

## The costs of payment methods in the retail sector

*Recent years have seen both academics and the public at large taking a greater interest in the costs associated with means of payment. As part of its statutory mandate, the Bundesbank seeks to hone its understanding of the costs of different payment instruments, and thereby contribute to an objective discussion of their advantages and drawbacks. In 2014, the Bundesbank therefore published an overview as well as initial estimates of the costs and benefits of cash and cashless payment instruments. This approach was built upon to produce the present study, "The costs of payment methods in the retail sector". Focusing on the retail sector, the study looks at a portion of the costs generated in the economy by the use of payment media.*

*The German retail sector processes roughly 20 billion transactions per year, of which just over 76% were cash payments in 2018. As a percentage of sales, cash payments still account for just under 50%. Innovations in the field of payments, and the new payment procedures that they are ushering in, are giving consumers an increasing variety of payment instruments to choose from. One area in which this is being reflected is the growing number of cashless transactions. Against this backdrop, the question of how much cash and cashless payments cost the retail sector is becoming increasingly important – because whatever means of payment consumers decide to use, they all generate costs. A large part of these costs is borne by retailers.*

*According to the present study, the total costs of payment procedures to German retailers in the narrower sense amount to €5.7 billion per year. Cash payments account for some three-quarters of all transactions and generate roughly €3.8 billion in costs. Taken together, card-based payment methods (such as girocard, direct debit and credit card) cost around €1.7 billion per year. The costs incurred for payments by invoice, finance purchases and voucher payments add up to about €0.3 billion.*

*Cash payments cost just under €0.24 per transaction, making them currently the most cost-efficient means of payment for retailers from a transaction perspective. According to the study's findings, girocard payments cost €0.33 per transaction, while SEPA direct debit payments cost €0.34. On account of higher transaction costs, credit card payments work out more expensive than cash or girocard payments from every perspective and generate costs of just under €1 per transaction. In terms of sales, however, card payments and, in particular, girocard payments prove cheaper for the retail sector than cash payments. When interpreting the figures, it should also be borne in mind that the costs presented are based on average values and that different payment structures have to be taken into account. The present survey from 2017 was only able to capture a small number of contactless payments. Broader uptake of this relatively new form of payment could see the costs of card payments, in particular, change. This underlines the fact that the costs associated with means of payment are in constant flux.*

*Payment habits,  
 costs and  
 changes*

## ■ Introduction

How do Germans pay for their purchases, what costs does this generate and how are payment habits changing? Through regular surveys such as its payment behaviour study,<sup>1</sup> the Bundesbank helps provide answers to these questions. With the costs of payment media having figured more prominently in discussions over past years, in 2014 the Bundesbank published an overview and initial estimates of the costs and benefits of cash and cashless payment instruments.<sup>2</sup> That study described the evolution of cash and cashless payment transactions in Germany and abroad, and provided a critical overview of previous cost studies at that time. The study also estimated the economic importance of payment instruments. The authors of the 2014 study highlighted that employees' time is also a key cost factor, with a large share of the costs in the retail sector found to be attributable to the payment process at the point of sale (POS). Only a survey would be able to provide the data needed to assess this time aspect in precise terms and put a price on it, however.

With a view to analysing these points in greater depth and, in particular, to delivering more granular answers to the questions regarding the costs per transaction as well as the cost volumes arising for the economy as a whole, the

Bundesbank collaborated with the EHI Retail Institute to conduct a study for 2017 on the costs of means of payment in the retail sector.<sup>3</sup> The work focused on ascertaining precisely which factors determine costs. Three cost components were identified for cash payments, and four for cashless payments. The first cost component represents the outlay for cashier time. Cashier time refers to the length of time spent on a payment process at the POS and the portion of staff costs arising from the employee's time spent working at the POS. The second cost component comprises POS background costs, which cover expenses relating to all background activities, such as cashing up, sorting receipts for card payments, and depositing and re-counting change. In the case of cash payments, cash removal and supply costs constitute the third cost component. For card payments, the third cost component is transaction

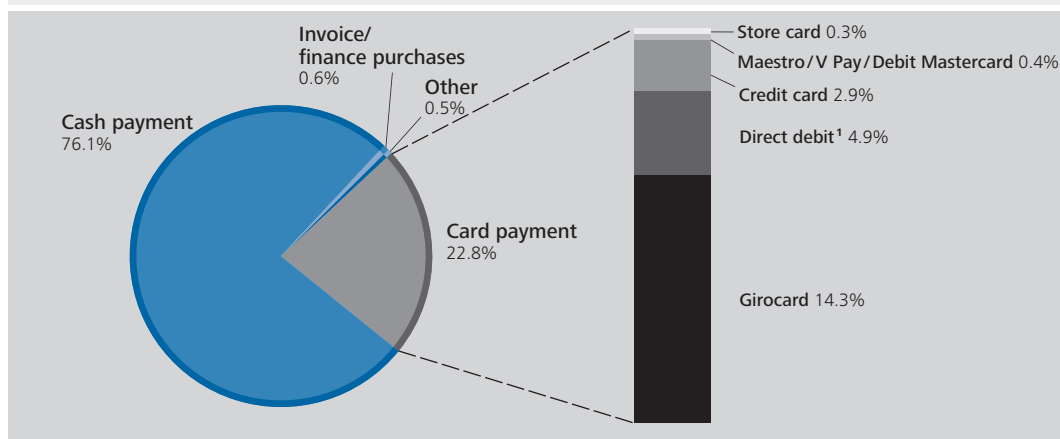
<sup>1</sup> See Deutsche Bundesbank (2018).

<sup>2</sup> See Krüger and Seitz (2014).

