debit card and (2) credit card, respectively. On translation into Danish kroner, the average exchange rates for the years in question have been applied.</p> <p>Source: Jacobsen (2012), Bergman et al. (2007), Brits and Winder (2005), Bolt et al. (2008), National Bank of Belgium (2005), Schwartz et al. (2007) and Segendorf and Jansson (2012).</p>		

lower. In addition, credit card payments are basically more resource-intensive to handle than Dankort payments.

These findings are in line with the results of studies in other countries, cf. Box 1. They also conclude that for small amounts, the social costs are lower for cash payments than for debit and credit card payments, while debit cards are the cheapest of these solutions for payments exceeding a certain amount. Furthermore, the surveys indicate that this amount is likely to decline as technological advances reduce the costs of card payments.

Consumer costs

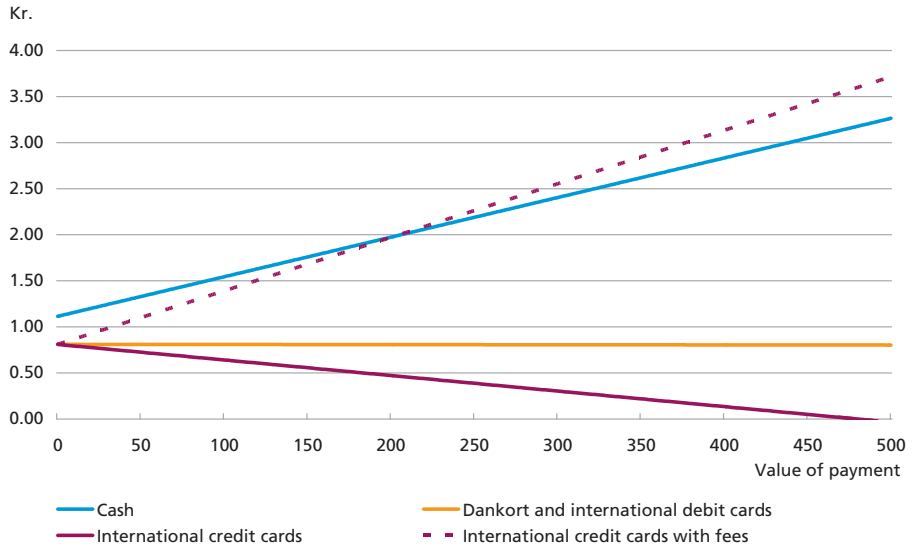
Consumers often have a choice of several payment methods. In addition to cash, virtually all retailers in Denmark accept the Dankort and many also accept international cards. Consumer choices depend on various factors, including the costs of making the payment. Hence, it is interesting to investigate whether these costs are in line with the social costs.

Chart 3 shows how consumer costs for the individual payment methods depend on the transaction amount. If card fees are disregarded, consumers incur the lowest costs by using credit cards, irrespective of the amount. This is because they obtain interest-free credit, the value of which increases with the amount. The latter also explains why consumer costs for credit card payments decline as the amount increases.

So, exclusive of card fees, consumer costs are not consistent with social costs. However, this changes if retailers choose to charge card fees to consumers, as the "split model" introduced in 2011 allows them to do, cf. Box 2. With the card fees, which are calculated as a percentage of the

CONSUMER COSTS OF ONE ADDITIONAL PAYMENT USING DIFFERENT PAYMENT METHODS, 2009

Chart 3



Source: Jacobsen (2012).

amount paid, credit card payments become more expensive for consumers than Dankort payments, irrespective of the amount.

It should be emphasised that the consumers' choice of payment method also reflects other factors than costs, including payment habits. That is why credit cards were used little in Denmark, even before the split model was introduced, although there were financial benefits for the individual consumer. Over many years, Danish consumers have become accustomed to using the Dankort for day-to-day purchases, and the widespread ownership of credit cards is a relatively new phenomenon.

