

The costs of cash payments in the retail sector

Study to determine and evaluate the costs
arising from cash payments in the retail sector

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Dr Johannes Beermann

Foreword

Dr Johannes Beermann

Member of the Executive Board of the Deutsche Bundesbank



Dear reader,

Cashless means of payment such as girocard and credit cards are becoming increasingly popular in the retail sector. And yet, in three out of four cases, customers decide to pay in cash at the point of sale (POS). From retailers' perspective, this decision is far from immaterial: irrespective of which means of payment a customer opts to use, they all involve costs. But how much does a cash payment cost? Does it take longer? And who bears the costs?

Against this backdrop, the Bundesbank together with the EHI Retail Institute conducted this study on the costs of cash payments. The objective of the study is to determine and compare the costs of cash and card payments in the retail sector. The study also sheds light on how the German retail sector is structured, how long it takes to make a payment at a POS and which activities are taken into account when calculating the costs.

I would like to take the opportunity at this stage to share three key findings of this study. First, cash is used in three out of four cases 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, a cash payment costs around €0.24 per transaction, while a debit card payment costs around €0.34. The cost of credit card payments amounts to just under €1.

One of the strengths of this study lies in making transparent the cost structures of various payment procedures. This provides you with 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, please note that the costs presented are based on average values and that various payment structures must be taken into account.

In order to increase the informative value of the data collected, a range of scenarios are simulated at the end of the study 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.

The findings of this study make a sound contribution to the debate on the efficiency of cash. I hope this study proves to be an interesting and insightful read.

Yours,

Dr Johannes Beermann

Member of the Executive Board of the Deutsche Bundesbank

1 Questions and findings of the study

1.1 How the study relates to the current debate

How much does a cash payment cost? How long does it take? What costs arise at which points? And how do cash payments compare with cashless payments in terms of costs? Answers to these and other questions are provided by this study on the costs of cash payments in the retail sector, contributing to the debate on the efficiency of payments at the point of sale (POS).

Roughly 20 billion transactions are made in the German retail sector each year. Despite the fact that many different means of payment exist today, consumers opt to pay for their purchases at the POS using cash in around three out of four cases. However, given the innovations being made in the world of payments and the new payment options emerging as a result, consumers are faced with an ever-increasing variety of choices. This is reflected, inter alia, in 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, each and every one generates costs, a large part of which is borne by retailers.

Over the past few years, the size of these costs has increasingly become a topic of academic and public debate. As part of its statutory mandate, the Bundesbank aims to broaden its knowledge of the costs associated with various payment instruments so as to be able to contribute to a factual debate on their advantages and drawbacks. In 2014, the Bundesbank published an overview as well as initial estimates of the costs and benefits of cash and cashless payment instruments. That study described the development of cash and cashless payment transactions in Germany and abroad and provided a critical overview of previous cost studies at that time. In addition, the study estimated the economic importance of payment

instruments on the basis of the payment participants' own resource costs, also referred to as the internal costs borne by parties involved in payment transactions.

The authors of the 2014 study highlighted that, in addition to hardware, software and data transmission, employees' time is a key factor in internal costs. In the retail sector, a large share of the costs was found to be attributable to the payment process at the POS. However, the authors pointed out that an exact estimate of the time factor and its monetary value could only be made with the help of a survey. To date, only a small number of studies have taken into account the costs arising from employees' time.

The objective of this study is to determine and compare the costs of cash and of cashless means of payment in the German retail sector as precisely as possible. In particular, the objective is to measure the time factor involved in payment processes in selected branches and at specific types of POS (e.g. self-service checkouts, POS systems for specialist retailers, over-the-counter) and collect data on all other cost factors (e.g. background costs, change and removal costs) with a view to capturing, structuring and evaluating all costs relating to cash and card payments, including staff costs.

1.2 Results of the study

More than 20 billion payments are effected in the German retail sector, most of them in grocery stores. This is equivalent to a total of 220 purchases per capita and just under 470 purchases per household per year. In three out of four cases, German citizens opt to pay in cash. The average purchase amount comes to just under €21, while that for payments in cash is somewhat lower, at around €14.

The payment amount has an impact on payment duration. Generally speaking, the duration of a payment increases with the payment amount; this applies to cash payments, in particular. Amounts below €10 are settled in just under 18 seconds

on average. This is partly due to the fact that consumers already know or are able to estimate smaller payment amounts and have the cash ready for payment. Overall, using cash is the fastest way of settling payment amounts of up to €100. Above that amount, card payments prove to be faster.

The time it takes to make a payment, in other words cashier time, is reflected in employees' time at the POS and represents a cost factor for the retailer. Added to this are the costs for back office activities, cash removal and supply as well as terminals and transaction fees in connection with card payments. Payment procedures cost the German retail sector a total of €5,432 million a year, with gross sales of €410 billion and roughly 20 billion transactions. Of this, around two-thirds, or €3,775 million, is attributable to cash payments and around one-third, or €1,657 million, to all card payments under review combined.

Around three-quarters of retail transactions (15.6 billion) are settled in cash. Spread over a year, each cash payment thus costs just under €0.24. Payments made by girocard or SEPA direct debit come to just under €0.33 and €0.34 each respectively. Totalling just over 3.6 billion, they make up around one-fifth of all retail transactions. As a result of higher transaction costs, credit card payments with PIN (0.1 billion transactions) amount to €0.97 each, while credit card payments with signature (0.3 billion transactions) amount to €1.04 each.

The results of this study also underpin the current state of research, according to which cash payments entail relatively low fixed costs and somewhat higher variable costs. This makes cash the cheapest payment option, especially when paying smaller amounts. As a rule, cash payments up to a payment amount of €50 entail lower costs than debit card payments.

Furthermore, the study looks at the impact of potential changes in the payment structure within the retail sector. For example, contactless payments were simulated

by adjusting cashier time, as the data on such payments were rather limited at the time the study was conducted. The simulation indicates that cash payments continue to generate the lowest costs per transaction.

1.3 Commissioning a scientific retail institute

In order to determine and evaluate the costs exactly, it is necessary to obtain data which reliably capture the structures of the retail sector. One of the challenges in this context is the heterogeneity of retail trade – a trait that is reflected in the various branches, enterprise sizes and types of establishments as well as the host of different payment processes within establishments. In view of this, the Bundesbank commissioned the EHI Retail Institute to collect the necessary data to evaluate the costs of payments in the retail sector.

The EHI Retail Institute possesses comprehensive expertise in conducting scientific studies in various retail-related fields of research, including the analysis of payment procedures in the retail sector. As part of a study series on card-based payment systems in the retail sector (Kartengestützte Zahlungssysteme im Einzelhandel), for example, the EHI Retail Institute examines payment behaviour in the German retail sector on an annual basis. An integral part of the study series lies in determining the transaction and sales shares of various payment instruments, which are used as a basis for calculating the costs in this study.

The EHI Retail Institute draws on a range of different methodological approaches such as measurements, surveys, process analysis, scenario planning, multivariate analysis procedures, in-depth interviews and internal EHI data pool research. The Institute has around 800 members involved in retail and the manufacture of consumer and capital goods, meaning that it has access to experts in payment transactions in the German retail sector. This is particularly crucial when it comes to providing sensitive cost data.

2 Methodology

This study consists of four parts. First, a structural analysis of the German retail sector; second, an original initial measurement of the current duration of payment transactions at retail POS; third, a survey in the form of interviews conducted with ten large (chain) and 20 small (independent, owner-operated) retailers to estimate the outlay on background activities related to payment procedures; and fourth, a concluding comparison of the established costs of cash with the most common cashless payment procedures.

2.1 Structural analysis of the retail sector

The study begins with an outline of the German retail sector's structure, taking into consideration key payment parameters. The basis for this is provided by secondary sources of statistical data and a number of earlier primary surveys conducted by the EHI on the branch-specific composition of the number of establishments, gross sales, cash sales, the number of POS and the number of cash transactions. This statistical foundation as well as the overall structural analysis of the retail sector are needed for the purpose of selecting appropriate branches for the subsequent time measurements. In addition, these data are used to extrapolate total costs.

2.2 Primary survey: time measurements at retail POS

The time it takes to make a payment at the POS represents a major cost factor for payments, owing to which a great deal of importance is attached to the time measurements. These are carried out in 15 establishments from six sectors (food retailers, drugstores, clothing stores, furniture stores, bakeries, DIY stores) and take into account the heterogeneous structure of the retail sector, i.e. the different branches, enterprise sizes and POS types as well as average purchase amounts.

2.3 Interviews on POS processes

The interviews with retailers from different branches and of varying sizes conducted following the time measurements aim to determine the outlay of time for upstream and downstream POS activities at both the cash register and cash office level, including change supply and cash removal. Another objective of the interviews is to assess retailers' costs arising from external service providers such as cash-in-transit (CIT) companies or banks. The interviews held with retail chain managers with cash responsibilities are mainly intended to collect data on internal processes and the associated time outlay as well as other external costs. Those conducted with independent retailers chiefly help determine the costs involved in the supply and removal of cash by the retailers themselves.

2.4 Costs of cash compared with cashless payment systems

Once a detailed breakdown of the costs of cash has been determined, the same cost calculations are carried out for girocard payments with PIN, payments by SEPA direct debit as well as credit card payments with PIN and credit card payments with signature; these costs are then compared with the costs of cash.

3 Structural data on the retail sector

In this study, the term "retail sector" refers exclusively to stationary retail trade in the narrower sense. These include food retailers, furniture stores and drugstores (see Chart 1). 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 butcher's 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 following analyses.

3.1 Number of establishments and gross sales

Germany's retail sector encompasses around 355,000 stores, which in 2016 recorded gross sales of €410 billion. The charts presented below provide a rough overview of the distribution of the number of stores and their sales by branch.

Measured in terms of the number of establishments, clothing, footwear and sports shops (16%) represent the largest group of retailers, while drugstores and perfumeries (2%) represent the smallest (see Chart 2). Of the 26% of other retailers, the largest shares in terms of numbers are attributable to computer, consumer electronics, photography and telecommunications specialist stores, home appliance stores as well as opticians (see Annex 1 for a complete list).

With a sales share of just under 42%, organised food retail is the group with by far the highest sales in the retail sector despite the fact that it represents just under 12% of all stores (see Chart 3). By contrast, the sales shares for drugstores and perfumeries and, to a lesser extent, furniture and furnishings stores are disproportionately high considering the corresponding number of stores. One of the reasons is likely to be that there are a number of large chains with correspondingly high sales in these branches.

Structural data on the retail sector

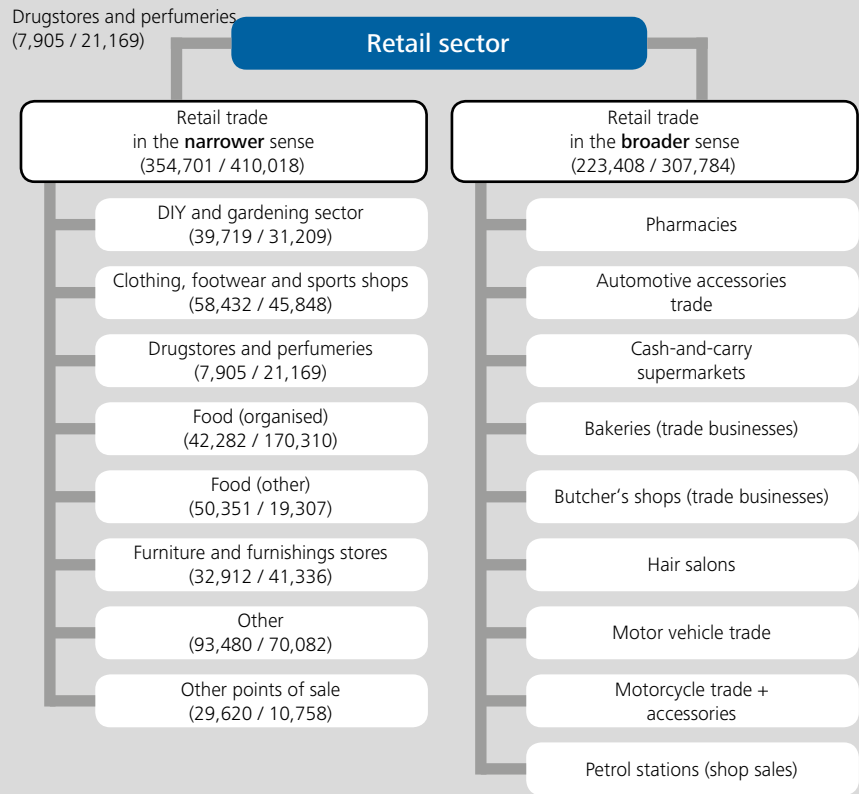
The costs of cash payments in the retail sector

20

Breakdown of the retail sector into retail trade in the narrower sense and retail trade in the broader sense

Chart 1

(Number of establishments/gross sales in brackets in € million for each category)



In common parlance, the term "food retail" is taken to mean the category Food (organised). However, there is also a host of smaller, often independently run businesses, such as kiosks or greengrocers' shops, which are usually excluded from other studies, despite the fact that they sell food products, on account of difficulties in obtaining statistics and the secondary importance of such businesses in the market. They are included here under Food (other).

The categories *Other* (e.g. antique shops, watch and jewellery stores) and *Other points of sale* are not separate branches; rather, they represent unreported or unclassifiable branches and points of sale.

Structural data on the retail sector

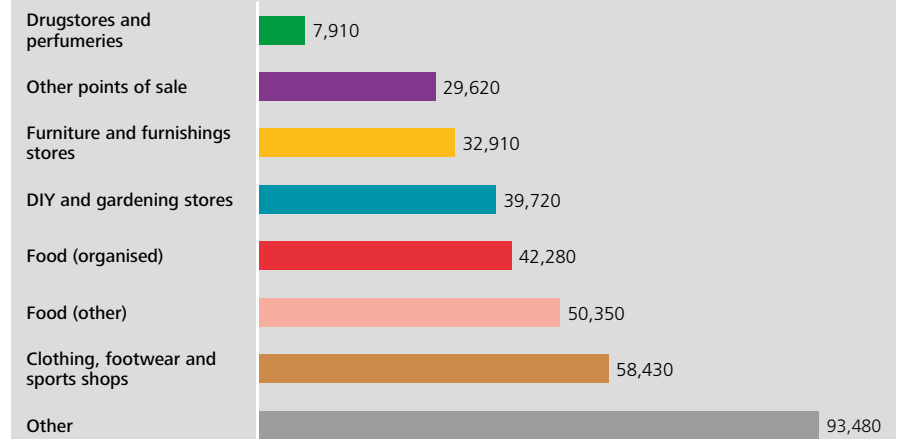
The costs of cash payments in the retail sector

21

Number of retail establishments in Germany

Chart 2

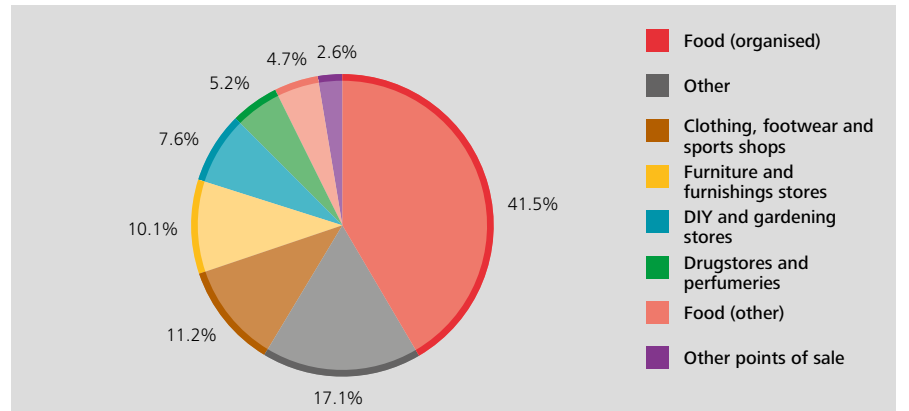
354,700 establishments in total



Gross sales in Germany's retail sector

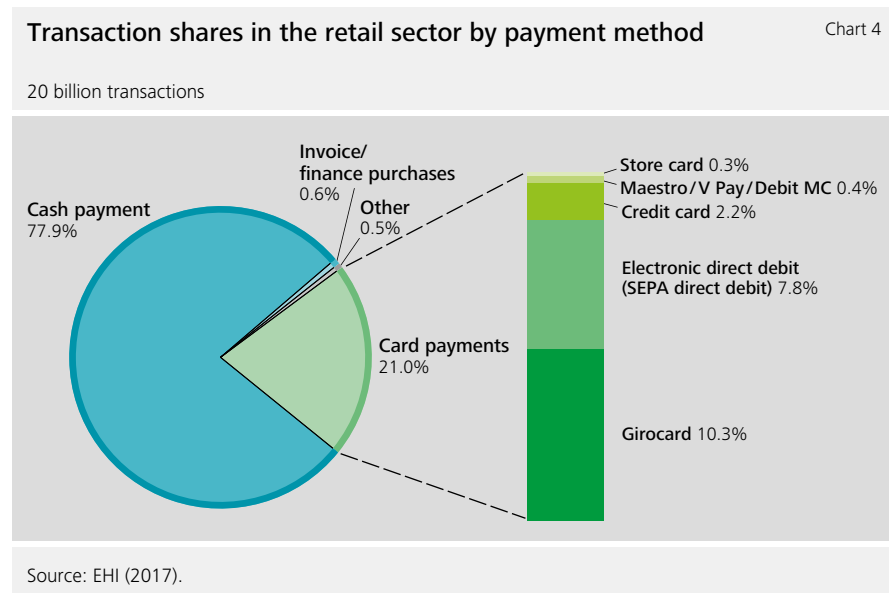
Chart 3

410 billion in total



3.2 Shares of payment methods

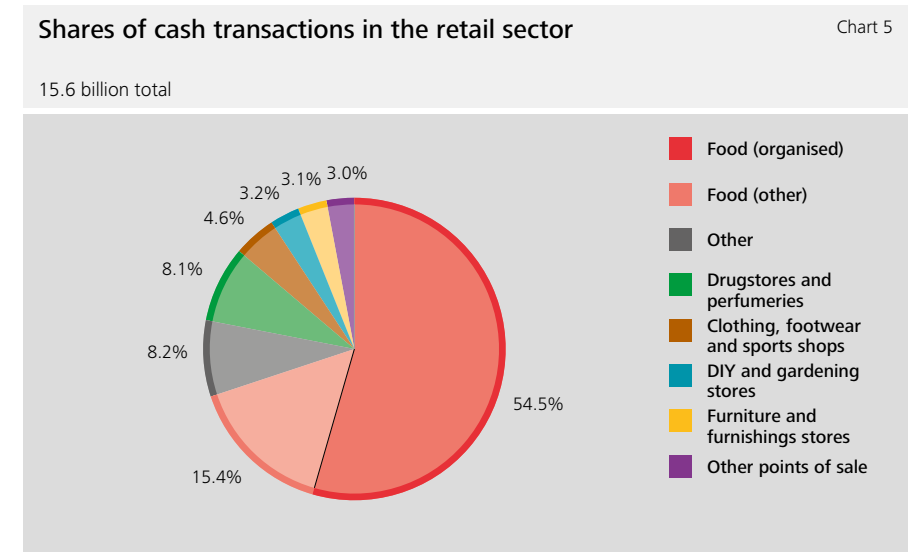
Measured against total transactions, cash payments make up 77.9% of transactions in the German retail sector, while the share of card payments comes to 21.0% (see Chart 4). The vast majority of all card payments can be attributed to the girocard system¹ (10.3%), followed by electronic direct debiting² (7.8%) and credit cards (2.2%). Invoice/finance purchases (0.6%) and other cashless transactions (0.5%) such as voucher transactions are used comparatively rarely. Extrapolated for the German retail sector as a whole, this amounts to 15.6 billion cash purchases, 4.2 billion card-based payment processes and a further 200 million other cashless transactions.