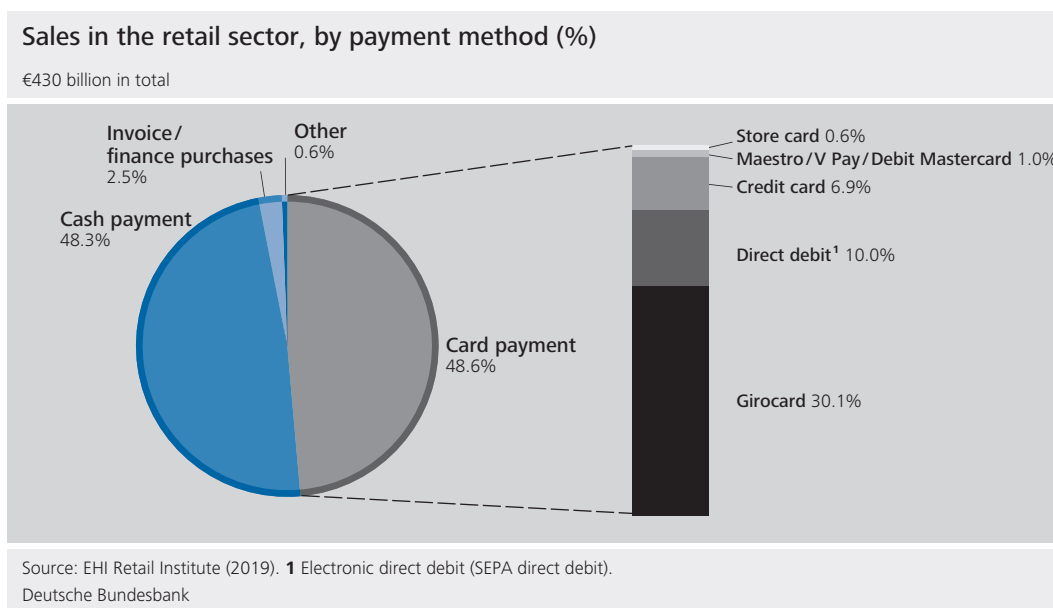
<sup>3</sup> The study looked at the costs for the stationary retail sector in the narrower sense. That includes, for example, food retailers, furniture stores and drugstores (see the chart on p. 68). Stationary retail trade in the broader sense comprises establishments with retail elements such as pharmacies, automotive accessories suppliers, cash-and-carry supermarkets, hair salons, motor vehicle traders and petrol station shops as well as trade businesses in the form of bakeries and butchers' shops. However, stationary retail trade in the broader sense is typically not deemed to be part of the retail sector and is not taken into account in the analyses which follow. See Cabinakova, Horst and Knümann (2019).

### Transactions in the retail sector, by payment method (%)

20 billion transactions



Source: EHI Retail Institute (2019). <sup>1</sup> Electronic direct debit (SEPA direct debit).  
 Deutsche Bundesbank



costs. The fourth cost component, reflecting the specificities of cashless payments, covers terminal costs, including those for maintenance and updates to software.

In order to estimate the economic dimensions of these costs, the study took account of volume data from the retail sector, measured the duration of payment transactions at retail POS and employed findings from in-depth interviews with retailers. The costs paying by cash as determined were then compared against those of the most common cashless methods. Breaking costs down into fixed and variable costs, running scenarios with altered average variables and estimating cost functions and developments also made it possible to analyse changes in payment behaviour. This is particularly relevant considering the growing use of contactless card payments.

It should be noted that the following remarks offer a partial insight into the costs of payment methods. Payment instruments generate costs not just for retailers but also for other agents within an economy, such as the central bank, cash-in-transit (CIT) companies, credit institutions and households. A portion of these costs is already accounted for by determining the costs borne by retailers. Precisely calculating the costs incurred at the macroeconomic level

is far from straightforward, however. Information on time outlay and other expenditure incurred by all actors would need to be broadly available, and this is not yet the case. Examination of the costs arising in the retail sector is therefore a first step towards ascertaining part of the economic costs and shows that calculating specific costs is a difficult and very much assumption-based exercise. The Bundesbank is committed to ensuring that citizens remain free to choose how they wish to pay and maintains a neutral stance on specific means of payment.

## The structure of the German retail sector

Germany's retail sector encompasses around 355,000 stores, which in 2018 recorded gross sales of €430 billion.<sup>4</sup> Just under 12% of stores fall into the organised food retail category. With a sales share of just under 42%, this group has by far the highest sales in the retail sector.<sup>5</sup> Relative to the number of stores, drugstores and perfumeries as well as furniture and furnishings stores also have disproportionately high shares of sales. One of the reasons for this

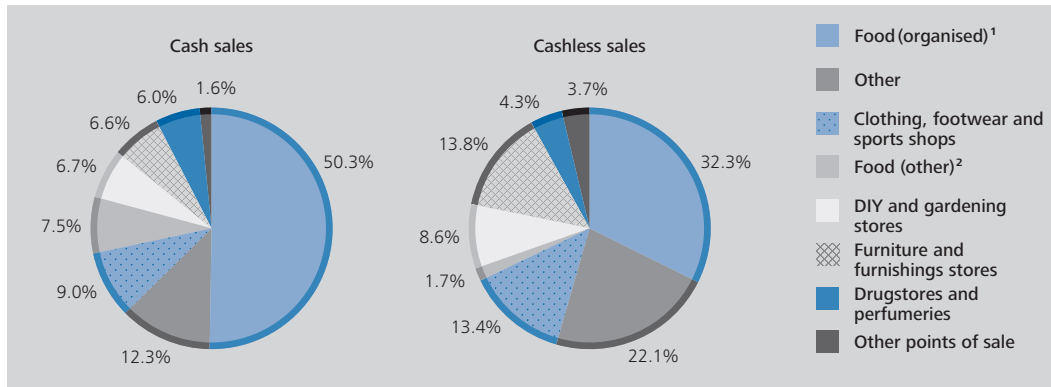
*Highest volume of sales in the organised food retail sector*

<sup>4</sup> See EHI Retail Institute (2019).

