The Importance of Cash and Cashless Payments in Germany:

- Overview and first estimates -[+]

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Abstract

This paper analyses cash and cashless payment instruments in Germany. After a description of developments in a national and international context, we will compile a critical literature overview on cost calculations and on the importance of payments media for different countries. Against the background of the criticism of these studies, we will present an independent and largely "demand-based" approach in Section 3 on the economic significance or cost of cash and cashless payments instruments without conducting a survey of our own. It can be interpreted as an addition to the supply-based cost studies which have predominated in literature up to now. All in all, it accounts for approximately 2% to 2,5% of GDP. However, these figures do not take qualitative factors into consideration.

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1. Introduction

A modern and specialised economy, which is based on the division of labour, is increasingly dependent on the effective functioning of large networks. Examples of networks with a marked macroeconomic significance are communications networks (landline and mobile phone networks, post), transport networks (roads, railways, aviation), energy networks (electricity, gas) and the water supply. Not least, these networks also include payment networks.

If the functional capability of any one of these networks is ever impaired, this would have serious repercussions for the economy as a whole. Without electrical energy, the production process would be largely crippled, and consumption possibilities for households would be seriously restricted. Malfunctions in other networks would have a similar adverse impact upon economic activity. This also applies, in particular, for disruptions to payment systems because the real flow of goods and services presupposes that money flows in the opposite direction. If the flow of money stagnates, the real flow of goods and services will follow suit. Not only that, financial markets would also be hugely hampered by problems in payment transactions. This, in turn, would have an adverse impact on the real economy.

Ever since the dawn of money, people have explored the advantages and disadvantages of different forms of payment. However, systematic research on the topic did not take place until the 1980s.[1] Cost-benefit analyses should concentrate on finding efficient methods of payment and on finding payment systems which offer efficiency both in microeconomic and macroeconomic terms. Consequently, the derived outcomes are both of relevance to policy-making and are of interest to the parties involved in the payment cycle. It should also be noted that the national payment systems are exposed to change through innovations in finance and payment transactions, as well as through changes in the payment habits of consumers. And that is, as we mentioned above, against the backdrop of an industry which is characterised by network externalities (see Leibbrandt, 2004). An efficient payment system is not an end in itself, but a necessary precondition for fostering national and international trade, as well as for the development of an efficient financial system and, ultimately, for the welfare of the economy as a whole.

In the study on the "Costs and Benefits of Cash and Cashless Payment Instruments" commissioned by the Deutsche Bundesbank, we will seek to explore the significance of (cash and cashless) payment transactions for the national economy and to analyse the costs and benefits of cash and cashless payment instruments in Germany. This study is divided into three modules. Module 1 "Overview and initial estimates", which is the subject of this paper, contains (1) a selected description of the volume

[1] Early studies were conducted by Godschalk (1983), Whitesell (1989), Humphrey & Berger (1990), Boeschoten (1992) and Virén (1993), to name but a few.

and of the development of cash and cashless payment transactions with specific reference to Germany, (2) an overview of existing studies on the costs and benefits of cash and cashless forms of payment, and (3) a first assessment of the significance and costs of cash and cashless forms of payment in Germany.[2]

Section 2 presents some facts on the development of cash and cashless payment instruments in Germany, comparing it with other countries on the basis of some selected examples. This section is largely descriptive in its focus. In some areas, specific patterns for Germany are noteworthy. Section 3 is devoted to a critical overview of existing studies on the costs associated with payment media. It focuses on cash and card payments. We will then try to quantify the significance of payment transactions and payment media for Germany applying a demand-based approach, without having collected any primary data of our own. In this approach, the focus is on the costs incurred by consumers of payment services (payment service users). Firstly, the costs incurred by consumers reflect their willingness to pay, and thus the benefits of the use of payment instruments, and, secondly, these costs represent revenue for payment service providers. This income must ultimately be sufficient to cover the costs. Consequently, such a demand-based approach also allows to indirectly infer the costs of the payment transactions. The costs incurred by consumers comprise the fees, possible loss in interest income and the cost of providing their own resources (in particular, their own time). In this section, an overall distinction is generally only made between cash and cashless payment instruments. The last chapter summarises the study and draws some conclusions.

2. Trends in payment methods and in payment transactions

2.1 Estimating cash payments

The nature of cash payments makes collecting statistics on the value and number of transactions difficult. Cash is an "offline" method of payment, and a cash transaction is not separately recorded. Many users feel that it is precisely this that makes cash particularly advantageous.

This means that the extent to which cash transactions are used for payments can only be estimated with the aid of indirect methods or on the basis of data collected by means of surveys. In principle, there are three possibilities:

1. Estimation of purchases that are generally settled in cash. As payment cards are in principle also used for these transactions, card transactions are deducted from the total volume and the remainder represents the volume of cash transactions.

[2] Modules 2 and 3 will explore the costs and benefits of payment instruments in detail.

2. Estimation of the amount of cash withdrawn from automated teller machines (ATMs) and over the counter. As cash is essentially withdrawn to be used to make subsequent payments,[3] this variable can be used as the upper limit for the volume of payments effected in cash.

3. Surveying of economic agents on their payment and cash procurement habits.

Table 1: Estimated volume of cash payments: Results of different approaches (€ bn)

	2008	2009	2010	2011
National accounts	573	566	562	578
VAT statistics	657	627	643	660
Withdrawals	664	660	625	640
Survey (expenditure)	637			538
Survey (withdrawals)	558			
Average	619	635	628	604

Source: Bartzsch et al. (2011a, b), BVH, Deutsche Bundesbank, Federal Statistical Office, and own calculations.

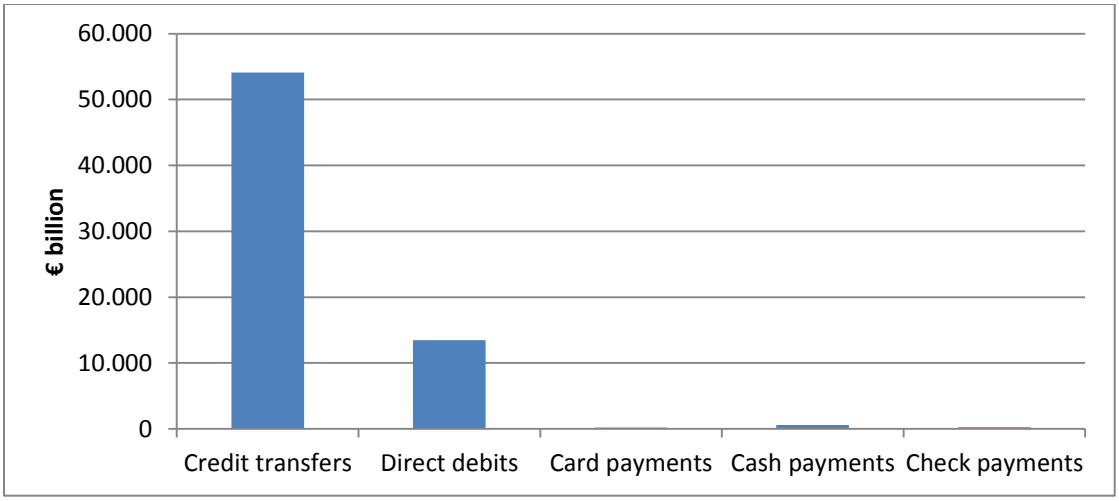
Table 1 provides a summary of the different methods used. The findings based on VAT statistics and on the withdrawals reported by the banking industry are relatively high and suggest that the value of cash payments in 2011 is well over €600 billion. The results based on the payments study conducted by the Bundesbank do not reveal a uniform picture, and the estimate on the basis of the national accounts is well under €600 billion. The average value for 2011 is €604 billion. Consequently, sales transacted in cash continue to be significantly higher than sales transacted by card (in 2011 this was about €188 billion according to the Deutsche Bundesbank's payment statistics and €269 billion according to PaySys Consultancy). This difference is even greater when measured in terms of the number of transactions. However, estimates of the number of cash transactions are less reliable than estimates of cash turnover. The number of transactions can ultimately only be estimated on the basis of the estimated turnover. In addition to turnover, an estimate of the average transaction value is also required. The findings of the Bundesbank's survey on payment behaviour can also be used here. The survey reveals an average amount of just under €20. Consequently, our calculations show that an estimated 32 billion cash payments were made in 2011 (equal to about 400 cash transactions per capita and year).

When comparing the principle payment instruments (credit transfers, direct debits, checks, cards and cash), credit transfers are by far the most important instrument in terms of value of transactions (see Fig. 1). However, in terms of the number of transactions, cash is still the most important

[3] For example, the findings on the share of cash using data from the payments diary (Deutsche Bundesbank, 2009a, Chap. IV) according to which the main determinants are transaction-driven could be interpreted in this sense.

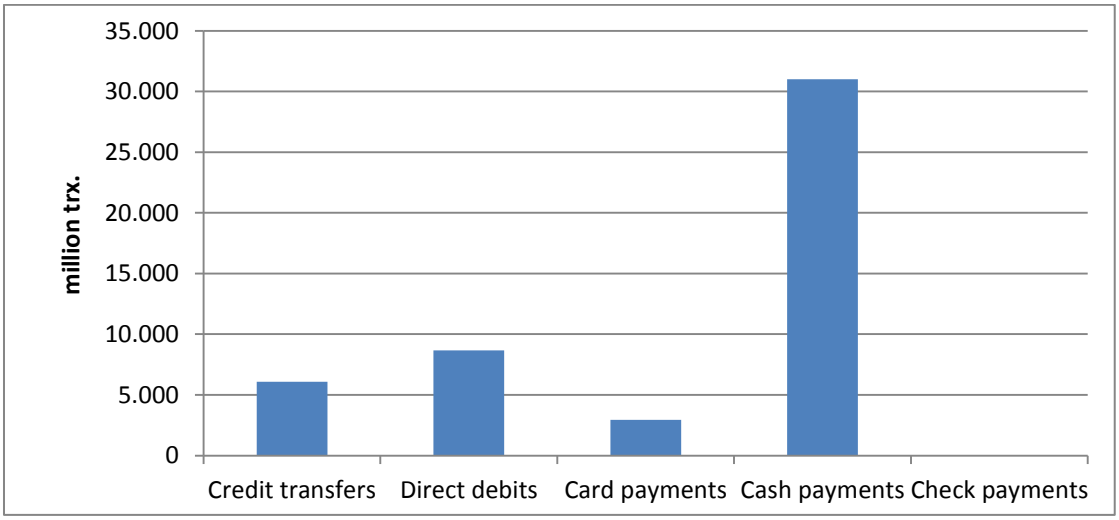
instrument. In particular, the estimated number of cash transactions (about 32 billion) is significantly higher than the number of card payments, which amounted to around 3 billion transactions according to the payment statistics (see Fig. 2).

Figure 1: Shares of payment media in 2011: Values



Sources: Deutsche Bundesbank and own calculations.

