

The use of cash and other payment instruments – a behavioural study using micro data

In recent years, cashless payment instruments have proliferated widely and the possibilities to use them have increased. Around 91% of consumers in Germany currently own a debit card and approximately 27% are in possession of a credit card. Cash payments have by no means diminished in importance, however: in 2008, 82% of all direct payment transactions were effected in cash, which was equivalent to 58% in terms of value.

The aim of this article is to examine the high level of cash usage in greater detail, based on a representative survey on the payment habits of consumers in Germany. The results of the analyses suggest that an individual's decision regarding which payment instrument to use is made consciously and is not simply a question of habit persistence. Older persons pay much more frequently in cash than younger persons. Age as such, however, seems to play only a subordinate role with regard to this difference in payment habits. Other characteristics which distinguish older consumers from younger consumers are of greater significance. It is therefore unlikely that cash will automatically become less significant in future as older persons are displaced by the younger generation. This applies only if the framework conditions remain unchanged, however.

Aim of this article and introductory remarks

High percentage of cash payments in Germany...

Since the introduction of the euro, it has become increasingly difficult to statistically trace the development of cash payment transactions in Germany. Data on cashless payment transactions in the euro-area member states can be used to provide a certain indication.¹ These figures clearly indicate that card payments in Germany are of comparatively little importance. The results of the Bundesbank study on "Payment behaviour in Germany" confirm that cash continues to play a very important role in Germany.² Although approximately 91% of consumers in Germany currently own a debit card and 27% are in possession of a credit card, 82% of all direct payment transactions were effected in cash in 2008, which was equivalent to 58% in terms of value.

There are various conceivable reasons for the high and relatively stable cash payment share in Germany. There could, for example, be well-founded preferences for the use of cash, such as consumers attaching special importance to anonymity. Furthermore, cash payments offer cost advantages in many cases as opposed to other types of payments. Consumers might also simply be subject to certain habits which have not yet been adjusted to the new circumstances.

... a result of incomplete diffusion?

The aim of this article is to explain the cash payment behaviour of individuals in Germany, that is to describe the influence that the reasons given have on the observed cash payment behaviour. On this basis, a judgement

can be made as to whether the high percentage of cash payments in Germany is primarily the result of inertia and habit persistence,³ or whether it can be considered to be the result of conscious and economically rational decisions. In the first case, an "automatic" decline in the significance of cash payments by individuals would be expected over time, not least because younger people, who will displace older generations, are more used to paying with cashless payment instruments than older people. However, if the payment behaviour of individuals is based on conscious and economically rational decisions, a reduction in the share of cash payments would only then be expected if the relative costs or the framework conditions surrounding the use of cash and cards were to change considerably.

Analytical framework

Microeconomic analyses are conducted on the payment behaviour of individuals to provide an answer to the question. The theoretical framework for the study is made up of a

Empirical analysis of the payment behaviour of individuals ...

¹ See European Central Bank, Statistical Data Warehouse (<http://sdw.ecb.europa.eu/>), "Payments and securities trading, clearing, settlement", of 18 February 2010.

² See Deutsche Bundesbank (2009), "Payment behaviour in Germany – an empirical study of the selection and utilisation of payment instruments in the Federal Republic of Germany", (http://www.Bundesbank.de/download/bargeld/pdf/bargeld_studie.en.pdf) and the chart on page 35.

³ In this context, habit persistence and inertia mean that individuals continue to pay in cash although changed framework conditions would make it seem logical to make greater use of cashless means of payment. The diffusion of cashless payment instruments would then be incomplete.

