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**Research Report**

## The social and private costs of retail payment instruments: a European perspective

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EUROPEAN CENTRAL BANK

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## OCCASIONAL PAPER SERIES

NO 137 / SEPTEMBER 2012

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and Wiebe Ruttenberg<sup>3</sup>

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## ABSTRACT

The European Central Bank (ECB) carried out a study of the social and private costs of different payment instruments with the participation of 13 national central banks in the European System of Central Banks (ESCB). It shows that the costs to society of providing retail payment services are substantial. On average, they amount to almost 1% of GDP for the sample of participating EU countries. Half of the social costs are incurred by banks and infrastructures, while the other half of all costs are incurred by retailers. The social costs of cash payments represent nearly half of the total social costs, while cash payments have on average the lowest costs per transaction, followed closely by debit card payments. However, in some countries, cash does not always yield the lowest unit costs. Despite countries' own market characteristics, the European market for retail payments can be grouped into five distinct payment clusters with respect to the social costs of payment instruments, market development, and payment behaviour. The results from the present study may trigger a constructive debate about which policy measures and payment instruments are suitable for improving social welfare and realising potential cost savings along the transaction value chain.

**Keywords:** Social costs, private costs, efficiency, payment instruments

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## EXECUTIVE SUMMARY

The objective of this study is to enhance the general understanding of the social and private costs of different retail payment instruments from a European perspective, with the aim of helping policy-makers, banks and retailers promote efficient payments. The study was carried out by the ECB with the participation of 13 national central banks of the ESCB.<sup>1</sup>

The existing literature is limited. In the past, some central banks have carried out their own national-level cost studies.<sup>2</sup> At present, however, there is no comprehensive analysis or empirical evidence at the European level.

The present study applies the concept of the private and social costs associated with payment transactions. Private costs refer to all the costs incurred by the relevant individual parties in the payment chain. Social costs are the costs to society, reflecting the use of resources in the production of payment services; that is, the total cost of production excluding payments, e.g. fees, tariffs, etc., made to other participants in the payment chain. In this sense, social costs measure the sum of the pure costs of producing payment instruments incurred by the different stakeholders in the payments market. The payments considered in the study are cash, cheque, debit and credit card, direct debit and credit transfer payments up to €50,000, which account for at least 5% of all payments in terms of volume in each country. Furthermore, this study explores the costs of central banks, banks and infrastructures, cash-in-transit companies and retailers; however, the costs incurred by consumers and households are not considered.

The key results of the study can be summarised as follows:

1. The social costs of retail payment instruments are substantial and amount to €45 billion, i.e. 0.96% of GDP for the sample of 13 participating EU countries. When the sample results from the participating

countries are extrapolated to 27 EU Member States, the social costs of retail payment instruments are comparable to those of the sample countries, being close to 1% of GDP or €130 billion. These results are robust against the estimation method used.

2. Half of the social costs are incurred by banks and infrastructures, while 46% of all social costs are incurred by retailers. The social costs related to central banks and cash-in-transit companies account for 3% and 1% respectively.
3. Retailers incur higher private costs than do banks or infrastructures, as they face higher external costs to be paid to other payment chain participants.
4. Due to the relatively high usage of cash, the social costs of cash are nearly half of the total social costs.
5. On average, cash payments show the lowest social costs per transaction, followed closely by debit card payments.
6. In some countries, cash does not always yield the lowest unit social costs. In fact, in more than one-third of the sample countries, debit card transactions have lower unit costs than cash transactions.
7. Economies of scale seem to be present in the provision of retail payment services for almost all payment instruments.

1 The following 13 central banks have been actively participating in the study: *Danmarks Nationalbank, Eesti Pank, Central Bank of Ireland, Bank of Greece, Banco de España, Banca d'Italia, Latvijas Banka, Magyar Nemzeti Bank, De Nederlandsche Bank, Banco de Portugal, Banca Națională a României, Suomen Pankki, and Sveriges Riksbank.*

2 Danmarks Nationalbank, Magyar Nemzeti Bank, Suomen Pankki and Sveriges Riksbank have published their national reports on the costs of retail payment instruments (respectively Danmarks Nationalbank, 2012; Turján et al., 2011; Nyandoto, 2011; and Segendorf and Jansson, 2012). Other participating central banks indicated their intention to also publish a report from their national perspective.



8. The retail payment industry is characterised by a relatively high proportion of indirect costs, in particular for non-cash payment instruments.
9. Recent data from Denmark and Hungary suggest that on average about 0.2% of GDP would need to be added to the social costs of retail payments if the costs for households and consumers were considered.<sup>3</sup>
10. Each of the countries participating in the cost study, like every EU27 Member State, has a unique retail payment market with its own market characteristics. In a cross-country comparison, however, some payment markets appear to be more similar or closer to each other than to other payment markets with respect to the social costs of payment instruments, market development, and payment behaviour. In fact, the European market for retail payments can be grouped into five payment clusters.

With these findings, the study intends to provide a sound basis and framework for further policy making and conclusions in relation to the execution and promotion of cost-efficient retail payments for society. The hope is that the results will trigger a fruitful and constructive debate about which policy measures and payment instruments are suitable for improving social welfare and realising potential cost savings along the transaction value chain.

<sup>3</sup> The social costs of payment instruments to households and consumers are beyond the scope of the current study

## I INTRODUCTION

Ensuring the smooth functioning of payment systems and preserving financial stability while promoting the efficiency of payment methods and systems, thus contributing to the optimal allocation of resources in the economy, are among central banks' primary responsibilities. Gaining a better understanding of how to make retail payment instruments cost efficient is of interest not only to central banks, but also to commercial banks, retailers, companies and the general public. To this end, the European Central Bank (ECB), in close cooperation with 13 National Central Banks in the European System of Central Banks (ESCB), conducted a study with a view to estimating and analysing the social and private costs of different retail payment instruments. The goal is to minimise the total social cost of making payments without sacrificing the availability or quality of the services. From this perspective, the social costs of payment instruments relate to the resource costs incurred by all stakeholders (i.e. consumers, retailers, companies, banks, interbank infrastructures, central banks and cash-in-transit companies) in the course of all activities along the payment transaction chain. However, the measurement of social and private costs is a very complex task, entailing certain difficulties and a significant number of assumptions and simplifications. This study uses a unique multi-country data set based on the information given in responses to different questionnaires for each individual stakeholder and for each retail payment instrument.

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. This study attempts to fill this void by providing a consistent and comprehensive cross-country analysis. It does not consider the differences in the benefits associated with different payment instruments. Instead, the study provides a one-year, one-off snapshot of the (total and average) social and private costs of different

payment instruments. This represents a first step towards a more dynamic approach to analysing the rapidly moving European payment market. In particular, the aim of this work is to analyse the true cost elements associated with different payment instruments that are incurred along the payment chain by the major stakeholders, taking a European perspective.