Figure 2: Shares of payment media in 2011: Transactions



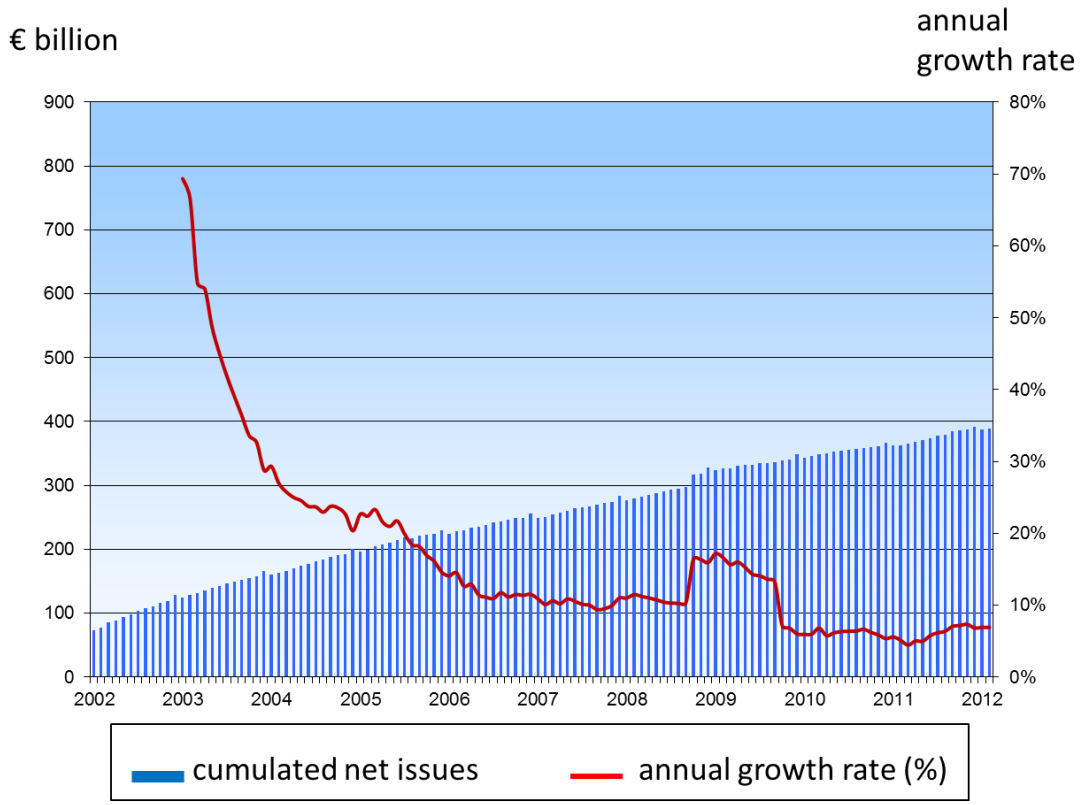
Sources: Deutsche Bundesbank and own calculations.

The continued importance of cash is also demonstrated by the evolution of cash holdings over time. The very dynamic trend in cumulated German net issues of banknotes since 2002 is striking in the first instance (see Figure 3).[4] The double-digit growth rates up to the end of 2009 differ significantly from the days of the Deutsche Mark prior to the introduction of euro cash (Bartzsch et

[4] The net issues are not to be confused with the cash in circulation in Germany, which cannot be determined precisely, especially within the framework of a monetary union.

al., 2011b, p. 7). If cash holdings in 2012 were simply divided by the number of German residents, this would yield a figure of around €5,000 per capita. This is not in line with experience, however.

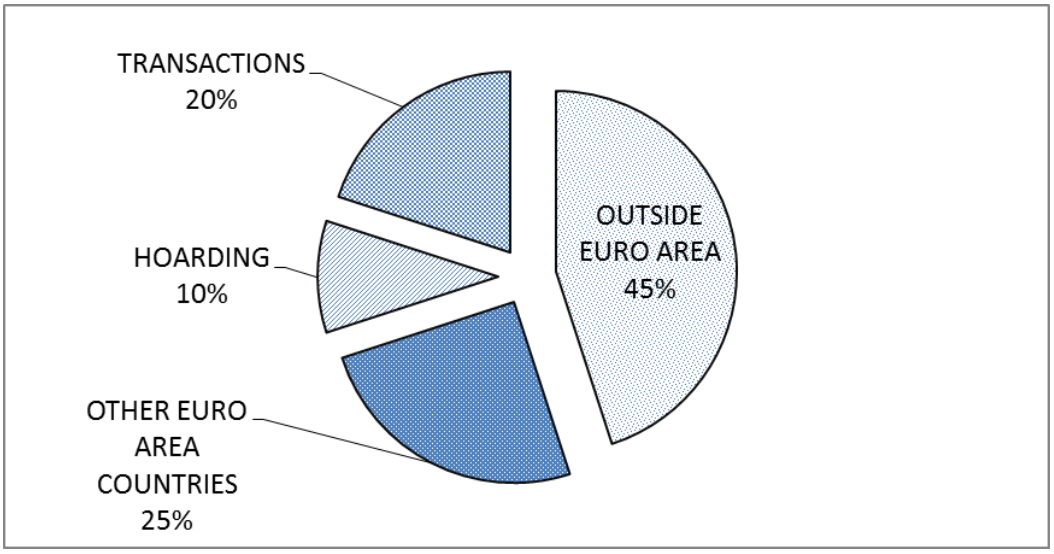
Figure 3: Euro banknotes in circulation: Germany



Notes: Annual rate of growth compared with the previous year.
Source: Deutsche Bundesbank.

The chart clearly shows how the insolvency of Lehman Brothers triggered a surge in the demand for cash. As we will see shortly, the German situation varies significantly, on the whole, from that in other countries both within and outside the euro area. The reason for the high levels of cash holdings is that all of the motives that create a demand for cash are at work in Germany (see Figure 4). Cash is used for transaction and hoarding purposes, and considerable proportions of the notes issued in Germany are held in other euro-area member countries as well as outside the euro area (see also Bartzsch et al., 2011a, b for a detailed account of this). 70% of the German note issues are held outside the country - for transaction and hoarding reasons - with the majority likely to be outside the euro area. Only a small portion of a *maximum* of 20% is required in Germany for transaction purposes. Hoarding for various reasons accounts for 10%.

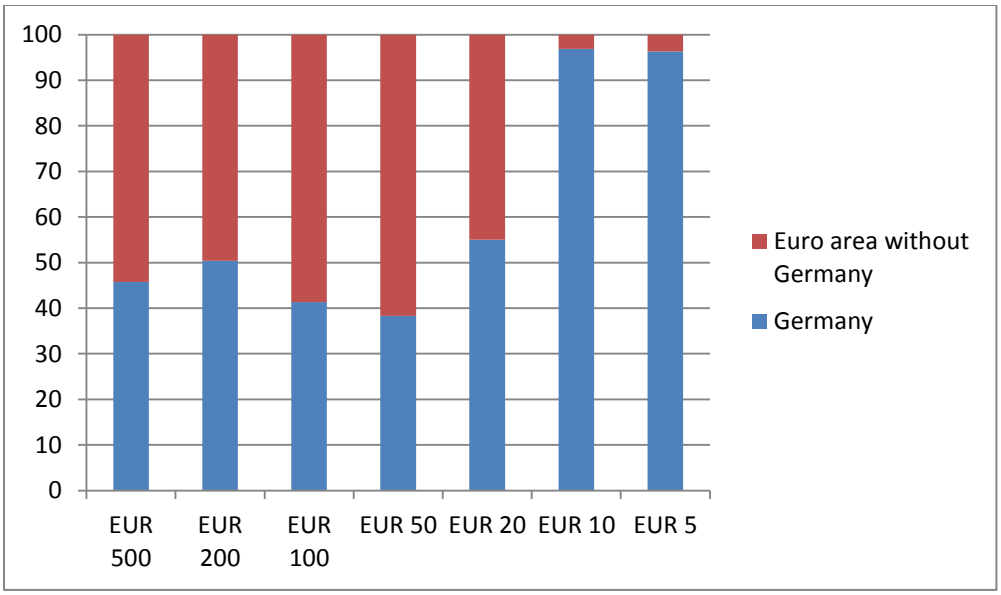
Figure 4: Cash motives and German net issues



Source: Bartzsch et al. (2011a, b).

Comparing the situation in Germany with the rest of the euro area, it is noticeable that the German share in cumulative net banknote issuance is greater than the German capital share in the ECB for all denominations in terms of both value and quantity. As shown in Figure 5, the share of small denominations is over 90%; the only value under 40% is with the €50 note. The reasons behind Germany's unusual position in this regard are largely uninvestigated. An initial analysis can be found in Bartzsch et al. (2011a, chap. 5).

Figure 5: Banknotes: German issuance share in terms of quantity (%, 2012)

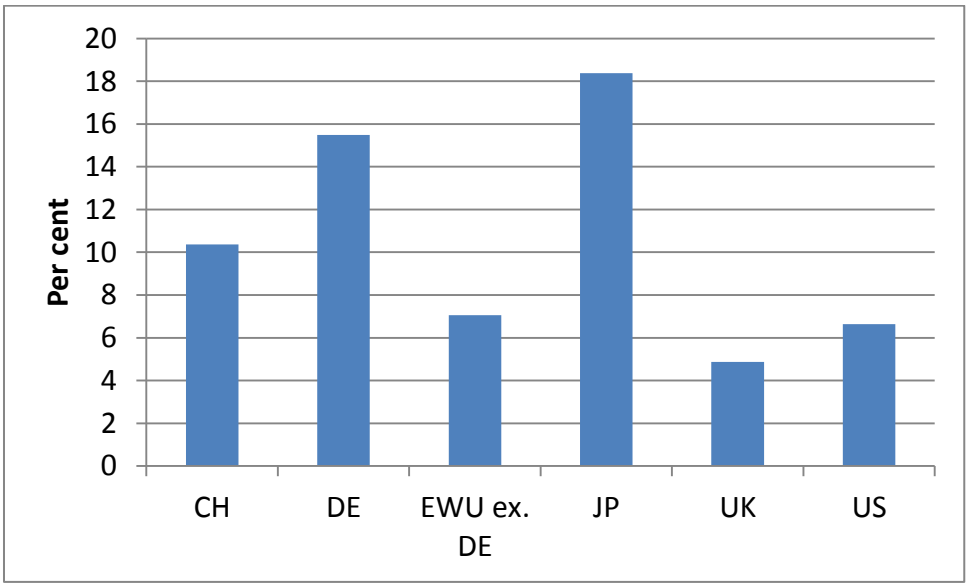


Note: End of February 2012.
Source: Deutsche Bundesbank.

In Figure 6, the cumulative net issue in the euro area relative to GDP is compared with the circulation of cash (which equals the cumulative net issue) in countries outside the euro area (USA,

Japan, Switzerland, United Kingdom) in 2011. Surprisingly, this quota is considerably lower in the USA (just under 7%) than in Germany despite the fact that high stocks of dollars are also held outside the country.[5] The highest values are achieved by Germany (over 15%) and Japan (over 18%), even though the Japanese yen is used almost exclusively in Japan. Switzerland is also in double figures at just over 10%. It is likely that all of the motives that create demand for cash also exist for the Swiss franc. At 7%, the figure for the other euro area countries is significantly lower than the German equivalent. Only the United Kingdom, with almost 5%, has a quota that lies within the range that one would more or less expect for transaction-related reasons.

Figure 6: "Cash in circulation" in relation to GDP in 2011 (in %)



Notes: CH: Switzerland, DE: Germany, EMU ex. DE: Euro area excluding Germany, JP: Japan, UK: United Kingdom, US: USA. The figures for the euro-area countries relate to the cumulative net issue.