<sup>5</sup> See Cabiakova, Horst and Knümann (2019).

### Cash sales and sales using card-based payment methods as well as other cashless transactions in the retail sector

€410 billion in total



**1** Including supermarkets and discounters in the food retail sector. **2** Smaller, often independently run outlets in the food retail sector, such as kiosks or greengrocers' shops.

Deutsche Bundesbank

is likely to be that these branches include a number of large chains with high sales.

*Three out of four retail transactions are settled in cash*

In terms of the total number of transactions in the German retail sector in 2018, just under 76% were settled in cash and roughly 23% by card<sup>6</sup> (see the chart on p. 66).<sup>7</sup> The vast majority of all card payments can be attributed to the girocard system (14.3%), followed by (SEPA) electronic direct debiting (4.9%) and credit cards (2.9%).<sup>8</sup> Invoice/finance purchases (0.6%) and other cashless options (0.5%), such as voucher transactions, figure comparatively rarely. Extrapolated for the German retail sector as a whole, this amounts to 15.2 billion cash purchases, 4.6 billion card-based payment processes and a further 220 million other cashless transactions.

*Around half of sales in the retail sector are paid for using cash*

As a share of the €430 billion in total sales recorded for the German retail sector, cash accounts for 48.3%, while card payments make up 48.6% (see the chart on p. 67).<sup>9</sup> The largest share of card payment sales is accounted for by girocard (30.1%), followed by electronic direct debiting (10.0%) and credit cards (6.9%). The share of invoice/finance purchases amounts to 2.5%, while other cashless payment instruments represent a sales percentage of 0.6%. Extrapolated for the German retail sector as a whole, this is equivalent to sales of €208 billion

from cash transactions, €209 billion from card payments and €13 billion from other cashless transactions.

The organised food retail branch alone accounts for around 50% of cash sales and around 32% of cashless sales (see the chart above),<sup>10</sup> giving food retail a disproportionately high percentage of cash sales. The same is true of drugstores and perfumeries. Besides organised food retail, a high percentage of cashless sales is attributable to furniture and furnishings stores as well as clothing, footwear and sports shops. This distribution reflects variation in payment behaviour, which is partly due to differences in the average payment amounts for each retail group.

*Differences between retail groups with respect to average payment amounts and the means of payment used*

The German retail sector's annual sales of €430 billion is generated in over 20 billion transactions. This is equivalent to around 220 purchases per capita and just under 470 purchases per household per year.<sup>11</sup> A total of 725,000 POS are in operation in around 355,000 retail establishments. These POS are generally settled

*Each citizen makes around 220 purchases per year, on average*

<sup>6</sup> Including contactless payments.

<sup>7</sup> See EHI Retail Institute (2019).

<sup>8</sup> Including payments by smartphone involving a linked credit card.

<sup>9</sup> See EHI Retail Institute (2019).

<sup>10</sup> See Cabinakova, Horst and Knümann (2019).

<sup>11</sup> See Cabinakova, Horst and Knümann (2019).

(or “balanced”) on a daily basis. Overall, this results in 34 million cash removals<sup>12</sup> per year, which is equivalent to around €6,170 per removal<sup>13</sup> and to cash registers being settled an average of 6.6 times per removal process. On average, each store thus has cash removed from its premises around 1.9 times a week.<sup>14</sup>

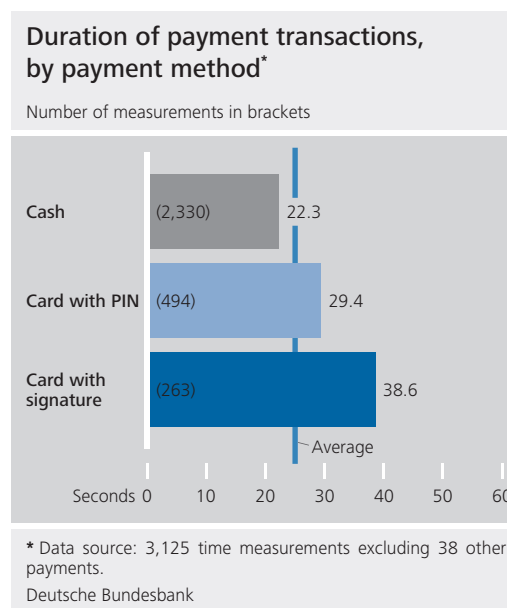
## Payment times in the German retail sector

*Paying by cash is fastest compared with other payment types*

Employees’ working hours are a major factor when calculating the costs of payment media borne by the retail sector. The payment process at the POS accounts for a large portion of these working hours. For this reason, a total of 3,125 time measurements were carried out at the POS on 17 days between May and November 2017 at 15 selected stores in six branches based on the results of a structural analysis of the retail sector. According to these measurements, paying in cash lasts 22.3 seconds on average. Card payments where a PIN is entered last 29.4 seconds on average, while card payments with a signature take 38.6 seconds (see the chart above). Each time measurement started as soon as the cashier stated the purchase amount. The time was stopped when the sales receipt and/or payment receipt was handed over, change was handed over or the cash drawer was shut. The point at which the cashier was ready for the next customer was the point at which the new time measurement was started. Only a small number of contactless payments were measured in the aforementioned study, and as such they cannot be considered representative. A cost simulation that takes contactless card payments into account was carried out nonetheless (see the box on pp. 76 f.).