The present European study builds on the existing national studies in a number of ways. It supports and reconfirms previous findings. It also allows for international comparisons of social costs over time where previous national studies are available. It examines the social and private costs of payment instruments for a number of European countries for which relevant and reliable data was previously unavailable. It presents current information on the social and private costs of payment instruments that is easily comparable across the 13 countries participating in the study. After making some simplifying assumptions, the data from the present study allows for extrapolating the sample results to the level of the 27 EU Member States. Finally, the study identifies different payment clusters of the European retail payment market.

The remainder of this paper is structured as follows. Section 2 reviews the recent literature. Section 3 presents the scope and data collection. Section 4 introduces the methodology of the European study on the costs of retail payment instruments. Section 5 describes the sample representativeness and summarises data statistics. Section 6 presents the results on the social and private costs of retail payment instruments from different perspectives. The final section provides conclusions.

## 2 REVIEW OF RELATED LITERATURE

Empirical evidence on the social costs of retail payment instruments can be useful when considering the future of the retail payments industry and the optimal mix of payment instruments. Over recent years a number of research studies have tried to shed light on this debate: see Banco de Portugal (2007); Banque Nationale de Belgique (2005); Bergman et al. (2007); Brits and Winder (2005); Gresvik and Øwre (2003); Humphrey et al. (2003); Koivuniemi and Kempainen (2007); Takala and Viren (2008); and Valverde et al. (2008). These help to raise general awareness of the costs to different stakeholders of payment transactions.

Intuitively, it is clear that the total cost to society of making payments can be high. However, until recently not much hard empirical evidence in support of this intuition was available. In an early study, the costs of making payments were estimated to be as much as 3% of gross domestic product (GDP) (Humphrey et al., 2003). A number of recent studies by central banks have provided more detailed estimates, especially where European countries are concerned. In the Netherlands, the total cost of all point-of-sale (POS) payments was estimated to be 0.65% of GDP in 2002 (Brits and Winder, 2005), while an equivalent estimation in Belgium amounted to 0.74% of GDP in 2003 (Bank Nationale de Belgique, 2005). Banks' costs in connection with the production of payment services were estimated at 0.49% of GDP in Norway (Gresvik and Øwre, 2003) and 0.77% of GDP in Portugal (Banco de Portugal, 2007). These figures clearly show that the costs related to payment activities are not negligible.

The differences between these cost studies are to some extent explained by the difference in their scopes; that is, which instruments and stakeholders are included, and what is the most accurate costing methodology. This highlights the importance of adopting a common scope and methodology for the current study, thus enabling well-founded cost comparisons. At present, only

limited information and estimations exist as to the costs and benefits of payment instruments across Europe.

A reviewing of the existing literature shows that these studies typically consider central banks, banks and retailers as the major stakeholders involved in the payment transaction chain. In this context, the estimation or approximation of the costs to and payment preferences of consumers and households is relatively complex, which is why they are typically excluded from the studies. In principle, all of these parties incur internal and external costs and may receive revenue from the other parties. To avoid the double-counting of some cost elements, only the “true” production costs enter the model as the total of all internal costs. The focus of these studies is mainly on POS payment instruments, comprising cash, debit and credit cards and e-money.

Studies in the second group, for example the Norwegian and Portuguese studies, use the Activity-Based Costing (ABC) methodology – at least where the banks' costs are concerned. ABC allocates the cost of the activities along the payment chain to the different payment products and services within a bank. In addition to POS payment instruments, these studies also consider direct debit and credit transfers. As the ABC methodology proved to be a suitable concept for analysing relevant costs in payment systems, it also provides the basis for the present study.

### 3 SCOPE AND DATA COLLECTION

This section describes the data and measurement issues of the study. The crucial dimensions of the study comprise the selection of the payment instruments, the identification of relevant stakeholders and the data coverage.

#### 3.1 RETAIL PAYMENT INSTRUMENTS

The study estimates the costs of the most frequently used retail payment instruments in Europe. As a general rule, only those payment instruments with a national market share of more than 5% of non-cash transaction volumes are considered. Accordingly, cheque payments can be reported only for some countries, while e-purse payments are excluded across the board. The study defines retail payment transactions as non-critical payments of relatively low values, i.e. of less than €50,000.<sup>4</sup> For banks and infrastructures, the study covers retail payment transactions carried out either by individuals or by companies. For retailers, the analysis focuses on consumer-to-business payments.<sup>5</sup> Therefore, the payment instruments include those used for POS payments, i.e. cash, credit and debit cards, and, in some countries, cheques; they also include credit transfers and direct debits, which are used mainly for remote payments.

Credit transfers and direct debits are used by different business parties. Typically, the heavy users of credit transfers and direct debits are large corporates, while retailers use more POS payment instruments. The inclusion or exclusion of credit transfers and direct debits can, therefore, have an effect on the scope of the study and the data collection process. The retailer and company survey focuses on POS payments and, where appropriate, remote payments. The costs of processing credit transfers and direct debits

were collected from the operators, i.e. interbank infrastructure providers.

In addition to the costs associated with the relevant payment instruments, it was important to collect data on the volumes and values of cash and non-cash retail payments. Data on the volume and value of payments are usually readily available for payment instruments that are by definition electronic, for example debit and credit cards, and/or those that are electronically processed, for example cheques, credit transfers and direct debits. For these payment instruments, the study has used the definition and methodology of the ECB's Statistical Data Warehouse. However, only customer-to-business payments should be included, thus excluding interbank payments, for example.

It is, however, more difficult to ascertain the total value and volume of cash payments. Nevertheless, for the purpose of this study, a reliable estimate of the volumes and values of cash payments is of vital importance, since the results are sensitive to these figures. For this reason, Annex I provides an overview of alternative methods that were used by the participating central banks to estimate the extent of cash usage at the country level, and discusses their strengths and weaknesses. A more detailed discussion of the methods presented in the Annex I can be found also in Gresvik and Haare (2008), Jonker and Kosse (2009), and Jonker et al. (2012).

4 In the 2007 Portuguese study, €100,000 was used as the maximum limit. In any case, the number of transactions between €50,000 and €100,000 seems relatively small and will, therefore, not have a big impact on the findings.

5 The analysis focuses on consumer-to-business payments for the sake of simplicity. The underlying hypothesis is that the estimated costs would be similar to the costs of the whole retail world, also taking into account business-to-business payments.

## Box

## GLOSSARY OF TERMS RELATING TO RETAIL PAYMENT TRANSACTIONS

In line with the ECB glossary of terms related to payment, clearing and settlement systems, the study relies on the following definitions of payment instruments. It should be noted that these are the definitions of concepts used by market participants, and not legal definitions.