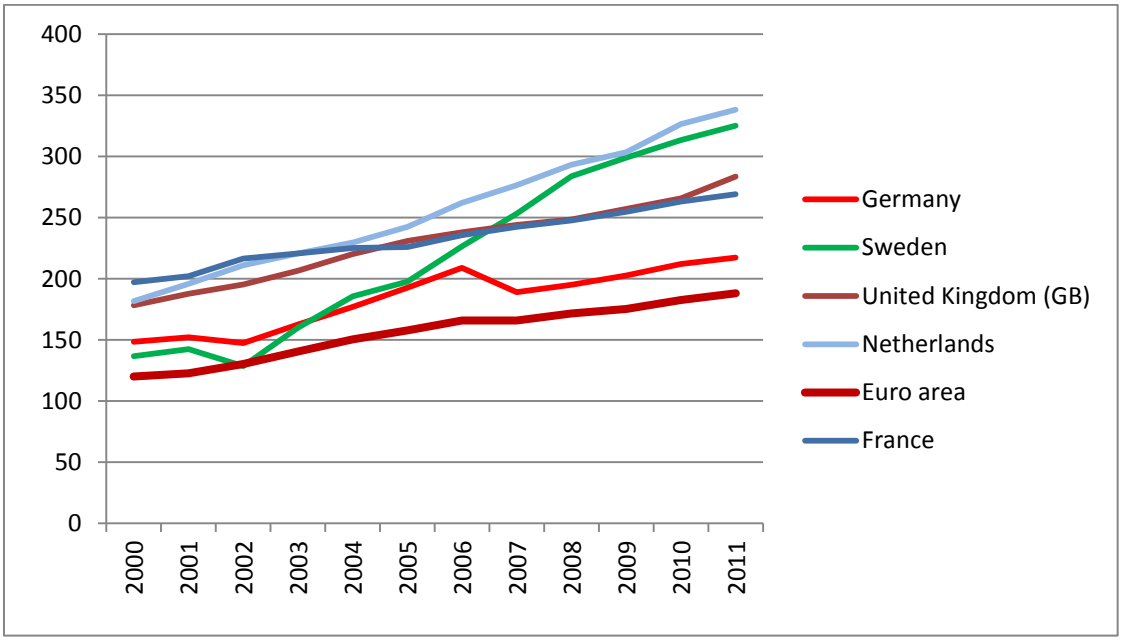
Sources: National central banks, ECB.

2.2 Cashless payments

Looking at cashless payment instruments, in 2011, every citizen made approximately 217 cashless transactions, on average. This puts Germany above the euro-area average (see Figure 7). However, cashless payment instruments have been used much more intensively in some countries (most notably in the Scandinavian countries and in the Netherlands). As will be seen later, this is largely due to the fact that Germans use payment cards relatively infrequently.

[5] The Fed estimates that up to ⅔ of dollar banknotes are located outside the country (United States Treasury Department, 2006 and Judson, 2012).

Figure 7: Cashless payment transactions per capita in selected EU member states



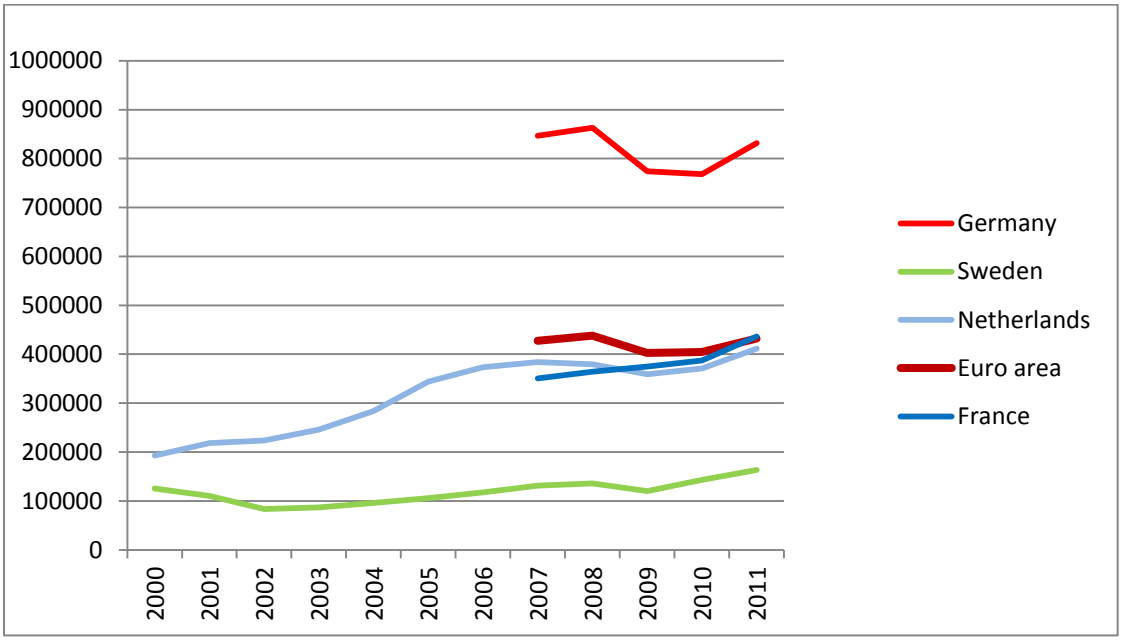
Notes: Values for Germany: Statistical break in 2007.

Sources: ECB Data Warehouse and own calculations.

Measured on the basis of the per capita value of cashless transactions, Germany is above-average for all the countries considered (see Figure 8). It should be borne in mind, however, that the statistics on the value of non-cash payments are dominated by high turnover in the B2B area and in the settlement of financial market transactions. In addition, the change in values over time and the large differences between similar countries would suggest that the statistics are not always comparable.

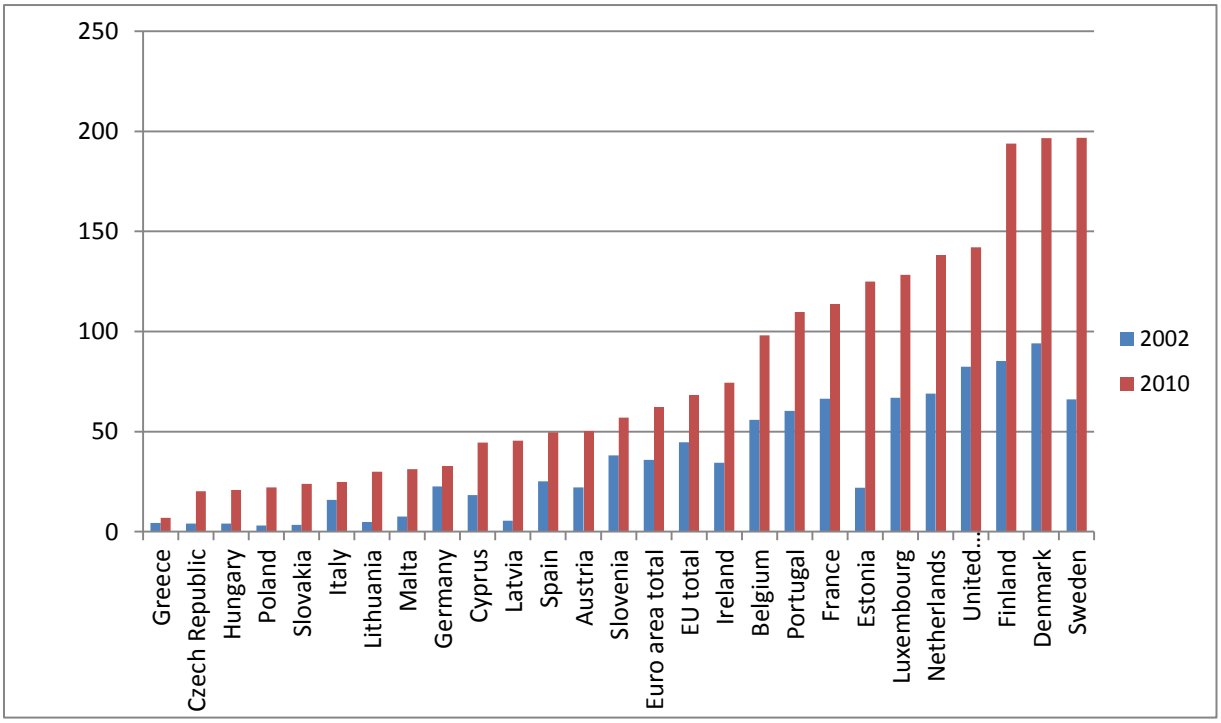
Figure 9 compares the numbers of *card payments* per capita in the EU in 2002 and in 2010. The values have increased in every country. The highest levels of growth, starting from a low initial level, are evidently in the Baltic states and in Poland. In 2010, the Scandinavian member states of the EU were clearly at the top with almost 200 transactions per inhabitant. Greece was at the bottom end of the scale with only seven transactions. With a score of 33 transactions, Germany is on a par with Malta and Lithuania, just ahead of Italy, but significantly behind France, Austria and the Netherlands. In comparison with the rest of the EU, growth in Germany has been slower. Outside the EU, the number of card payments per capita in 2010 was 211 in the US, 64 in Japan, 77 in Switzerland, and 4 in China. Therefore, according to these figures and bearing in mind the level of development, the value for Germany is relatively low.

Figure 8: Value of cashless payment transactions per capita in selected EU member states



Notes: Values for Germany: Statistical break in 2007.
Sources: ECB Data Warehouse and our calculations.

Figure 9: Per capita card payments in the EU (2010 and 2012)

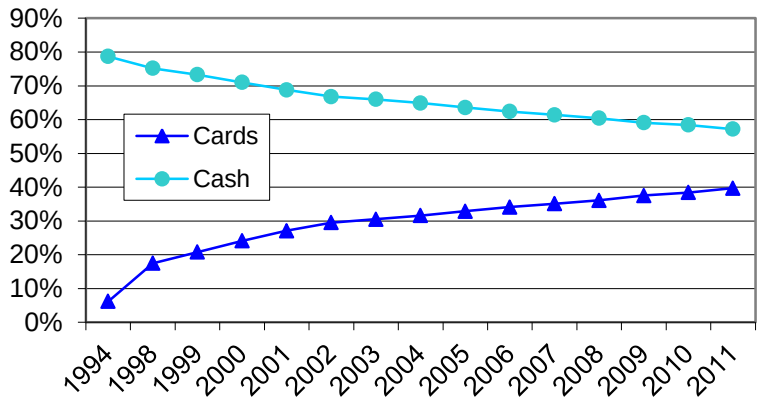


Source: ECB.

However, when looking at cards use over time, statistical evidence from the retail sector clearly shows that cards are gaining ground vis-á-vis cash. From 1994 to 2011, the share of cash payments

(in terms of the value of transactions) fell from almost 80% to less than 60% while the share of card payments rose from 5% to almost 40% (see Figure 10).[6]

Figure 10: Share of cash and cards in retail trade according to the EHI



Source: EHI, own chart.

Direct debits are particularly popular in Germany, and the trend is rising. Based on the number of transactions, Germany is well ahead of most other countries. Only the Netherlands and Austria have comparable figures. This is due to the fact that direct debits in these countries are designed to be especially user-friendly. For example, direct debits are not only used in Germany for many regular payments (telephone billing, insurance premiums, etc.); they are also used for payments at the POS (electronic direct debit, or ELV) and for payments on the internet.

Any regular payments that are not processed by direct debit in Germany are settled by *credit transfer*, frequently using a standing order. Besides that, the credit transfer is the most commonly used instrument for making larger one-off or irregular payments. This applies not only to payments by households but also by businesses. In particular, credit transfers are also used for payments arising from financial market transactions. This also explains the high value of the transactions which are effected by credit transfer (see Fig. 1).

The comparative data on the use of the different payment instruments have shown that there are significant differences across Europe. While cash is used relatively frequently in Germany, card use is below the European average. However, that does not mean that cashless payment instruments are generally used less frequently here. Credit transfers are frequently used, and Germany is ahead of the rest in its use of direct debits.

[6] These figures are in line with survey results of the Deutsche Bundesbank. For 2008 the survey yields a share of cash transactions (in value terms) of 57.9% and for 2011 of 53.1%. See Deutsche Bundesbank (2009a) and (2012).

3. Cost studies: Overview of literature

It is already clear from the different developments shown in Chapter 2 that one should be careful when comparing payment systems internationally. This applies, in particular, with respect to costs of different payment media. Hayashi & Keeton (2012, p. 1f) conclude following an analysis of different cost studies: "The studies have reached different conclusions …, suggesting that cost rankings can depend on the *specific characteristics of a country's payments system* and the *scale* at which a payment method is used in the country. (…) These differences suggest a need for each central bank to *conduct its own cost study*." In a similar vein, Schmiedel et al. (2012, p. 8) state: "The existing literature shows that, in spite of recent efforts, there is still only limited knowledge and information available for making valid comparisons of the costs of making payments across European countries."