*The duration of a cash payment increases as the amount rises*

The payment amount influences how long a payment process takes. The present study shows that the duration of a payment increases as the amount paid rises across all of the payment media analysed.<sup>15</sup> While payments of up to €10 generally take just over 18 seconds, pay-



ments of over €50 take longer than half a minute on average (see the chart on p. 70). Small amounts of below €10 paid in cash even take less than 18 seconds on average, while more than 32 seconds are needed to pay amounts of between €50 and €100. For cash payments, the payment duration shows a linear increase as the payment amount rises. This is likely to be attributable, amongst other things, to the fact that customers are more likely to know or estimate the total of smaller purchase amounts and have the cash ready for payment. Also, as a rule, less cash is needed to pay smaller amounts. With medium and higher amounts, however, the customer generally has to wait to find out the final total, then decide which payment instrument to use and, if applicable, find the appropriate banknotes and coins. Customers and cashiers also tend to, or are required to, check payments involving higher amounts more closely to avoid any mistakes or to identify counterfeit money, for instance.

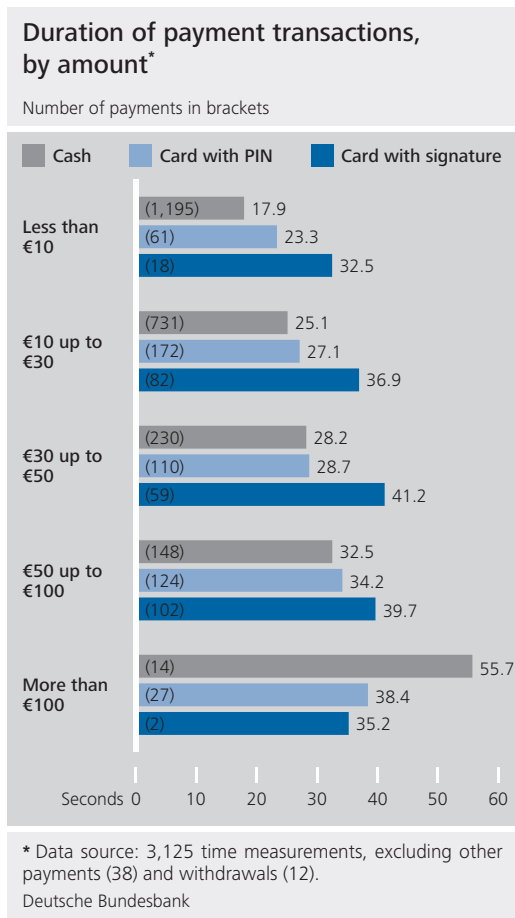
Compared with cash payments, the duration of a payment by card with PIN increases to a

<sup>12</sup> Meaning when cash is paid in to commercial banks or the Bundesbank.

<sup>13</sup> Once a cash register has been reconciled, the day’s takings are removed and a fixed or variable amount of change remains in the cash drawer.

<sup>14</sup> See Cabinakova, Horst and Knümann (2019).

<sup>15</sup> See Cabinakova, Horst and Knümann (2019).



*The payment duration for card payments also rises as the payment amount rises, though to a lesser extent than for cash payments*

lesser extent as the payment amount goes up. Small amounts of below €10 generally take just under 23 seconds, whereas amounts of between €50 and €100 need more than 34 seconds. It is only for purchase amounts of more than €100 that paying by card with PIN is much quicker than a cash payment. Payments by card with signature take the longest across all payment amounts. While payments of below €10 take the shortest amount of time (32.5 seconds) for this payment method, too, there is no clear linear correlation between payment duration and purchase amount. For example, amounts of more than €30 but less than €50 have the longest payment duration (41.2 seconds). A payment duration that tends to increase as the purchase amount rises could be attributable to the fact that customers and cashiers tend to check payments involving higher amounts more closely in order to avoid any payment errors at the checkout. Nevertheless, payment durations fluctuate less strongly

for card payments than for cash payments across all payment amounts.

## Costs of payment instruments

The interviews with retailers from different branches and of varying sizes conducted in addition to the time measurements aimed to determine the outlay of time for upstream and downstream POS activities, including change supply and cash removal. For this purpose, an average staff cost rate and the costs of back office activities relating to payment procedures were calculated based on interviews with ten large (chain) and 20 small (independent, owner-operated) retailers. Another objective of the interviews was to assess retailers' costs arising from external service providers such as CIT companies or banks.

*Interviews held with retailers were used to collect data on internal processes and the associated time outlay as well as other external costs*

## Costs of cash and cashless payment media

Adding together the respective overall expenditure for the three cost components, cash payments cost the retail sector a total of €3,775 million annually. Based on the €210 billion in cash sales and 15.6 billion cash transactions, a cash payment costs an average of €0.24 per transaction, corresponding to a cash sales-related charge of 1.80% (see the chart on p. 73).

*Costs of cash payments in retail trade total around €3.8 billion a year*

Adding together the overall expenditure of the four cost components for cashless payment media gives the following costs: for girocard payments with PIN, the retail sector incurs overall annual costs of around €675 million. Based on the 2.1 billion transactions and sales of €101 billion, a girocard payment with PIN costs an average of €0.33, which corresponds to a sales-related charge of 0.67% (see the chart on p. 78). Debit card payments result in overall annual costs of around €535 million for the retail sector. Accordingly, a debit card payment costs €0.34 on average (1.6 billion trans-

*On average, girocard payments with PIN cost €0.33, debit card payments €0.34, credit card payments with PIN €0.97 and credit card payments with signature €1.04 per transaction*

## Point-of-sale processes in the retail sector

At the start of each cash register shift in the retail sector, change is usually either deposited into the cash drawer or the change that is already in the cash drawer is re-counted. In some cases, additional rolls of coins are deposited. If the same drawer is to be used by the same cashier who counted its contents at the end of the previous day, this step is not necessary. Although, in most cases, cash registers are balanced individually at the end of the day or shift, the detailed processes vary immensely from establishment to establishment. The differences depend mainly on:

- the type and scope of the cash office/cash office functions;
- the type and scope of the dual control principle;
- the type and scope of the two-person principle when transporting cash internally;
- whether cashiers share a cash drawer over the course of the day or whether each cashier has their own cash drawer;
- whether cash is counted at the cash register or in the cash office;
- whether cash is counted at the end of the day or the next morning;
- whether cash is counted manually or there is single-denomination weighing of all denominations;
- whether there are intermediate cash drops;
- whether exact daily takings are pulled from the cash register or only surplus banknotes;
- the cashier’s knowledge of how much money should be in the cash register when balanced;
- rules on personal liability and cash shortages.