NEW DANISH RULES FOR CARD FEES – THE SPLIT MODEL

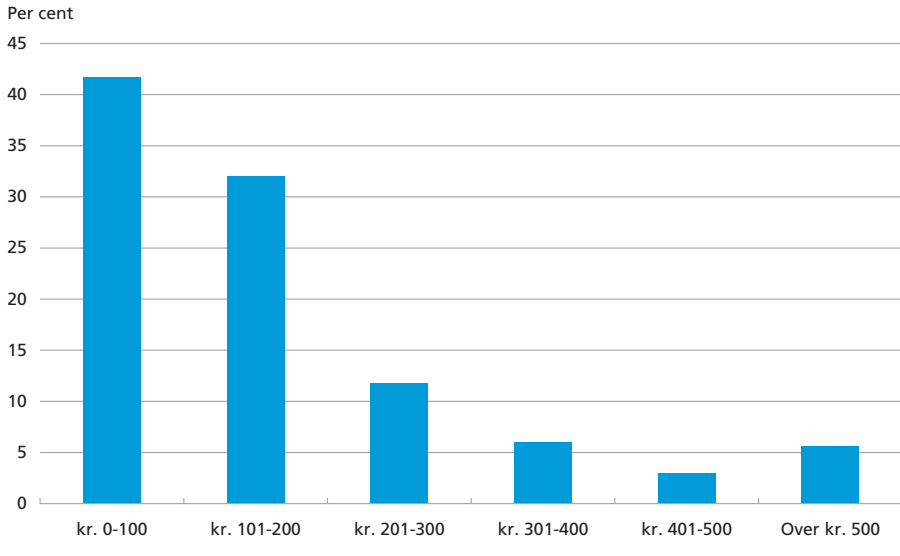
Box 2

The Danish rules for card fees were amended effective 1 October 2011. Previously, retailers were not allowed to pass on the bank fees for cards issued in Denmark to consumers in connection with payments at point of sale. Furthermore, there was a cap on bank fees of 0.75 per cent of the amount on international credit card payments and 0.40 per cent or kr. 4, whichever was lower, on international debit card payments.

The amendment of the rules abolished the ceiling on fees to banks. In addition, the fees that retailers may charge to consumers were linked to the card type. For debit card payments, e.g. by Dankort, Visa Electron or MasterCard Debit, retailers may not charge fees to consumers, while this is now permitted in connection with credit cards such as MasterCard, American Express and Diners Club – hence the name "split model".

DISTRIBUTION OF CASH PAYMENTS BY AMOUNT, 2009

Chart 4



Source: Danmarks Nationalbank.

Shift between payment methods

A breakdown of costs as performed in this article can also be used to estimate the impact on costs of a given shift from e.g. cash to Dankort payments. According to the above calculations, such substitution would reduce social costs for amounts exceeding kr. 29. The effect will increase both with the number and size of the payments substituted.

Cash is primarily used for small payments, but about one fourth of all cash payments are estimated to exceed kr. 200, cf. Chart 4. Assuming that 25 per cent of these payments were made by Dankort instead, the savings would amount to kr. 145 million in terms of social costs. The calculation assumes that neither the fixed costs for cash payments nor for Dankort payments are affected by such a shift.

A breakdown of costs as shown above can also be used to assess the effects of the split model, which can be assumed to lead to a decline in the use of credit cards in favour of other payment methods. Studies show that consumers who stop using credit cards will opt for the Dankort instead, rather than e.g. cash.¹ The reason is that most consumers who have a credit card also have a Dankort and that credit cards are mainly used for larger payments.

Table 4 shows the calculated consequences for society of a given substitution from credit card payment to Dankort or cash payment. According to the Table, the split model is most likely to result in modest

¹ See e.g. Jacobsen and Nielsen (2011).