- **Card payments (credit and debit):** Card payments cover all payment transactions performed by means of a card with a debit, credit or delayed debit function. Debit cards enable cardholders to make cash withdrawals and/or have their purchases directly and immediately charged to their accounts, whether or not the account is held with the card issuer. A credit card enables the cardholder to make purchases and/or withdraw cash up to a prearranged ceiling. The credit granted may be settled in full by the end of a specified period, or may be settled in part with the balance taken as extended credit on which interest is usually charged. A card with a delayed debit function enables the holder to have his/her purchases charged to an account with the card issuer, up to an authorised limit. The balance of this account is then settled in full at the end of a specified period.

It is important to note that only payment-related costs are considered in this study. The costs of the credit-granting services of credit and delayed debit function cards are excluded. In other words, neither credit facility and associated costs, nor the costs of delayed debit functions are considered in the exercise. The distinguishing feature of a card with a delayed debit function, as compared with a card with a simple credit or debit function is the contractual agreement whereby the cardholder is granted a credit line but is obliged to settle the full amount of the debt incurred at the end of a specified period. In cases where credit cards and cards with a delayed debit function entail other credit-related costs, these costs are excluded.

- **Cash payments (banknotes and coins):** Cash payments refer to money transfers in the physical form of a currency, such as banknotes and coins. Where appropriate, in the bank and infrastructure survey, a distinction has been made between the volume and value of, and costs incurred from, automated teller machine (ATM) and over-the-counter (OTC) withdrawals and deposits.
- **Cheques payments:** A cheque is viewed as a written order from one party, i.e. the drawer, to another, i.e. the drawee – normally a credit institution is requiring the drawee to pay a specified sum on demand to the drawer or to a third party specified by the drawer.
- **Credit transfers:** Credit transfers allow the payer to instruct its account-holding institution to transfer funds to the beneficiary. Where appropriate, in the surveys, a distinction is made between the volume and value of, and costs incurred from, electronic self-service and OTC-initiated credit transfers.

**Direct debits:** Direct debits can be defined as a payment instrument for debiting a payer's account where a payment transaction has been initiated by the payee on the basis of an authorisation given by the payer. It should be noted that the cost structures might differ when using a creditor-based mandate flow or debtor's-bank-based mandate flow for its direct debit services.

Source: European Central Bank

Notes: In the strictest sense, a payment is a transfer of funds which discharges an obligation on the part of a payer vis-à-vis a payee. However, in a technical or statistical sense, it is often used as a synonym for "transfer order". A payment instrument is viewed as a tool or a set of procedures enabling the transfer of funds from the payer to the payee.





### 3.2 RELEVANT STAKEHOLDERS

Due to the considerable effort necessary to collect viable data on the costs incurred by all of the parties in the payment chain, the analysis focuses on the most important parties:

- issuing authorities, i.e. central banks and governments;
- banks<sup>6</sup> and interbank infrastructure providers (automated clearing houses, ATM networks, etc.)<sup>7</sup>;
- retailers and companies; and
- cash-in-transit companies.

Overall, four questionnaires have been developed: one for banks and interbank infrastructures; one for retailers covering both retailers and companies; one for central banks/issuing authorities; and one for cash-in-transit companies. The questionnaires are available from the authors upon special request. With regard to the survey of cash-in-transit companies, it is well understood that reporting separately on cash-in-transit companies was not relevant for all countries. In cases where the reporting central bank plays an active role in the operation of a retail payment system, the central bank in question was invited to report the data and information regarding non-cash payment instruments by completing the bank and infrastructure survey. Any costs for processing retail transactions via the TARGET2 system are reported by commercial banks using the banks' questionnaire.

The surveys concentrate exclusively on the economic sectors in which firms have a strong direct relationship with consumers. As a result, the analysis offers a good estimation of the costs of the POS and remote payment instruments, such as credit transfers and direct debits. In this context, the retailer and company surveys target "non-financial services" and exclude "manufacturing sectors" and other business-to-business activities. Following the International Standard Industrial Classification of All

Economic Activities (ISEC)<sup>8</sup>, the survey focuses on the areas of: retail trade, transport, telecommunications, accommodation, food, real estate activities and other services, as well as services related to public utilities, e.g. electricity, gas, steam and air conditioning supply, which are usually provided by a few large companies. Each participating central bank, taking into consideration its respective national specificities, defined its own sample of retailers.

Experience has shown that payment costs for consumers are difficult to estimate. Therefore, it has been decided not to include consumers in the study and, thus, not to conduct consumer surveys on the costs, benefits and perception of payments. However, for the purpose of estimating the volume and the value of cash transactions, some of the participating central banks carried out consumer surveys.

### 3.3 DATA COLLECTION AND SAMPLE COVERAGE

For data collection, the participating central banks, banks and infrastructures, cash-in-transit companies and retailers collected and provided quantitative and qualitative information on their costs and transaction volumes in respect of the payment instruments that they provide. Participation in the fact-finding exercise has been voluntary. However, for the results of the study to be comparable, it was essential that all participating entities follow and adopt a common methodology and reporting scheme to the highest possible extent. The study includes 13 European countries. It covers a representative share of the overall European retail payments market, thus allowing for valid cross-country comparisons.

Every attempt was made to ensure that, as far as possible, the samples cover retailers of

6 Banks should also indicate and specify potential fees and costs incurred when information and communication technology (ICT) services are being outsourced to other parties

7 This does not include, for example, ICT and other activities outsourced by individual banks

8 For further details see International Standard Industrial Classification of All Economic Activities at <http://unstats.un.org/unsd/cr/registry/isic-4.asp>

different sizes (i.e. small, medium and large<sup>9</sup>) and different industry sectors. For this, it was important that the population of retailers is rather heterogeneous. In general, large retailers tend to have a thorough knowledge of their current payment volumes and the costs associated with different payment instruments. Small and medium-sized enterprises (SMEs), on the other hand, often do not have accurate and up-to-date information available on these issues.

With regard to retailers, the criteria set out for the selection of the sample are crucial because the costs and benefits of accepting different payment methods could differ among the retailers, especially according to the following variables:

- size of merchant;
- industry sector;
- typical payment method and value of transaction; and
- set of payment instruments available to customers.

To ensure that the samples are representative of the European retail payments market as a whole, the bank and infrastructure survey aimed to cover a large relevant share of the market. The retailer and company survey was based on the pre-defined, broad and commonly used categories of the retail sectors. These industry sectors were grouped into the following three main categories, each one reflecting a typical purchasing pattern.

**1. Remote purchases:** Purchases of relatively high value where payment often takes place before the provision of the goods or services. This set of merchants, comprising airlines, hotels, travel agencies or operators, car rental firms and the like, seems particularly suitable for comparing the costs of accepting different payment methods in POS and card-not-present transactions, as the set consistently handles both.

This category also includes e-commerce without physical establishment, which allows for comparison with cases in which the set of payment instruments is electronic only.

**2. OTC purchases:** Frequent purchases of relatively low value, where payment usually coincides with the provision of the goods. This includes, among other merchants, supermarkets, grocery stores, clothing retailers, restaurants, bars, pubs, snack bars, nightclubs and petrol stations.