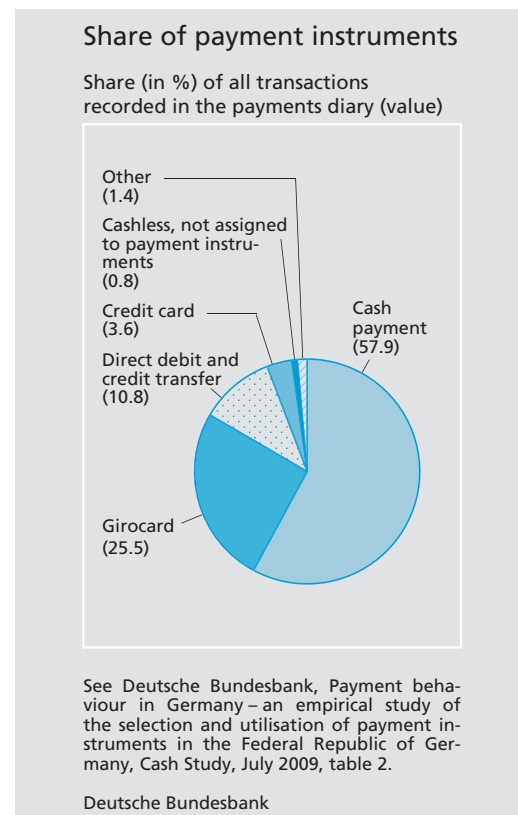
multi-tier decision-making model.⁴ The individuals decide first of all which payment instruments they would like to have. Based on their “payment infrastructure”, the individuals then choose a specific payment instrument for a given transaction. It is to be expected that the payment instruments available will play a significant role when deciding whether to pay in cash. Conversely, people who have a preference for cashless payments tend to acquire payment cards much more frequently. Both decisions should therefore influence one another and must consequently be modelled together. The study referred to is the first of its kind for Germany. The theoretical model described here is empirically tested using survey data.⁵

From an analytical viewpoint, this study initially focuses on three payment instruments: cash, girocards and credit cards. Nevertheless, given their vast distribution, it is not possible to conduct an empirical investigation into the choice of girocards (debit cards which are used to make direct payments) as a payment instrument.⁶ For this reason, the sample is restricted to persons who own a girocard, and therefore only the decision to acquire a credit card is assessed. In connection with this, the individual share of cash payments is then determined.

Transaction cost approach

... on the basis of a transaction cost approach ...

The estimation equations are based on a transaction cost approach: an individual selects his/her payment structure such that his/her overall transaction costs are as low as possible. The



transaction costs here are a function of the payment structure and of various individual characteristics. The better the payment behaviour follows such transaction cost motives, the sooner the hypothesis of pure habit persistence will lose significance.

Variables were included in the empirical models as potential influencing factors, which have proven to be reliable explanations in the literature. These can be summarised into four groups.

⁴ See U von Kalckreuth, T Schmidt and H Stix (2009), “Choosing and Using Payment Instruments: Evidence from German Microdata”, Deutsche Bundesbank Research Centre, Discussion Paper, Series 1, No 36/2009.

⁵ The empirical models are described in more detail in the box on page 36.

⁶ The vast majority of adults in Germany own a girocard. A sufficient data basis is not available to allow debit card ownership to be modelled. Furthermore, virtually all credit card owners are also in possession of a girocard.

The empirical models

A probit model is used to analyse the decision as to whether to procure a credit card. This estimation procedure can be used to test which of the factors under observation has a significant influence on the probability of possessing a credit card.

To analyse cash payment behaviour, two different types of dependent variable are used, each of which measures an individual's cash payment intensity. They allow payment behaviour to be investigated from various perspectives.

The first dependent variable targets the payment behaviour observed in the short term and is based on individual transactions which were recorded in the payments diary. The cash payment share (by number of transactions) of the entire week's transactions is determined for each person. Here, the cash share is ascertained only for those transactions in the case of which the respondent has a choice between various payment options. Transactions in the case of which retailers accepted only cash are therefore excluded.¹

By contrast, a further set of dependent variables focuses on longer-term payment behaviour. The respondents were to make general statements in the interviews regarding their customary payment behaviour for certain transactions in different payment situations, and, in doing so, were to select between several payment instruments from a given list (eg "cash", "ec card", "credit card").² Using this information, an indicator variable is constructed which takes the value one if a person pays "exclusively in cash"³ at one location, and the value zero if a person also or exclusively uses cashless payment instruments. Since it can be anticipated that payment behaviour depends very strongly on the place and purpose of payment, specific transaction types are used as a basis for the analysis, ie daily

retail transactions and payments at petrol stations. These are the two most frequent types of transaction recorded in the payments diary.