CHANGE IN ANNUAL SOCIAL COSTS ON SUBSTITUTION OF CREDIT CARD PAYMENTS, 2011, KR. MILLION

Table 4

Cash per cent Dankort, per cent	Cash per cent										
	0	10	20	30	40	50	60	70	80	90	100
0	-	4.7	9.4	14.0	18.7	23.4	28.1	32.8	37.5	42.1	46.8
10	-3.0	1.7	6.4	11.1	15.8	20.4	25.1	29.8	34.5	39.2	-
20	-5.9	-1.3	3.4	8.1	12.8	17.5	22.1	26.8	31.5	-	-
30	-8.9	-4.2	0.4	5.1	9.8	14.5	19.2	23.9	-	-	-
40	-11.9	-7.2	-2.5	2.2	6.8	11.5	16.2	-	-	-	-
50	-14.9	-10.2	-5.5	-0.8	3.9	8.5	-	-	-	-	-
60	-17.8	-13.1	-8.5	-3.8	0.9	-	-	-	-	-	-
70	-20.8	-16.1	-11.4	-6.8	-	-	-	-	-	-	-
80	-23.8	-19.1	-14.4	-	-	-	-	-	-	-	-
90	-26.7	-22.1	-	-	-	-	-	-	-	-	-
100	-29.7	-	-	-	-	-	-	-	-	-	-

Note: The Table shows the change in the social costs if x per cent of credit card payments are made by Dankort instead (rows in the Table) and y per cent are made in cash instead (columns in the Table). Negative values indicate a fall in total costs. Consumer costs are not included in the calculations.

Source: Jacobsen (2012).

savings. For example, if 40 and 10 per cent, respectively, of credit card payments are replaced by Dankort and cash payments, respectively, this will reduce the social costs by kr. 7 million on an annual basis.

APPENDIX – BREAKDOWN INTO FIXED AND VARIABLE COSTS

The results presented in this article are based on a breakdown of the costs in Danmarks Nationalbank (2012) into fixed costs and costs linked to either the number or the size of the payments. The costs for banks, retailers, card companies and consumers are elaborated on in this Appendix.

Banks' costs

The banks' aggregate costs for performing services in connection with point-of-sale payments amounted to kr. 3.2 billion in 2009. Almost two thirds of these costs related to cash payments, while Dankort payments accounted for 20 per cent and payments with international cards for 14 per cent, cf. Table 5.

Many of the banks' costs are fixed costs, such as depreciation of IT equipment, system development costs, rent, and payroll costs for administrative staff. The costs for collection and transport of cash and issuance of payment cards are also regarded as fixed costs.

Other bank costs vary with the volume of payments. These include payroll costs for staff handling cash withdrawals and deposits or handling card payments and enquiries about such payments. Many banks also

BANKS' COSTS, 2009				Table 5
Kr. million	Cash	Dankort	Int. debit cards	Int. credit cards
Total costs	2,144.4	595.0	240.2	196.3
Fixed costs	1,250.2	306.0	205.6	153.3
Variable costs	894.2	289.0	34.6	43.0
Transaction-linked costs	220.7	289.0	34.6	32.2
Sales-linked costs	673.5	-	-	10.8

Source: Jacobsen (2012).

pay a transaction fee per card payment to Nets for providing card issuance services.

The banks' variable costs in connection with cash withdrawals are equally split on transaction-linked and sales-linked costs. This is because withdrawal of a given amount can be used to cover both a random number of payments of a fixed amount and as a fixed number of payments of random amounts.

In contrast, the banks' variable costs for cash deposits are solely defined as sales-linked costs. The reason is that such deposits are primarily made by retailers and that the derived time consumption for the banks is not linked to the number of payments retailers receive, but only to the total amount paid.

Finally, the banks incur an interest-rate loss on their cash holdings, and as card issuers they incur interest expenses on credit card payments. Both these cost types have been included in the sales-linked costs.

Retailers' costs

Retailers costs of receiving payments totalled kr. 4 billion in 2009, of which almost 60 per cent related to cash payments, while Dankort payments accounted for just over one third of the costs, cf. Table 6.

Half of the retailers' costs for receiving cash payments relate to the time spent on internal routines. Some of these activities are not linked to the volume of payments, e.g. opening the cash register and de-

RETAILERS' COSTS, 2009				Table 6
Kr. million	Cash	Dankort	Int. debit cards	Int. credit cards
Total costs	2,383.9	1,415.1	94.3	112.5
Fixed costs	1,426.4	756.9	32.4	15.8
Variable costs	957.6	658.1	61.8	96.8
Transaction-linked costs	548.6	600.2	29.3	13.5
Sales-linked costs	408.9	58.0	32.5	83.3

Source: Jacobsen (2012).

positing the day's turnover in a night safe. Payroll costs for such activities are regarded as fixed costs.