These merchants usually accept cash and card payments only.

**3. Other purchases:** Purchases of relatively high value where payment often takes place after the provision of specific goods or services or following a recurring pattern. Merchants include those offering professional services (dentists, architects, etc.), retailers of credence goods, jewellers and watch shops, and utilities.

These merchants accept cheques and bank transfers (credit transfers and direct debits), which may not be accepted by the merchants in the other categories.

The final decision regarding the composition of the samples of the cash-in-transit companies and of the retailers has been left to the discretion of the participating central banks.

The central banks<sup>10</sup> also ensured the appropriate number, quality, consistency and comparability of responses to the surveys by providing direct and ongoing assistance to participating retailers, cash-in-transit companies, and banks and interbank infrastructures. Furthermore, central

<sup>9</sup> For a more specific description of the retailer size classification, please refer to the Eurostat definitions at [http://epp.eurostat.ec.europa.eu/portal/page/portal/european\\_business/special\\_sbs\\_topics/small\\_medium\\_sized\\_enterprises\\_SMEs](http://epp.eurostat.ec.europa.eu/portal/page/portal/european_business/special_sbs_topics/small_medium_sized_enterprises_SMEs)

<sup>10</sup> Some central banks outsourced the data collection for retailers to an external research company, which was responsible for assuring the quality of the data. To see a list of these central banks, please refer to Table 2

banks carried out quality control procedures by testing for consistency, validity and dispersion.

With regard to cash-in-transit companies, the reporting of the requested data has been very sensitive, in some cases due to the competitive positions and particularities in some countries. In cases where the competitive environment did not allow for a separate reporting, it is possible to include aggregated figures for cash-in-transit companies as a cost item in the bank and infrastructure questionnaire.

The relevant data was collected by the respective central banks with 2009 as the reference year. All cost items were reported in local currency.

The data was reported to the ECB at an aggregate national level only, and not at the level of individual reporting institutions. The participating central banks were requested to aggregate and extrapolate the results of the surveys and provide a clear and consistent presentation of the main findings in their national contexts. They were asked to return to the ECB the four questionnaires completed at an aggregate national level, representing the feedback from their respective countries.

In order to achieve consistent cost figures and results across different retail payment instruments and countries, the study must be based on a commonly defined methodology. The common methodology needs to be built on two elements. The first is the distinction between social and private costs. The second is the choice of the most suitable costing and accounting method. Both components are presented below.

The study applies the concept of the social and private costs associated with payment transactions. Private costs refer to all the costs incurred by the relevant individual parties in the payment chain.

Since payment services are produced along a supply chain, the calculation of the social costs needs to take into account the fact that one party's revenue is another party's cost. Without a correction for this, the sum of the private costs of all participants in the chain would lead to an overestimation of the true social costs. Therefore, the social costs are the costs to society, reflecting the use of resources in the production of payment services; that is, the total cost of production excluding payments made to other participants in the payment chain, e.g. fees, tariffs, etc.

It is important to clarify that costs are only one side of the coin. In principle, the benefits of payment instruments should also be taken into account. Although aspects such as convenience and safety determine, to an important extent, the

Legend:

- seigniorage flow
- cost-sharing flows within the infrastructure
- revenue from customer tariffs
- costs for customer rebate

Diagram illustrating the flow of funds in a payment system:

- Corporate customers** send payments to **Issuers, e.g. Central banks** (seigniorage flow).
- Issuers, e.g. Central banks** send payments to **Interbank infrastructures, CTIs** (seigniorage flow).
- Interbank infrastructures, CTIs** send payments to **Banks Card companies** (seigniorage flow).
- Common interface services** send payments to **Banks Card companies** (seigniorage flow).
- Corporate customers** send payments to **Banks Card companies** (seigniorage flow).
- Corporate customers** send payments to **Retailers** (seigniorage flow).
- Retailers** send payments to **Banks Card companies** (seigniorage flow).
- Consumers** send payments to **Banks Card companies** (seigniorage flow).
- Consumers** send payments to **Issuers, e.g. Central banks** (seigniorage flow).
- Consumers** send payments to **Interbank infrastructures, CTIs** (seigniorage flow).
- Consumers** send payments to **Common interface services** (seigniorage flow).
- Consumers** send payments to **Retailers** (seigniorage flow).
- Cost-sharing flows within the infrastructure** (red arrows) connect **Issuers, e.g. Central banks** to **Banks Card companies** and **Interbank infrastructures, CTIs** to **Banks Card companies**.
- Revenue from customer tariffs** (light blue arrows) flow from **Corporate customers** and **Consumers** to **Banks Card companies**.
- Costs for customer rebate** (medium blue arrows) flow from **Banks Card companies** to **Corporate customers** and **Consumers**.

Source: European System of Central Banks.

choice of payment instruments, they are hard to quantify. For this reason, this study follows a cost-based approach and does not take into account the social benefits associated with the use of different payment instruments. Building on previous studies by central banks, as mentioned above, Chart 1 provides an overview of the parties involved in the payment chain, and their respective costs and payment transfers.

Chart 1 depicts the participants in the payment service chain. Banks (and card companies) receive revenue in the form of tariffs paid by consumers, corporate customers and retailers. The cost of running a payment network is shared between the issuers of the payment services, the interbank infrastructure providers and the banks and card companies. In general, costs faced by payment service issuers are passed on to interbank infrastructure providers, which in turn pass the costs on to the banks and card companies. As shown in the figure, costs can also flow from issuers directly to banks and card companies. Finally, in order to encourage a payment facility, consumers may be offered rebates as an incentive to participate in the payment chain.

In Chart 1, each participant has its own internal costs, but the charges among the participants, i.e. external costs, affect the private costs incurred by each of them. The total social cost of producing payment services is the sum of the

internal costs of all participants, excluding any payments made among the participants.

The proposed study uses the concept of social costs and relies on the following definitions:

- External costs = payments (fees, tariffs, etc.) made to other participants in the payment chain for services rendered.
- Internal costs = resources used by the participant itself, including services bought from other service providers in the payment chain that are not considered separately, e.g. leased terminals or software. Internal costs are equal to private costs minus external costs.
- Private costs = costs incurred by the relevant individual participants in the payment chain. Private costs are equal to the sum of the internal and external costs.
- Social costs = the sum of all internal costs incurred by the relevant participants in the payment chain in order to carry out POS and remote payment transactions.

Table 1 contains calculations of the private costs of each participant, as well as the social costs. It shows that the social costs are the sum of all internal costs incurred by the relevant participants in the payment chain.