¹ According to the German Banking Industry Committee, total electronic cash/girocard transactions virtually tripled from 1.027 billion to 2.928 billion between 2006 and 2016. Around two-thirds of this amount is ascribable to the retail sector, according to EHI calculations.

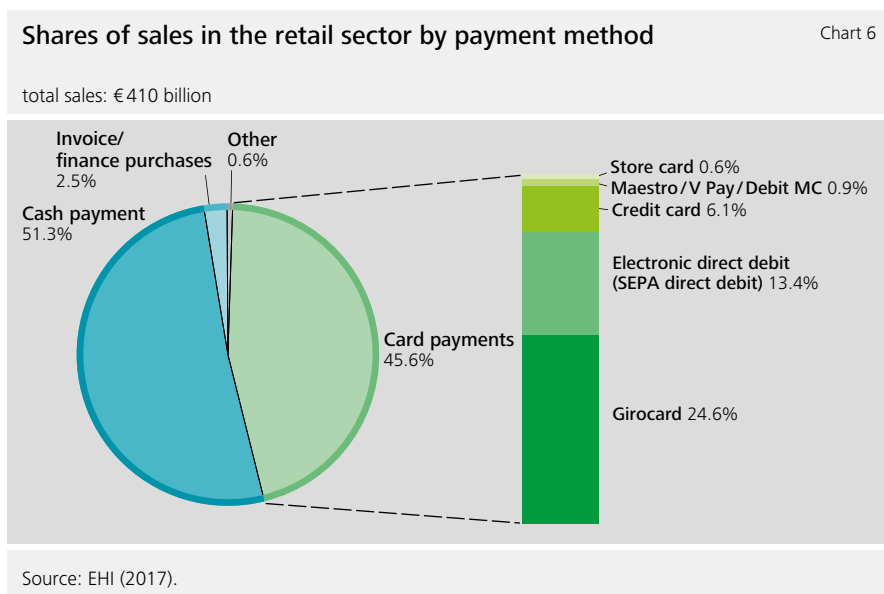
² As a rule, customers have no say in whether a card payment is processed with PIN or signature (for debit card payments in Germany, this would apply to electronic direct debiting).

Of all cash transactions, more than half (55%) can be chalked up to organised food retail alone, while furniture and furnishings stores account for the lowest share of cash payments (3%) (see Chart 5). These large differences are, amongst other factors, down to the average purchase amounts and the resulting choice of payment method. Lower purchase amounts tend to be paid in cash, while higher amounts are predominantly settled in cashless form.³ In food retail, the average purchase amounts are relatively low, whereas they are relatively high at furniture and furnishings stores (see Section 3.3).



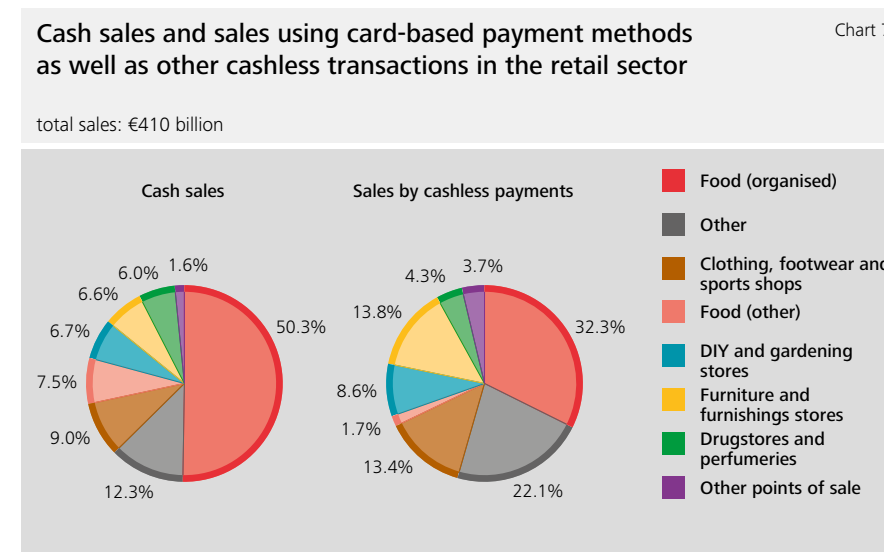
³ In line with the Bundesbank's findings in the context of its regular payment behaviour study, consumers tend to pay by card for higher purchase amounts (of €50 and above) and in cash for smaller amounts; Deutsche Bundesbank (2018).

Measured as a share of total sales recorded for the German retail sector, which amount to €410 billion, cash accounts for 51.3%, while card payments make up 45.6% (see Chart 6). The largest share of sales from card payments is accounted for by girocard (24.6%), followed by electronic direct debiting (13.4%) and credit cards (6.1%). The share of invoice/finance purchases amounts to 2.6%, while other cashless payment instruments account for a sales share of 0.6%. Extrapolated for the German retail sector as a whole, this is equivalent to sales of €210 billion from cash, €187 billion from card payments and €13 billion from other cashless transactions.⁴



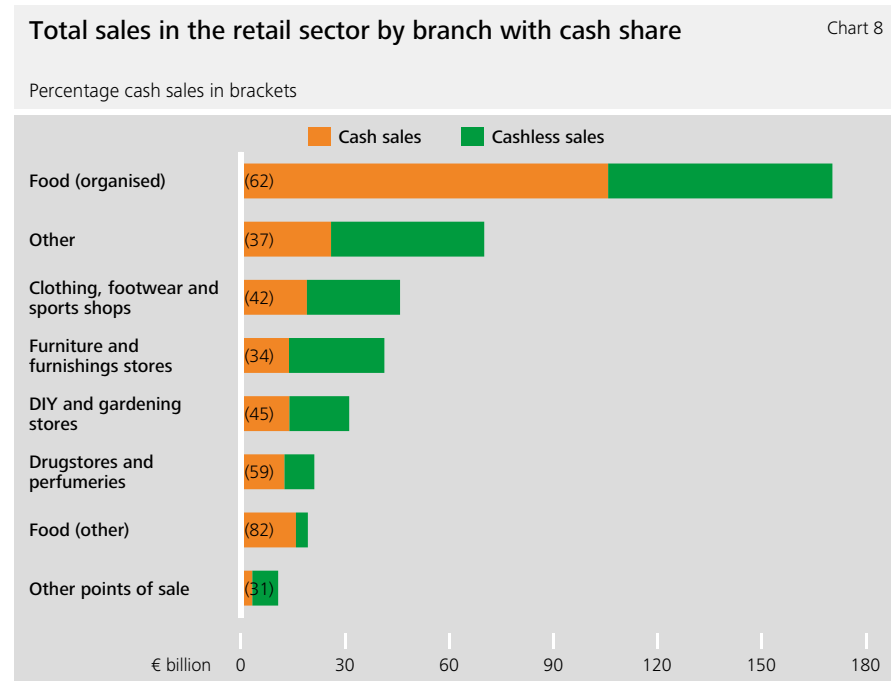
⁴ The transaction and sales shares recorded by EHI for the German retail sector are thus consistent with the data from the Bundesbank's 2018 payment behaviour study (by comparison: cash transaction share of 74.3%; cash sales share of 47.6%). Compared with the EHI study, the Bundesbank's payment behaviour study looks not only at the German retail sector but at all irregular POS payments, including purchases made online.

Organised food retail alone accounts for around 50% of the €210 billion in cash sales and roughly 32% of cashless sales (see Chart 7). This means that food retail as well as drugstores and perfumeries account for a disproportionately high share of cash sales (see Chart 8). Besides organised food retail, a high share of cashless sales is attributable to furniture and furnishings stores as well as clothing, footwear and sports shops. This distribution reflects varied payment behaviour and is, inter alia, attributable to the differences in average payment amounts (see Section 3.3).

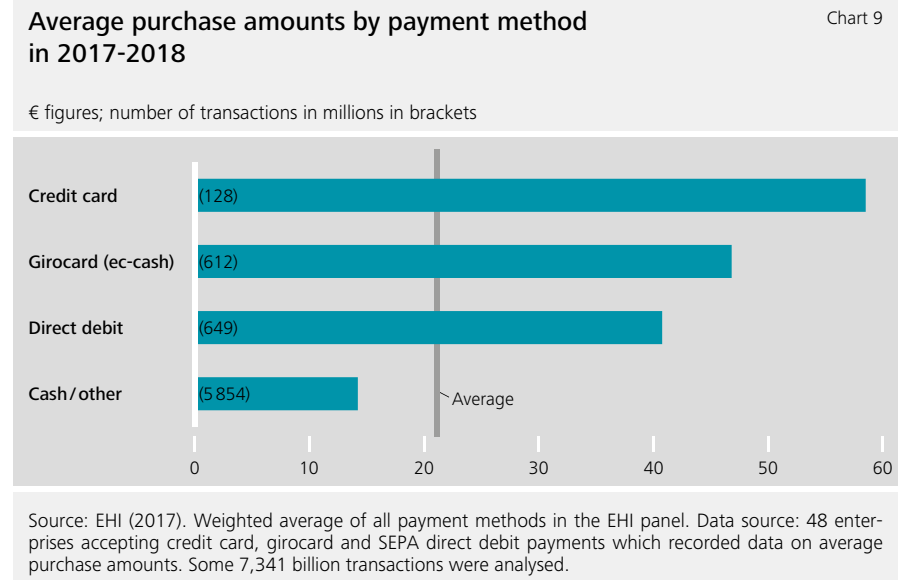


3.3 Payment amounts

Based on the panel of the EHI study on card-based payment systems in the retail sector in 2017, the average purchase amount comes to €21.11.⁵ On average, cash payments amount to €14.21, direct debit payments to €40.75, girocard payments to €46.81 and credit card payments to €58.50 (see Chart 9). Chart 10 illustrates how the average purchase amounts differ across branches. The distribution confirms that groups with relatively low purchase amounts also tend to have a higher share of cash payments, whereas cashless payments tend to dominate in groups with higher average purchase amounts (see also Section 3.2).



⁵ The EHI estimates the total number of annual transactions in the German stationary retail sector to be worth around €20 billion. As few of the smallest transactions (at kiosks, bakeries, etc.) are recorded, the average transaction probably amounts to around €20 to €20.50.



Unlike the panel in the above-mentioned EHI study, this study found the average cash payment amount to be lower, at €13.48. This is likely to be due to the fact that, for example, kiosks and other businesses with comparatively low cash payment amounts were taken into account, which is not the case for the above-mentioned EHI study.

3.4 Number of POS, POS settlements and cash removals

The German retail sector’s annual sales of €410 billion are generated in over 20 billion checkout processes (EHI calculations 2017). This is equivalent to around 220 purchases per capita and just under 470 purchases per household per year. A total of 725,000 POS are in operation in around 355,000 retail establishments.

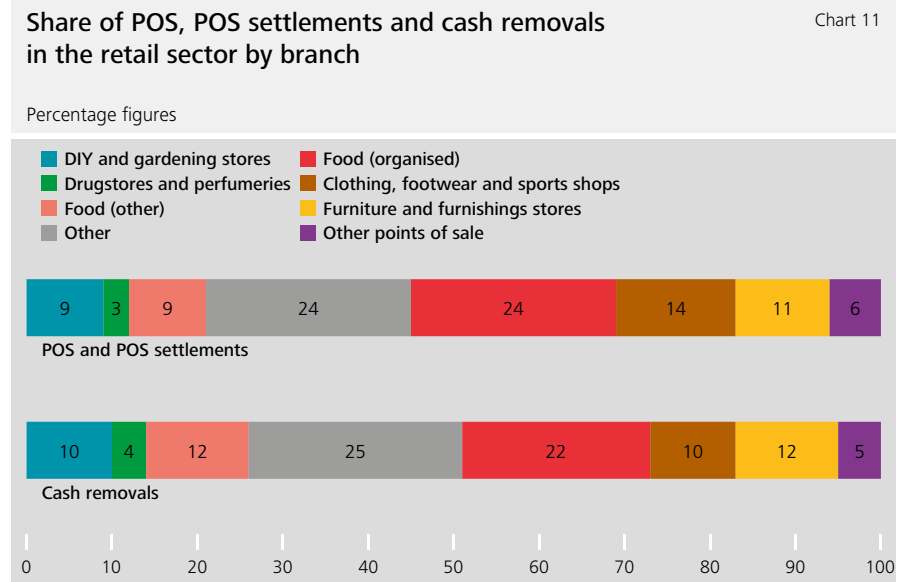
As a rule, a POS must be settled on a daily basis. However, given that the number of available POS tends to be geared towards high-sales days, not all POS are used on each and every trading day. Then there are POS which are settled several times a day due to employees working multiple shifts. In order to reduce the cost of POS settlement, retailers try to have several employees perform checkouts at the same POS. On the whole, it can be assumed that unused POS are balanced out by those settled several times. This means that a total of 224.75 million POS settlements are carried out on 310 trading days per year.⁶ The resulting €936 average cash balance in the context of POS settlements⁷ is supported by the data provided by the interview partners surveyed.

Estimating the frequency of cash removals by CIT companies and by retailers themselves is done by extrapolating the removal cycles reported in the surveys, examining previous EHI findings and taking into account the average daily takings per business per branch and carrying out plausibility calculations. Overall, EHI calculations yielded

⁶ Trading days x POS = 310 x 725,000

⁷ Cash sales / POS settlements = €210 billion / €224.75

34 million cash removals per year (see Chart 11), which is equivalent to around €6,170 per removal and an average of 6.6 cash register settlements per removal process. On average, each store thus has cash removed from its premises around 1.9 times a week.



4 Data and data collection

In methodological terms, the study comprises two parts. In the first part, time measurements were carried out at the POS in 15 selected markets – based on results of a structural analysis of the retail sector. A questionnaire was designed for this purpose (see Annex 3: Questionnaire) which asks for details pertaining to the payment duration, the payment instrument selected and the purchase amount as well as other information that is relevant for the payment process and for determining the costs of payment. Section 3.1 presents a descriptive evaluation of the time measurements that form the basis for the cost analysis in Section 5. In the second part of the study, interviews were conducted with representatives from 10 large (chain) and 20 small (independent, owner-operated) retailers to estimate the time that background activities related to payment procedures take. These are based on an interview guideline that was set in advance (see Annex 3: Interview guideline). The results of the interviews are presented in Section 3.2.

4.1 Time measurements at retail POS





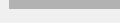

This analysis focuses on measuring how long pure payment processes take at retail POS. To this end, a total of 3,125 time measurements were taken on 17 days over the period from May to November 2017 in 15 selected establishments in six branches (see Table 1). The establishments in which the measurements were taken were selected based on the results obtained from the structural analysis of the retail sector. This ensured that parameters, such as cash as a percentage of overall sales, cash transactions as a percentage of overall transactions or the average size of the basket of goods, were considered when selecting the branches.

The time to be measured was defined as follows:

“Time between statement of purchase amount and handover of receipt and/or payment confirmation and change, or closing the cash drawer.”

It was essential to ensure that the cashier was ready for the next customer before starting the new time measurement.⁸ The following additional points were noted for the payment transactions: age group and gender of the customer paying, age group and gender of the cashier as well as special features of the payment process, such as checking banknotes, using bonus or discount cards, validating parking tickets and customers paying the exact amount.