The more recent studies, many of which incorporate all the parties involved in the payment process, calculate what are known as resource costs.[7] An overview of selected studies, including policy recommendations, is provided by Koivuniemi & Kemppainen (2007), as well as by Hayashi & Keeton (2012). In addition, there are also analyses which only consider individual parties, mainly retailers and/or banks (for example, Banco de Portugal, 2007; Guibourg & Segendorf, 2007) or which analyse costs without consolidation (e.g., Takala & Virén, 2008).

In determining the *resource costs*, all the costs incurred by the sectors under analysis are added in a first step.[8] The costs which represent a source of income for another sector (fees, interest, etc.), i.e. so-called external costs, are then subtracted.[9] Therefore, only the actual cost (use of own resources: capital, labour, etc.) is calculated for each sector. Examples are the time that it takes households to obtain cash; the task of counting cash by retailers and the removal of cash; the costs to the central bank for the production and processing of banknotes, or the cost to commercial banks of cash deposits and disbursements.

Different indicators for cash and cashless transactions are calculated in the studies for the purposes of comparison, divided under certain circumstances by sectors. Debit and credit cards are considered most notably in the case of cashless instruments. Other payment media are only included in exceptional cases.

[7] See Ardizzi & Giucca (2013), Banque Nationale de Belgique (2005), Bergman et al. (2007), Brits & Winder (2005), Danmarks Nationalbank (2012), Gresvik & Haare (2009), Humphrey et al. (2003), Nyandoto (2011), PaySys Consultancy (2006), Schwartz et al. (2008), Segendorf & Jansson (2012), Simes, Lancy & Harper (2006), Turjan et al. (2011), Valverde et al. (2008), as well as the multi-country contributions by Schmiedel et al. (2012) and Retail Banking Research (2010). A general critical assessment, taking due account of qualitative factors, benefit aspects and welfare considerations can be found in Shampine (2007, 2009).

[8] The term "social costs", which is frequently used synonymously for resource costs, is confusing because it has actually been used for over a century as an established term in public finance, specifically in the area of environmental economics and negative external effects.

[9] The use of the term "external costs" contrasts with its use in allocation theory and environmental economics, where it is a synonym for negative external effects.

Table 2: Costs of payment instruments: per transaction

	Cash	Cards	Debit	Credit
US 2003 $54	2.18		1.07	1.16
US 2003 $11	0.90		1.00	0.95
Austr. 2005 $A50	1.64		0.80	0.99
Austr. 2005 $A10	0.96		0.80	0.99
Australia 2007 ($A)	0.37		0.80	1.22
Germany 2004 (€)	0.36		0.82	2.73
Belgium 1998 (€)	0.56	0.64		
Sweden 2009 (€)	0.78		0.42	1.15
Norway 2007 (€)	1.53	0.74		
Denmark 2009 (€)	0.78		0.36	3.86
Hungary 2009 (€)	0.39		0.33	3.59
Netherlands 2002 (€)	0.30		0.49	3.59
Netherlands 2009 (€)	0.39		0.32	
Italy 2009	0.33		0.74	1.91
EU13 2009 (€)	0.42	0.99	0.70	2.39

Notes: US: Calculation for transactions of 54 and 11 US dollars, respectively; Australia 2005: Calculation for transactions of 50 and 10 Australian dollars, respectively. The annual number relates to the data upon which the study is based. The red numbers indicate the highest and lowest estimates (in €).

Sources: Our own calculations as well as EU13 in Schmiedel et al. (2012)[10], Belgium 1998 in De Grauwe et al. (2000), Netherlands 2002 in National Forum on the Payment System (2004), Netherlands 2009 in Jonker (2013) (only cash and debit cards), Denmark 2009 in Danmarks Nationalbank (2012), Norway 2007 in Gresvik & Haare (2009), Germany 2004 in PaySys Consultancy (2006), US 2003 in Schwartz et al. (2008), Australia 2005 in Simes et al. (2006), Australia 2007 in Schwartz et al. (2008), Hungary 2009 in Turján et al. (2011), Sweden 2009 in Segendorf & Jansson (2012), Italy 2009 in Ardizzi & Giucca (2012).

The payment costs from which the importance of cash and cashless payments can be inferred can be calculated as

- costs per transaction,
- costs as a percentage of sales,
- costs as a percentage of GDP,
- costs per capita.

Each of these criteria seems plausible at first glance, although they are problematic, most notably in international comparisons. In the case of costs per transaction, for instance, it is important to remember that the transaction amounts vary, which is why it is ultimately not a like-for-like comparison. This inadequacy also affects the costs as a percentage of sales or per euro of sales because the fixed costs per transaction vary between countries and, consequently, the transaction amounts considered also affect the outcome. In order to compare the costs of each payment instrument, it is also necessary to estimate the number or value of transactions. This is extremely difficult with cash, in particular. The costs relative to GDP depend, in their turn, on the degree of development of the respective payment system. And the costs per person and per annum are

[10] Countries analysed: Denmark, Estonia, Ireland, Greece, Spain, Italy, Lithuania, Hungary, Netherlands, Portugal, Romania, Finland, Sweden.

ultimately markedly determined by the relative usage of each of the payment instruments, as well as by income per person. As Tables 2 to 5 show, the findings vary accordingly between studies and between countries depending on the indicator used. We have only included studies which at least include banks, retailers and, in some cases, consumers, as well as cash and cards as payment instruments.

Table 3: Costs of payment instruments: as a percentage of turnover

	Cash	Cards	Debit	Credit	Total
US 2003 $54	4.02%		1.97%	2.14%	
US 2003 $11	7.85%		8.68%	8.25%	
Austr. 2005 $A50	3.28%		1.60%	1.98%	
Austr. 2005 $A10	9.60%		8.00%	9.90%	
Australia 2007	3.16%		1.79%	2.94%	
Germany 2004	1.78%		1.33%	3.09%	1.77%
Belgium 1998	9.00%	1.23%			
Sweden 2009	3.29%		1.09%	2.38%	
Norway 2007	1.67%	1.49%			
Denmark 2009	3.90%	0.99%	0.84%	5.38%	0.85%
Hungary 2009	0.39%		2.87%	9.83%	
Netherlands 2002	3.20%		1.11%	3.12%	
Italy 2009	1.07%		0.54%	1.73%	
EU13 2009	2.3%	1.7%	1.4%	3.4%	

See Table 2 for notes and sources.

The four tables show quite clearly that there is a very wide range in findings, even in the case of estimates for one country (for example, for Australia in 2003 and 2005). Measured in terms of GDP, the cash costs vary from 0.74% in Belgium and Hungary to 0.15% in Norway (see Table 4). And the per capita costs of the payment instruments as a whole (see Table 5) range from €89 in Hungary to over €400 in Denmark. Even among the 13 EU member states of the ECB study, whose figures were collected applying a standardised methodology, the fluctuation range of the social costs of payment instruments varies from 0.42% to 1.35% of GDP (Schmiedel et al., 2012, p. 35). In addition to differences in methodology, the following factors contribute to this result:

- the intensity with which payment instruments are used,
- the parties to be taken into consideration,
- the types of costs involved,
- specific assumptions made in the calculations (for example, about the extent of cash transactions[11]),
- the valuation of time and
- interest rates used (for measuring opportunity costs).

[11] Determining the share of cash transactions is especially important for Germany because the German net issues are not only used to finance domestic transactions; parts of them are also hoarded and are held abroad, both within and outside the euro area (see Figure 4).

Table 4: Costs of payment instruments: as a percentage of GDP

	Cash	Cards	Debit	Credit	Total
US 2000					3.00%
Australia 2007	0.50%	0.50%	0.10%	0.20%	1.00%
Germany 2004	0.61%	0.12%	0.07%	0.05%	0.73%
Germany 2008 (RBR)	0.63%	0.45%			1.08%
Belgium 1998	0.74%	0.10%			0.85%
Sweden 2009	0.26%	0.28%	0.19%	0.09%	0.54%
Norway 2007	0.15%	0.24%			0.49%
Denmark 2009	0.27%	0.18%	0.14%	0.04%	0.78%
Hungary 2009	0.74%	0.19%	0.11%	0.08%	1.30%
Netherlands 2002					0.65%
Netherlands 2009					0.42%
EU13 2009	0.50%	0.21%	0.11%	0.10%	1.00%
Italy 2009	0.53%		0.04%	0.07%	1.00%
Europe 2008 (RBR)	0.60%	0.57%			1.17%
Germany 2011	0.31%	0.03%			0.34%

Notes: RBR: Retail Banking Research (2010); Germany 2011 based on Kleine et al. (2013); for further comments and sources, see Table 2.

Table 5: Costs of payment media: per person and per annum (in €)

	Cash	Cards	Debit	Credit	Total
Australia 2007	139.00		49.23	69.50	257.72
Germany 2004	161.37		18.34	12.90	192.61
Germany 2008 (RBR)	191.18	136.39			
Belgium 1998	162.91	22.99			185.91
Sweden 2009	87.11		60.34	28.45	
Norway 2007	92.49	141.81	62.37	25.57	295.43
Denmark 2009	141.04	60.79			403.66
Hungary 2009	71.78		10.76	6.96	89.49
Netherlands 2002	131.40		32.20	10.22	
Italy 2009	132.84	117.06	11.15	18.10	250.84
Netherlands 2009					144.88
Germany 2011	97.80	9.78			107.58

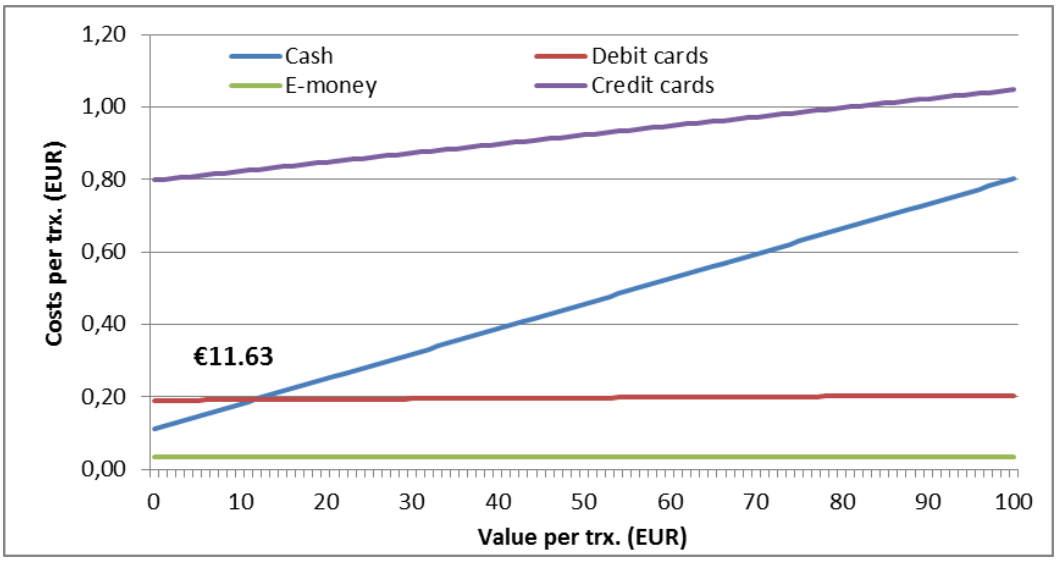
Notes: RBR: Retail Banking Research (2010); Germany 2011 based on Kleine et al. (2013); for further comments and sources, see Table 2.

This makes it difficult to perform international comparisons. Therefore, we would strongly advise against extrapolating the findings to a larger group of countries, such as from 13 EU member states to all EU member states, as is done in Schmiedel et al. (2012), for example. Under no circumstances should any conclusions be drawn about the efficiency of a particular payment instrument from one indicator alone. For example, high costs per transaction could actually be attributable to an inherently inefficient method of payment, but could also be due to a high average transaction value or to low usage of economies of scale. In the case of credit cards, for instance, high costs per transaction (see Table 2) combined with high costs per unit of sales (see Table 3) generally indicate that high transaction values are not the only factor that is responsible for this. Network effects and

economies of scale are apparent in all payment media which have to be taken into consideration in the determination of costs and, particularly, in simulations and scenario analyses.