Table 1 Calculating private and social costs of retail payment instruments per stakeholder

Participants	Private costs
Banks	$C^{b,int} + C^{b,ext} = C^{b,int} + P_{b \rightarrow ii} + P_{b \rightarrow r} + P_{b \rightarrow infra} + P_{b \rightarrow gp}$
General public <sup>1)</sup>	$C^{gp,int} + C^{gp,ext} = C^{gp,int} + P_{gp \rightarrow ii} + P_{gp \rightarrow b} + P_{gp \rightarrow r} + P_{gp \rightarrow infra}$
Issuing institutions	$C^{ii,int} + C^{ii,ext}$
Retailers	$C^{r,int} + C^{r,ext} = C^{r,int} + P_{r \rightarrow ii} + P_{r \rightarrow b} + P_{r \rightarrow infra}$
Interbank infrastructures	$C^{infra,int} + C^{infra,ext}$
Social costs	$C^{ii,int} + C^{b,int} + C^{r,int} + C^{infra,int} + C^{gp,int}$

Source: European System of Central Banks.

Notes: C = external (ext) and internal (int) costs; P = payment transfers from one party to another; b, gp, ii, r and infra = the relevant participants, i.e. banks, general public, issuing institutions, retailers and interbank infrastructures, respectively.

The general public, i.e. consumers and households, is not part of the present study and its costs are not considered in the private and social cost calculations; that is, all costs and payment transfers to and from the general public (gp) are excluded from all further private and social costs calculations. However, some indicative results on the social costs of households from recent country data analysis are summarized in Section 6.6.



## 4.2 DIRECT AND INDIRECT COSTS AND ALLOCATION KEYS

In addition to the distinction between private and social costs, an analysis of costs typically depends on the underlying costing systems used by the individual market participants. Common to all methods of costing is the assumption that the production of a product, i.e. payment services, consumes resources and therefore implies costs. These costs are then either direct or indirect.

Direct costs are those that arise from a direct and exclusive use of resources to make payment products and services available. In other words, direct costs are the costs “directly related” to the activities carried out for each payment instrument, and which can be imputed in a straightforward way (e.g. costs associated with fees and commissions and with staff directly involved in each activity and with each payment instrument).

Indirect costs are those that arise from a non-exclusive use of resources to make payment products and services available. Indirect costs are the costs associated with the local overhead<sup>11</sup> and support functions<sup>12</sup> that are necessary to carry out the activities involved with each payment instrument, and should be imputed using specific allocation keys (e.g. costs associated with rentals, maintenance and depreciation, and other corporate support services).

Direct cost allocation is unproblematic, as these costs can be directly observed and assigned to a certain activity in the production chain. However, this is not the case for indirect costs. Usually, payment systems share several cost items with other banking and support services.<sup>13</sup> Allocation keys are needed to divide the indirect costs between payment and other services, and among the different payment services themselves. Banks rarely have internal costing systems that developed enough for data on the costs of different payment instruments to be

available, and even the total cost of producing payment services is generally not extracted into a separate cost or profit centre. For this reason, this study applies a methodology for allocating the indirect costs. In the end, the cost allocations were made at the national level, but it seemed appropriate to ensure a general framework and as many common elements as possible.

The ABC method has been developed to facilitate well-defined cost allocation among different product lines. This method was used in Gresvik and Haare (2009) and Banco de Portugal (2007) to estimate the costs to banks, but not the costs to retailers. The use of this method requires the basic activities and cost drivers to be defined and assigned among the payment services. If this is done properly, ABC can result in coherent figures.

Indirect costs could also be allocated on the basis of more general and higher level allocation keys, for example simple volumes or roughly

11 Costs that are direct at the level of the organisational entity that is responsible for executing the concerned activities/delivering the concerned service or product, but which cannot directly be allocated to them in an economically feasible way (e.g. division head and the secretariat function or other support functions (e.g. conceptual work) within the respective organisational entity)

12 Support functions are all functions that refer to financial accounting and reporting, information and communication technology (ICT), secretariat services to decision-making bodies, communication, event and meeting services, language services & lawyer-linguist services, planning and controlling, and organisation, internal auditing, internal institutional, legal, tax and administrative issues, human resources management and social affairs, and internal services

13 For example, banks' computer centres are shared by different applications and the applications available to customers serve both deposit and payment functions. The branch personnel serve all customers and initiate all transactions at the same premises using the same terminal facilities. The bank cards and underlying applications for registering cards and customers serve card usage at both POS and Automated Teller Machines (ATMs). Banks' e-banking services provide interfaces for all kinds of banking services, including remote payment services. The interbank payment network and clearing services provide common payment services to all or some part of the interbank infrastructure, depending on the national or local payment structures. Domestic and international payments are still often routed via different applications and networks, although they do also share some common facilities. Banks' general management, administration, general facilities and overhead marketing, legal, etc. functions serve all kinds of product lines within the banks and other service providers.

estimated shares of the costs.<sup>14</sup> One important decision to be made regarding cost allocation is whether to follow the full or partial cost coverage approach. To compare the cost efficiency of the different payment instruments, data on costs need to be collected to the extent that the costs differ among the instruments. To analyse the total cost of making payments and the extent to which the revenue from payments covers the cost of making them, full cost coverage is necessary, requiring the allocation of all indirect and overhead costs of the service providers.

Given that the production of payment services involves support functions to a large extent, a distinction between direct and indirect costs is particularly suitable for dealing with this type of services. Following this approach, we first identified the main activities involved in making payment products and services available. The selection of the cost tasks was built upon previous well-established national cost studies. We then allocated costs to these activities depending on whether they are direct or indirect.

The total operating costs for the reference year (i.e. 2009) served as the starting point. These total operating costs were broken down by cost item (staff, specialist services, commissions, depreciations, etc.) and by departmental cost centre (IT department, marketing department, accounting department, cards department, etc.). Accordingly, the surveyed sample banks were invited to follow three steps to collect the relevant data and information.

In the first step, the sample banks were asked to examine all of these cost items and departmental cost centres in detail to identify:

- the relevant shares of the costs which are linked to the performance of the activities directly related to each payment instrument – these were taken as the direct costs for each specific payment instrument;
- the relevant shares of the costs which are linked to the development of the support

functions necessary for making payment products or services available – these were considered as indirect costs (examples include costs associated with human resources management, logistics, buildings and asset management, overall management and training); and

- the relevant shares not related to the provision of payment instruments – this remaining share of the costs is necessary in order to check if the sum of the direct and indirect costs is equal to the total operating costs of the participating bank or infrastructure.

In this way, the sample banks were able to report direct costs by payment instrument and by activity, and the overall indirect costs. Since the direct costs were already divided by payment instrument and by activity, it was necessary to allocate the indirect costs to the different payment instruments and to the respective activities.

In the second step, the banks were asked to use allocation keys to impute the total indirect costs to the different payment instruments and to the respective activities. In principle, they were allowed to use the allocation keys that are best suited to their situations. The following best practices proved to be helpful.