Breakdown of branches in sample with number (and percentage) of time measurements conducted Table 1

Branch	Establishments	Time measurements	
	Number	Number	%
DIY stores	2	479	15% 
Drugstores	2	315	10% 
Food (organised)	4	1174	38% 
Furniture stores	1	209	7% 
Textiles and department stores	4	634	20% 
Bakeries	2	314	10% 
∑ Total	15	3125	100%

Although, as a trade business, bakeries do not count as retailers in the narrower sense, for reasons of practicability, EHI also conducted time measurements and interviews in two such establishments. They represent many establishments in the stationary retail sector in the narrower sense that have small average purchase amounts and a high proportion of cash, such as kiosks, post offices and newsagents. Furthermore, the POS set-up (over-the-counter) is similar, as is the way in which cash is supplied and removed.

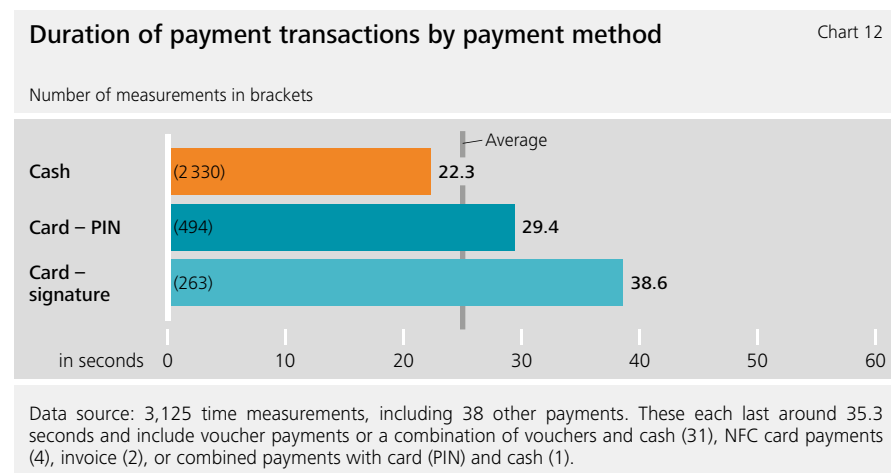
4.1.1 Payment duration by payment method

On average, a cash payment takes 22.3 seconds. Chart 12 shows the average payment duration, broken down by payment instrument.

⁸ All EHI staff members charged with taking time measurements took part in the first measurement to ensure that they all had the same interpretation of when to start and stop timing a transaction. The measurements were thus harmonised. This also enabled the staff members to discuss how to deal with particularities of certain payment transactions.

Payments by card with PIN take 29.4 seconds on average, whereas payments by card with signature take 38.6 seconds on average. Other payments, mainly voucher payments or a combination of vouchers and cash, take around 35.3 seconds. Paying in cash is thus faster than paying with any of the other instruments.

It was only possible to measure a low number of contactless payments (near field communication; NFC).⁹ These cannot be deemed representative and have therefore not been outlined in further detail in the study. The weighted mean across all 3,125 payment transactions in the sample is 25.0 seconds.



⁹ NFC is the technical standard for contactless payments.

4.1.2 Payment duration by amount

For all payment instruments, the higher the purchase amount, the longer a transaction takes (see Chart 13). While payment transactions of below €10 take just over 18 seconds on average, payments of above €50 take longer than 30 seconds on average. However, for determining payment costs later on, it is important to consider payment times separately.

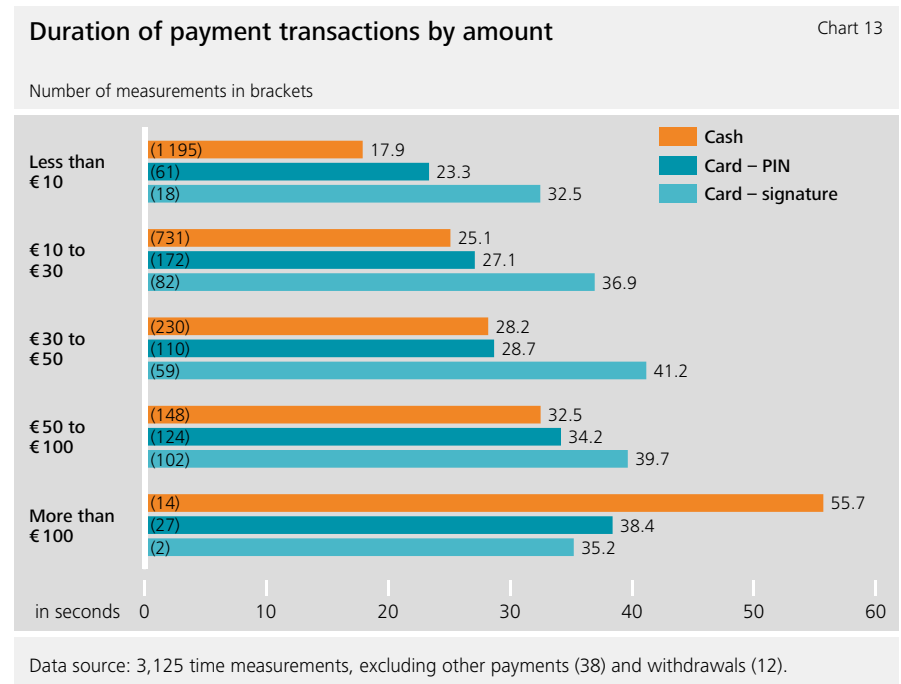
As the purchase amount rises, there is an almost linear increase in the time it takes to make a cash payment. Small amounts of below €10 generally take less than 18 seconds, whereas amounts of between €50 and €100 need more than 32 seconds. The purchase amount is thus a significant factor in the duration of payment transactions. This is likely to be due, 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. As a rule, smaller amounts generally need less cash. With medium and higher amounts, 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 check payments involving higher amounts more closely to avoid any mistakes.

In contrast to cash payments, the duration of a payment by card with PIN does not increase as sharply as the purchase amount rises. Small amounts of below €10 generally take just under 23 seconds, whereas amounts of between €50 and €100 need more than 34 seconds, as they do with cash payments. It is only for purchase amounts of more than €100 that paying by card with PIN is much quicker than a cash payment. Overall, the duration of a girocard payment fluctuates less than that of a cash payment.

In comparison with the other payment instruments observed, payments by card with signature take the longest, across all purchase amounts. While payments of below €10 take the shortest amount of time (32.5 seconds) in this category, too,

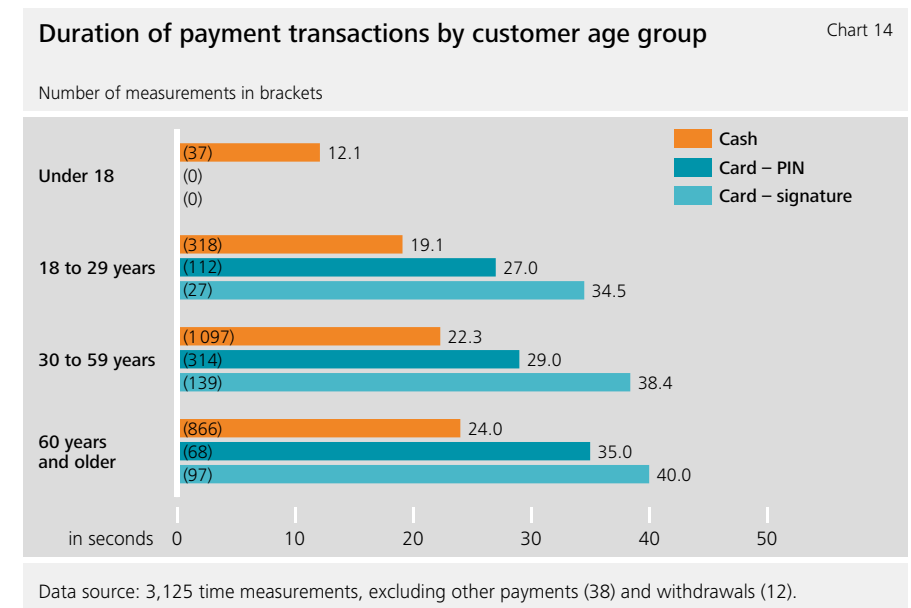
there is no further linear correlation between payment duration and purchase amount.

As the average purchase amount for payments using cashless payment instruments is more than double that of cash payments, the fact that the average payment duration is longer in relative terms is not really surprising. For larger purchase amounts, customers tend to check the amounts more closely in order to avoid any payment errors at checkout.



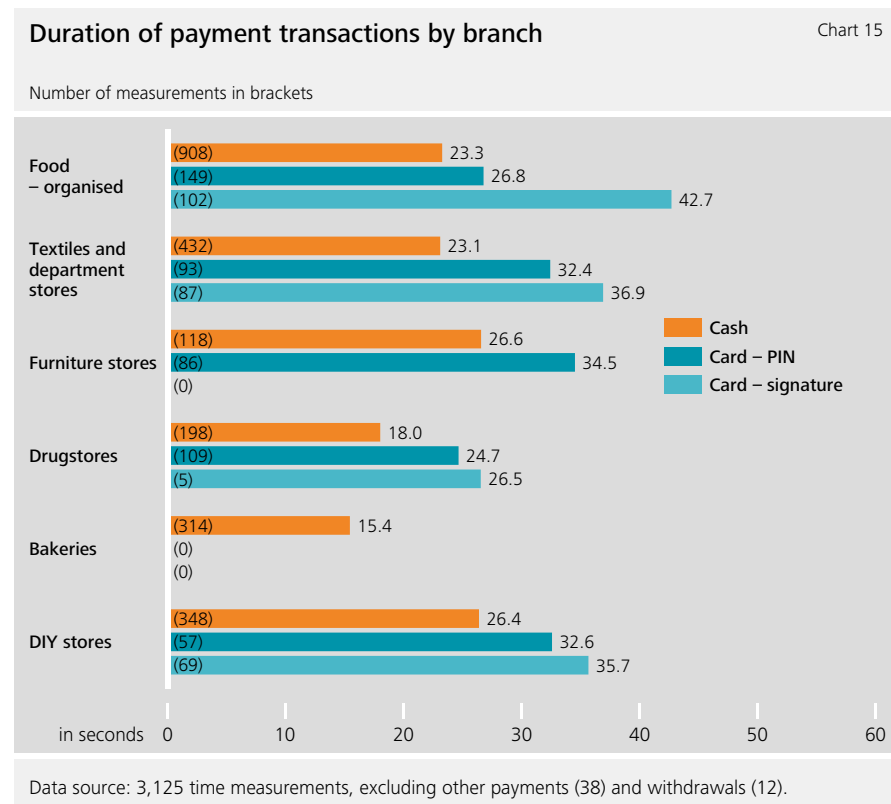
4.1.3 Payment duration by customer age group

As part of the time measurements, the customers' age was also recorded. As this study is not based on a direct survey, the people measuring the transaction time estimated the age of customers, putting them into one of four categories (under 18, 18-29, 30-59 or 60 plus). The results of the time measurements show that the duration of a payment transaction, irrespective of the payment instrument used, increases with age (see Chart 14). Leaving aside the "under 18" category (as figures could not be obtained for each type of payment instrument), the greatest differences in transaction time in the various age groups were recorded for card payments with signature.



4.1.4 Payment duration by branch

The average duration of a payment transaction across all payment instruments varies from branch to branch. On average, payment transactions were fastest in bakeries and drugstores (see Chart 15). This finding is not so surprising given that the average purchase amounts are smallest in these branches. On average, the longest payment transactions take place in furniture stores where the average purchase amounts are over €130, both for cash payments and payments using cashless payment instruments.



4.2 Interviews with retailers

The main aim of the interviews was to collect reliable information from retailers – broken down by branch and size of establishment – that enables a qualified and quantifiable evaluation of the upstream and downstream POS processes as well as cash supply and removal in the retail sector. The survey method used is a combination of mainly face-to-face (22) and some telephone (8) interviews based on an interview guide (see Annex 3: Interview guideline) with supplementary written questionnaires often being sent afterwards. All interviews were conducted during the period from September to early December 2017. Contact persons at retail chains (sales between €300 million and €7.5 billion) were managers, mainly from the cash management, finance, controlling and POS organisation areas). For independent retailers (sales between €100,000 and €1.5 million), discussions were held almost exclusively with the proprietors.

4.2.1 Evaluation using standard average hourly rate

A standard average staff cost rate is used to evaluate the time taken for a transaction in order to avoid costs being distorted by various wage levels and ensure that the individual branches can be compared. In its surveys, the EHI collected information on average staff cost rates for cashiers in 11 retail chains, some of which differed between cashiers and cash office employees. The management of the 20 mostly owner-operated smaller retailers were asked for their valuation measures for employee cost per hour. The average hourly rates comprised gross wages including employee contributions, additional payments such as holiday allowance and Christmas bonus, other bonus payments as well as offset holiday and sick leave. For the retail chains, the mean was €20.50 (11.20/ 13.80/ 17.40/ 20.53/ 20.90/ 22.58/ 23.00/ 23.50/ 23.75/ 24.29/ 24.50). For the small retailers, the average was €17.50, with the range spanning from €13.50 to €26.00. The calculations in this study use an hourly rate of €19.50 as a mean that conforms with market practice, giving retail chains a higher weighting (2/3 to 1/3).

4.2.2 Differences in POS processes

At the start of each POS shift, change is usually either deposited into the cash drawer or the change that is already in the cash drawer is recounted. In some cases, additional rolls of coins are deposited. If the same drawer is to be used by the same cashier that counted it at the end of the day before, this step is not necessary.

Although, in most cases, the end-of-day or end-of-shift settlement takes place for each cash register individually, the detailed processes vary immensely from establishment to establishment. The differences mainly depend on:

- type and scope of cash office/cash office functions
- type and scope of dual control;
- type and scope of two-person principle when transporting cash internally;
- whether cashiers share a cash drawer over the course of the day or whether each cashier has an individual cash drawer;
- whether cash is counted at the POS 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 transferred or only surplus banknotes;

- cashier's knowledge of nominal balance upon POS settlement;
- 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 POS (often after opening hours) or, for safety reasons, in the cash counting room. After that, the branch manager/cash office confirms the closing balance. If there are no differences, the cashier pays in the 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. 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, at the end of the day or after a number of days, the entire cash takings are prepared for removal (i.e. merged, recounted, usually put into safebags) before they are collected by an employee from the CIT company, who initially merely confirms receipt of the numbered safebags. Cash drops that are made during the day are often packed into safebags in advance and stored in the safe in the meantime. For this purpose, some enterprises have a safe with a deposit slot 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 and deposited at the Bundesbank. However, some of the larger retail chains do not have cash offices at their outlets, instead the CIT company receives one safebag per POS 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 transported in sealed P-boxes or containers. The 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.

4.2.3 Time required for POS activities

The heterogeneity of POS preparation and settlement processes, including intermediate cash drops and replenishing change, makes it difficult to clearly define an average scenario to evaluate the individual processes (POS preparation, POS 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 POS settlement process or for which a proportion of the activity can be assigned to the process in question. This includes the following activities:

- depositing and recounting quantities of change at the beginning of each shift, with dual control if applicable;
- depositing additional rolls of coins;
- if applicable, preparing a replacement POS (emergency POS), on a pro rata basis;
- transit time between cash office and POS;

- intermediate cash drop at cash register including transit time, generally on a pro rata basis according to frequency;
- intermediate emptying of cash depository/safe, including transit time – doubled if two-person principle is in effect;
- intermediate replenishment of change at cash registers including transit time, generally on a pro rata basis according to frequency;
- ordering of 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;
- transit time between POS and cash office;
- manual counting or single-denomination weighing of daily takings;
- cash register settlement, including counting and deposit in safe and entry into cash book;
- cash register reconciliation, generally on a pro rata basis according to frequency;
- regular or irregular POS cash checks (cash registers);
- regular or irregular safe cash checks;
- cash office difference reconciliation (safe), generally on a pro rata basis according to frequency.

Considering all activities involved in cash handling, the interviews revealed that POS settlement takes 17 minutes on average. This figure, including all the background activities listed above, is required to determine the overall cost.¹⁰ The retail chains surveyed reported an arithmetic mean of 21 minutes, of which 7.5 minutes were for cash office activities and 13.5 minutes were for activities concerned with preparing and settling cash registers. The individual enterprises reported figures ranging from 12 to 35 minutes. For the small retailers that had only a few or even just one POS, the average POS settlement time was 15 minutes; with 3 minutes for cash office activities and 12 minutes for cash register activities. The individual enterprises in this category reported figures ranging from 10 to 21 minutes. These figures do not include the time for restocking with change and cash removal by retailers.

Additional costs factored in are the depreciation of safes, cash counting machines, cash scales, banknote verification machines as well as costs for safebags and insurance fees, which amount to an average of €100 per year and per POS. These costs are offset as 1 minute per POS settlement.¹¹ This results in a total of €72.5 million for the entire retail sector or €200 per year and per establishment.

POS differences at shift end amount to less than 0.01% net of daily cash takings on average. Most enterprises recorded a figure of 0.008%. This gives an amount of around -€17 million in POS differences per year for cash payments in the German retail sector. As part of these calculations, this figure is taken into consideration by rounding up (by around 14 seconds) the minutes calculated for the activities that can be assigned to POS settlement.

¹⁰ Duration of activity × hourly rate = $\frac{17}{60} \times €19,50 = €5,53$

¹¹ Settlements per year × hourly rate = $31 \times \frac{1}{60} \times €19,50 = €101$

4.2.4 Cash removal and change supply

If service providers are hired to supply and remove cash, total external costs for the retail sector mainly comprise the following items:

- Cost of supplying change, which is usually reflected in roll prices (cents per roll). In addition to the price per roll, some enterprises also pay a lump sum per order/delivery to the CIT company. The retail chains surveyed reported that the average price is currently €0.09 per roll.
- Cash transport costs are usually expressed in terms of stop prices.¹² Most enterprises have agreed monthly lump-sum prices for cash transport which, for the sake of comparability, have been converted into average stop prices. The average stop price for the enterprises surveyed as part of this study is €19.75.
- Cash handling costs for processing cash in cash centres are usually calculated as less than 1% of the cash value to be processed. In some cases, minimum charges per safebag (or equivalent) also apply. The enterprises surveyed reported an average charge of 0.041% of the cash value to be processed.