Both approaches are complementary. They differ not only by virtue of their time horizon, but also with regard to their content (actual behaviour as opposed to self-evaluation) and the data source on which they are based (outcome derived from the payments diary as opposed to responses from the questionnaire).

The empirical analysis of the relationship between the cash share from transaction data and the explanatory variables was conducted using ordinary least squares estimation and an instrumental variable approach. Whilst the first estimation method does not take account of the retroactive effects of the cash share on credit card possession, the second explicitly accounts for this retroactive impact.

How the respondent chooses one particular payment instrument for day-to-day items at retail outlets and at petrol stations was investigated using a multivariate probit model. The variables for longer-term payment behaviour and the indicator variable for credit card possession are applied to this model. The class of model used takes into account explicitly the retroactive relationship between credit card possession and payment behaviour at both places of payment mentioned and behavioural correlations at both places of payment.

In order to examine the impact of age on payment behaviour, interaction terms were introduced to the model. These interaction variables are calculated by multiplying the key variables in the basic model by an indicator variable which takes the value of one if the respondent is 58 years old or more and zero if the respondent is between 18 and 57 years old.

¹ Roughly 50% of all transactions recorded fall into this category according to information provided by the respondents. — ² The respondents could, in each case, choose only from the payment instruments they have. A maximum of two payment instruments could be named

per place and purpose of payment. — ³ The group "exclusively in cash" also includes those individuals who stated that they usually pay in cash, regardless of the place and purpose of payment.

- Transaction characteristics: the higher the value of a transaction, the less likely it is that the transaction will be settled in cash, and the location and the type of a transaction (eg payments on the internet, in restaurants and hotels) often determine the type of payment used.
- Demographic characteristics of the individual: people with higher income and a higher level of education are often associated with a busy lifestyle and consequently prefer a particularly fast type of payment.
- Direct costs associated with the use of cash compared with other payment instruments: indicators of this include the density of the network of electronic payment terminals, consumers' fear of theft and loss as well as the distance to the cash dispenser or bank counter that they usually use.
- Preferences for certain characteristics of payment instruments (eg preference for an anonymous type of payment, familiarity with the use of certain payment instruments).

If these variables can be used to provide a good explanation for payment behaviour, this would support the view that consumers make conscious decisions when selecting a payment instrument. One exception to this supposition could be the preference for using payment instruments with which one is familiar. Although the strong explanatory power of this variable would be compatible with

the transaction cost approach, it could also support an interpretation based on habits or inertia. Age can also have an impact on the relative costs of different forms of payment. Certain structures in the age distribution can also be an indication of habit persistence, however. Which interpretation applies in each case needs to be examined separately.

Database – “Payment behaviour in Germany”

The data were taken from a survey which was conducted on behalf of the Bundesbank between April and June 2008 among adults in Germany.⁷ The survey respondents were chosen using a three-stage random selection process to ensure the representativeness of the sample. 3612 persons were contacted in total, each of whom up to a maximum of three times. Of these, 2272 actually took part in the survey. This corresponds to a response rate of approximately 63%.

... based on data from a survey carried out among adults in Germany

The primary statistical survey consisted of two parts: a computer-assisted personal interview (CAPI) and a payments diary which the participants used to record their payments over a period of one week. While the personal interview aimed to identify self-evaluations with regard to the use of cash and certain cashless payment instruments, the focus of the payments diaries was on individual transactions. Both parts of the survey were restricted to payments for goods and services effected at the place of payment/place of performance.

⁷ See Deutsche Bundesbank (2009), op cit.

Regularly recurring payments, which are generally settled on a cashless basis or debited from an account directly (such as rent, insurance premiums and bills) were not taken into consideration in the study.