- For costs associated with human resources management and other corporate support services, the sample banks could apply the time used by employees to carry out their tasks or headcount.
- For costs associated with IT and communications or with the maintenance and depreciation of machines, banks could apply the number of machine-hours used for

<sup>14</sup> For example, for branch costs, it could be estimated that 20% belongs to payment services in general and, of this, half is distributed among payment services based on the volume of over-the-counter (OTC) cash withdrawals and OTC credit transfers, and the other half is distributed evenly between card payments, electronic credit transfers and direct debits, based on the general marketing and support services provided by the branch personnel

each activity or the number of each type of transaction carried out.

- For costs associated with rentals and depreciations, banks could apply the area occupied by each service or department.

It was suggested that the banks carry out small in-branch surveys in order to measure, for example, the time employees dedicate to each activity (or even to each payment instrument) and the number of machine-hours used for each activity.

In the third step, the banks asked to calculate the total costs of each payment instrument by summing the costs (direct and imputed indirect costs) of all activities necessary to make that instrument available.

With regard to the use of common allocation keys for imputing indirect costs to the different payment instruments and to the respective activities, it is well understood that the application of the aforementioned criteria by the banks might have generated different keys, i.e. percentages. These allocation keys might vary not only according to the production structure of the banks (e.g. more outsourcing vs. more internal staff), but also according to the nature of banks (e.g. savings vs. commercial banks).

Naturally, and as a realistic reflection of common market practice, banks could not be obliged to use the same allocation keys, given that all banks across countries and within the countries themselves do not have the same production structure. Therefore, it should be kept in mind that the choice and use of common allocation keys could influence unit and average costs.

The questionnaires for retailers followed a simplified resource-based approach, taking into account that these stakeholders may not have been able to split their costs into direct and indirect costs. Therefore, the retailer and company questionnaire adopted broader and more general measurements and estimations of the cost of each payment task and instrument.

## 5 SIGNIFICANCE OF SAMPLE AND DESCRIPTIVE STATISTICS

The ECB study has been conducted with the participation of 13 ESCB national central banks. The following central banks actively participated in the study: *Danmarks Nationalbank, Eesti Pank, Central Bank of Ireland, Bank of Greece, Banco de España, Banca d'Italia, Latvijas Banka, Magyar Nemzeti Bank, De Nederlandsche Bank, Banco de Portugal, Banca Națională a României, Suomen Pankki, and Sveriges Riksbank.*

Overall participation in the study and willingness to provide the necessary data and information have been fairly good and representative. In addition to this European report, the participating central banks were invited to publish their respective national reports as soon as these were finalised. At the time of writing, Danmarks Nationalbank and Magyar Nemzeti Bank had already completed the whole exercise and published their respective national reports – Danmarks Nationalbank (2012) and Turján et al. (2011). Suomen Pankki has published a national study on the cost of payment instruments from the

bank and infrastructure perspective – Nyandoto (2011). Sveriges Riksbank has published a national study on the cost of payments from a consumer perspective – Segendorf and Jansson (2012). Other participating central banks have also indicated their intention to publish their respective national studies.

When collecting and analysing the data, several robustness checks and quality controls were performed in a two-step procedure to ensure the consistency and accuracy of the data used in the study. In a first step, different robustness tests were conducted by the participating central banks. In a second step, the ECB undertook an intensive quality control and robustness check on an individual country and on a cross-country level. The country level checks were conducted by comparing the cost study data provided by the national central banks with the data provided to the Statistical Data Warehouse (SDW) of the ECB. Furthermore, all country-level data and results were also compared with the results from previous studies on the cost of payment instruments, where available. Moreover, all individual country data have been checked across countries. In cases where there were

**Table 2 Overview and representativeness of the data**

Country	Central bank	Banks and Infrastructures		Cash-in-transit companies <sup>1)</sup>		Retailers	
	Coverage market share (%)	Sample size	Coverage market share <sup>2)</sup> (%)	Sample size	Coverage market share (%)	Sample size	Survey conducted by
Denmark	100	9	≥70	2	100	231	Central Bank
Estonia	100	4	33	1	99	17	Central Bank
Finland	100	8	93-98	2	100	40	Central Bank
Greece	NR	4	37-78	1	8	6	Central Bank
Hungary	100	10-14 <sup>^</sup>	61-97	3	100	349 <sup>4)</sup>	External research firm
Ireland	NR	6	98-99	NR	NR	51	Various sources
Italy	NR	10	63	In B&I	NA	376	Various sources
Latvia	100	5+	80	In B&I	NA	29	Central Bank
Netherlands	NR	3	90	In B&I	NA	1,008	External research firm
Portugal	NR	8	80	In B&I	NA	206	Central Bank
Romania	100	31	90	In B&I	NA	1,038	External research firm
Spain	NR	12	60 <sup>3)</sup>	In B&I	NA	183	Central Bank
Sweden	100	5	80-95	4	100	11	Central Bank

Source: European System of Central Banks.

Notes: 1) Denotes that if the CIT company questionnaire is not submitted separately due to the competitive situation in some countries, the data for CIT companies are included in the Banks and Infrastructures (B&I) data. 2) Stands for data based on percentage of total volume of retail payments. 3) Stands for data based on percentage of total assets. <sup>^</sup> represents that not all banks offer all payment instruments. 4) Denotes that the study has been conducted in two rounds. + this figure represents only banks, data on the three major infrastructures in the country was also considered for this report. "NA" signifies that the sample description data was not available, and thus not provided by the relevant central bank. "NR" stands for data which was available but not reported.

unjustified discrepancies or inconsistencies, data were reviewed, clarified and corrected in close bilateral cooperation with the participating central banks.

Overall, each participating central bank was asked to report the necessary and relevant data on the basis of the commonly developed methodology using the different questionnaires for each stakeholder. Table 2 provides a summary of the country-specific replies to the central bank, bank and infrastructure, cash-in-transit companies and retailers questionnaires. As depicted in Table 2, the participation in the exercise and the market coverage of the participants in the payment chain demonstrates the keen interest in and support of the study by the various stakeholders. In particular, some countries reported full participation by banks and infrastructures and cash-in-transit companies. Substantial efforts have also been undertaken to ensure a relatively fair representation of retailers. With regard to central banks, it should be noted that costs related to euro banknotes are excluded from the study on the social costs of retail payment instruments. Cash data based on a common banknote cost methodology might be gathered at a later stage. However, some euro area and non-euro area central banks decided to share central bank-related costs for the purpose of this study based on the identified methodology.

Demonstrating the representativeness of the study, Table 3 compares the volumes and values of cash and non-cash payment instruments of the sample countries with those of all 27 Member States. Using data from 13 European countries, the study represents about 40% of the European retail payments market in terms of volumes. Moreover, it has a market share for cash payments of 46% and about 30% of non-cash payments, all expressed in volumes. The sample seems to be slightly biased towards more cash-using countries, as within the sample of the study more than two-thirds of all payments are made in cash. This is slightly higher than the EU27 average of 60%.