In addition, deposit fees at Bundesbank branches or commercial banks apply, as do the resulting booking fees. For instance, for direct deposits in P-containers, the Bundesbank charges €6.75 per deposit; a cost item that, in relation to the deposit, is almost always far below 0.014%.

The large retail chains' typical total costs for coin rolls and cash removal (transportation, handling, deposit and booking) amount to just under 0.2% of cash takings. Some enterprises additionally have costs for monitoring cash logistics.

¹² Price per arrival/departure of a CIT at/from a retailer to supply/remove cash.

The interviews revealed that small retailers spend an average of 24 minutes removing cash from their premises themselves.¹³ This figure was also confirmed by the time measurements taken at one retail chain where cash at some of the branches is removed by the employees themselves and a mean of 25 minutes was measured for this process. This includes the time taken to count and pack the amount to be removed from the safe or POS, the transit time to the bank and, if applicable, back again, the time spent waiting at the machine or cash desk, the deposit time at the machine or cash desk and the additional time on a pro rata basis when collecting coin rolls from the machine or cash desk. Enterprises that obtain supplies of coins from their banks pay either no charges or an average of around €0.35 per roll. It is assumed that small and medium-sized retailers are mid-way between charges and no charges, paying an average of around €0.15 per coin roll.

Given the statistical basis and the average daily cash takings per establishment, approximately €34 million worth of cash removal processes take place per year in the German retail sector.

If deposit charges and booking fees (typically €0.60 to €3.00) as well as pro rata costs for obtaining supplies of change for each removal process are added to the average time taken, the cost of retailers removing cash themselves is likely to range between €12.00 and €13.50 on average. Cash removal by CIT company, including obtaining supplies of change, transportation costs, cash handling costs, deposit charges and booking fees plus any monitoring, costs somewhere between €35.00 to €45.00. Taking an average of €17.00 per removal process, this results in total costs of €578 million per year or 0.275% of cash takings.

Plausibility factors: assuming costs of €12.50 for removal by retailers themselves and costs of €35.00 for CIT removal and assuming that 80% of removal processes

¹³ Duration of activity × hourly rate = $\frac{24}{60} \times €19.50 = €7.80$




are carried out by retailers and 20% by CIT companies, the former account for €340 million and the latter for €238 million. Given total sales in the CIT industry stand at around €600 million, this is indeed a plausible and realistic value for CIT removals as the industry also supplies around 60,000 automated teller machines (ATMs) as well as bank branches. On the other hand, large retailers' external cash supply and removal costs are known to amount to just under 0.2% of cash sales. Therefore, 0.275% is plausible and realistic for the market as a whole.

The entire retail sector requires around 350 to 400 million coin rolls per year. Assuming 275 million rolls of €0.10 and 100 million rolls of €0.15, this results in total costs for coin supply of around €42.5 million per year. This corresponds to around 7.5% of total costs for the supply of change and removal of cash, a figure that is also usual in practice.

5 Cost calculation

5.1 Costs of cash payments

Costs of cash payments are calculated from the times measured for the checkout process and the insights gained from the surveys on the time spent on background activities, valued at an average staff cost rate. In addition, there are the average costs for technical aids and the average costs of cash supply and removal (see Table 2). A distinction is made between three cost items:

-  – total cashier time outlay (measured cashier times);
-  – total POS background outlay (outlay for all background activities, including technical aids);
-  – removal and change costs (outlay for change supply and cash removal).

The **total cashier time outlay** is obtained by multiplying the measured times (average cash payment = 22.3 seconds) by the hourly rate of €19.50 and the transactions conducted annually. This results in a total cashier time outlay of €1,881.93 million per year, which is equivalent to €0.12 per cash transaction and a charge on sales of 0.90% (see Table 3). Table 2 illustrates how the individual cost items are calculated.

The **total outlay for background processing** is calculated by multiplying the average 18 minutes¹⁴ allocated per POS settlement by the hourly rate of €19.50 and the annual number of POS settlements and transactions. Overall, the background costs for cash handling thus amount to €1,314.79 million per year, €0.08 per transaction and 0.63% of cash sales.

¹⁴ Cash handling takes 17 minutes; 1 minute is attributed to costs for the depreciation of safes, cash counting machines, cash scales, banknote verification machines as well as costs for safebags and insurance fees (see Section 4.2.3).

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.

Cost calculation structure: cash payment

Table 2

	Amount	Cost item
	€210 billion	Cash sales
	15,578,635,015	Cash transactions per year
	€13.48	Average amount
	725,000	POS number
	224,750,000	Settlements per year
	€19.50	Average hourly rate
	18.00	Average duration in minutes per settlement
	€1,314,787,500	Total POS background costs
	€0.084	Per transaction
	0.626%	As a percentage of sales
	€19.50	Average hourly rate
	22.3	Average duration in seconds per cash transaction
	€1,881,934,167	Total cashier time outlay
	€0.121	Per transaction
	0.896%	As a percentage of sales
	34,000,000	Cash removals per year
	€17.00	Average € amount per removal including change
	€578,000,000	Removal and change costs per year
	€0.037	Per transaction
	0.275%	As a percentage of sales

Adding together the respective overall expenditure for the three cost items, cash payments cost the retail sector a total €3,774.72 million annually (see Table 3). Based on €210 billion cash sales and 15.58 billion cash transactions, a cash payment costs €0.24 per transaction on average, which is equivalent to a charge on cash sales of 1.80%.








Cost item		Amount		
	(Cash) sales	€210,000,000,000		
	(Cash) transactions	15,580,000,000		
	Average amount	€13.48		
Cost items	Absolute value	Per transaction	As a percentage of sales	
	Total cashier time outlay	€1,881,934,167	€0.121	0.896%
	Total POS background costs	€1,314,787,500	€0.084	0.626%
	Removal and change costs	578.000.000 €	€0.037	0.275%
	Total costs	€3,774,721,667	€0.242	1.797%
	Total costs (€ million)	€3,775		

Table 3

5.2 Costs of cashless payment methods

As with the detailed allocation of costs for cash payments, individual and cost comparison calculations are conducted for girocard and direct debit payments, as well as for credit card payments with PIN and credit card payments with signature. A distinction is made between four cost items:

-  – total cashier time outlay (measured cashier times);
-  – total POS background outlay (outlay for background processing and receipt processing);
-  – transaction fees per payment process;
-  – terminal costs (depreciation), maintenance, software updates.

The **total cashier time outlay** is obtained by multiplying the measured times (payment by card + PIN = 29.4 seconds; payment by card + signature = 38.6 seconds) by the hourly rate of €19.50 and the transactions per payment type conducted annually.

The total **transaction fees** per payment method are calculated according to the specific payment type. The EHI assumes that card payment terminals are also already in place at around 85% of retail POS, which means a base of around 616,250 payment terminals overall.

According to information provided by the companies surveyed, the **acquisition costs per terminal** are between €150 and €800, depending on design (with/without signature pad), performance, “intelligence” of the device in terms of range of functions and location where software is saved. Added to this are maintenance and regular software updates, which are calculated differently: partly as monthly

flat rates, partly as annual flat rates or individual invoices. The necessary cabling for connections to the POS should also be taken into account. After extensive research, it can be assumed that, with a five-year life cycle (depreciation) for a device on average, a cumulative sum of €750 per terminal is realistic. This means that total annual costs per terminal of €150 are applied at the same rate for all payment procedures, with 616,250 terminals therefore resulting in total annual costs of €92.4 million. The terminal costs are broken down on the basis of their actual use. According to the card transactions carried out, girocard accounts for 50.7% of the total costs, SEPA direct debit 38.4%, credit cards with PIN 3.3% and credit cards with signature 7.6%. This 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 are often sorted when cashing up at the end of the day, but in any case are definitely archived. If terminals crash, for example, manual intervention is required in order to log on again. Furthermore, statements from card operators and service providers must be checked and reconciled for accounting purposes. Software updates are also a considerable cost factor in many cases, with retail staff having to carry out a time-consuming update for each device up to six times a year. It is difficult to quantify these total costs exactly, especially as the amounts vary significantly from enterprise to enterprise, depending on the organisational structure. As an aid, two minutes is therefore calculated per day and terminal for payments which are virtually paperless (girocard and credit card with PIN) and three minutes for payments which still mainly involve authorisation slips (SEPA direct debit, credit card with signature). Two minutes corresponds to around ten staff hours per year and terminal, thus around €200 per year or around €0.03 per transaction. Here too, the basis is provided by the respective number of terminals, which, as mentioned above, is derived from the actual use of the terminal according to payment type.

The **transaction fees**, with their respective components, are presented separately below. Only the network operator fees are relatively consistent: for girocard and direct debit, 0.05% of the transaction value is payable on average, while it averages around 0.06% for credit card payments. In most cases, this is not a percentage fee, but a fixed amount which is applied to each transaction (e.g. €0.01 or up to €0.28). For the sake of comparability, these amounts were converted into a percentage.

5.2.1 Cost calculation for girocard payments (card + PIN)

With reference to retailers' structural data, girocard sales in the German retail sector totalled €101.0 billion in 2016.¹⁵ With 2.06 billion girocard transactions, this corresponds to an average receipt of €49.03.

The **total cashier time outlay** is obtained by multiplying the measured times (payment with card + PIN = 29.4 seconds) by the hourly rate of €19.50 and the girocard transactions conducted annually. This results in a total cashier time outlay of €328 million, which is equivalent to €0.03 per transaction and a charge on sales of 0.06% (see Table 5). Table 4 illustrates how the individual cost items are calculated.

The **total outlay for background processing** is calculated by multiplying the average two minutes allocated per terminal settlement by the hourly rate of €19.50 and the annual number of terminal settlements and transactions (see Table 4). Overall, the background costs for girocard payments are just under €63 million.

¹⁵ Source: Sales and transaction values from EHI (2017)

Cost calculation structure: girocard payments with PIN Table 4

Amount	Cost item
€101,000,000,000	girocard sales
2,060,000,000	girocard transactions
€49.03	Average girocard receipt
616,250	Number of terminals
50.7%	Terminal technical administration costs (as a percentage)
96,891,034	girocard terminal settlements per year ¹
€19.50	Average hourly rate
2	Minutes per terminal per day
€62,979,172	Total POS background costs
€0.031	Per transaction
0.062%	As a percentage of sales
€19.50	Average hourly rate
29.4	Average duration in seconds per card + PIN
€328,055,000	Total cashier time outlay
€0.159	Per transaction
0.325%	As a percentage of sales
€76.11	Costs per terminal (girocard) pro rata per year ²
€46,901,786	Total terminal costs per year (girocard)
€0.023	Terminal costs per transaction (girocard)
0.046%	As a percentage of sales
0.185%	girocard average authorisation fee as a percentage of sales
0.050%	girocard average network provider fee as a percentage of sales
0.235%	Total girocard average transaction fee as a percentage of sales
€237,354,230	Total girocard transaction fee
€0.115	girocard transaction fee per transaction
0.235%	As a percentage of sales

1 Number of trading days x number of terminals x share of girocard terminals = 310 x 616,250 x 0.507 = 96,891,034

2 Total annual costs per terminal x share of girocard terminals = €150 x 0.507 = €76.11

Taking into account the total annual costs per terminal, the proportional **terminal costs** amount to €46.9 million.

The authorisation fee for girocard payments with PIN is 0.19% of sales on average. In addition, there are network operator fees of 0.05% of the transaction value on average, resulting in total transaction fees of 0.24% of sales on average. This means annual **transaction costs** of €237.35 million. Table 4 summarises how the individual cost items for girocard payments with PIN are calculated.

Adding together the respective overall expenditure for the four cost items, girocard payments cost retailers a total of €675.27 million annually (see Table 5). Based on €101.0 billion in sales and 2.06 billion transactions, a girocard payment with PIN costs €0.33 on average, which corresponds to a charge on sales of 0.67%.

Cost overview for girocard payments with PIN Table 5

Cost item	Amount		
(girocard) sales	€101,000,000,000		
(girocard) transactions	2,060,000,000		
Average amount	€49.03		
Cost items	Absolute value	Per transaction	As a percentage of sales
Total cashier time outlay	€328,055,000	€0.159	0.325%
Total POS background costs	€62,979,172	€0.031	0.062%
Transaction costs	€237,354,230	€0.115	0.235%
Terminals	€46,882,759	€0.023	0.046%
Total costs	€675,271,161	€0.328	0.669%
Total costs (€ million)	€675		

5.2.2 Cost calculation for SEPA direct debit payments (card + signature)

As already shown in German retailers' structural data, around 1.56 billion transactions with sales of €54.8 billion were made by direct debit in 2016, which corresponds to an average payment amount of €35.13.

The **total cashier time outlay** is obtained by multiplying the measured times (payment by card + signature = 38.6 seconds) by the hourly rate of €19.50 and the SEPA transactions conducted annually. This results in a total cashier time outlay of €326.17 million.

The **total outlay for background processing** is calculated using a similar method to that applied to girocard payments by multiplying the average three minutes allocated per terminal settlement per trading day by the hourly rate of €19.50 and the number of terminal settlements and transactions in the year (see Table 6). Overall, the background costs for SEPA payments are just under €71.57 million.

Cost calculation structure: SEPA payments with signature

Table 6

Amount	Cost item
€54,800,000,000	SEPA sales
1,560,000,000	SEPA transactions
€35.13	Average SEPA receipt
616,250	Number of terminals
38.4%	Terminal technical administration costs (as a percentage)
73,373,793	Terminal settlements under SEPA direct debit scheme per year ¹
€19.50	Average hourly rate
3	Minutes per terminal per day
€71,568,482	Total POS background costs
€0.046	Per transaction
0.131%	As a percentage of sales
€19.50	Average hourly rate
38.6	Average duration in seconds per card + signature
€326,170,000	Total cashier time outlay
€0.209	Per transaction
0.595%	As a percentage of sales
€57.64	Costs per terminal (under SEPA direct debit scheme) pro rata per year ²
€35,517,857	Total terminal costs under SEPA direct debit scheme per year
€0.023	Terminal costs per transaction (SEPA direct debit scheme)
0.065%	As a percentage of sales
0.132%	SEPA average insurance and default risk as percentage of sales
0.050%	SEPA average network provider fee as a percentage of sales
0.182%	Total SEPA average transaction fee as a percentage of sales
€99,736,000	Total SEPA average transaction fee as a percentage of sales
€0.064	SEPA transaction fee per transaction
0.182%	As a percentage of sales

¹ Number of trading days x number of terminals x share of SEPA direct debit terminals = 310 x 616,250 x 0.3842 = 73,373,793

² Total annual costs per terminal x share of SEPA direct debit terminals = €150 x 0.3842 = €57.64

Taking into account the total annual costs per terminal, the proportional **terminal costs** amount to €35.52 million.

No authorisation fees are charged for direct debit transactions. However, payment defaults (around 0.07%) and the processing outlay for temporary and permanent defaults or corresponding insurance premiums (around 0.15% on average) should be taken into account. In addition, an average insurance and default risk of 0.132% was calculated, which also includes internal processing costs (dunning letters, bank charges, where applicable) for temporary payment defaults. In addition, there are network operator fees of 0.05% of the transaction value on average, resulting in total transaction fees of 0.182% of sales on average. This means annual **transaction costs** of €101.38 million. Table 6 summarises how the individual cost items for SEPA payments with signature are calculated.

Adding together the respective overall expenditure for the four cost items, the retail sector incurs annual costs totalling €534.59 million for SEPA payments (see Table 7). Based on €54.8 billion in sales and €1.56 billion transactions, a SEPA payment with signature costs €0.343 on average, which corresponds to a charge on sales of 0.976%.

Cost overview for SEPA payments with signature

Table 7

Cost item	Amount		
(SEPA) sales	€54,800,000,000		
(SEPA) transactions	1,560,000,000		
Average amount	€35.13		
Cost items	Absolute value	Per transaction	As a percentage of sales
Total cashier time outlay	€326,170,000	€0.209	0.595%
Total POS background costs	€71,568,482	€0.046	0.131%
Transaction costs	€99,736,000	€0.064	0.182%
Terminals	€35,517,857	€0.023	0.065%
Total costs	€532,992,339	€0.342	0.973%
Total costs (€ million)	€533		

5.2.3 Cost calculation for credit card payments with PIN

The results of the structural analysis show that sales of €25.1 billion in the German retail sector were generated via credit cards in 2016. With a total of 440 million transactions, this corresponds to an average receipt of €57.05. Given that around 30%¹⁶ of these are processed using a PIN, credit card payments with PIN account for sales of €7.53 billion and 132 million transactions.

The **total cashier time outlay** is again obtained by multiplying the measured times by the average hourly rate of €19.50 and the credit card transactions with PIN conducted annually. Here it is important to note that the payment duration of 29.4 seconds measured for cashless payments made using a PIN applies when calculating the costs for girocard payments and payments by credit card using a PIN. This results in total cashier time outlay of €21.02 million.