According to the studies, the highest costs of payment instruments as a whole are generally among banks and in the retail sector (see overview in Schmiedel et al., 2012, p. 36). However, figures for the total economy of 3% of GDP for the USA, as reported in Humphrey et al. (2000), could not be confirmed in more recent studies and surely represent an upper limit. Where a distinction is made between fixed and variable costs (for example, in Brits & Winder, 2005; Bergman et al., 2007; Segendorf & Jansson, 2012; BNB, 2005), a large portion of the costs for cashless payment media is attributable to setting up the infrastructure and is, thus, of a fixed nature. In order to undo the effects of different transaction values, the US (Garcia-Swartz et al., 2006a, b) and Australian (Simes et al., 2006) studies use specified standard amounts (see Tables 2 and 3). As high variable costs and relatively low fixed costs are estimated for cash, the relative advantages associated with cash diminish as the value of the transaction increases.[12] It is also apparent in this procedure that the representative standard amounts vary from country to country.

Figure 11: Comparison between costs for different payment media: the Netherlands



Source: Brits & Winder (2005).

The problem of the limited comparability of the indicators presented can be countered by the determination of cost functions for payment media which relate costs to transaction values (see, for instance, National Forum on the Payments System, 2004, Brits & Winder, 2005; BNB, 2005; Turján et al., 2011; Bergman et al., 2007; Simes et al., 2006). The aim is to deduce a break-even point for the transaction value from which a particular payment medium becomes relatively more or less

[12] Fixed costs include, for example, the acquisition of safes and counterfeit money detectors by retailers, as well as shoe-leather costs for consumers. A distinction is made in the fees for cash-in-transit companies between a fixed and a value-dependent amount. Variable costs would also include interest foregone in the sense of opportunity costs. The classification also depends on the time horizon under consideration.

expensive. For that purpose, the costs are divided into fixed and variable costs. The variable costs are subdivided into transaction-dependent and value-dependent costs. In a second step, the variable costs are shown as a function of the transaction value. The case of the Netherlands is illustrated in Figure 11 (National Forum on the Payments System, 2004 and Brits & Winder, 2005). It is apparent that a transaction amount of €11.63 is the threshold from which payment by debit card is more favourable than a cash payment.[13] Irrespective of the transaction amount, the most favourable payment medium would be e-money, which is rarely used. This is the chipcard-based payment function "Chipknip" (comparable to the "GeldKarte" in Germany). Credit cards are clearly the most expensive option up to a transaction value of €100. The results depend upon a number of estimates and the assumption that certain costs are fixed. Consequently, there is a risk that the findings will be sensitive to variations in specification, in particular the division between fixed and variable costs.

The resource costs of households are also estimated in some more recent studies (for example, Garcia-Swartz et al., 2006a, b; Gresvik & Haare, 2009; Turján et al., 2011; Danmarks Nationalbank, 2012). Since resource costs do not include fees by definition, these costs essentially comprise the time that households have to spend on the payment process, on procuring cash and on reviewing settlements afterwards. Depending on which of these time costs are taken into account, which time is set, how time is valued, and which other costs of households are considered (e.g. risk-related costs due to acts of fraud and counterfeits), the results vary considerably. For example, the social costs for households amount to 0.05% (of GDP) in Sweden, but to 0.23% in Denmark.[14]

The problem can be explained with great clarity in the case of cash withdrawals at ATMs. Initially, it seems plausible to estimate the time spent at the ATM and then to price it accordingly (in the sense of opportunity costs). However, if these costs are actually substantial, it is fairly simple to lower them because higher withdrawal amounts imply fewer trips to the bank. If the same distance is always covered per withdrawal, the costs depend proportionally on the number of transactions effected at the ATM, and the cost minimisation problem is as follows: by selecting amounts which are as high as possible, the overall distance covered, and thus the time, can be kept to a minimum. However, this approach disregards the risk of loss, as well as the fact that people do not often go

[13] This value fell to €3.06 in 2009 (Jonker, 2013).

[14] In the study conducted by Segendorf et al. (2012) for Sweden, the time costs of cash for households are estimated with the aid of an inventory theoretic model. Applying a very low rate of interest of 0.27%, this gives rise to time costs of only SEK 20 million in 2009 (approximately EUR 1.9 million). Had the calculation been performed with an interest rate of 2.5% instead, this would have given rise to costs of SEK 170 million (approximately EUR 16 million). According to the study conducted by Danmarks Nationalbank (2012) for the same year, however, the time costs are the key cost drivers at household level. They amount to DKK 1.352bn (approximately EUR 182 million), i.e. almost 100 times higher. These figures were determined by multiplying the time cited by consumers in a survey for withdrawing cash and queuing at POS by an average net hourly wage rate. According to the study, time costs account for almost 85% of the *total* costs incurred by households in Denmark for cash *and* cashless payment media. By contrast, time costs for consumers are completely disregarded in the study conducted by Ardizzi & Giucca (2012) for Italy.

specifically to the ATM, but rather go because there happens to be one nearby. Still, the revealed preferences of households show that they do not seem to regard the costs associated with withdrawing cash at ATMs as unduly high.[15]

Accordingly, there are two methods in the valuation of the withdrawal process. In the first (for example, Gresvik & Haare, 2009; Danmarks Nationalbank, 2012), the time taken to withdraw cash is simply multiplied by a representative hourly wage rate and by the total number of ATM withdrawals per year. In the second method, an economic model (such as the Baumol Tobin model) is set up in order to determine the costs per cash withdrawal from the number of ATM transactions per person as a means of trading-off opportunity and transaction costs (see, for example, PaySys Consultancy, 2006). Method 1 generally leads to considerably higher costs than method 2. This can be demonstrated with the aid of a simple stylised example for Germany. Applying method 1, we set the net hourly rate at €20 and the time per withdrawal at 3 minutes. The 2.1 billion ATM transactions in 2011 would then correspond to total costs of the order of €2.1 billion. We use the Baumol Tobin model in method 2. Given an average of €450 withdrawn every month, an annual rate of interest of 3% and three withdrawals per month, the model yields costs per withdrawal of €0.063. With the same number of ATM transactions, i.e. 2.1 billion, this would "only" translate into total costs of €132.3 million.

The problems which arise in the valuation of time also occur in other sectors. For example, the wage costs for bank employees must actually be allocated to the individual payment media in the calculations. In retail, the time taken to process the payment at the POS must be evaluated. And it has to be decided whether the removal of cash is done during working hours or on the way home. The study by de Grauwe et al. (2000), for example, put cash removal costs for retailers in Belgium at almost €1.2 billion per annum by assuming 1.5 hours per day and per retailer for removal. All in all, a considerable portion of the costs determined for the banking industry and for retail is made up of wage costs. In this regard, a decision also has to be taken on whether time spent is really opportunity costs. This may be the case in a large supermarket because lengthy payment transactions there would mean that more till operators have to be hired. This, however, is not the case in a small shop with rather sporadic visits by customers. Furthermore, the hourly wage rates used in retail and for households have a significant bearing on the results.

Therefore, serious quantification and valuation problems are associated with the cost studies, in particular if all parties that are involved in the payment cycle are included into the analysis. Moreover, the advantages of individual payment media in the sense of a cost-benefit analysis are

[15] However, depending on the country and region in question, withdrawing small amounts relatively frequently might also be due to fears of loss and theft.

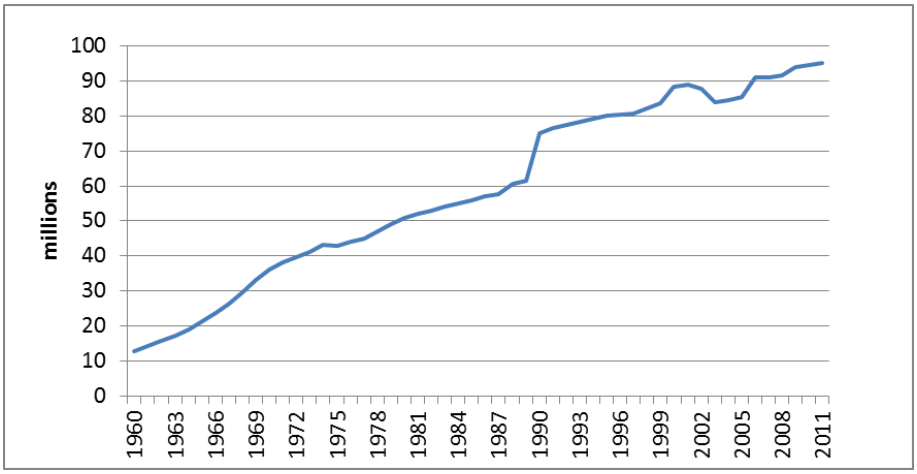
normally not taken into account at all (apart from Garcia-Swartz et al., 2006a, b). The lack of transparency of the calculations and of the data basis in some studies is also striking. For instance, the abstract in Retail Banking Research (2009) makes reference to figures for Germany without quoting sources and without any methodological explanations. However, there is no specific reference to Germany in the main text. And in Kleine et al. (2013) reference is made in the majority of cases to unspecified interviews with experts in determining cash costs. In addition, qualitative factors, which often concern the relative advantages (net) of cash, are ignored in virtually all the studies (Garcia-Swartz et al., 2006a, b is once again the exception in some regards).

4. The significance of payment media in Germany

4.1 The central role of banks in payment transactions

In the past, the flow of money was largely self-organised. Money was brought into circulation by central banks and/or mints and was then passed on by other economic agents. Cashless payment transactions were initially of little significance to households and small businesses, and were restricted to larger businesses and wealthy people. However, cashless payment transactions started to make progress as cashless wage and salary payments became more widespread between the late 1950s and the early 1970s. This does not mean that cash payments were displaced completely. But the nature of the cash cycle has been completely transformed in the course of these changes. Cash transactions, and in particular the procurement and removal of cash, have become increasingly intertwined with cashless payment transactions.

Figure 12: The number of current accounts in Germany

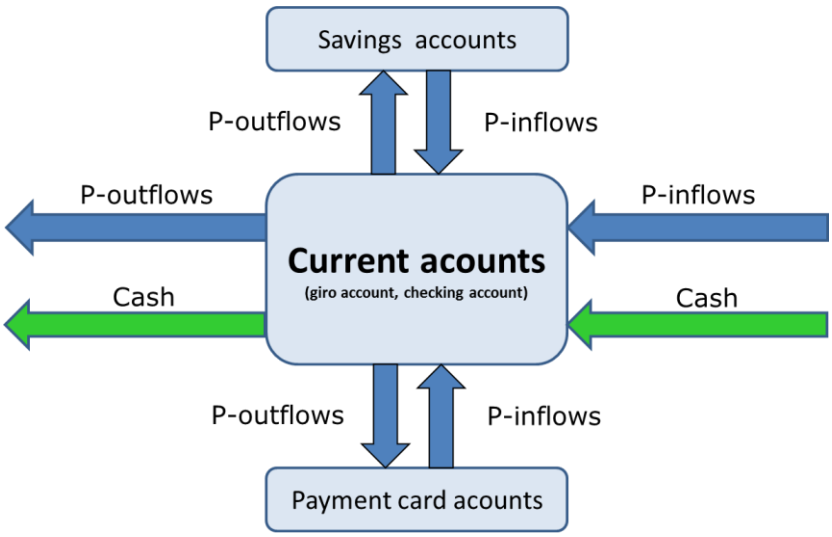


Sources: Deutsche Bundesbank and own calculations.