Influence of the payment infrastructure

Credit card ownership does not significantly influence the cash share

The econometric⁸ studies on the influence of the number of payment instruments owned on cash payment behaviour led to a new and, at first glance, surprising result. If the retroactive effects of the relationship between payment behaviour and credit card ownership are disregarded in the model, credit card ownership has a significantly adverse impact on the share of cash payments in the estimates. However, if account is taken of the fact that people who want to make a relatively large number of cashless payments are more likely to acquire a credit card (in addition to their girocard) than people who like to pay in cash, this negative relationship no longer applies. This is a result of reverse causality: owning a credit card (in addition to a girocard) does not significantly influence the tendency to pay in cash. Rather, it is highly likely that people who do not want to pay in cash will acquire a credit card. In other words, if a household which already owns a girocard were given a credit card as a gift, this would not affect the household's payment behaviour. This not only applies to the cash payment share from the payments diary but also to the longer-term payment behaviour at petrol stations and retail outlets.

Explanatory power of the transaction cost model

The results of the econometric analysis not only show that, in accordance with the theory, the economics-based determinants have a significant impact on payment behaviour, but also demonstrate that the variables of the empirical models largely explain payment behaviour. For 78% of individuals, credit card ownership is correctly predicted by the econometric model. For 71% and 74% respectively of the persons surveyed, the model correctly predicts whether or not they exclusively pay in cash at retail outlets and at petrol stations. These are exceptionally high values for studies using micro data.

Empirical transaction cost model accurately predicts payment behaviour

All groups of explanatory variables (socio-demographic factors, expenditure structure, relative costs of using cash and preference for certain characteristics of payment instruments) influence the probability of owning a credit card and, according to the self-assessments, also long-term payment behaviour.

Credit card possession and longer-term cash payment behaviour are influenced by...

The analysis confirms that payment behaviour depends very strongly on the type of transaction and the place of payment. This corresponds with the results obtained in previous studies.⁹

As expected, the economic position of an individual is also particularly important. For

⁸ Detailed tables of results can be found in: U von Kalckreuth, T Schmidt and H Stix (2009), op cit.

⁹ See W C Boeschoten (1998), Cash Management, Payment Patterns and the Demand for Money, De Economist 146(1), pp 117-142.

... the individual's economic position and the relative costs of using cash ...

example, a relatively high income and a high level of education significantly increase the probability of owning a credit card. These same characteristics also reduce the probability of paying in cash at petrol stations and retail outlets.

There is one especially interesting result with regard to the relative costs of using cash: people who make particularly frequent withdrawals from cash dispensers also make particularly frequent cashless payments. This may seem surprising at first, yet frequently withdrawing cash points to high (subjective) costs associated with the holding of cash. Furthermore, individuals who frequently withdraw cash usually carry their girocard with them and are familiar with using them at cash dispensers. They are therefore well acquainted with cashless payment instruments. Unlike in the case of cash payments, card payments are therefore particularly economical for these individuals.

... as well as by preferences for certain characteristics of payment instruments

Preferences for certain characteristics of payment instruments are closely linked to payment behaviour. Consumers for whom the possibility to use a payment instrument for transactions on the internet or abroad is important pay less frequently in cash at retail outlets and petrol stations.

According to payments diary, cash share is primarily determined by transaction characteristics

There are certain reservations with regard to the results concerning the cash share when using data from the payments diary. The main contribution towards an explanation is made here by the transaction characteristics, ie the share of certain transaction types in the week under assessment and the average transac-