¹⁶ Source: EHI estimates based on the general market consensus

Cost calculation structure: Credit card payments with PIN

Table 8

Amount	Cost item
€7,530,000,000	Credit card (PIN) sales
132,000,000	Credit card (PIN) transactions
€57.05	Average credit card (PIN) receipt
616,250	Number of terminals
3.25%	Terminal technical administration costs (as a percentage)
6,208,552	Credit card (PIN) terminal settlements per year ¹
€19.50	Average hourly rate
2	Minutes per terminal per day
€4,037,196	Total POS background costs
€0.031	Per transaction
0.054%	As a percentage of sales
€19.50	Average hourly rate
29.4	Average duration in seconds per card + PIN
€21,021,000	Total cashier time outlay
€0.159	Per transaction
0.279%	As a percentage of sales
€4.88	Costs per terminal credit card (PIN) pro rata per year ²
€3,005,357	Total credit card (PIN) terminal costs per year
€0.023	Terminal costs per credit card (PIN) transaction
0.040%	As a percentage of sales
0.360%	Interchange fee
0.100%	Scheme fees
0.060%	Acquirer fees
0.520%	Total: Charge on sales according to IC++ model
1.330%	Actual credit card (PIN) transaction fee (including IC++ model)
€100,149,000	Credit card (PIN) – total transaction costs
€0.759	Credit card (PIN) – transaction fee per transaction
1.330%	As a percentage of sales

¹ Number of trading days x number of terminals x share of credit card (PIN) terminals = 310 x 616,250 x 0.0325 = 6,208,551.72

² Total annual costs per terminal x share of credit card (PIN) terminals = €150 x 0.0325 = €4.88

The **total outlay for background processing** is calculated by multiplying the average two minutes allocated per terminal settlement by the hourly rate of €19.50 and the number of terminal settlements and transactions in the year (see Table 8). Overall, the background costs for credit card payments with PIN are just under €4.04 million.

Taking into account the total annual costs per terminal, the proportional **terminal costs** amount to €3.0 million.

Based on the major credit cards (MasterCard, Visa, American Express, Diners Club), the weighted average credit card fee is 1.33% of sales.¹⁷ In the case of Visa and MasterCard this includes interchange fees, scheme fees and merchant service charges (MSC), which have to be calculated or reported for large enterprises based on the IC++ model. Taking into account the share of sales made up by international cards and business cards, interchange fees average around 0.36% and scheme fees around 0.10% of sales. On top come acquirer fees of 0.06% of the transaction value on average, which are thus slightly higher than the network operator fees for girocard payments. The resulting charge on sales of at least 0.52% based on the IC++ model can also be seen as the current lower limit for all credit card transactions. Taking these fees as the basic minimum fee for all credit cards, most retailers pay credit card fees which are 0.81 percentage point higher on average, i.e. average transaction fees of 1.33% of sales. This means annual **transaction costs** of €100.15 million for credit card payments with PIN.

Adding together the respective overall expenditure for the four cost items, the retail sector incurs annual costs totalling €534.59 million for credit card payments with PIN (see Table 9). Based on sales of €7.53 billion and 132 million transactions, a credit card payment with PIN costs €0.971 on average, which corresponds to a charge on sale of 1.703%.

¹⁷ Source: EHI (2017)

Cost overview for credit card payments with PIN			
Table 9			
Cost item	Amount		
(Credit card + PIN) sales	€7,530,000,000		
(Credit card + PIN) transactions	132,000,000		
Average amount	€57.05		
Cost items	Absolute value	Per transaction	As a percentage of sales
Total cashier time outlay	€21,021,000	€0.159	0.279%
Total POS background costs	€4,037,196	€0.031	0.054%
Transaction costs	€100,149,000	€0.759	1,330%
Terminals	€3,005,357	€0.023	0.040%
Total costs	€128,212,554	€0.971	1.703%
Total costs (€ million)	€128		

5.2.4 Cost calculation for credit card payments with signature

As with the credit card sales presented above, credit card payments with signature account for sales of €17.57 billion and 308 million transactions.

The **total cashier time outlay** is again obtained by multiplying the measured times with the average hourly rate of €19.50 and the credit card transactions with signature conducted annually. It is important to note that the measured payment duration of 38.6 seconds for cashless payments with signature is used to calculate both the costs of SEPA direct debit payments and credit card payments with signature. This results in a total cashier time outlay of €64.40 million.

The **total outlay for background processing** is calculated by multiplying the average three minutes allocated per terminal settlement by the hourly rate of €19.50 and the number of terminal settlements and transactions annually (see Table 10). Overall, the background costs for credit card payments with signature are just under €14.13 million.

Taking into account the total annual costs per terminal, the proportional terminal costs amount to €7.0 million.

The **transaction fees for credit card payments** with signature are around 1.33% of the transaction value, as for credit cards with PIN. This means annual transaction costs of €233.68 million for credit card payments with signature.

Cost calculation structure: Table 10

Credit card payments with signature

Amount	Cost item
€17,570,000,000	Credit cards (signature) sales
308,000,000	Credit card (signature) transactions
€57.05	Average credit card (signature) receipt
616,250	Number of terminals
7.59%	Terminal technical administration costs (as a percentage)
14,486,621	Credit card (signature) terminal settlements per year ¹
€19.50	Average hourly rate
3	Minutes per terminal per day
€14,130,188	Total POS background costs
€0.046	Per transaction
0.080%	As a percentage of sales
€19.50	Average hourly rate
38.6	Average duration in seconds per card (signature)
€64,397,667	Total cashier time outlay
€0.209	Per transaction
0.367%	As a percentage of sales
€11.38	Costs per terminal credit card (signature) pro rata per year ²
€7,012,500	Terminal costs per credit card (signature) transaction
€0.023	Terminalkosten je Transaktion Kreditkarte (Unterschrift)
0.040%	As a percentage of sales
1.330%	Tatsächliche Kreditkarten (Unterschrift) – Transaktionsgebühr
€233,681,000	Credit card (signature) – total transaction costs
€0.759	Credit card (signature) – transaction fee per transaction
1.330%	As a percentage of sales

¹ Number of trading days x number of terminals x share of credit card (signature) terminals = 310 x 616,250 x 0.0759 = 14,486,620.69

² Total annual costs per terminal x share of credit card (signature) terminals = €150 x 0.0759 = €11.38

Adding together the respective overall expenditure for the four cost items, the retail sector incurs annual costs totalling €319.22 million for credit card payments with signature. Based on sales of €17.57 billion sales and 308 million transactions, a credit card payment with signature costs €1.04 on average, which corresponds to a charge on sales of 1.82%.

Cost overview for credit card payments with signature Table 11

Cost item	Amount		
(Credit card with signature) sales	€17,570,000,000		
(Credit card with signature) transactions	308,000,000		
Average amount	€57.05		
Cost items	Absolute value	Per transaction	As a percentage of sales
Total cashier time outlay	€64,397,667	€0.209	0.367%
Total POS background costs	€14,130,188	€0.046	0.080%
Transaction costs	€233,681,000	€0.759	1,330%
Terminals	€7,012,500	€0.023	0.040%
Total costs	€319,221,354	€1.036	1.817%
Total costs (€ million)	€319		

Taking all credit card payments, i.e. PIN and signature, together, retailers incur annual costs of €447 million in total. Based on sales of €25.1 billion and 440 million transactions, a credit card payment costs €1.02 on average, which corresponds to a charge on sales of 1.78%. Table 12 summarises the overall credit card payment costs.

Cost overview for credit card payments			
Table 12			
Cost item	Amount		
Credit card sales	€25,100,000,000		
Credit card transactions	440,000,000		
Average amount	€57.05		
Cost items	Absolute value	Per transaction	As a percentage of sales
Total cashier time outlay	€85,418,667	€0.194	0.340%
Total POS background costs	€18,167,384	€0.041	0.072%
Transaction costs	€333,830,000	€0.759	1.330%
Terminals	€10,017,857	€0.023	0.040%
Total costs	€447,433,908	€1.017	1.783%
Total costs (€ million)	€447		

5.3 Total costs of payment procedures in retail

The payment procedures presented above cost German retailers €5,430 million in total per year (see Table 13). Cash payments account for €3,775 million per year and all card payments forming part of the study (girocard, direct debit, credit card) for €1,656 million per year, with cash payments having a significantly higher share of transactions. This does not take into account sales of €13 billion from invoice/finance purchases/voucher payments and sales of around €6 billion from other card payments (store cards, Maestro, VPAY). When these are included¹⁸, with gross sales of €410 billion and 20 billion transactions, total costs in retail amount to around €5.7 billion.

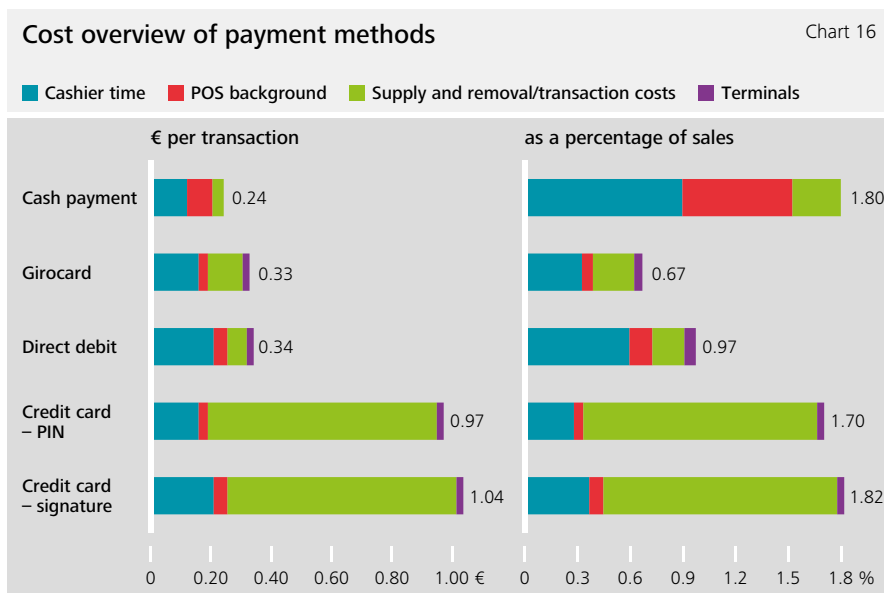
¹⁸ For the calculation of the total costs for invoice/finance purchase/voucher payments and other card payments (store cards, Maestro, VPAY) a cost component of 1.76% of sales is assumed.

Cost overview of all payment methods in comparison

Table 13

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature	∑ Total costs
Sales (€ billion)	€210.00	€101.00	€54.80	€7.53	€17.57	€390.9
Transactions (in million)	15.579	2.060	1.560	132	308	19.640
Average receipt amount	€13.48	€49.03	€35.13	€57.05	€57.05	/
Average payment duration (in seconds)	22.3	29.4	38.6	29.4	38.6	/
Total outlay POS background	€1,314,787,500	€62,991,952	€71,568,482	€4,037,196	€14,130,188	€1,467,515,318
Per transaction	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	€1,881,934,167	€328,055,000	€326,170,000	€21,021,000	€64,397,667	€2,621,412,955
Per transaction	€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%	/
Total terminal costs per year	/	€46,901,786	€35,517,857	€3,005,357	€7,012,500	€92,437,500
Per transaction	/	€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 p.a.	€578,000,000	/	/	/	/	€578,000,000
Per transaction	€0.037	/	/	/	/	/
As a percentage of sales	0.275%	/	/	/	/	/
Transaction costs	/	€237,354,230	€99,736,000	€100,149,000	€233,681,000	€670,920,230
Per transaction	/	€0.115	€0.064	€0.759	€0.759	/
As a percentage of sales	/	0.235%	0.182%	1.330%	1.330%	/
∑ Total costs	€3,774,721,667	€675,302,968	€532,992,339	€128,212,553	€319,221,355	€5,430,286,003
∑ Total costs (€ million)	€3,775	€675	€533	€128	€319	€5,430
Per transaction	€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%	

The results of the cost analysis show that, in terms of transactions, cash is currently the most cost-effective payment method for retailers (see Table 13). In terms of sales, the relationship is reversed, with girocard payments being the most cost-effective payment method in retail. Direct debit payments and credit card payments with PIN are also more cost-effective than cash payments in terms of sales. These direct comparisons have only limited informative value, however, as the various payment methods entail different payment amounts, amongst other things. Overall, it is striking that the costs for back-office activities are relatively high for cash payments, while for card payment systems, in particular credit card payments, the transaction costs account for a relatively large proportion of the costs.



6 Cost analysis

The costs associated with the different payment methods presented in the previous section are based on different average variables. The number of transactions, average payment amount and the resulting sales differ from payment method to payment method, making comparison between them difficult. Depending on how one looks at the data – transaction-wise or sales-wise – either cash or girocard works out as the cheapest payment procedure.

The following cost analyses are intended to enhance comparability across the different means of payment and make the data collected more informative. To begin with, various simulations with modified variables are set out. This is followed by calculations of cost behaviour patterns for cash and cashless means of payment depending on payment amount as well as a cost forecast for payments in cash and by girocard.

6.1 Simulations

6.1.1 Simulation 1 – overview: same average receipt for all payment methods

The first scenario simulates what would happen if the average payment amount for card payments was the same as that for cash payments. An average payment amount of €13.48 is assumed for all means of payment (see Table 14). Sales stay the same; the respective number of transactions adjusts accordingly.

Overall, the number of card transactions would rise from its current level of 4.1 billion to 13.4 billion, leading to higher background, transaction and terminal costs for card payments.¹⁹ As a result, with sales unchanged, the total cost of card

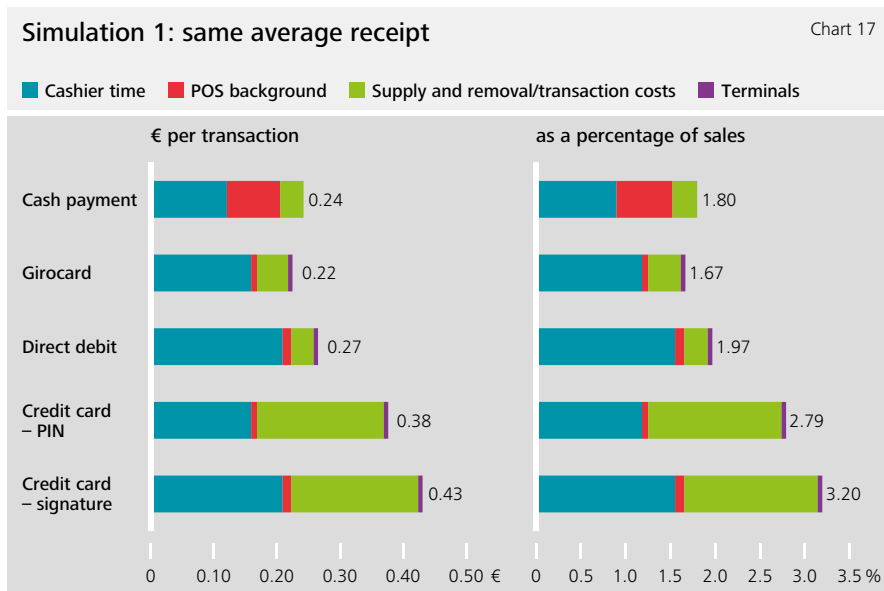
¹⁹ There would also be changes in costs owing to altered transaction shares for the individual card-based payment procedures.

payments would double from €1,656 million to €3,532 million. In this scenario, girocard payments would prove cheaper than cash payments on both a per transaction basis and in terms of sales.

Simulation 1 – same average receipt

Table 14

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature
Sales (€ billion)	€210.00	€101.00	€54.80	€7.53	€17.57
Transactions (in million)	15.579	7.493	4,065	559	1,303
Average amount	€13.48	€13.48	€13.48	€13.48	€13.48
Cashier time	€0.121	€0.159	€0.209	€0.159	€0.209
POS background	€0.084	€0.009	€0.014	€0.009	€0.014
Supply and removal / transaction costs	€0.037	€0.049	€0.035	€0.201	€0.201
Terminals	/	0.007	€0.007	€0.007	€0.007
Total costs per transaction	€0.242	€0.225	€0.265	€0.376	€0.431
Cashier time	€1,881,934,166.67	€1,193,193,620.18	€849,982,690.41	€88,957,900.59	€272,521,822.45
POS background	€1,314,787,500.00	€69,328,976.64	€56,424,177.03	€5,168,784.10	€18,090,744.35
Supply and removal / transaction costs	€578,000,000.00	€368,650,000.00	€143,576,000.00	€112,197,000.00	€261,793,000.00
Terminals	/	€51,609,660.03	€28,002,072.97	€3,847,730.10	€8,978,036.90
Total costs absolute	€3,774,721,667	€1,682,782,257	€1,077,984,940	€210,171,414.79	€561,383,604
Total costs absolute (€ million)	€3.775	€1.683	€1,078	€210	€561
Cashier time	0.896%	1.181%	1.551%	1.181%	1.551%
POS background	0.626%	0.069%	0.103%	0.069%	0.103%
Supply and removal / transaction costs	0.275%	0.365%	0.262%	1.490%	1.490%
Terminals	/	0.051%	0.051%	0.051%	0.051%
Total costs as a percentage of sales	1.797%	1.666%	1.967%	2.791%	3.195%



6.1.2 Simulation 2 – overview: contactless card payments

In recent times, the number of contactless card payments being made in the retail sector has increased markedly. An estimated 5-10% of all card payments are now contactless, and this proportion is rising.²⁰ Contactless payments are made by holding a card equipped with near-field communication (NFC) technology²¹ up against a special kind of payment terminal. In contrast to payments requiring contact, the card is not inserted into the reader. Another difference is that, up to a certain amount, contactless payments do not, as a rule, require any verification such as entry of a PIN.²² This threshold is currently set at €25 in the German retail sector.

²⁰ Source: Rüter (2018)

²¹ Contactless payments can, in principle, also be made using smartphones or other devices if these are equipped with NFC functionality.

²² Currently a PIN is required even for amounts under €25 after five transactions or a cumulative total spend of €150.

The contactless method and omission of the verification step are meant to speed up the payment process. 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.²³ 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. Currently, just under 73% of large retailers and 22% of small retailers in Germany have contactless-capable terminals.²⁴

The present study only captured an extremely small and, therefore, probably unrepresentative sample of contactless card payments. This is likely due to the fact that contactless payments have only recently become more commonplace. So as nevertheless to consider potential costs associated with this new form of payment, two scenarios for contactless card payment are simulated below.