The current account is the mechanism around which payment transactions revolve. There has been a steady rise in the number of current accounts in Germany for five decades (see Figure 12). The key payment flows of households (earnings, transfers, taxes and a large portion of regular

expenditure) and of companies pass through this account (see Figure 13). This also applies to the procurement and removal of cash. Any person who requires cash withdraws it from his current account, or anyone who has a high cash income pays it into a current account. Therefore, an autonomous, self-organised cash cycle now only exists to a very limited extent.[16] Despite the diverse range of payment instruments available, there is essentially one integrated payment system with the current account pivotal to it.

Figure 13: The current account as focal point of the payment system



Note: P: Payment.

The special position held by the current account in payment transactions justifies the special role accorded to banks in ensuring that the payment system functions properly. The banks are the most important payment service providers for private and business customers.

4.2 Costs and revenues in the payments system: the demand-based approach

As in any market, there is supply and demand in the market for payment services (see Table 6). The suppliers are banks and "other service providers", whereby the banks bear the load of the system because of the significance of the current account, which we touched upon above. Remuneration within the payments system represents earnings for the suppliers and costs for consumers. The suppliers, in turn, must meet their expenditure for providing payment transaction services from their earnings. In addition to the remuneration which they have to pay to payment

[16] It would be worthwhile to analyse to what extent risks can be reduced by supporting or safeguarding the circulation of cash during periods of crisis.

service providers, consumers are faced with additional expenditure in the form of their own resources of time and real capital (see Table 6).[17]

Consequently, there are two ways of answering the question about costs and about the significance of the payments system.[18]

A. Estimates are made about the costs arising in the production of payment services (see, for example, the overviews contained in Schmiedel et al., 2012 as well as in Koivuniemi & Kemppainen, 2007). This requires a detailed understanding of the cost accounting practices of banks and specialist service providers. Corresponding data are generally collected through questionnaires (and payment diaries) from banks, consumers and retailers, whereby the results hinge greatly on the quality of the questionnaires (see, e. g., Jonker & Kosse, 2009). In addition, the surveys are frequently only conducted once or at irregular intervals due to cost constraints.
B. Estimates are made about the level of expenditure incurred by customers (households, businesses) for payment services. This is based on the idea of estimating the significance (or costs) of payment media by ascertaining users' willingness to pay for payment services. This information can be obtained from the customers on the spending side or from the producers on the earnings side. An analysis of earnings requires that earnings from payment transactions can be separated from other earnings.

Table 6: Classification of the costs for payment services

	Consumers of payment services	
Suppliers	**Businesses***	**Households**
Banks	Explicit prices Implicit prices	Explicit prices Implicit prices
Other service providers	Explicit prices for: Secure transport Network operation Acquiring	
Customers' own resources	Own resources (in particular labour) for: Cash handling / Cash deposit Reconciliation / Control	Own resources (in particular time) for: Cash withdrawal Reconciliation / Control

Note: *: Including state agencies.

[17] This is also the case in other markets. For example, when a household goes shopping, he not only has to take account of prices, but also has to allow for his time spent.
[18] Unfortunately, determining the value created by the payment system directly is not possible because this value creation is not recorded separately in the national accounts.

In both approaches it is also important to consider that the customers, too, incur certain expenses which must also be estimated (for example, the time taken to withdraw cash or the purchase of payment terminals by the retailer). There is great uncertainty and much variation in outcomes in assessing these items.

If banks and other payment service providers only offered payment services, then both approaches would be relatively simple to implement because all revenues or all costs would be assigned to the delivery of payment services. However, both banks and the "other" payment service providers generally offer a whole array of services. Therefore, the costs or revenue which relate to the delivery of payment services have to be isolated. The estimation of the associated costs requires detailed data from the cost accounting of the businesses affected. Any such data are normally not made available to the public and must be collected from the banks and service providers.

The estimation of revenue from payment transactions is straight forward if market prices exist for the payment services (in the form of a "price per unit of quantity"). Revenue can then be assigned to individual services. In annual reports, revenues are frequently classified according to product groups, facilitating allocation to individual fields of business, such as payment transactions. It is more difficult to estimate revenue if services are offered in packages, and/or if a form of indirect pricing takes place. This is frequently the case with banks. Many payment services are offered as part of the current account package and are not billed separately. Instead, there is a flat-rate price and/or implicit pricing through the low interest paid on demand deposits (generally at 0%). Customers dispense with the interest which is offered by interest-bearing assets and rather keep deposits in current accounts as that means that they can benefit from other banking services, in particular payment services. Therefore, the customer pays a "price" for payment services (or for liquidity) in the form of lower interest (liquidity premium).

Consequently, the two most important revenue models in the banking sector are:

- price per service ("commission")
- implicit fee[19]

Method A has largely been used in cost studies conducted up to now. As we have already mentioned above, it requires relatively extensive knowledge of the cost accounting practices of the companies which offer payment services. This knowledge can only be obtained in detail with the cooperation of the businesses in question. Even if these businesses were prepared to do so, an adequate quality of data is often not available, however. Particularly for banks, it is frequently

[19] This implicit fee could also be referred to as "seigniorage". Seigniorage is understood to mean gains from money creation. In general, this term is restricted to central bank gains from the creation of central bank money, most notably cash. However, it can also be extended to the money creation gains achieved by commercial banks, which are based on the creation of deposits.

difficult to allocate costs because many of their services are closely tied to the current account, which is a prerequisite for carrying out cashless payment transactions and for the provision of cash alike.

For this reason and because we are not conducting an own survey, we will adopt method B, which we will refer to as the 'demand-based approach'. It can place greater emphasis on data which are routinely published in the annual reports of banks and service providers or which are published in sources which are otherwise freely accessible. An approach which is similar to method B can be found in studies to determine the value-added created by the banking sector (for example, Colangelo & Inklaar, 2010 and Wang, 2003). These studies also assume that there are implicit fees for certain banking services contained in the interest margin.

The earnings differ from the costs by any profits or losses which may arise. Therefore, if one were to estimate costs from the revenue perspective, the costs may be over or under-estimated. Only in a situation of perfect competition would this problem not arise. In reality, the conditions for perfect competition are rarely met. Having said that, as long as there is a certain degree of competition present, the profits are likely to level off at something akin to "normal". However, in order to estimate the *significance* of the payment transaction in the sense of a willingness to pay for payment services, the approach we have selected is more suitable than method A.

Recording the revenue at a relatively high level of aggregation implies that revenue has to be broken down to individual payment instruments in a second step. If data on costs are collected directly, this breakdown usually occurs automatically. However, even in this case larger cost blocks (such as account or debit card-related costs) frequently also have to be broken down to individual cost units using an appropriate distribution key.

4.2 Determination of the banks' revenue from payment transactions

Determining the gross income is the point of departure for determining the revenue from payment transactions. This is defined as:

Gross income = interest received + commissions received

Subtracting interest paid yields operating income:[20]

Operating income = gross income – interest paid

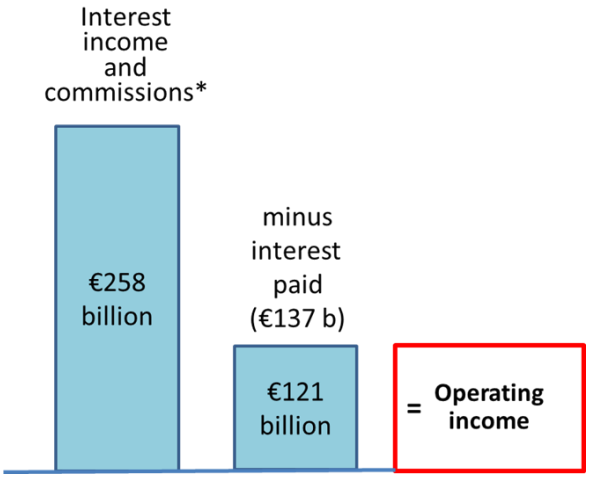
Thus, operating income ultimately consists of two components:

- Firstly, commission revenue. This is comparable to revenue in the insurance industry, for example.

[20] In Deutsche Bundesbank (2013) commissions paid are subtracted from commissions received. However, for the present purpose, all commissions paid to non-banks should not be subtracted. Since there are no statistics separating commissions paid to banks and to non-banks, we included gross commissions in operating income.

- Secondly, the interest margin. This corresponds to the mark-up (on purchase prices) in retailing, for example.

Figure 14: Operating income of payment transaction banks in Germany (2011)



Remark: *: adjusted to allow for loan losses. Relates to the banking sector, excluding real estate credit institutions, building societies and banks with special functions.

Sources: Deutsche Bundesbank and own calculations.

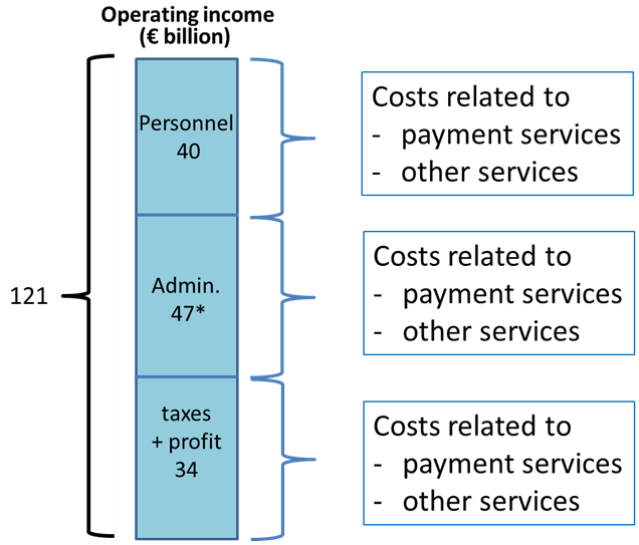
In the Bundesbank statistics, the banking sector also includes the groups "real estate credit institutions, building societies and banks with special functions". However, these banking groups only offer their customers marginal payment services and have no significant demand deposits on the liability side of the balance sheet.[21] Therefore, a narrow definition will be used in this study. We will look solely at private commercial banks, state-owned regional banks, savings banks, central cooperative banks and credit cooperatives. They are combined under the term "payment transaction banks" (PT banks).

The total revenue of the PT banks on average in 2011 was €258 billion. €137 billion of this was to be deducted in the form of interest paid, leaving an average of €121 billion (see Figure 14). This corresponds to the operational income of the PT banks.

The operational income indicates the level of the banks' net revenue. Expenditure for the payments made by the banks has to be financed from the operational income (see Figure 15). They essentially consist of personnel costs, operating expenditure, the outlay for external services, taxes and interest on equity. It may also include profit.

Figure 15: Operating income and offsetting items on the expenditure side (2011)

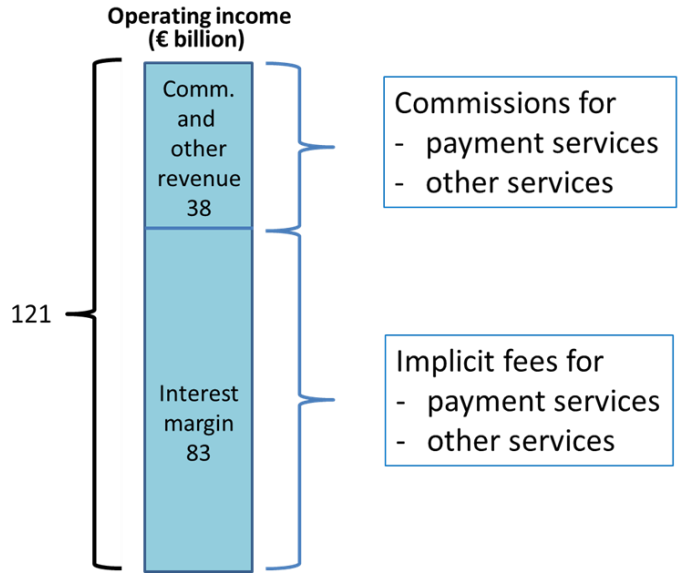
[21] Measured in terms of balance sheet totals, these three groups account for around 20% of the market. However, they only account for 1% of overnight deposits.