Where settlement takes place at the end of the day, all cash holdings in the drawer are counted and added up. This process usually takes place either directly at the cash register (often after opening hours) or, because of the added security, in the cash counting room. After that, the branch manager/cash office confirms the closing balance. If there are no discrepancies, the cashier pays out their daily takings, usually in the presence of a second person (head cashier/cash office employee/branch manager), and receives a fixed or variable amount of change in return. Once the cash register has been reconciled, the daily takings are removed and a fixed or variable amount of change remains in the cash drawer. There are a number of variations on the usual process, stemming mainly from the differences outlined above.

Depending on the volume of cash takings, all cash takings are prepared for removal either at the end of the day or after a number of days (i.e. merged, re-counted, usually put into safebags) before they are collected by the cash-in-transit (CIT) company, which initially merely confirms receipt of the numbered safebags. Cash drops made at intermediate intervals are often packed into safebags in advance and stored in the safe in the meantime. For this purpose, some enterprises have deposit slot safes that can only be opened by the CIT company.

Safebags are usually taken to the CIT company’s cash processing centre to be opened, checked and counted for each of the enterprise’s branches individually and then merged for deposit and subsequently deposited at the Bundesbank. However, some of the larger retail chains do not have cash offices at their stores; instead, the CIT company receives one safebag per cash register or cashier. Retailers with very high daily takings use the Bundesbank’s direct deposit process. In this case, the CIT company merely transports the cash from the retailer to the Bundesbank branch without processing it further. The cash is usually trans-

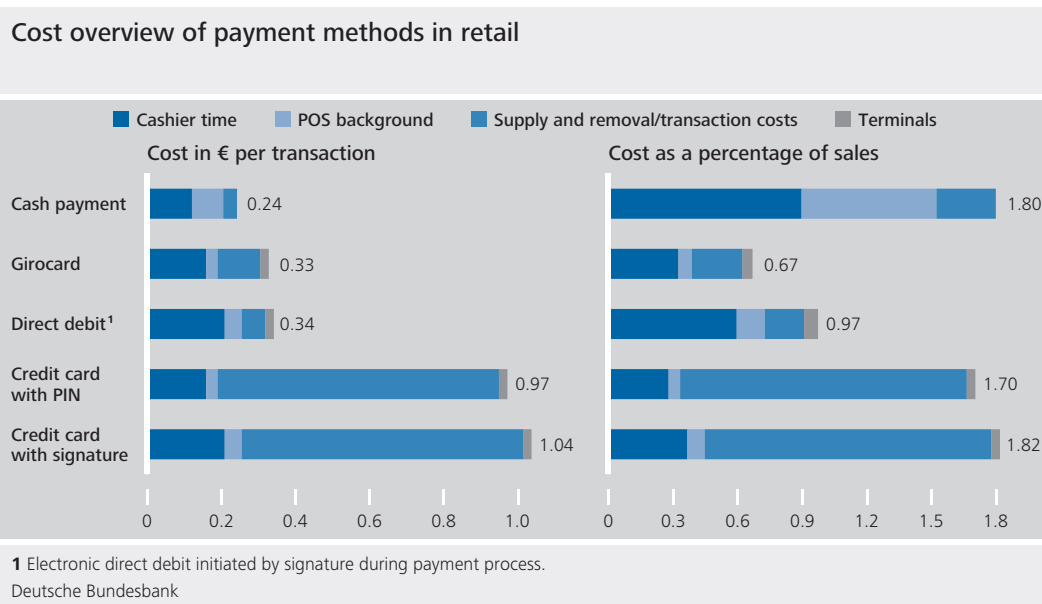
ported in sealed P-boxes or containers. By contrast, the vast majority of retail stores deposit their cash takings themselves, with the proprietor or a staff member paying in cash holdings to a bank at regular intervals. These are usually stores where holdings of cash are so low that it is not worth hiring a CIT company to collect them.

The heterogeneity of point-of-sale preparation and settlement processes, including intermediate cash drops and replenishing change, makes it difficult to clearly define an average scenario for evaluating the individual processes (point-of-sale preparation and settlement, cash drops, ordering change, etc.) or function groups (cash register, cash office) which would enable a reliable extrapolation for the entire retail sector. This is further hampered by the fact that the quantity structures required for such an extrapolation are extremely difficult to determine or estimate.

The results are therefore more reliable if the extrapolation takes cash register settlement as the reference variable. This means that the times are added up for all background activities that occur on average during the settlement process or for which a proportion of the activity can be assigned to the process in question. These activities include the following:

- depositing and re-counting change at the beginning of each shift, with dual control if applicable;
- depositing additional rolls of coins;
- if applicable, preparing a replacement point of sale (emergency point of sale), on a pro rata basis;
- time spent en route between the cash office and the checkout area;
- intermediate cash drops for cash registers, including time spent en route, generally on a pro rata basis according to frequency;
- emptying the cash depository/safe at intermediate intervals, including time spent en route – doubled if the two-person principle is in effect;
- replenishing change at cash registers at intermediate intervals, including time spent en route, generally on a pro rata basis according to frequency;
- ordering change, generally on a pro rata basis according to frequency;
- receiving change, including counting and depositing, generally on a pro rata basis according to frequency;
- time spent en route between the checkout area and the cash office;
- manually counting daily takings/weighing daily takings by denomination;
- settling the cash register, including counting and depositing into the safe and entry into the cash book;
- reconciling cash register discrepancies, generally on a pro rata basis according to frequency;
- regular or irregular cash checks (cash registers);
- regular or irregular cash checks (safe);
- reconciling cash office (safe) discrepancies, generally on a pro rata basis according to frequency.





actions), or 0.97% of the transaction value (total sales of €55 billion). Credit card payments with PIN result in overall annual costs of €128 million. Based on the approximately €8 billion in sales and 132 million transactions, a credit card payment with PIN costs €0.97 on average, or 1.70% of the transaction value. Credit card payments with signature generate overall annual costs of €319 million. With €17.6 billion in sales and 308 million transactions, a credit card payment with signature costs €1.04 on average, which corresponds to a sales-related charge of 1.82%.