²³ On 27 June 2017, the company EURO Kartensysteme published the results of a study they had commissioned on the speed of different means of payment. Across a total of 840 transactions in different markets belonging to the food retail sector, average payment durations of 24 seconds for a cash payment, 23 seconds for contact girocard payment with PIN and 28 seconds for electronic direct debit were observed. Contactless girocard payments, meanwhile, took an average of just 11 seconds, half the time measured for contact girocard payments with PIN. At €12.45, the average payment amount for contactless girocard was by far the lowest, compared with €22.00 for cash and €41.25 for contact girocard payment.

²⁴ Source: EHI (2018)

6.1.2.1 Simulation 2a – overview: reduction of average payment duration for girocard and credit card payments with PIN

The following simulation posits all girocard and credit card payments currently made with PIN being made contactless instead (see Table 15). It is also assumed that where payments are below €25 there is no verification involved.

Simulation 2a – duration of girocard and credit card payments with PIN entry halved

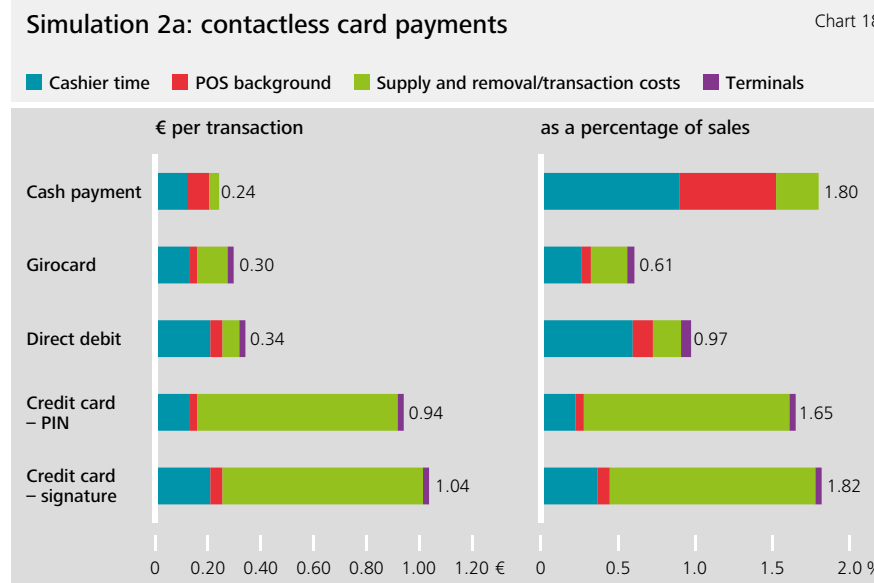
Table 15

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature
Sales (€ billion)	€210.00	€101.00	€54.80	€7.53	€17.57
Transactions (in million)	15.579	2.060	1.560	132	308
Average amount	€13.48	€49.03	€35.13	€57.05	€57.05
Cashier time	€0.121	€0.129	€0.209	€0.129	€0.209
POS background	€0.084	€0.031	€0.046	€0.031	€0.046
Supply and removal / transaction costs	€0.037	€0.115	€0.065	€0.759	€0.759
Terminals	/	€0.023	€0.023	€0.023	€0.023
Total costs per transaction	€0.242	€0.297	€0.342	€0.941	€1.036
Cashier time	€1,881,934,166.67	€264,953,947.37	€326,170,000.00	€16,977,631.58	€64,397,666.67
POS background	€1,314,787,500.00	€63,004,732.14	€71,568,482.14	€4,037,196.43	€14,130,187.50
Supply and removal / transaction costs	€578,000,000.00	€237,350,000.00	€101,380,000.00	€100,149,000.00	€233,681,000.00
Terminals	/	€46,901,785.71	€35,517,857.14	€3,005,357.14	€7,012,500.00
Total costs absolute	€3,774,721.667	€612,210,465.23	€534,992,339.29	€124,169,185.15	€319,221,354.17
Total costs absolute (€ million)	€3,775	€612	€535	€124	€319
Cashier time	0.896%	0.262%	0.595%	0.225%	0.367%
POS background	0.626%	0.062%	0.131%	0.054%	0.080%
Supply and removal / transaction costs	0.275%	0.235%	0.182%	1.330%	1.330%
Terminals	/	0.046%	0.065%	0.040%	0.040%
Total costs as a percentage of sales	1.797%	0.606%	0.973%	1.649%	1.817%

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.

Taking account of the respective shares, the new average payment duration for girocard and credit card payments previously carried out with PIN would then be just under 24 seconds. Girocard payments would thus continue to take longer, on average, than 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 electronic 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.

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



6.1.2.2 Simulation 2b – overview: reduction in average payment duration for girocard and credit card payments with PIN and same average receipt

In this simulation, in addition to the reduction in the average payment duration for girocard and credit card payments as a result of contactless payment, the same payment amount of €13.48 is assumed for all payment types and every contactless payment is assumed to involve no verification step.

In this scenario, girocard payments would be the cheapest payment option for retailers, both on a per transaction basis and in terms of sales.

Simulation 2b – same average receipt plus cashier time for girocard payments halved

Table 16

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature
Sales (€ billion)	€210.00	€101.00	€54.80	€7.53	€17.57
Transactions (in million)	15.580	7.493	4.065	559	1.303
Average amount	€13.48	€13.48	€13.48	€13.48	€13.48
Cashier time	€0.121	€0.081	€0.209	€0.081	€0.209
POS background	€0.084	€0.009	€0.014	€0.009	€0.014
Supply and removal / transaction costs	€0.037	€0.049	€0.035	€0.201	€0.201
Terminals	/	€0.007	€0.007	€0.007	€0.007
Total costs per transaction	€0.242	€0.147	€0.265	€0.298	€0.431

Cashier time	€1,881,934,166.67	€608,772,255.19	€849,982,690.41	€45,386,683.98	€272,521,822.45
POS background	€1,314,787,500.00	€69,328,976.64	€56,424,177.03	€5,168,784.10	€18,090,744.35
Supply and removal / transaction costs	€578,000,000.00	€368,650,000.00	€143,576,000.00	€112,197,000.00	€261,793,000.00
Terminals	/	€51,609,660.03	€28,002,072.97	€3,847,730.10	€8,978,036.90
Total costs absolute	€3,774,721,666.67	€1,098,360,891.87	€1,077,984,940.41	€166,600,198.18	€561,383,603.70
Total costs absolute (€ million)	€3.775	€1.098	€1.078	€167	€561

Cashier time	0.896%	0.603%	1.551%	0.603%	1.551%
POS background	0.626%	0.069%	0.103%	0.069%	0.103%
Supply and removal / transaction costs	0.275%	0.365%	0.262%	1.490%	1.490%
Terminals	/	0.051%	0.051%	0.051%	0.051%
Total costs as a percentage of sales	1.797%	1.087%	1.967%	2.212%	3.195%

Simulation 2b: contactless card payments and same average receipt

Chart 19



6.1.3 Simulation 3 – overview: all retail sales via one single payment method

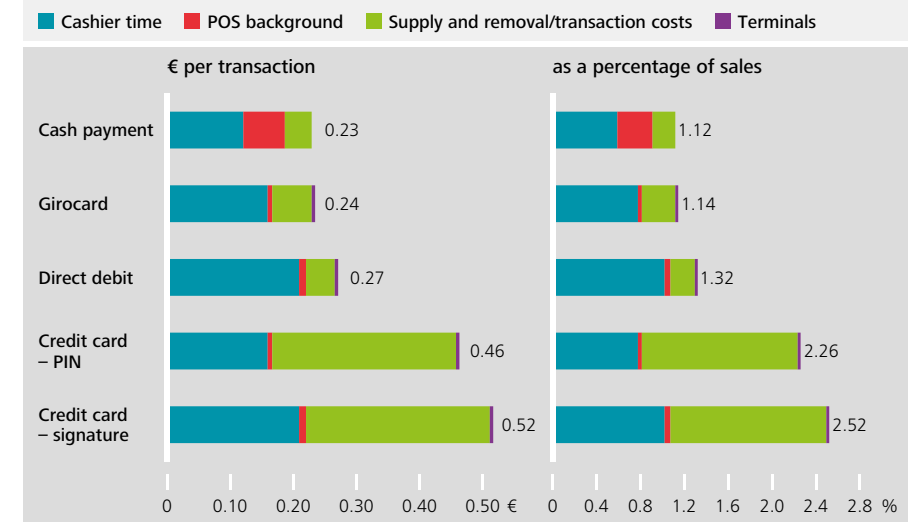
The following scenario simulates what would happen if the total retail sales of €410 billion resulting from 20 billion transactions were to be effected using just one payment method.

The following assumptions apply. Since every POS would have to be equipped with a terminal, the number of terminals would rise to 725,000, entailing a commensurate cost increase. Transaction costs would rise in percentage terms. In the case of cash, it is assumed that it would be primarily cash supply and removal costs that would rise since the volume of cash being dealt with in the retail sector would almost double. An across-the-board increase of 50% was applied to these costs, taking them to €850 million.

Ultimately, with sales and number of transactions equal across all payment methods, cash proves cheaper than all other options, both per transaction and from a sales perspective.

Simulation 3: total retail sales using only one payment method

Chart 20



Simulation 3 – all retail sales via one single payment method

Table 17

Cost item	Cash	Girocard	Direct debit	Credit card – PIN	Credit card – signature
Sales (€ billion)	€410.00	€410.00	€410.00	€410.00	€410.00
Transactions (in million)	20.000	20.000	20.000	20.000	20.000
Average amount	€20.50	€20.50	€20.50	€20.50	€20.50
Cashier time	€0.121	€0.159	€0.209	€0.159	€0.209
POS background	€0.066	€0.007	€0.011	€0.007	€0.011
Supply and removal / transaction costs	€0.043	€0.063	€0.046	€0.291	€0.291
Terminals	/	€0.005	€0.005	€0.005	€0.005
Total costs per transaction	€0.229	€0.235	€0.271	€0.463	€0.517

Cashier time	€2,415,833,333	€3,185,000,000	€4,181,666,667	€3,185,000,000	€4,181,666,667
POS background	€1,314,787,500	€146,087,500	€219,131,250	€146,087,500	€219,131,250
Supply and removal / transaction costs	€850,000,000	€1,250,500,000	€910,200,000	€5,822,000,000	€5,822,000,000
Terminals	/	€108,750,000	€108,750,000	€108,750,000	€108,750,000
Total costs absolute	€4,580,620,833	€4,690,337,500	€5,419,747,917	€9,261,837,500	€10,331,547,917
Total costs absolute (€ million)	€4,581	€4,690	€5,420	€9,262	€10,332

Cashier time	0.589%	0.777%	1.020%	0.777%	1.020%
POS background	0.321%	0.036%	0.053%	0.036%	0.053%
Supply and removal / transaction costs	0.207%	0.305%	0.222%	1.420%	1.420%
Terminals	/	0.027%	0.027%	0.027%	0.027%
Total costs as a percentage of sales	1.117%	1.144%	1.322%	2.259%	2.520%

6.2 Cost analysis for cash and cashless means of payment

The cost calculations presented up to this point are fundamentally based on average values – average payment amounts or transaction shares, 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 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 true when it comes to higher payment amounts, with card payment working out less costly than cash payment.²⁵ Below, the individual cost components of cash and card payments are first grouped into different cost types. This serves as the basis for establishing a cost function depending on sales or payment amount for each of the means of payment and finally calculating the respective cost behaviour patterns.

6.2.1 Assumptions

When seeking to ascertain the costs associated with each payment method for different payment amounts it is helpful to differentiate between fixed and variable costs. The variable costs can be further broken down into transaction-dependent and sales-dependent costs.²⁶ 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.

²⁵ Source: M. Krüger and F. Seitz (2014)

²⁶ Source: M. Krüger and F. Seitz (2014)

6.2.1.1 Cash payments

Costs for cashier time are incurred every time a transaction is made and are therefore variable. In the case of cash payments, increasing sales means increased cashier time (and thus higher costs). Some elements of the checkout process for a cash payment are likely to be largely unaffected by the payment amount (for example, opening and closing the cash register, handing over money and the receipt), while others depend on the payment amount in question (for example, looking for the correct change). Cashier time where cash payment is concerned thus involves a mixture of transaction-dependent costs and sales-dependent costs. To determine the size of the respective shares in this mixture, payment amount is regressed on payment duration.²⁷ If the payment amount goes up by €1, payment duration increases by 0.0226 seconds. Considering an hourly rate of €19.50, that is just under 0.01% per additional euro of payment amount. Just under €0.12 is incurred for every transaction irrespective of sales.

The costs involved in cash supply and removal can also be counted among the variable costs since, as a rule, they are only incurred if customers actually pay with cash. In the present study, these costs are calculated as a percentage share of sales. It is conceivable that, especially in the case of small amounts – particularly low denomination coins – the costs are dependent not on sales but only on number. However, given that – when averaged out – the number of transactions is also likely to be reflected in sales and that the expenses for cash removal (either by a CIT company or by the retailer itself) are habitually based on nominal value, supply and removal costs are classified as sales-dependent costs. Here, that is equal to a 0.275% share of sales.

POS background costs include a multitude of activities. Some of these are likely to be fixed, such as costs for safes, cash counting machines or banknote verification

²⁷ See Annex 4: Statistical section

machines. Most, however, are likely to be contingent on POS settlements and thus on the number of transactions (for example, depositing and re-counting quantities of change at the beginning of each shift, manual counting of the day's takings or cash drops from individual cash registers including transit time). Measured by the number of activities, around 17 minutes of the 18 minutes factored in for POS background costs can be allocated to the variable costs and one minute can be ascribed to the fixed costs (for example, depreciation of safes, cash counting machines, cash scales). Fixed costs are estimated at around €100 per year per POS. With a total of 725,000 POS that amounts to annual costs of €72.5 million. 1/18 of the total background costs are thus factored in as fixed costs and the remaining 17/18 of the background costs (approximately €1.24 billion) are counted as transaction-related costs.

6.2.1.2 Card payments

The cashier time costs again fall into the category of variable costs where card payments are concerned. In comparison to cash payments these do not exhibit any clear linear relationship overall and are therefore counted among the transaction-dependent costs.²⁸

²⁸ For card payments with PIN, a weak linear relationship between payment amount and payment duration is apparent but the same is not true of card payments with signature. Since the increase in payment duration for larger payment amounts is only faint and seems less plausible in substance than that observed with cash payments and given that other factors could be responsible for this linear relationship, cashier time for card payments has ultimately been grouped among the transaction-dependent costs.

So far as background costs are concerned, this study applies a time outlay of two minutes for paperless payment procedures (girocard, credit card plus PIN) and of three minutes for payments requiring paper-based authorisation (electronic direct debit, credit card with signature) (see Section 5.2). The background costs in connection with card payments primarily comprise software updates, terminal registration and checks of statements from card operators for accounting purposes. In the case of card payments involving paper-based authorisation there is also the sorting and archiving of authorisation slips to consider. Software updates and terminal registration are likely to be fixed costs; by contrast, statement checking – plus archiving of authorisation slips in the case of electronic direct debit and payment by credit card plus signature – are likely to constitute transaction-dependent variable costs. In line with the number of activities, 50% of background costs for girocard payments and payments by credit card with PIN are therefore ascribed to the fixed cost category and the other half are counted as transaction-dependent costs. Since, in the case of electronic direct debit and payment by credit card with signature, there is the additional outlay (here: one minute) associated with the archiving of authorisation slips, one-third of the background costs are allocated to the fixed costs and two-thirds are classed as transaction-dependent.

In the present study, the transaction costs of all card payments are calculated as a percentage share of sales (see Section 5.2). However, some cost components may, in actual fact, be transaction-linked.²⁹ It is likely that there will be considerable variation between the individual cost components of transaction costs depending on the retailer in question. However, a breakdown into transaction-linked and sales-

²⁹ For girocard payments and electronic direct debits, network operator fees are generally transaction-linked costs, while authorisation fees (girocard) and the average insurance and default risk (electronic direct debit) are sales-linked costs. Various fees are associated with payment by credit card (interchange fees, scheme fees, acquirer fees). The present study gives the sum of these in terms of sales. Since the average fee differs from the sales-based IC++ model, however, a distinction between transaction-related and sales-related fees cannot confidently be made. In the workings which follow, the network operator fees, authorisation fees, the average insurance and default risk (electronic direct debit) and total transaction costs for credit card payments are therefore classified as variable sales-dependent costs.

linked variable cost types is not readily possible since transaction fees were capped and minimum fees essentially proscribed by the 2015 EU Regulation applying to interchange fees.³⁰ For this reason, all variable costs are counted as variable sales-linked costs as described in Section 5.2.

Terminal costs consist of the depreciation costs for payment terminals and are fixed costs.

6.2.2 Determining the cost function

Cash payments, at €0.005, have relatively low fixed costs, and card payments, at €0.038, have relatively high fixed costs. This differential is due, on the one hand, to the relatively high terminal costs of cashless methods of payment and, on the other, to the current high number of cash transactions lowering the average fixed costs per transaction.³¹ Table 18 shows the average fixed and variable costs per transaction of the various means of payment.

With regard to transaction-dependent costs, cash payments cause marginally higher costs, at €0.198 per transaction, than payments by girocard or credit card with PIN (both €0.175) and somewhat lower costs than payments by electronic direct debit or credit card with signature (both €0.24). Although cashier times are lowest in the case of cash payments, they incur relatively high background costs with every transaction. In the case of electronic direct debiting and payment by credit card (signature), every transaction involves relatively high costs for the cashier times and for processing the payment receipts.