Comparing the data per country and per payment instrument obtained from the cost study with the data available in the SDW, the data used in the study provides a sound basis and a relatively good fit compared with the data from the SDW. Although not quoted here, for example, the average number of retail payments per capita in the sample is 416, which closely matches the average of 444 payments per capita from the SDW. When considering the value of retail payments as a percentage of GDP, the cost study data also matches the data from the SDW to a large extent. The only exceptions are the figures for cheques and credit transfers, which are somewhat higher in the SDW. This is mainly due to the fact that these payments are often business-to-business payments and/or exceed the study's threshold of €50,000. A similar picture emerges when considering the average transaction value per payment instrument. Within the sample of participants, the relatively high figures of the value of credit transfers as a percentage of GDP in some countries (Estonia, Finland, Hungary and Latvia) can be explained by the fact that these countries process a relatively high number of payments within the applied threshold of €50,000. This is also mirrored by the data on average transaction values.<sup>15</sup>

Table 4 shows the number of transactions per payment instrument for each of the participating countries as a percentage of the total market. In general, the usage of retail payment instruments differs quite substantially across countries. For example, a country's proportion of cash usage can range from a relatively low 27% (Sweden) up to 95% (Greece and Romania). It is also interesting to see that the usage and adoption of card payments is very asymmetric across European countries, with a maximum of 44% (Denmark) and a minimum of 1.5% (Romania). On average, cash is still the most frequently used retail payment instrument:

<sup>15</sup> Further information on the comparison of the sample data versus SDW data can be obtained from the authors upon special request



Table 3 Cash and non-cash payment instruments of sample countries and EU27 Member States

Country	All payments		Non-cash payments <sup>1)</sup>		Cash payments			
	Volume Percentage of EU27	Value Percentage of EU27	Volume Percentage of EU27	Value Percentage of EU27	Volume Percentage of EU27	Value Percentage of EU27	Volume Percentage of all payments in each country	Value Percentage of all payments in each country
Denmark	1.03	0.32	1.78	0.32	0.61	0.57	37.39	2.26
Estonia	0.22	0.06	0.33	0.06	0.15	0.10	44.16	2.19
Finland	1.25	1.86	2.13	1.87	0.76	1.02	36.06	0.70
Greece	2.39	0.54	0.22	0.50	3.63	3.71	96.61	8.77
Hungary	1.46	0.77	1.02	0.77	1.71	1.00	72.79	1.64
Ireland	1.03	0.39	0.84	0.38	1.13	1.31	69.07	4.24
Italy	12.89	4.28	4.79	4.10	17.51	18.13	86.27	5.40
Latvia	0.32	0.15	0.26	0.15	0.36	0.19	67.74	1.57
Netherlands	3.55	2.55	6.07	2.55	2.12	2.53	36.95	1.26
Portugal	1.71	0.79	1.95	0.78	1.58	1.09	57.91	1.77
Romania	2.59	0.53	0.35	0.52	3.87	1.59	93.39	3.82
Spain	9.62	5.55	6.72	5.47	11.27	11.77	74.24	2.70
Sweden	2.05	0.53	3.44	0.51	1.26	1.47	38.29	3.56
<b>Cost study participants</b>	<b>40.12</b>	<b>18.32</b>	<b>29.89</b>	<b>17.99</b>	<b>45.95</b>	<b>44.49</b>	<b>68.83</b>	<b>3.70</b>
Austria	2.26	1.02	2.68	0.99	2.02	2.77	52.52	3.48
Belgium	2.23	1.81	2.77	1.81	1.92	2.04	54.42	1.43
Bulgaria	0.86	0.06	0.08	0.05	1.31	0.44	94.61	9.87
Cyprus	0.17	0.18	0.10	0.18	0.21	0.22	77.35	1.53
Czech Republic <sup>2)</sup>	1.64	0.93	1.01	0.92	2.00	1.39	76.89	1.91
France	13.02	10.64	19.87	10.65	9.11	9.81	44.15	1.17
Germany	19.54	28.55	20.06	28.61	19.25	23.39	60.79	1.04
Lithuania	0.50	0.12	0.26	0.12	0.64	0.41	80.23	4.23
Luxembourg	0.34	0.42	0.66	0.43	0.16	0.21	29.06	0.63
Malta	0.07	0.07	0.04	0.07	0.09	0.08	82.30	1.51
Poland	5.13	2.72	2.47	2.72	6.64	3.36	79.93	1.57
Slovakia	0.80	0.51	0.50	0.50	0.97	0.60	75.91	1.52
Slovenia	0.39	0.11	0.39	0.10	0.40	0.36	64.18	4.33
UK	12.92	34.54	19.23	34.85	9.33	10.43	45.28	0.39
<b>EU27</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>59.72</b>	<b>2.16</b>

Source: ECB Statistical Data Warehouse.

Notes: 1) Non-cash payments include cheques, payment cards, direct debits and credit transfers; 2) denotes that SDW data for cards is for 2010, since SDW data for 2009 is incomplete.

POS cash payments are estimated following Sisak (2011) using:  $Total\ POS\ consumption = Cash\ POS\ consumption + non-cash\ POS\ consumption$ . Consequently,  $Cash\ POS\ consumption = Total\ POS\ consumption - non-cash\ POS\ consumption$ . Data for total POS consumption has been taken from the National Accounts data from Eurostat, excluding types of consumption where payment is typically delayed, i.e. housing, health, education, financial goods and services, and miscellaneous. Non-cash POS consumption has been approximated by taking card payments data from SDW, while cheque payments are excluded due to their declining importance. Volume of cash payments has been estimated following two different approaches. The first approach uses the average value of a cash transaction obtained from the cost study, which is €18. Dividing the value of cash payments by the average cash transaction yields the cash volume. The second method uses the average number of payments per capita in 2009, namely 416, which is based on cash data from the cost study and non-cash payment instruments data from SDW. Thereby,  $Cash\ payments\ per\ capita = 416 - Non-cash\ payments\ per\ capita$ . The cash volume is then calculated by multiplying cash payments per capita by population. Finally, the average from the two approaches entered the estimation.

69% of the transactions across the sample countries and 65% of all transactions in the EU27 in 2009 were made in cash. The usage of cheque payments is either marginal or even non-existent in most of the sample countries. Some other payment instruments may be important in some national communities, but do

not represent a substantial share from a cross-country or European perspective.