## Total costs of the payment methods

The payment procedures above, calculated in this way, cost German retailers €5,430 million in total per year (see the chart on p. 75). Of this, cash payments make up €3,775 million per year and all card-based payments considered (girocard, direct debit, credit card) make up €1,656 million, and while similar percentages of sales are attributable to the two payment media, at just under 50% in each case, a significantly larger proportion of the transactions was paid in cash. This does not take into account sales of €13 billion from invoice/finance purchases/voucher payments and

around €6 billion in sales from other card payments (store cards, maestro, VPAY). When these are included,<sup>16</sup> with gross sales of €410 billion and 20 billion transactions, total costs in retail amount to around €5.7 billion annually.

The results show that, in terms of transactions, cash is currently the most cost-efficient payment method for retailers. Looked at in terms of sales, the relationship is reversed: in this case, girocard payments are the cheapest payment method for retail trade. Direct debit payments and credit card payments with PIN are also cheaper than cash payments in terms of sales. It is striking that the costs for back-office activities are relatively high for cash payments, whereas for card payment systems, in particular credit card payments, the transaction costs account for a relatively large proportion of the costs. These direct comparisons have only limited informative value, however, as the various payment methods entail different payment amounts, amongst other things.

*Cash payments are the cheapest in terms of transactions, girocard payments in terms of sales*

*Costs of payment methods in the retail sector total around €5.7 billion a year*

<sup>16</sup> For the calculation of the total costs for invoice/finance purchase/voucher payments and other card payments (store cards, Maestro, VPAY), a cost component of 1.76% of sales is assumed; see Cabinakova, Horst and Knümann (2019).

## Cost analysis for cash and cashless means of payment

For cash payments, the total cashier time outlay is obtained by multiplying the measured times (average cash payment = 22.3 seconds) by the calculated hourly wage of €19.50 and the respective annual transactions. This results in total costs for cashier times of €1,882 million per year, which is equivalent to €0.12 per cash transaction and 0.90% of cash sales. The total outlay for back-end processing is calculated by multiplying the average 18 minutes<sup>1</sup> of time spent per POS settlement by the hourly wage of €19.50 and the annual number of POS settlements and transactions. Overall, the background costs for cash handling thus amount to €1,315 million per year, €0.08 per transaction and 0.63% of cash sales. For cash removal and change supply, with 34 million removal processes annually costing an average of €17 each, a total of €578 million is spent per year. This is equivalent to €0.04 per cash transaction and 0.28% of cash sales.

The total cashier time outlay for cashless payment methods is also obtained by multiplying the measured times (payment with card + PIN = 29.4 seconds; payment with card + signature = 38.6 seconds) by the hourly wage of €19.50 and the respective transactions per payment type conducted annually. According to the EHI Retail Institute, card payment terminals are already in place at around 85% of tills in the retail sector,<sup>2</sup> which means a base of around 616,000 payment terminals overall. Taking into account the limited life cycle of a device, total annual costs per terminal of €150 are applied at the same rate for all payment procedures.<sup>3</sup> 616,000 terminals therefore incur annual costs of €92.4 million. The terminal costs are broken down on the basis of their actual use of the individual payment pro-

cedures, which means that the same hardware costs are charged for each transaction.

The processing of card payments is not completely automated in most cases. It is important to consider staff time here, too. For example, there are still receipts from card payments which when cashing up at the end of the day are often archived or sorted, as appropriate. Furthermore, manual intervention is required if terminals crash, statements from card operators and service providers must be checked for accounting purposes and software updates conducted. These costs vary greatly depending on the organisational structure. Alternatively, two minutes per day and terminal are applied for payments which are virtually paperless (girocard and credit card with PIN) and three minutes for payments which still mainly involve paper (SEPA direct debit, credit card with signature).

The transaction fees with their respective components differ among cashless payment procedures. Only the network operator fees are relatively consistent: for girocard and direct debit, 0.05% of the transaction value is payable on average and for credit card payments around 0.06% on average. In most cases, this is not a percentage fee, but a fixed amount which is applied for each transaction (e.g. €0.01 or up to €0.28). There is also an authorisation fee for girocard payments with PIN of around 0.19% of sales on average. No au-

<sup>1</sup> Cash handling accounts for 17 minutes; measured in units of time, 1 minute is attributed to costs for write-downs of safes, cash counting machines, cash scales, banknote verification machines, costs for safebags and insurance.

<sup>2</sup> See Cabinakova, Horst and Knümann (2019).

<sup>3</sup> See Cabinakova, Horst and Knümann (2019).

thorisation fees are charged for direct debit transactions. However, payment defaults and the processing outlay for defaults or corresponding insurance premiums should be taken into account. An average insurance and default risk of 0.132% was calculated overall, which also includes internal processing costs (dunning letters, bank charges or similar, where applicable) for temporary payment defaults. In the case of transaction fees for credit card payments, a weighted average fee of 1.33% of the transaction value was calculated. This includes interchange fees, scheme fees and Merchant Service Charges (MSC) as well as network operator fees.