³⁰ Source: Regulation (EU) 2015/751 of the European Parliament and of the Council 29. 4. 2015 about Interchange fees for card-based payment transactions, OJ L 123/1.

³¹ When interpreting fixed costs, it is important to bear in mind the fact that, at present, there exist more retail POS (725,000) than payment terminals (616,250). With card payments accounting for a growing percentage of transactions, the number of payment terminals is likely to increase and bring higher fixed costs.

In terms of sales-dependent costs, too, the amount of time needed for cash supply and removal as well as fees mean that cash payments, at 0.287%, cost somewhat more than payments by debit card (girocard: 0.235%; electronic direct debiting: 0.182%), although they are well below the costs for credit card payments (PIN and signature: both 1.33%). The latter comprise a number of different cost items and therefore incur relatively high sales-dependent costs compared with other payment methods. Payments by electronic direct debit, unlike girocard, do not involve authorisation fees and therefore incur the lowest sales-dependent costs.

Kostenvergleich unterschiedlicher Zahlungsverfahren

Table 18

Costs per transaction	Fixed costs (€)	Variable costs	
		Transaction-dependent (€)	Sales-dependent (as a percentage)
Cash	0.005	0.198	0.287
Girocard	0.038	0.175	0.235
Direct debit	0.038	0.240	0.182
Credit card – PIN	0.038	0.175	1.330
Credit card – signature	0.038	0.240	1.330

On the whole, cash payments tend to have low fixed costs as well somewhat higher variable costs. Payments by debit card (girocard, electronic direct debiting) cause comparatively high fixed costs, but low variable costs. Credit card payments incur both high fixed costs and high variable costs. These observations are consistent with earlier findings in the literature.³² From these considerations, it is possible to derive the following function to show the total costs of a payment method depending on the payment amount:

$$\begin{aligned}
 F(z) &= K + T + U \\
 &= K + (t + u \times z) \times n
 \end{aligned}
 \tag{1}$$

³² See H. Brits and C. Winder (2005) or M. Krüger and F. Seitz (2014)

With:

$K = \text{fixed costs}$

$t = \text{transaction – dependent variable costs}$

$u = \text{sales – dependent variable cost rates}$

$Z = \text{average payment amount}$

$n = \text{number of transactions}$

The costs per transaction for each payment method may thus be shown as follows:

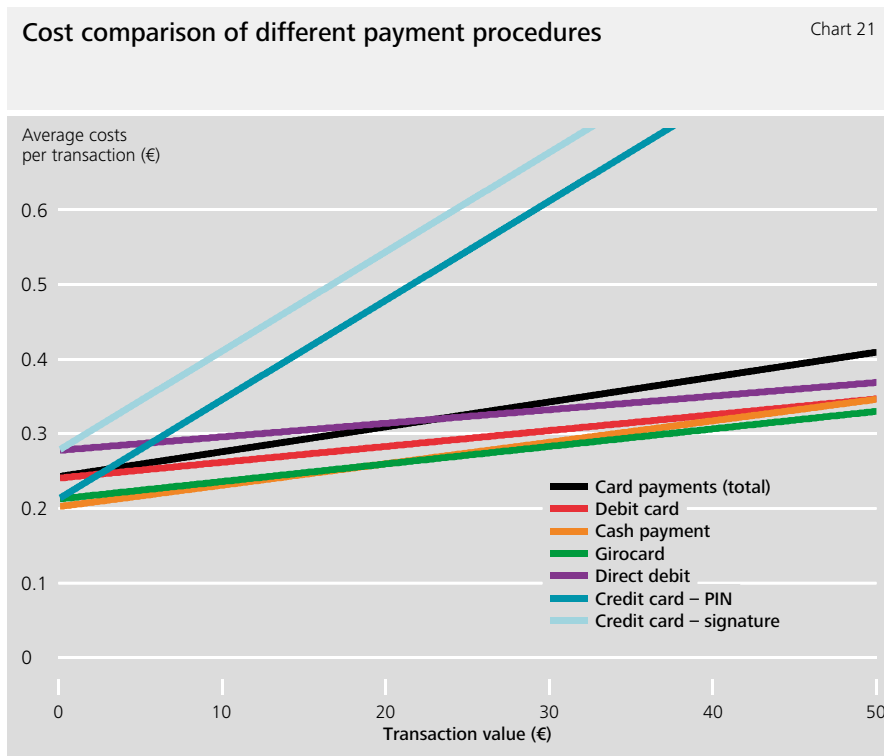
$$f(z) = \frac{K}{n} + t + u \times z \quad (2)$$

6.2.3 Calculating cost behaviour patterns

Chart 21 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 electronic 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 the other payment methods and, for most payment amounts, are higher than all the other observed means of payment. It is solely in the case of amounts below €10 that the costs of electronic direct debiting are higher (because of the higher background costs) than those for credit card payments with PIN.

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 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 cashless payments should, in addition, therefore also be looked at and analysed 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 transaction. 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 electronic 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 Germany, where payment amounts up to €50 are mostly paid in cash and amounts higher than €50 are predominantly paid by debt card,³³ appears to be favourable payment behaviour in terms of the overall costs.

³³ Source: Deutsche Bundesbank (2018)



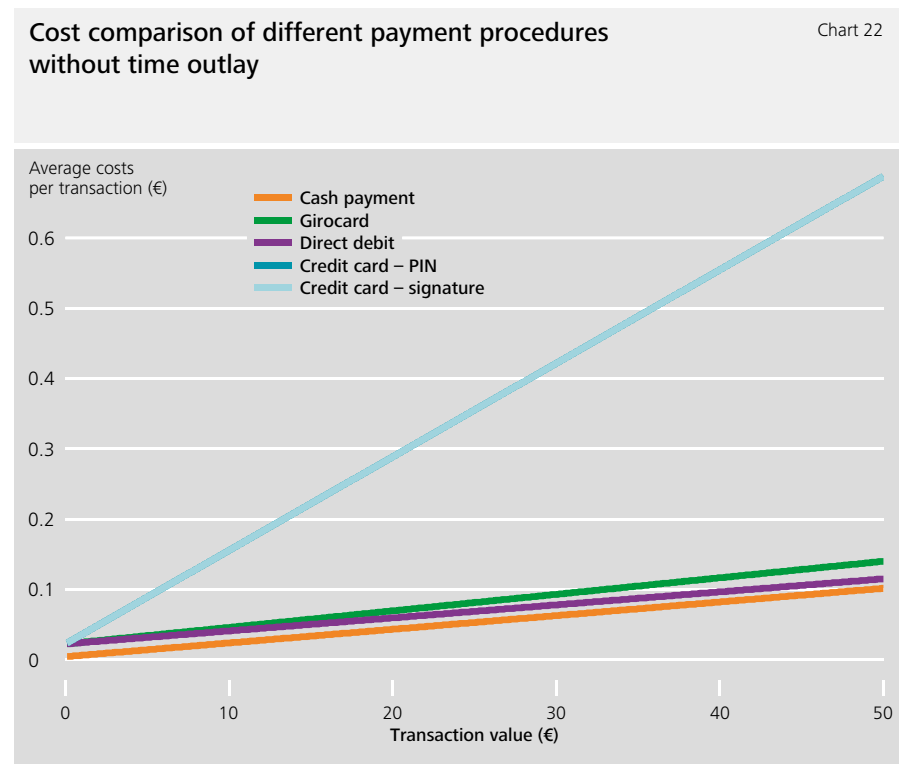
With an increasing payment amount, the cost behaviour patterns of payment by debit card, in cash and by girocard would intersect. For relatively high payment amounts, a transaction by electronic direct debit would therefore be more cost-efficient than a payment in cash or by girocard. Since the default and insurance costs for payments by electronic direct debit are averaged, however, it may be assumed that the actual costs of electronic direct debit transactions increase more sharply as the payment amount increases than is shown here.

The calculations so far take into account, first, costs incurred by retailers through purchases and fees (e.g. in the case of cashless payment methods, safe costs, terminal costs, transaction fees or, in the case of cash payments, charges for the ser-

vices of CIT companies). Second, we have also looked at costs that represent an outlay of time (such as cashier times, various background costs and supply and removal of cash by retailers). While purchases and fees represent costs which a retail enterprise generally remits to other enterprises, the amounts of time analysed using the personnel cost rate are generally costs which have more to do with cost accounting. For some retail groups, such costs are likely to play, if anything, a minor role if time savings (owing, for example, to quicker cashier times) have no impact on personnel costs or productivity. This might be true, say, of retail groups which have a comparatively small amount of customer traffic. It is also possible that some of the retailers perform various activities themselves and do them when it happens to seem convenient and/or not much additional time spent is needed. For that reason, the following calculation includes solely those costs which do not have any cost-accounting characteristics. In the case of cash payments, these are fixed costs as well as costs for the fees due to cash supply and removal. In the case of cashless payment methods, terminal as well as transaction fees are included.

Based on these considerations, Chart 22 shows, for various payment methods, the resulting changes in the cost behaviour patterns per transaction depending on the payment amount. Given low payment amounts, the costs of cash payments when compared with cashless payment methods are still lower than in the calculation where the amounts of time spent are taken into consideration. This is due to what is now largely an absence of background costs in the case of cash payments, which require a comparatively large outlay of time. Since the average sales-dependent costs of cash payments, at 0.194%, are higher than the sales-dependent costs of electronic direct debiting (0.182%), but lower than those of girocard payments (0.235%), the costs per cash transaction are invariably lower than the costs of a girocard transaction. In this model, the costs of payments by electronic direct debiting would be lower than the costs of a cash payment from a payment amount of €194.96 upwards. Since only an average default and insurance risk was assumed in the case of electronic direct debiting, it is questionable whether the cost curve

of electronic direct debiting does not rather resemble an exponential curve and rises disproportionately at a point well before this payment amount. Once again, the high fees mean that the costs of credit card payments are significantly higher than the costs of other payment methods. Looking exclusively at the costs incurred without an outlay of time, cash payment is thus the most cost-efficient payment method even with higher payment amounts.



Overall, the calculations confirm earlier research findings that cash payments cause relatively low fixed costs and somewhat higher variable costs. On the basis of the data established here, the variable costs of cash payments are, however, only marginally higher than the variable costs of payments by girocard or electronic direct debiting and are well below the variable costs of credit card payments. As a result of the low fixed costs, cash payments up to an average payment amount of just under €20 are the most cost-efficient for the retail sector, girocard is more cost-efficient for higher amounts. If payments by girocard and electronic direct debit are combined as debit card payments, cash is the most cost-efficient means of payment up to around €50. Cash payments are invariably more cost-efficient if all the card payment methods are considered in aggregate. If the costs arising from time outlays are ignored, cash payments are the most cost-efficient means of payment for each of the payment amounts under consideration here.

6.3 Cost forecast

As part of the previous analyses and simulations, the modification of various variables made it possible to set aside the payment structures of the different payment methods to some extent and make the costs more comparable with each other. When changing the figures for total sales or the average payment amounts, for example, the respective parameters of the payment method adjusted in line with the following equation.

$$\text{Number of transactions} \times \text{average payment amount} = \text{sales} \tag{3}$$

One of the three variables of the equation was always treated as fixed so that it was possible to observe what effect the change of one variable had on the third variable. It seems more likely, however, that a change in one variable, such as the percentage share of one payment method in transactions, results in a change in all the other variables, too. Especially for a forecast of future cost developments, the static simulations are therefore of no more than limited informative value. Below,

a model for predicting the costs of cash and girocard payments is developed, which is designed not to be limited by fixed shares of sales or of transactions but display a more dynamic character instead.

6.3.1 Model assumptions

The Bundesbank's previous payment behaviour studies show that the transaction share of cash payments has been decreasing every year by around 1 percentage point since 2011.³⁴ The transaction shares of girocard payments, on the other hand, have recently been increasing by somewhat more than 1 percentage point per year. Below, we investigate how retail costs are going to develop given a continuation of the existing trend of an increasing share of cashless transactions and a declining share of cash payments. For the sake of simplicity, however, we analyse only cash and girocard payments. The following assumptions are made:

1. total sales across all payment methods,³⁵
2. the total number of transactions across all payment methods³⁶ and
3. the average payment amount of a cash payment³⁷ remain constant.

Assumption No 1 follows the observation that the retail sector as a whole has seen comparatively stable sales figures over the past few years. The sales figures in 2017, at €420 billion, showed only a marginal change compared with €410 billion in 2016 (EHI 2018). It is true that future increases in GDP could also result in higher

³⁴ Source: Deutsche Bundesbank (2018)

³⁵ The total sales from cash payments and girocard payments amount to around €311 billion.

³⁶ The total number of transactions involving cash payments and girocard payments amounts to 17.64 billion.

³⁷ In the present study, the third assumption is the average payment amount of a cash payment (€13.48).

sales figures, but the fact that retail sales are shifting more and more from stationary retail to online trading is likely to have a dampening impact. For the sake of simplicity, it is therefore assumed that cash and girocard payments together will continue to be at around €311 billion.

Assumption No 2 is based on the fact that the number of transactions in the retail sector as a whole in 2016 and 2017 showed no or only marginal change. According to EHI, there were just under 20 billion transactions in each of these years. It therefore seems plausible that the number of transactions involving cash and girocard payments (together €17.64 billion) will remain stable in the immediate future.

Assumption No 3 results from the fact that the average payment amount of retail cash payments in the past two years remained more or less the same despite changes in the transaction share.³⁸ It is therefore assumed that the average cash payment amount will be just under €13.48 even if there are further shifts in the transaction shares.

³⁸ In 2016 this amounted to €14.21, in 2017 €14.27. The observed EHI panel differs somewhat from the panel of the present cost study, resulting in slight changes in the reported average payment amount of €13.48.

These assumptions produce the following equations:

$$Z_i = \text{€}311 \text{ billion} - Z_j \quad (3)$$

$$\bar{Y}_i = \frac{Z_i}{X_i} \quad (4)$$

$$Z_j = X_j \times Y_j \quad (5)$$

$$X_j = \text{€}17.64 \text{ billion} - X_i \quad (6)$$

$$\bar{Y}_j = 13,48 \text{ €} \quad (7)$$

X = number of transactions

\bar{Y} = average payment amount

Z = sales

i = girogard payments

j = cash payments

From this it follows:

$$Y_i = \frac{\text{€}311 \text{ billion} - (\text{€}17.64 \text{ billion} - X_i) \times \text{€}13.48}{X_i} \quad (8)$$

$$Z_i = X_i \times Y_i \quad (9)$$

Here, the number of girocard payments is an exogenous variable with which the change in the transaction share can be determined. The average payment amount is given by dividing the figures for girocard sales and the number of girocard transactions. The girocard sales figures, in turn, are obtained by deducting cash sales from total sales (here: €311 billion)

The average cash payment amount of €13.48 is assumed to be fixed. The number of cash transactions is given by the total number of transactions (here: €17.64 billion) less the number of non-cash transactions. The sales figure for girocard payments is derived by multiplying the number of transactions by the average payment amount.

Cost functions can now be formed for girocard and cash payments. These are composed of the known cost components (cash: cashier times, background costs, cash supply and removal; girocard: cashier times, background costs, terminal costs and transaction costs). By inserting the above equations and rearranging after the exogenous variable, the costs per transaction can be shown for both girocard and cash payments depending on the number of girocard transactions.

$$\text{Costs per girocard transaction} = f_i(X_i) = \text{€}0,159 + \text{€}0,015 \quad (10)$$

$$\begin{aligned} & + \frac{(616,250 \text{ thousand} + 109 \text{ Tsd} \times (-10.3\% + \frac{X_i}{20 \text{ billion}})) \times (\frac{1}{77.9\%}) \times \frac{\text{€}100,75 \times X_i}{X_i + 2 \text{ billion}}}{X_i} \\ & + \frac{(616,250 \text{ thousand} + 109 \text{ Tsd} \times (-10.3\% + \frac{X_i}{20 \text{ billion}})) \times (\frac{1}{77.9\%}) \times \frac{\text{€}150 \times X_i}{X_i + 2 \text{ billion}}}{X_i} \\ & + \frac{(\text{€}311 \text{ billion} - (17.64 \text{ billion} - X_i) \times \text{€}13.48) \times 0.235\%}{X_i} \end{aligned}$$

$$\begin{aligned}
 \text{Costs per cash transaction} &= f_j(X_i) && (11) \\
 &= \text{€}0.121 \\
 &+ \frac{725 \text{ thousand} \times \left(18 + 10 \times \left(-77.9\% + \frac{17.64 \text{ billion} - X_i}{20 \text{ billion}}\right) \times \frac{1}{77.9\%}\right)}{17.64 \text{ billion} - X_i} \\
 &+ \frac{(17.64 \text{ billion} - X_i) \times \text{€}13.48 \times 0.275\%}{17.64 \text{ billion} - X_i}
 \end{aligned}$$

It should be borne in mind that, if transaction numbers go up or down, some cost components probably also change. This is likely to be true, say, of background costs. This is because, while some of the background costs are fixed costs (e.g. acquisition costs) which are incurred independently of the number of transactions, the vast majority of them are transaction-dependent costs. It is therefore assumed that transaction-dependent background costs decrease proportionally to the number of transactions, while fixed costs remain unchanged.³⁹

With respect to the cashier times, unchanged costs per transaction are assumed both for cash payments and for girocard payments. Although a clear connection between the cashier time and the payment amount was observed in the case of cash, the average amount of a cash payment remains constant in this model, which means that no change is to be expected.