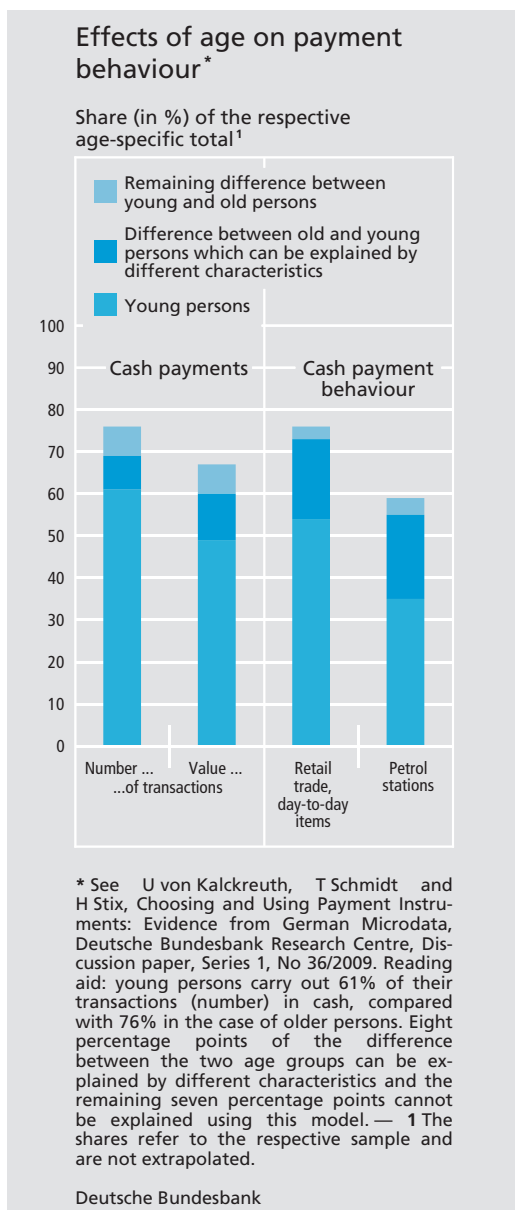
tion value. Only to a slight degree, however, do the relative costs of using cash, the socio-demographic variables and the preference indicators influence the cash share calculated on the basis of the diary data. A significant influence is exerted here only by the frequency of the use of cash dispensers and the preference for being able to use a payment instrument on the internet. This does not contradict the rationality of payment behaviour as the value and the transaction type also have an influence on the relative costs of different means of payment.

On the whole, it can therefore be seen that payment behaviour can largely be explained using a classic transaction cost approach. This contradicts the hypothesis that the cash payment behaviour observed is the result of inertia and habit persistence. At the same time, we note that the direct measurement of the importance of habits in using payment instruments¹⁰ does not have a significant influence on the cash share in any of the equations considered.

This article started with the question of whether the payment behaviour observed follows rules which concur with rational decisions. In light of the results of econometric analysis, this question can be answered in the affirmative. The results discussed in the following section regarding the influence of the age of the respondents on their payment behaviour clarify this picture further.

¹⁰ This measurement is generated from a question relating to important criteria in the selection of a payment instrument. It states the level of importance that familiarity with a payment instrument and many years' experience using it has for the respondent.

Payment behaviour can largely be explained using a classic transaction cost approach



Influence of age

Age affects payment behaviour primarily indirectly...

Research has shown that older persons often need a particularly long time to adjust their habits to changing conditions. If the large share of cash payments in Germany were therefore primarily a result of a delayed adjustment to the new options available in the area of cashless payment instruments, it

should be found that older consumers make very few cashless payments.

Descriptive statistics do actually show that older persons carry out a larger share of their transactions in cash than younger persons.¹¹ This needs to be examined in greater detail, however. Generally speaking, these two groups differ not only in terms of age but also in terms of numerous other characteristics, such as employment status, income or insecurity when carrying large amounts of cash. If these factors are also taken into consideration, then no significant direct influence of age can be identified in the estimated equations. This counters the notion that cash payment behaviour is currently subject to an ongoing adjustment process, whereby knowledge of the possibilities offered by cashless payment instruments is spreading only slowly. In such a scenario, the cash share would automatically decline in future with the decreasing importance of today's older generation.

In order to examine to what extent the differences in the use of cash are determined by the differences in the observed characteristics, a simulation experiment was carried out on the basis of the collected data. The behaviour of younger and older individuals was modelled separately first of all. The results showed how certain factors influence the cash payment share of both younger and older persons. In a second step, the characteristics and variable values of older persons were then incorporated into the estimate for

¹¹ See Deutsche Bundesbank (2009), op cit.