Most of the retailers' time consumption in connection with cash payments relates to activities that vary with the volume of payments, such as cash reconciliation and sorting and packing banknotes and coins. Payroll costs for these activities have been included as sales-linked costs.

In addition, retailers have a number of other costs in connection with cash payments that are also seen as sales-linked. These include loss of interest on cash held overnight, value loss from not receiving interest on cash deposits until one or two days after payment and losses resulting from cash discrepancies.

Retailers' costs for the payment time, i.e. payroll costs for the time cashiers spend on the actual payments, are transaction-linked costs. These costs are based on a time study which shows that the average transaction time for both cash and card payments is approximately 15 seconds.

A significant cost for retailers is the fee payable to banks for receiving card payments. For the Dankort, this is an annual subscription fee, i.e. a fixed cost. For payments with international cards, the fee is calculated as a percentage of the value of the payment; hence it is a sales-linked cost.

Like cash payments, card payments entail a value loss for retailers since the money is typically not credited to the retailer's account until one or more days after the sale, and in the intermittent period the retailer does not receive interest. Again, this is a sales-linked cost.

In addition, retailers have costs for e.g. depreciation of point-of-sale and security equipment, for external cash handling, primarily services performed by cash-in-transit companies, and for payment terminals and data connections. These costs are all regarded as fixed costs.

Card companies' costs

Card companies can issue cards, perform card issuance services and acquire card payments. In 2009, their costs amounted to almost kr. 650 million, of which about one third related to the Dankort and the rest to international cards, cf. Table 7.

A card acquirer is a company that receives retailers' card payments, forwards them to the issuer and guarantees the payments. The largest acquirer in Denmark is Nets, which is the sole acquirer of Dankort payments and via the subsidiary Teller acquires most of the international card payments.

A large share of the acquirers' costs are the fees payable to the issuers for each transaction. For Dankort payments, this is a fixed fee per transaction, i.e. a transaction-linked cost; for international card payments, it is a percentage of the value of the payment, i.e. a sales-linked cost.

CARD COMPANIES' COSTS, 2009 Table 7

Kr. million	Card issuance		Card acquisition	
	Dankort	Int. cards	Dankort	Int. cards
Total costs	102.1	262.2	111.3	169.9
Fixed costs	58.6	230.1	34.2	85.5
Variable costs	43.5	32.1	77.1	84.4
Transaction-linked costs	43.5	32.1	77.1	4.0
Sales-linked costs	-	-	-	80.3

Note: Card issuance also includes costs for companies providing issuance services.

Source: Jacobsen (2012).

Nets also provides card issuance services to Danish banks. Such services include sending cards and PINs to customers, handling card transactions and monitoring fraudulent use. The costs for these services are regarded as transaction-linked if assessed to vary with the number of payments, and otherwise as fixed.

Consumer costs

Consumer costs for payments are mainly the time spent on related activities, such as withdrawing cash, paying at point of sale and checking account statements. In 2009, these costs totalled approximately kr. 2.4 billion, of which more than 60 per cent related to cash payments, cf. Table 8.

The primary cost to consumers in connection with cash payments is the time spent withdrawing cash from an ATM or at the counter in a bank branch. These costs are equally split on transaction-linked and sales-linked costs, the argument being the same as that used for the breakdown of the banks' costs.

Other time spent by consumers on payments, mainly the actual payment time and the time spent checking account statements, is regarded as transaction-linked costs. Finally, consumers pay an annual fee for some payment cards; in the analysis such fees are included as fixed costs.

CONSUMER COSTS, 2009 Table 8

Kr. million	Cash	Dankort	Int. debit cards	Int. credit cards
Total costs	1,523.4	721.5	76.8	88.0
Fixed costs	-	81.7	45.0	73.9
Variable costs	1,523.4	639.9	31.8	14.1
Transaction-linked costs	876.3	639.9	31.8	14.1
Sales-linked costs	647.2	-	-	-

Source: Jacobsen (2012).

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