Remark: *: including commissions paid. Relates to the banking sector, excluding real estate credit institutions, building societies and banks with special functions.
Sources: Deutsche Bundesbank and own calculations.

The operational income of €121 billion consists of commission (€38 billion) and the interest margin (€83 billion) (see Figure 16). From the customers' perspective, the operational income thus represents remuneration for services provided by the banking industry. Revenue from commission is generated in payment transactions, as well as in other areas of banking. The interest margin can, thus, be interpreted as an implicit fee for payment services and "other services" (portfolio management, debt management, monitoring, etc.).

Figure 16: The composition of operational income (2011)

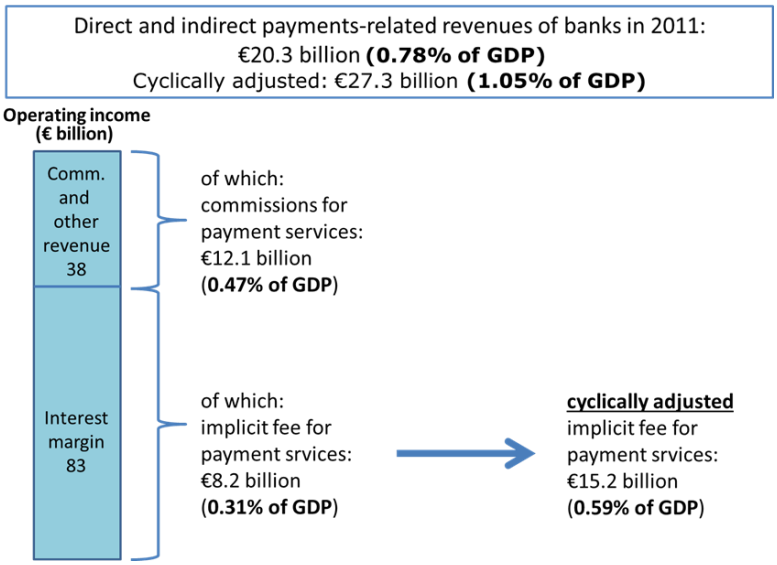


Remark: Relates to the banking sector, excluding real estate credit institutions, building societies and banks with special functions.
Sources: Deutsche Bundesbank and own calculations.

We estimate payment transactions to account for around €20 billion of the entire operational income: €12.1 billion in commission and €8.2 billion in implicit fees (see Figure 17). In other words, businesses and households paid banks €20 billion for payment services in 2011, which equates to 0.78% of GDP. Please note that the implicit revenue fluctuates with the interest level which is currently historically low. After adjusting for this cyclical effect, the estimate of implicit fees would be as high as €15.2 billion. Together with commissions, this amounts to cyclically adjusted revenue of €27.3 billion from payment transactions. This equates to 1.05% of GDP.

At a "normal" rate of interest or taken as an average over an interest rate cycle, the banks' revenue from payment transactions (or the expenditure incurred by their customers) consequently amounts to around 1% of GDP.

Figure 17: Revenue from payment transactions of PT banks

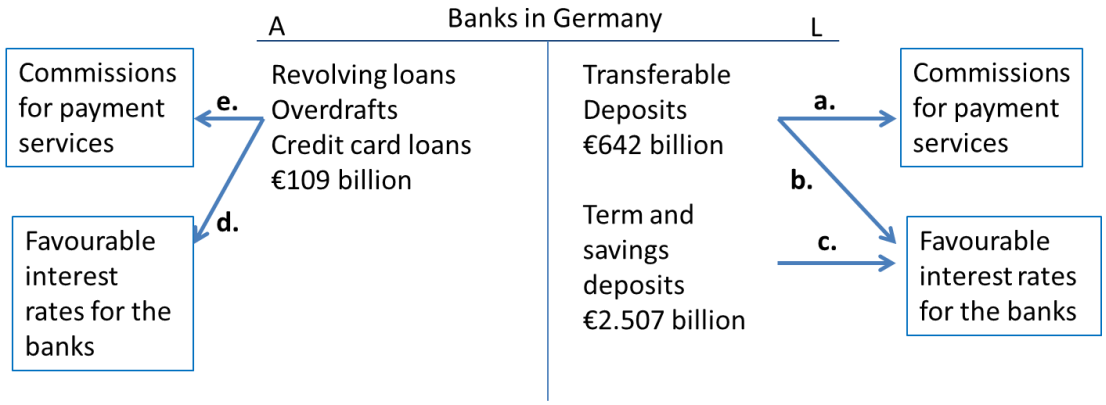


Remark: Relates to the banking sector, excluding real estate credit institutions, building societies and banks with special functions.
Sources: Deutsche Bundesbank and our own calculations.

When calculating the revenue which can be accredited to payment transactions, the only factors which have been taken into consideration up to now are that transferable deposits generally do not bear interest, and that the issuers therefore receive a form of seigniorage. Additionally, the provision of payment services reduces the "elasticity of demand of customers", whereby the banks are able to increase their interest revenue or reduce their interest costs. This not only applies to current accounts which are usually non-interest bearing; often it is also more convenient for savings and term deposits to be invested with the "house bank". Therefore, a bank with a broad basis of current account customers can also offer savings and term deposits with relatively low interest rates. The same also applies on the asset side. Customers find credit lines that are linked to the current account

(or a payment card account) more convenient. Even if the terms are less favourable, they still avail themselves of these credit lines and will not instantly consider changing banks.

Figure 18: Starting points for revenue from payment transactions



Remark: Stocks at the end of 2011.
Sources: Deutsche Bundesbank and own calculations.

The analysis above, however, focusses only on commissions for payment services (a. and e. in Fig. 18) and revenues due to low interest rates on deposits (b.). Revenues due to favourable rates for savings and time deposits (c.) as well as revenue due to favourable rates on loans are not considered (see Figure 18).

4.3 Determination of the payment transaction revenues from other service providers

The demand-based approach implies that most payment costs can be deduced from the estimates of banks' payment revenues. This also applies to all costs incurred vis-á-vis third-party payment service providers. Supposedly, these costs are recovered via commissions and interest rate margins. However, payment service users – in particular firms - also contract directly with payment service providers. The revenues of such providers in their business with non-banks therefore also have to be included in the estimate of resource costs. Below, we are focusing on three groups of payment service providers: network operators, card acquirers and cash-in-transit companies (CITs).

So-called "network operators" offer merchants (retailers, hotels, etc.) an array of card payment services. They include transaction services, terminal leasing and related services, risk management in electronic direct debits (ELV), etc.

In order to accept cards from international card organisations, merchants must have a contract with an acquirer. While the acquiring function is performed by the banks themselves in many countries, there are specialised service providers (owned by the banks) which perform this function in Germany.

CITs are important service providers for banks and retailers. They transport cash in the course of the distribution and collection of cash. In addition, they offer further services such as cash preparation, filling automatic teller machines and machine services.

Total revenue of payments-related business with non-bank amounts to approximately €834-984 million or 0.03 to 0.04% of GDP.

Table 7: Revenues of other service providers in 2011

2011*	Network operators[a]	Acquirers[b]	CITS*[c]	Total
Trx. revenue (€ m)	323	211	300 - 450	834 - 984

Remark: *: Included are only revenues for merchants.
a: Based on an estimate of the revenue per transactions and statistics on the volume of transactions.
b: Based on an estimate of the acquirer margin and statistics on the value of transactions.
c: Based on estimates of the Association of German CITs and estimates of one market player.
For more detailed information refer to our study "Costs and benefits of cash and cashless payment instruments" (forthcoming).
Sources: Network operators: Annual reports of easycash GmbH, InterCard AG and TeleCash GmbH & Co. KG; PaySys Consultancy GmbH (2013), as well as own calculations. Acquirers: PaySys Consultancy GmbH (2013), various annual reports and our own calculations. CITs: Nattmann (2009) and BDGW, pp. 4-5.

4.4 Internal expenditure of consumers

In addition to explicit and implicit bank fees, households in particular incur costs in the form of time taken for the payment process and to obtain cash. Most studies do not make estimates of the time taken to perform credit transfers and direct debits, as well as for checking payments and for any complaints, as these factors are difficult to estimate.

One item which is frequently estimated is the time taken to obtain cash. There are two methods of doing this (see Chapter 3).

1. Estimate of the required time and valuation of the time based on an average wage rate.
2. Use of an economic model (cash management model) to estimate costs.

Due to the drawbacks of the first method (see ch. 3), we apply the second approach in the following in order to estimate household's internal cost of obtaining cash.

It permits to draw conclusions about costs from observed behaviour.[22] It takes account of the fact that it is relatively simple for customers to lower the cost of withdrawing cash. They can simply visit the ATM less frequently and withdraw larger amounts each time.

[22] However, this method, too, cannot be used without having to make further assumptions. See Baumol (1952) and Tobin (1956) with regard to the theoretical principles.

According to the payment statistics, people make about two cash withdrawals at ATMs every month. The average value of each transaction is €155. Together with an opportunity costs proxied by an interest rate, the two figures are sufficient for calculating the cost per transaction, incurred from a customer's perspective. The opportunity costs measure the costs of holding cash. It may comprise a loss of interest if the bank account is in credit or an interest payment if the bank account is in debit. Therefore, the corresponding rates would be a credit or deposit rate. It should also be noted that cash can get lost. Thus, compared to deposits held in a bank account there is an additional negative return in terms of risk (see Bergman et al., 2007, pp. 9 f).

Table 8: Estimate of costs of the time taken to withdraw cash at an ATM

Assumptions (based on payment statistics)				
	Per user per month		All users per annum	
Number of cash withdrawals	2.5		2,100 (m)	
Value per withdrawal	155 €		325.5 (€ b)	
Assumptions for the different scenarios				
Opportunity cost rate (%)	10.17	1.35	20	38.7
Derived estimate				
Transaction costs per withdrawal (€)	0.26	0.03	0.52	1.00
Transaction costs (€ m)	536	71	1054	2040
in % of GDP	0.02%	0.00%	0.04%	0.08%

Notes: Number of users: It is assumed that there are 70 million ATM users. Opportunity cost rate: overdraft lending rate (10.17%), rate of interest on savings deposits with the statutory withdrawal notice (1.35%), penultimate column: Opportunity cost rate, including a risk premium which covers the risk of losing cash. Transaction costs per withdrawal: shoe leather costs. Opportunity costs: lost interest revenue.

Sources: Deutsche Bundesbank, our own calculations.

As there is considerable uncertainty regarding the relevant opportunity cost rate, a number of rates are used (see Table 8): first, we use the average overdraft lending rate in 2010 (10.17%), second, the average savings rate in 2010 (1.35%), and third, an increased rate of 20% to reflect a possible high risk premium. We ultimately also estimate how high the risk premium has to be to allow for time costs as calculated in method 1 (refer to the final column in Table 8).

The behaviour which is observed would only be consistent with costs of €1 per transaction (see ch. 3) if possession of cash is associated with very high interest foregone and/or a very high risk. All told, the opportunity costs would have to be almost 40% (see the last column in Table 8). This appears completely unrealistic given the level of interest and the relatively high level of safety in Germany.

It is more difficult to calculate the costs involved when withdrawing cash over the bank counter. Counter transactions occur much less frequently. However, the average amount of a withdrawal over

the bank counter is considerably higher (see also Deutsche Bundesbank, 2010). Based on a volume of 286 million counter transactions, this computes to an average of about 3.5 withdrawals per person and month. This is far in excess of the possible number of irregular large payments. Therefore, the counter presumably continues to be used by some bank customers as their "normal" source of cash (Deutsche Bundesbank, 2010, 6 f).[23] This means that the calculation which has been used for the purposes of estimating the costs of ATM withdrawals can also be applied to a portion of the counter transactions. But there are also transactions for relatively large amounts which only occur sporadically. In these transactions, the amount withdrawn is either used to make a payment in the immediate future or to hoard the money for a variety of reasons. Consequently, the cash management model cannot be applied to this scenario.