Decomposition of the age effect *

Item	Least squares estimation			Multivariate probit estimation					
	Cash payments as a share of all payments (number of transactions)			Cash payment behaviour in retail trade for day-to-day items 1		Cash payment behaviour at petrol stations 2		Credit card possession	
	Number of observations	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Total sample	1,599	0.65	0.16	0.60	0.21	0.42	0.25	0.30	0.24
Old (58 years and over)	439	0.76	0.17	0.76	0.20	0.59	0.26	0.25	0.23
Young (57 years and under)	1,160	0.61	0.14	0.54	0.19	0.35	0.21	0.32	0.24
Counterfactual situation: coefficients of persons aged 57 and under, but using the characteristics of persons aged 58 and over	439	0.69	0.13	0.73	0.17	0.55	0.21	0.22	0.23
Difference between the above two age groups which can be explained by different characteristics	in %			84		83		139	
	58								

* The specified values refer to the respective sample and are not extrapolated. — 1 Indicator variable: The variable takes the value one if a person usually pays cash regardless of the transaction type or usually pays cash for day-to-day items in retail

trade. In all other cases, it takes the value zero. — 2 Indicator variable: The variable takes the value one if a person usually pays cash regardless of transaction type or usually pays cash at petrol stations. In all other cases, it takes the value zero.

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younger persons, ie it was simulated what the behaviour of older persons would be like if their characteristics determined their payment behaviour in the same way as with younger persons. The differences emerging here in the forecast of payment behaviour between the two groups are then only caused by differences in the characteristics.

future, the cash share should not fall significantly. This naturally applies only if the framework conditions for payment behaviour remain constant.

Conclusions

The results of the empirical analyses support the view that the selection of payment instruments calls for a multi-tier and multi-layered

Selecting a payment instrument is a complex decision-making problem

12 See chart on page 40 and the table above.

13 With regard to credit card ownership, the resulting value is 139%, ie according to the model, fewer older people should own a credit card than is actually the case. However, the reason for the high value is that credit card ownership in the case of older persons can be traced back to decisions made in the past when the most significant characteristics of today's older generation were still in line with those of the younger generation. It would appear that consumers only hesitantly return credit cards acquired in the past if there is a change in circumstances (characteristics).

... through differences in characteristics of old and young persons.

The results¹² indicate that the differences in the cash share can largely be traced back to differences in the characteristics. With regard to the differences in the shares of those who pay solely in cash at retail outlets on the one hand and those who pay solely in cash at petrol stations on the other, the resulting value is more than 80% in both cases.¹³ If, therefore, today's young consumers were to take on the characteristics of today's older consumers in

decision-making process. The results show that the payment behaviour observed follows rules which are compatible with rational economic conduct and are not the result of inertia and habit persistence.

Cash share should not fall significantly below the defined parameters in the near future

Individual payment behaviour can largely be explained by the type of transaction, the features of payment instruments and the characteristics of individuals. Given the existing technology, and assuming the other determining factors will continue to apply to the decision as to payment behaviour, the share of cash payments among all transactions should not fall substantially in the foreseeable future. Changes to the framework conditions, such as new technologies or changed strategies on the part of retailers and payment system suppliers, might however lead to behavioural adjustments. Furthermore, a shift towards places of payment where typically there is a tendency to pay on a cashless basis (eg internet purchases) could lead to a reduction in the cash share.

The analysis has shown that owning a credit card (in addition to a girocard) does not have

an impact on the share of cash transactions where the fact is taken into account that the demand for credit cards and the decision as to the manner of payment influence one another. Decisions regarding whether to acquire a new payment instrument and how often to use it appear to be hierarchically structured. Individuals first decide whether a payment should be settled in cash. If this is not the case, the decision as to which payment instrument will be used to make the cashless payment depends on other variables. From the user's point of view, there appears to be only a small difference when deciding whether to use a girocard or a credit card.

Both competing cashless payment systems are close substitutes when it comes to card use in Germany. With most credit cards issued in Germany, the credit card balance is settled on a monthly basis. The credit card is therefore used as a payment instrument, and not as a means of obtaining a loan facility. Against this backdrop, it may not make much difference from the user's point of view which of the two systems is used.

Credit cards and girocards are close substitutes for making payments in Germany