### Cost overview of all payment methods in comparison

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature	Totals
Sales (in € billion)	210.00	101.00	54.80	7.53	17.57	390.90
Transactions (in billions)	15.58	2.06	1.56	0.13	0.31	19.64
Ø-receipt amount (in €)	13.48	49.03	35.10	57.05	57.05	.
Ø-payment duration (in seconds)	22.3	29.4	38.6	29.4	38.6	.
Total outlay						
POS background (in € million)	1,314.79	62.99	71.57	4.04	14.13	1,467.52
Per transaction (in €)	0.084	0.031	0.046	0.031	0.046	.
As a percentage of sales	0.626	0.062	0.131	0.054	0.080	.
Total outlay						
Cashier time (in € million)	1,881.93	328.06	326.17	21.02	64.40	2,621.41
Per transaction (in €)	0.121	0.159	0.209	0.159	0.209	.
As a percentage of sales	0.896	0.325	0.595	0.279	0.367	.
Terminal costs						
Total per year (in € million)	.	46.90	35.52	3.01	7.01	92.44
Per transaction (in €)	.	0.023	0.023	0.023	0.023	.
As a percentage of sales	.	0.046	0.065	0.040	0.040	.
Removal and change costs						
Per year (in € million)	578.00	.	.	.	.	578.00
Per transaction (in €)	0.037	.	.	.	.	.
As a percentage of sales	0.275	.	.	.	.	.
Transaction costs (in € million)	.	237.35	99.74	100.15	233.68	670.92
Per transaction (in €)	.	0.115	0.064	0.759	0.759	.
As a percentage of sales	.	0.235	0.182	1.330	1.330	.
Total costs (in € million)	3,774.72	675.30	532.99	128.21	319.22	5,430.29
Per transaction (in €)	0.242	0.328	0.342	0.971	1.036	.
As a percentage of sales	1.797	0.669	0.973	1.703	1.817	.

## Contactless payments

Recent times have seen a marked increase in contactless payments. These are payments made by holding a card, smartphone or another device equipped with near-field communication (NFC) technology<sup>1</sup> up against a payment terminal. Verification, for example by entering a PIN, is not required up to a certain amount. This threshold is currently set at €25 in the German retail sector. More than 20% of all card payments are now estimated to be contactless, and this proportion is rising.<sup>2</sup>

The contactless method and omission of the verification step are meant to speed up the payment process. For example, the card is not inserted into the reader when making a contactless card payment. However, little is known as yet in terms of precisely how long the average contactless payment takes. Studies to date suggest that – when the operation is carried out correctly – average payment times of between ten and 15 seconds are to be expected, providing verification is not required. At present, it is mainly credit cards that feature NFC technology in Germany. However, by the start of 2020, the intention is for all girocards issued by banks and savings banks to be NFC-enabled, too.

Only an extremely small and, therefore, probably no longer representative sample of contactless card payments were captured in the Bundesbank's cost study in 2017. This is due to the fact that contactless payments have only recently become more commonplace. Simulations for contactless card payments are carried out, so as nevertheless to consider potential costs associated with this new form of payment. In order to derive an upper limit for the maximum time saving achievable, it is assumed that all girocard and credit card payments so far carried out with PIN shift to contact-

less and that no verification step is involved for payments of amounts less than €25.

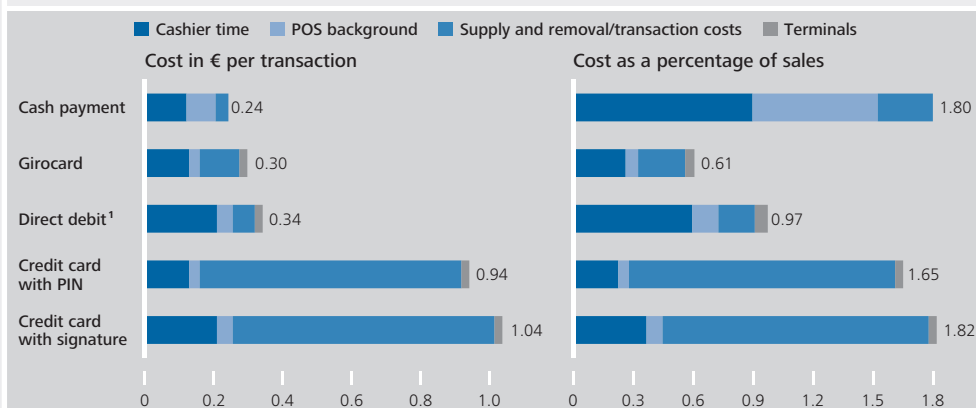
Around 40% of the girocard and credit card payments currently made with PIN are for amounts under €25. For these payments, it is assumed that the average cashier time is cut in half, reducing from just under 30 seconds to 15 seconds, due to the omission of the verification step. Payments over €25 still have a cashier time of 29.4 seconds. It is unclear to what extent cashier times for payments in excess of €25 (contactless but including verification) change as a result of contactless payment. Given the lack of empirical data in this area, the average cashier time as it stands now is assumed. Based on these assumptions, the new average payment duration for girocard and credit card payments previously carried out with PIN would then be just under 24 seconds, giving card payments an average duration comparable to that of cash payments. The cashier time costs for girocard and credit card payments with PIN would fall in this scenario.

It is also conceivable that progressive uptake of contactless payment would result in migration flows. It is possible, for instance, that relatively small amounts paid using cash up until this point would instead be paid using a contactless girocard or credit card in this scenario. A portion of current direct debit or credit card payments with signature would probably also be carried out using a contactless option. This would bring about changes in terms of cost structures and transaction and sales shares. For the sake of simplicity, it is therefore assumed in this simulation that only girocard and credit card payments currently carried out with PIN shift to contactless.

<sup>1</sup> NFC (near-field communication) is the technical standard for contactless payments.

<sup>2</sup> See EHI Retail Institute (2019).