However, in order not to disregard the costs which households incur when they withdraw cash at the bank counter, we assume that a counter transaction is twice as expensive for the customer as an ATM transaction. This means that costs are increased by about a quarter.

Table 9: Estimate of the time costs incurred by households in obtaining cash[24]

Ratio of counter trx to ATM trx	0.14
Relative costs of counter trx/ATM trx	2
Costs at the counter (€ m)	150
Costs at the ATM (€ m)	536
Total costs (€ m)	686
as a % of GDP	0.03%

Remark: Based on an assumed opportunity cost rate of 10.2%.
Source: Deutsche Bundesbank and own calculations.

If the average debit interest rate is taken as the opportunity cost rate and counter transactions are also taken into consideration, this produces a value of around 0.03% of GDP for the internal costs incurred by households in obtaining cash (see Table 9). Given the fact that cash is also withdrawn for the purposes of hoarding, these costs cannot be attributed fully to payment transactions.

4.5 Internal costs incurred by businesses

Businesses use their own resources to process payment transactions. To a large degree, this is the employees' time. In addition, costs for hardware, software and data transmission also have to be taken into consideration. In the case of cash, this may involve checking and sorting equipment as well

[23] This is likely to be older people, in particular.
[24] The costs for counter and ATM transactions were determined separately. Alternatively, a single method could also be applied for all cash withdrawals. This produces slightly higher costs (approximately 0.1% of GDP).

as safes; with cashless payment transactions, it may involve terminals or systems for connecting to banking organisations (including card service providers).[25]

Employees' time costs are of particular significance in situations where customers effect payment at the POS. This is the case most notably in shops, restaurants and some other sectors. However, estimating the time cost and, more specifically, according a value to it represent another major problem. These costs are difficult to estimate without conducting a detailed survey. The heterogeneous nature of retail makes this especially difficult. For example, 0.01% of businesses in retail and hospitality account for almost 40% of sales, whereas the three smallest business categories (70% of all firms) only account for less than 7% of sales.

If the costs of the payment transaction are divided into[26]

- fixed costs
- variable costs which are dependent on the number of transactions and
- variable costs which are dependent on the value of the transactions,

the segment for small and medium-sized enterprises is of particular importance for estimating the fixed costs. When it comes to estimating the variable costs, on the other hand, large businesses count almost exclusively.

In situations where large quantities of cashless payments are processed collectively (for instance, payments for electricity, gas, water, telecommunications) or in the B2B sphere, employees' time is of less significance. However, systems have to be implemented for processing the payments and occasionally have to be updated. Once again, business heterogeneity makes extrapolations difficult. This too is due to the fact that the majority of firms are small, and that a large portion of sales are achieved by relatively few, large firms.

Given these uncertainties, existing estimates have to be interpreted with great care, especially since some of the estimated totals are very high (see Table 10). Consequently, it is difficult to make a reliable estimate of the internal costs incurred by businesses without conducting an extensive own data collection.

Table 10: Estimates of the internal costs of businesses

Study	Region – Year	€ bn	Remarks
Capgemini	EU-16 - 2006	112	Internal costs of businesses (without cash costs)
Derived from	DE - 2006	22.4	Estimated share of DE in EU-16: 20%

[25] Where terminals are leased by network operators to retailers, these costs are included in the network operators' revenue. However, larger retailers, in particular, purchase their own terminals.
[26] This subdivision was adopted by the Dutch Central Bank and subsequently in many other studies (see National Forum on the Payment System, 2004).

Capgemini			
WincorNixdorf	DE - 2009	8.6	Internal cash costs for retailers
PaySys Consultancy	DE - 2004	3.9	Internal cash costs for retailers
PaySys Consultancy	DE - 2004	6.9	Internal cash costs for retailers (incl. payment time)

Sources: Capgemini (2008), Nattmann (2009), PaySys Consultancy (2006) and own calculations.

4.6 Payments-related costs of the Bundesbank

The estimates of the costs of the payments banks are based on the demand approach. This approach has been chosen because there are hardly any data on payments-related costs. However, in case of the Bundesbank a rough estimate based on published data is possible. Therefore, it is not necessary to analyse payments-related revenues of the Bundesbank.[27]

Table 11: Total expenses of the Deutsche Bundesbank in 2011 (€ million)

Staff costs	615
Other administrative expenses	306
Depreciation on tangible and intangible fixed assets	107
Banknote printing	71
Other expenses	209
Total expenses	1.308

Source: Deutsche Bundesbank (2011).

Total costs incurred by the Bundesbank in 2011 amounted to about €1.3 billion (see Table 11). When looking at the breakdown of costs, "banknote printing" is the only category that can be directly counted as costs of cash payments. For all other categories, costs are allocated to payments on the basis of the share of employees in the payments and cash departments.

Overall, the Bundesbank's payment-related costs amount to an estimated €403 million. When interpreting this figure it has to be taken into account that a significant share of the banknotes issued by the Bundesbank are circulating abroad (within the euro area and in non-euro-area countries). In fact, the share of cash that is used for transactions within Germany is much smaller than the stock of cash that has been issued. According to recent estimates, in 2010 only about €110 billion was held in Germany. Of this amount, about €73 billion was held as transaction balances (see Bartzsch et al., 2011a, b). This is equal to 20% of the entire stock of banknotes that has been issued by the Bundesbank. However, transactions balances are likely to account for a much larger share of the Bundesbank's cash-related costs, since banknotes used for payments within Germany are likely to

[27] Since issuing cash is not a business that is subject to competition, the demand-based approach is likewise not applicable. The Eurosystem, represented in Germany by the Deutsche Bundesbank, is a monopolist in issuing cash. Therefore, revenues are unlikely to be closely linked to costs.

return much more often to the Bundesbank, causing cash handling costs.[28] Nevertheless, overall, the estimate of €375 million of cash costs of the Bundesbank can be interpreted as an upper bound.

Table 12: Expenses of the Deutsche Bundesbank related to cash and cashless payments in 2011

	€ million
Estimated costs of cash	375
Estimated costs of non-cash payments	28
Total	403
in % of GDP	0.02%

Source: Deutsche Bundesbank (2011) and own calculations.

At least some of the Bundesbank's payments costs are covered by payments-related revenues. Fees that the banks have to pay for Bundesbank services are already indirectly included in our estimate of banks' payments costs. If banks pass these costs on to their customers, they are contained in banks' revenues.

In addition to revenues based on fees, the Bundesbank also has seigniorage income based on the ability to issue non-interest bearing banknotes. For cash users, seigniorage constitutes opportunity costs. Again, as far as banks are concerned, costs are likely to be passed on to customers. Thus, they are included in banks' revenues.

More important is seigniorage income based on cash holdings of non-banks. This income covers the Bundesbank's remaining payments-related costs plus all other costs. Moreover, it provides the basis for the profits earned by the Bundesbank in most years. Thus, these payments-related revenues are not closely linked to payments-related costs.

Overall, payments-related costs of the Bundesbank amount to € 403 million. This is equal to 0.02% of GDP. Of these costs, a maximum of € 254 million is already contained in the costs of the payments banks.

6. Summary, conclusions

Great uncertainty is attached to estimates of the costs associated with the payment system. Due to the many unique aspects of the different countries, we would especially warn against attempts to apply the findings for one country to another without making adjustments. This study does not alter

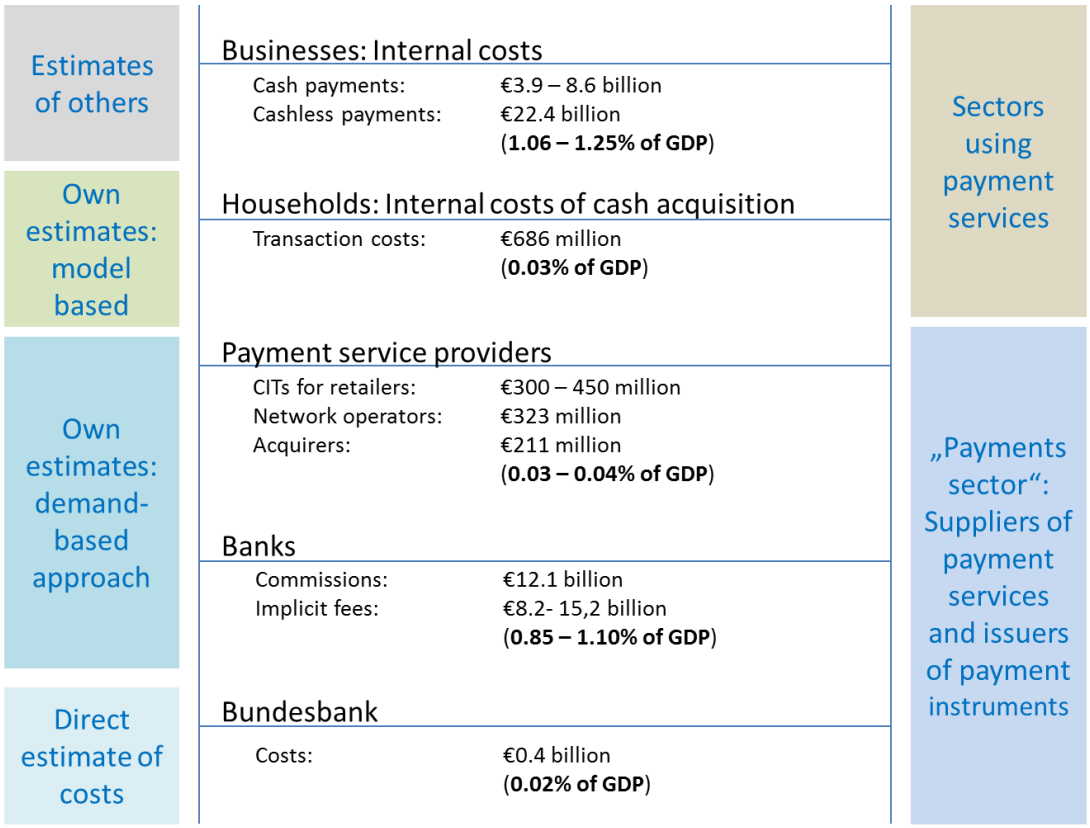
[28] It has also to be taken into account that the hoarding of cash (or use of cash abroad) is closely linked to the use of cash as a medium of exchange. After all, it is not conceivable that cash should be used to a substantial degree as a means of hoarding if it could not be used as a means of payment, as well. In this respect, the time horizon becomes important. Sooner or later hoards will be used for payments – thus becoming, once again, transaction balances.

this either. However, there are some areas which are more readily suited to estimates and other areas which can only be determined with a marked absence of precision. The latter include the internal costs incurred by households and businesses.

Figure 19 briefly summarises our estimates. It is easier to make estimates in situations where payment services are offered on the market. The commercial banks are important suppliers of payment services. Depending on whether the current extremely low rates of interest are taken as a basis or the rates are smoothed over an interest rate cycle, the payment services provided by banks are quantified at between €20 and €27 billion (0.78 – 1.05% of GDP). This value is to be regarded as more of a lower limit because payment transactions presumably provide further revenue in the form of preferential loan and deposit terms.

The other suppliers play a much less significant role. This is due in part to the fact that they operate as service providers for the banks, and the banks bill the customers for the costs that the former incur. An estimate of the direct revenue achieved with non-banks by service providers in cash and card payments produced volumes of under €1 billion.

Figure 19: Summary of results



Sources: See Chapter 4.

Factoring in findings from external estimates of the internal costs of businesses, we can put the macroeconomic significance of cash and cashless payment media at a figure of at least 2-2.5% of GDP

all in all. However, it is important to tread with caution when interpreting estimates of the internal expenses incurred by businesses and private individuals.

Finally, one should observe that cost estimates also ignore a number of quality-related factors, such as the role of cash in monetary policy, questions of data protection or the importance of different payment media in crisis phases (see the end of Chapter 3).

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