Furthermore, it is conceivable that rising transaction numbers have an impact on the transaction fees (such as network operator fees) – for example, conditions could improve and fees go down. On the other hand, greater dependence on service providers of cashless payment instruments means that oligopolistic tendencies and, hence, rising fees are possible. Owing to this uncertainty as well as any offsetting effects, the current average transaction fees for girocard payments are assu-

³⁹ For the sake of simplicity, a linear dependence was assumed at this point. It is also conceivable that these variable costs would develop in another way – exponentially, for example.

med to amount to 0.235%. With regard to the costs of cash payments, it is conceivable that, given a declining share of cash payments, there will also be a reduction in the number of cash collection and distribution points. This is likely to lead to costs per cash transaction tending to increase, say, because of a greater outlay of time and/or rising fees. As developments in cash collection and distribution points are subject to major uncertainty, however, the current average sales-related cost rate of 0.275% continues to be assumed for the costs of cash supply and removal.

With girocard accounting for an increasing share of transactions, however, the number of terminals and, thus, terminal costs are likely to change. For instance, the retail sector is equipped at present with 725,000 retail POS, but only 616,250 terminals. It is taken as given that, with a growing share of girocard transactions, there is likely to be a linear increase in the number of terminals. It is also assumed that 725,000 terminals would be needed in retail for cash payments to be substituted completely by girocard payments. An increase in the number of terminals has the effect of both the acquisition costs and depreciations as well as the fixed percentage of background costs (see Section 5.2) rising as whole (the transaction-dependent percentage of background costs rises, by contrast, in proportion to the number of transactions).

6.3.2 Cost forecast for payments in cash and by girocard

Various values can now be inserted for the transaction number of girocard payments. This makes it possible to simulate changes in the transaction share and effects on the costs of the payment instruments.

Chart 23 shows the cost curves of cash payments and girocard payments for various girocard transaction shares. It may be seen from this that, with an increasing share of transactions, the costs per girocard transaction go down, while the costs per cash transaction go up. It is striking that the average costs per girocard transaction fall

comparatively sharply at the beginning, but decline less sharply with an increasing share of transactions. This is likely to be due to the fact that the girocard has relatively high fixed costs. With an increasing percentage of girocard payments, however, the fixed costs of cash payments are spread over fewer cash transactions, resulting in the average costs per cash transaction increasing with a declining share of transactions. Since the fixed costs of cash payments are relatively low compared with their variable costs, however, the increase shows a comparatively flat curve.

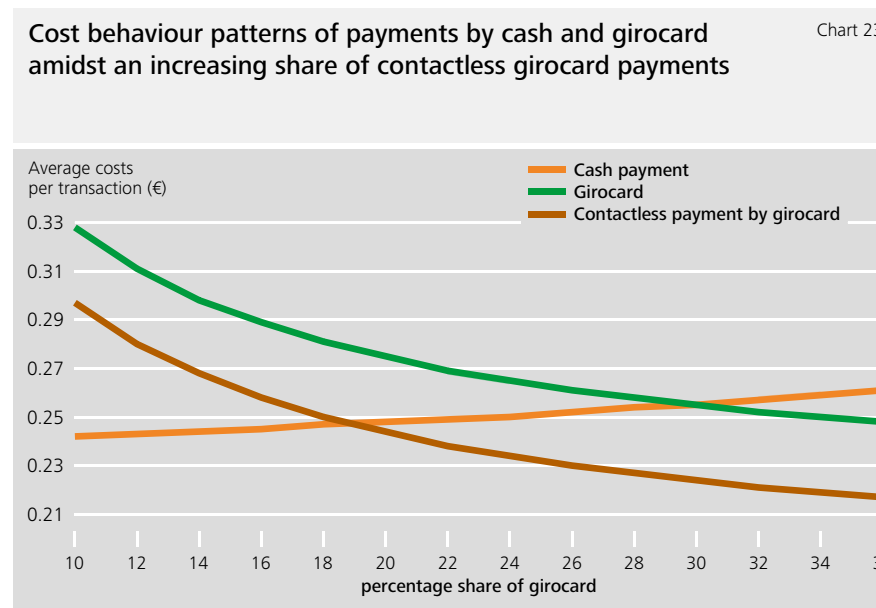
At a girocard share of 30.1% (corresponds to a cash share of 58.1%), the cost curves intersect. At this point, the costs per cash transaction and per girocard transaction both amount to €0.225. Up to this point, the costs per cash transaction are lower than the costs per girocard transaction; after this the relationship is reversed and the costs per girocard transaction are lower. The average payment amount of a girocard payment at the intersection is €25.66.⁴⁰ As long as customers therefore pay for over 58% of their shopping at an average retailer in cash, the costs of the cash transactions are likely to be more favourable on average.⁴¹ The total costs for cash payments and girocard payments at the intersection of the two curves amount to €4.5 billion and would therefore be roughly €50 million higher than the present costs (€4.45 billion). On the basis of this calculation, decreasing shares of cash payments hence do not lead a reduction in the overall costs of the retail sector.

Assuming that, in future, too, the share of girocard transactions continues to increase by around 1 percentage point annually and the share of cash payments continues to decline by 1 percentage point annually, based on the current variables girocard

⁴⁰ The point at which the costs intersect applies to an average card payment amount of €13.48 and a forecast average girocard payment amount of €25.66. If the average girocard payment amount were higher with the same transaction share, higher costs per girocard transaction are to be assumed owing to the sales-dependent transaction fees.

⁴¹ This is predicated on the average payment amounts of €13.48 for cash payments and €25.66 for girocard payments.

payments are likely to be more cost-efficient on average than cash payments in just under 15 years. Taking into account a shortened payment duration resulting from universal contactless payments, the intersection would be as low as a girocard transaction share of 19.2% (see Chart 23).⁴² This corresponds to a cash share of 69% in just under five years. As it may be assumed, however, that contactless card payment will become progressively more widespread, it may rather be assumed that, in just under ten years, the average costs for girocard payments will be lower than the costs of payment in cash.



⁴² The predicted average girocard payment amount would then be €33.61. With smaller average payment amounts, a larger percentage of transactions would be below €25 and therefore need no authorisation at the terminal (at present this would be roughly 39% of girocard transactions). The likely outcome of this is that the average payment duration and thus the costs of the cashier times continue to decline proportionately. Owing to the uncertain distribution of the payment amounts, this possible effect is not considered here. An average payment duration given universal contactless card payments of 23.7% is assumed on the basis of the current distribution.

7 Summary and conclusions

The findings of this study are summarised below, along with the outlook for future developments in terms of the costs of the various individual payment instruments, taking into consideration the German retail sector's structure.

Cash remains popular at the POS.

Used to settle just under 78% of all POS transactions, cash remains extremely popular as a means of payment. Measured as a share of total sales recorded for the German retail sector, which amount to €410 billion, cash accounts for around 51% of the whole while card payments make up just under 46% of transactions. The branch in which cash is used the most is the food retail sector, where average purchase amounts are relatively low.

On average, cash payments are the fastest to be settled

The average time taken to complete a cash payment at the POS is 22.3 seconds. This makes cash payments around seven seconds faster than card payments requiring the entry of a PIN, and just short of 16 seconds faster than card payments requiring a signature.

Both for cash payments and card payments made by entering a PIN, the higher the amount involved, the longer it takes to complete the transaction. This is not so in the case of card payments requiring a signature. While payments of below €10 take the shortest amount of time (32.5 seconds) in this category, too, there is no further linear correlation between payment duration and purchase amount. Paying small amounts of below €10 by cash generally takes less than 18 seconds, whereas amounts of between €50 and €100 require more than 32 seconds. Moreover, the age of the customer also has a bearing on the length of time needed to complete payment. The results of the time measurements show that the duration of a pay-

ment transaction, irrespective of the payment instrument used, rises in line with the age of the person making payment.

Cash is the most cost-efficient option on a per transaction basis.

In terms of transactions, cash is currently the most cost-efficient means of payment for retailers, with such payments accounting for just under €0.24 per transaction. That said, girocard payments come a close second. As regards the transaction costs entailed, SEPA direct debit payments have proved less expensive than girocard payments, but more expensive if the longer time needed to make a payment is taken into account. Payments by direct debit are nonetheless favoured among many retailers because cashier time is not necessarily considered to be a relevant cost factor. Whatever the perspective, credit card payments are more costly than payments effected using cash or a girocard on account of the high transaction costs they incur.

Viewed in terms of sales, the reverse argument applies, with girocard payments proving by far the least costly payment option for retailers. Even so, it is important to remember that each payment method has its own different payment structure, as mirrored, for example, in the differing average purchase amounts attached to cash and girocard payments (€13.48 and €49.04 respectively). These divergences impede a direct comparison.

Total costs attached to payments in the retail sector.

The total cost of payment procedures⁴³ to German retailers comes to €5,432 million a year, of which €3,775 million is spent on facilitating cash payments and a combined figure of €1,657 million on effecting all the card payments considered (i.e. girocard, direct debit and credit card). This does not take into account sales of €13

⁴³ That is, excepting the total costs for invoice/finance purchase/voucher and other card payments (store cards, Maestro, VPAY).

billion from invoices/finance purchases/vouchers and of €6 billion from other card payments (store cards, Maestro, VPAY) which, together, generate an estimated cost burden of €334 million.⁴⁴ If these costs are factored into the calculation, then the retail sector is charged total costs of €5.7 billion for all payments made, based on a gross sales figure of €410 billion and 20 billion transactions. When assessing the absolute amounts, however, it is always necessary to bear in mind the market definition applied, which in this case is the retail sector in the narrower sense.

Cost analysis reveals a high degree of transparency in terms of cost structure.

The cost calculations presented reveal a high degree of transparency in terms of the cost structures entailed in the various payment procedures. Hence, the results of the cost analysis must be scoured to find out exactly what share of the overall costs are accounted for by the following components: POS background costs, cashier time costs, terminal costs and removal and change costs (for cash payments) as well as the transaction costs (for card payments). It should be noted that the same valuation criteria apply to all payments, but in reality this does not necessarily have to tally with the perspective of the individual business. This is especially true when evaluating the cashier time needed for a given payment and the achievable savings implied by that, which in everyday practice cannot always be realised.

Simulations provide additional findings regarding the advantages of the various payment instruments.

Using simulations based on the same average purchase amounts, numbers of transactions or sales, it is possible to obtain more detailed information on the advantages of the various individual payment procedures. These have shown that, with regard to the average total costs incurred, cash and girocard payments are not far apart, such that, in individual cases, an analysis of just one specific enterprise is probably

⁴⁴ For the calculation of the total costs for invoice/finance purchase/voucher and other card payments (store cards, Maestro, VPAY) a cost component of 1.76% of sales was used.

enough to clearly identify the benefits attached to a given payment procedure. For most retailers, however, the question of the benefits on offer is not of great importance as they offer their customers a range of payment options, thus allowing the end user to decide which option they would prefer to use.

Low fixed costs make cash payments attractive for small amounts from the retailers' perspective.

Overall, the calculations confirm earlier research findings that cash payments incur relatively low fixed costs and somewhat higher variable costs. On the basis of the data established here, the variable costs of cash payments are, however, only marginally higher than the variable costs of payments by girocard or electronic direct debit and are well below the variable costs of credit card payments. As a result of the low fixed costs, cash payments up to an average payment amount of just under €20 are the most cost-efficient for the retail sector, with girocard proving more cost-efficient for higher amounts. If payments by girocard and electronic direct debit are considered together as debit card payments, then cash is the most cost-efficient means of payment up to around €50. Cash payments are invariably the more cost-efficient approach if all the card payment methods are considered in aggregate. Leaving aside the costs that arise from time outlays, cash payments are the most cost-efficient means of payment for each of the payment amounts under consideration here.

Using a variety of payment methods is currently the most attractive arrangement for retailers.

Finally, it should be noted that all the simulations are based on average values and a relatively wide margin. For example, major retailers have, in some instances, negotiated considerably more favourable transaction fees. Viewed individually, the relative benefits of cash or a girocard may, therefore, already present a different picture today. Conversely, in the case of credit cards, the differences can be so substantial that, even in individual cases, no advantage of this means of payment over pay-

ment by cash or girocard is likely to materialise. Going forward, it will be especially interesting to observe how speedily contactless card payments catch on, an option that will greatly reduce the time needed at a POS to complete a payment, and thus rein in the cost of paying by credit card.

Consequently, it is not possible to ascertain which means of payment is currently the most cost effective for a given enterprise, so having a mixture of payment options from which German retailers can take their pick would seem to be the most attractive arrangement at present. This study also reveals that cash does not necessarily work out more expensive than electronic payment procedures and, in some cases, may even be the least costly choice.

8 Annexes

8.1 Annex 1: Overview of the retail structure

Branches	Number of establishments	Gross sales (€ million)
Retail trade in the narrower sense	354,701	€410,018
DIY and gardening stores	39,719	€31,209
DIY stores	14,796	
DIY and hardware stores covering more than 1,000 m ² retail sp	2,390	
DIY and hardware stores covering 400 – 1,000 m ²	1,810	
DIY and hardware stores covering less than 400 m ²	10,596	
Gardening stores, florists and pet shops	24,923	
Garden centres (top 12)	875	
Florists and small gardening stores	19,388	
Pet shops	4,660	
Clothing, footwear and sports shops	58,432	€45,848
Retail sale of clothing in specialised stores	31,001	
Leather goods	1,514	
Specialist shoe shops	12,157	
Specialised sports and camping stores	6,754	
Discount stores selling textiles	7,006	
Drugstores and perfumeries	7,905	€21,169
Drugstores	5,930	
Perfumeries	1,975	

Overview of the retail structure 2/4

Table 19

Branches	Number of establishments	Gross sales (€ million)
Food (organised)	42,282	€170,310
Discount markets	16,054	
Large supermarkets	1,127	
Convenience stores	8,750	
Hypermarkets	851	
Supermarkets	10,900	
Other food outlets	4,600	
Food (other)	50,351	€19,307
Fishmongers	1,381	
Fruit and vegetable stores	5,410	
Cash-and-carry beverage stores	10,810	
Other beverage stores	4,055	
Kiosks	19,022	
Seasonal kiosks	4,100	
Tobacconists	5,573	
Furniture and furnishings stores	32,912	€41,336
Household items	4,632	
Household textiles	8,508	
Furniture stores (home furniture)	14,233	
Wallpaper, floor coverings and textiles	5,539	

Overview of the retail structure 3/4

Table 19

Branches	Number of establishments	Gross sales (€ million)
Other	93,480	€70,082
Antique shops	5,821	
Opticians	11,800	
Specialist bookstores	4,523	
Specialist bicycle stores	6,792	
Home appliance stores	10,130	
Electrical home appliances	8,314	
Purveyors of porcelain, earthenware and glass	1,816	
Department stores	337	
Art, coins and gifts	8,988	
Music stores, including audio and video sellers	2,039	
Toy stores	2,950	
Computer, consumer electronics, photographic and telecommunications stores/markets	24,000	
Computers, software and related articles	7,749	
Specialist photographers	1,788	
Telecommunications stores	7,346	
Consumer electronics stores	7,117	
Watch, clock and jewellery stores	8,000	
Specialist stationery and office supplies stores	8,100	
Stationery, school and office products	5,602	
Newspapers and magazines	2,498	
Other sales outlets	29,620	€10,758

8.3 Annex 3: Interview guideline

In consultation with the Deutsche Bundesbank, the respondents were asked the following questions. An introductory chat explained the aims of the survey to the interview participants, providing them with an overview of the questions posed: typical POS processes, the time needed for POS preparation and settlement, the manner of supplying change and the scope of this activity, the way in which cash is removed and the frequency of this activity, cashiers' average hourly rates of pay, costs of cashless payment.

Questions posed on the cost of using cash (large and small retailers)

1. How do your POS processes typically function?

- Cash office
- Cash register
- Cash drawer exchanged/not exchanged when cashier at the POS changes
- Frequency at which change is supplied per POS settlement
- Frequency at which cash drops are made per POS settlement
- Manner of cash removal
- Other: cash checks, checks of the safe's contents
- Average cash balance per settlement
- Average amount of cash removed

2. How much time is usually needed for the following activities?

- Preparation time per POS
- POS settlement (cash register)
- End-of-day settlement, no cash office
- POS settlement (cash office)
- Supply of change for each POS
- Cash drops for each POS

- Cash removal
- Cash checks, checks of the safe's contents

3. What hourly rates of pay for POS staff usually apply?

- Cashiers and cash office staff

4. Typical cost of removing cash?

- Frequency at which cash is removed each week
- Cost per stop
- Cash handling costs
- Deposit charges and booking fees
- Monitoring of cash logistics

5. Typical costs associated with supplying change?

- How is the supply of change organised?
- Costs per roll of coins
- Number of rolls needed per €10,000 of cash takings

6. Other cash-related costs

- Safes/banknote verification machines/cash scales/cash counting machines/insurance

Questions on the costs of card payment systems

1. What transaction-related costs arise from the use of an electronic payment procedure?

- girocard (electronic cash)
- SEPA direct debit scheme
- Credit cards (Visa+Mastercard)
- Network operator fees (acquirers)
- Total transaction costs

2. What costs arise from the use of electronic payment procedures for payment at terminals?

- Purchase/rent/leasing
- Maintenance costs/software updates/other

3. What other relevant costs are incurred by card payment?

- Costs of issuing and archiving receipts
- Payment default insurance
- Booking fees
- Other

8.4 Annex 4: Statistical section

Regression output from cash payment amount and time needed to complete a cash payment

Table 20

Source	SS	df	MS	Number of obs	
				= 2,330	
				F(1, 2328)	= 250.56
Model	38742.8425	1	38742.8425	Prob > F	= 0.000
Residual	359964.516	2,328	154.623933	R-squared	= 0.0972
				Adj R-squared	= 0.0968
Total	398707.359	2,239	171.192511	Root MSE	= 12.435

dauerinsec	Coef.	Std. Err.	t	P> t	[95 % Conf. Interval]	
kaufbetrag	.0226386	.0014302	15.83	0.000	.0198341	.0254432
_cons	21.7851	.2598123	83.85	0.000	21.27562	22.29459

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