### Simulation for contactless card payments: cost overview of payment methods in retail



<sup>1</sup> Electronic direct debit initiated by signature during payment process.  
 Deutsche Bundesbank

Overall, cash payments continue to have the lowest costs per transaction. Contactless girocard or credit card payments become even cheaper than direct debit and credit card payments with signature due to the faster payment time (see the chart

above). Looked at in terms of sales, the relationship is reversed: contactless girocard payments have the lowest costs, followed by electronic direct debit, contactless credit card payments, cash payments and credit card with signature payments.

## Summary

*Payment instruments are multi-dimensional – the costs of payments at the POS were the focus here*

Payment habits are changing, albeit slowly. This not only entails changes for the retail sector – the main sector in which members of the German public shop – but also different cost structures and total costs to the economy, which remain unexamined at this stage. The debate surrounding what constitutes an “ideal” means of payment in terms of efficiency, speed, security and also data protection, to name just a few aspects, goes far beyond the scope of the calculations outlined here. Using the present study, the Bundesbank can calculate granular costs attributable to the various payment instruments in the retail sector, aggregated at the national level, and thereby contribute to an objective discussion about the advantages and drawbacks of the various payment instruments.

The study delivers three key findings: first, cash is used in three out of four cases in Germany to

pay at the POS. All other payments are made in cashless form. Second, card payments average around 29 or 39 seconds in duration, depending on whether the payment involves a PIN or a signature. Cash payments are completed in just under 22 seconds on average. Third, cash is the cheapest means of payment per transaction, ahead of debit card payments and far ahead of credit card payments, while, in terms of sales, card payments, especially girocard payments, are cheaper for the retail sector than cash payments.

One of the strengths of this study lies in making transparent the cost structures of various payment procedures. It provides an overview of the points where costs arise – stemming, for example, from the payment process, background activities or various fees. However, when interpreting the figures, it should be noted that the costs presented are based on average values and that various payment structures must be taken into account.

## Cost analysis

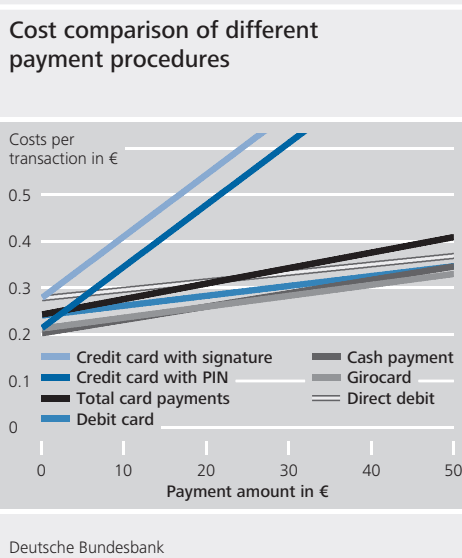
The aforementioned cost calculations are fundamentally based on average values – average payment amounts or transaction percentages, for instance. If these variables change, different cost components also change, and with them the total cost of the means of payment in question. For example, transaction fees for card payments depend on sales or, to be precise, the average payment amount. Other cost components, meanwhile, are generally incurred irrespective of the number or value of transactions, such as the cost of purchasing terminals. It is therefore conceivable that different payment amounts may see different means of payment generating the lowest costs. It is often assumed that cash payment for transactions involving relatively low payment amounts gives rise to fewer costs than card payment, while the opposite is the case when it comes to higher payment amounts, with card payment working out less costly than cash payment.

When seeking to ascertain the costs associated with each payment method for different payment amounts, it is helpful to differ-

entiate between fixed and variable costs. The variable costs can be further broken down into transaction-dependent and sales-dependent costs.<sup>1</sup> Transaction-dependent costs give rise to the same amount every transaction, whereas sales-dependent costs are also contingent on sales or the payment amount. The three cost components for cash payments are cashier time, background costs and cash supply and removal. For cashless payments the following components are duly allocated: cashier time, background costs, transaction costs and terminal costs.

The chart below shows the costs of a transaction depending on the payment amount for cash payments and each of the card payment methods. Owing to their relatively low fixed costs, cash payments have the lowest costs on average for small payment amounts. The costs are higher in the case of payments by girocard or credit card with PIN; payments by direct debit and credit card with signature incur significantly higher costs. Using the above-mentioned estimates as a basis, the costs of a girocard transaction are lower than those of a cash transaction only when the payment amount is €19.42 or higher. Owing to the high sales-dependent costs, the costs of a transaction by credit card (PIN or signature) increase much more sharply than those of the other payment methods and, for most payment amounts, are higher than those of all the other observed means of payment.

When comparing a cash payment with a cashless payment method, such as girocard, it should be borne in mind that retailers, if they accept cashless payments, frequently



<sup>1</sup> See Krüger and Seitz (2014).

offer more than one cashless payment method. Retailers then generally have no say in whether a customer uses a method of payment that is either more favourable or more costly for them. The costs of cash payments should, in addition, therefore also be compared with some or all of the costs of cashless payment methods. Taking into account the transaction percentages of the individual card payments, the average costs of all card payments per transaction are invariably higher than the costs of a cash payment. Some retailers – say, owing to the comparatively high transaction fees for credit card payments – accept only payments by debit card at their payment terminals. Considering the transaction percentages of girocard and direct debiting, it is only at an amount of €51.67 or higher that payments by debit card involve lower costs per transaction than cash payments. Accordingly, payment behaviour in Ger-

many, where payment amounts up to €50 are mostly paid in cash and amounts higher than €50 are predominantly paid by debit card, appears to be favourable payment behaviour in terms of the overall costs.

In order to increase the informative value of the data collected, a range of scenarios were simulated using various variables, including greater use of contactless card payments. This type of

payment barely registered on the radar when the study was conducted in 2017, but is likely to gain in importance in future studies.

## ■ List of references

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