Overall, the sample data provided for the study fairly represents the European retail payments market. On average, cash turns out to be the most frequently used retail

Table 4 Market share of retail payment instruments per country in terms of volume

(percentages)									
Country	Cash <sup>1)</sup>	Cheques	Cards	Debit cards	Credit cards	Direct debits	Credit transfers	Other <sup>2)</sup>	Overall
Denmark	34.85	0.43	44.03	41.16	2.87	7.90	12.79	0.00	100.00
Estonia	48.88	0.00	29.29	26.06	3.23	3.52	18.31	0.00	100.00
Finland	38.82	0.02	31.30	29.07	2.23	2.92	26.88	0.05	100.00
Greece	94.99	0.70	2.28	0.26	2.02	0.39	1.51	0.13	100.00
Hungary	76.10	NA	5.20	4.48	0.72	1.92	16.40	0.38	100.00
Ireland	66.39	4.94	15.70	10.39	5.31	5.39	7.57	0.00	100.00
Italy	82.66	1.47	6.45	3.95	2.49	2.52	5.28	1.62	100.00
Latvia	77.25	0.00	9.85	7.77	2.08	0.46	11.97	0.47	100.00
Netherlands	47.73	NA	21.56	20.62	0.93	13.26	15.60	1.85	100.00
Portugal	60.65	3.51	25.96	22.02	3.94	5.40	4.40	0.07	100.00
Romania	94.88	0.16	1.54	1.25	0.29	0.06	3.35	0.00	100.00
Spain	77.86	0.45	8.45	3.79	4.66	9.69	3.22	0.33	100.00
Sweden	26.64	0.02	39.63	34.45	5.18	6.21	23.40	4.10	100.00
Cost study participants' weighted average	69.12	0.95	14.34	11.34	3.00	5.99	8.49	1.11	100.00
EU27 weighted average	64.57	2.50	13.51	11.61	1.90	8.74	9.63	1.06	100.00

Sources: ECB Statistical Data Warehouse and European System of Central Banks.

1) Denotes that cash is based on cost study data; non-cash is based on SDW data.

2) Comprises those payment instruments existing in some countries that cannot be included in any of the other categories of payment instrument; often e-money. The weights used for calculating weighted averages are country GDPs for 2009 as reported in the ECB's Statistical Data Warehouse.

payment instrument across the sample and the EU countries. However, in some countries card payments exceed the usage of cash payments.

This report provides a multi-country snapshot of payments data for the reference year 2009. In this respect, it should be taken into consideration that payment systems in each country have a long history, and payment habits may not change very rapidly, although more and more innovative payment instruments are becoming available and accepted.



## 6 COSTS OF RETAIL PAYMENT INSTRUMENTS

### 6.1 AGGREGATED SOCIAL AND PRIVATE COSTS

The study considers the private and social costs per payment instrument and participant along the payment transaction chain as explained in Section 4.1. Private costs are the costs incurred by the relevant individual participants in the payment chain. They equal the sum of the internal and external costs. Social costs are the sum of all internal costs incurred by the relevant participants in the payment chain in order to carry out POS and remote payments.<sup>16</sup>

Using actual sample data for the 13 EU countries, Table 5 presents the social and private costs for each participant in the transaction payment chain and for all six retail payment instruments considered in the study. Overall, the social costs of retail payment instruments add up to 0.96% of GDP. Considering the composition of the social costs, it is estimated that about 51% of the social costs of retail payment services are incurred by banks and infrastructures, and 46% by retailers. The estimated social costs incurred by central banks and cash-in-transit companies are 3% and 1% respectively. It can also be shown that banks incur slightly higher costs for cash than for card payments. Among card payments, credit cards seem to be, to some extent, more costly compared with debit cards in terms of absolute social costs. Retailers incur the most costs on accepting and using cash. More than 60% of the social costs by retailers are made up by cash payments.<sup>17</sup>

On average, retailers have higher private costs than banks and infrastructures, at 0.587% and 0.493% of GDP respectively. In other words, fees and tariffs paid by retailers to third parties apparently represent a considerable part of their costs (about 0.15% of GDP on average). At the country level, this is the case in the majority of the countries. This is chiefly due to the fact that retailers incur high external costs to be paid to other payment chain participants. Retailers' overall social-to-private cost ratio is about 75%. This means that about one-quarter of the retailers' private costs are made up by tariffs

and fees paid to other participants. For banks and infrastructures, central banks and cash-in-transit companies, this ratio is (almost) 100%, as they incur almost no external costs.<sup>18</sup> Table 6 summarizes the findings on the social costs per payment instrument and per stakeholder.

Table 7 presents a split of social costs by payment instrument. As mentioned, the total social costs are calculated to be close to 1% of the total GDP, including the costs for all payment instruments and stakeholders. On average, the social costs of cash are nearly half of the total social costs. Across countries, the total social costs can vary from as low as 0.42% and 0.68% of GDP up to 1.35% of GDP. On average, it remains that cash represents the largest component of the social costs of all payment instruments. Overall, retailers incur higher social (and private) costs for cash, but lower social (and private) costs for all non-cash payment instruments, when compared with banks and infrastructures.

Table 8 makes it apparent that the social costs for banks and infrastructures are slightly higher than those incurred by retailers. Even considering the breakdown of costs by stakeholder, Table 8 shows that banks and infrastructures' social costs are somewhat higher than in the case of retailers. However, the level of costs for banks can differ substantially across countries. Compared with banks and retailers, the social costs incurred by central banks and cash-in-transit companies are only marginal, and range between 0.01% and 0.03% of GDP.

<sup>16</sup> In Tables 5-8, all costs for the 13 countries measured in percentage of total GDP of the 13 countries. The weights used for calculating weighted averages are country GDPs for 2009 as reported in ECB's Statistical Data Warehouse. Information on fees and tariffs is reported optionally, so it cannot be excluded that the private costs and the fees paid are underestimated. The social costs of CIT companies are assumed to be zero if the CIT data is reported together with the banks and infrastructures data. Therefore, the weighted average is an underestimation of the actual CIT company social costs. It is important to note that there might be big differences from country to country depending on the role of the national central bank in the national cash cycle.

<sup>17</sup> This analysis does not consider the volume of payments for each payment instrument. Therefore, it does not allow for direct efficiency comparisons among payment instruments.

<sup>18</sup> In this case, the majority of the tariffs and fees are paid intra-sector, and they are therefore not computed here.

**Table 5 Social and private costs of retail payment instruments per stakeholder**

(average of sample countries in percent of total GDP)

	Private costs	Fees paid	Social costs = Private costs - Fees paid	Percentage of total social cost	Social costs/ Private costs
<b>CENTRAL BANKS</b>					
Cash	0.025	0.000	0.025	3	100
- Fees paid for outsourcing cash services		0.000			
- Fees paid to cash-in-transit companies		0.000			
<b>BANKS AND INFRASTRUCTURES</b>					
Cash	0.193	0.002	0.191		99
Cheques	0.021	-	0.021		100
Cards	0.158	0.001	0.157		99
- Debit cards	0.076	0.001	0.076		99
- Credit cards	0.081	0.000	0.081		100
Direct debits	0.051	-	0.051		100
Credit transfers	0.070	-	0.070		100
<b>Total</b>	<b>0.493</b>	<b>0.003</b>	<b>0.490</b>	<b>51</b>	<b>99</b>
<b>CASH-IN-TRANSIT COMPANIES</b>					
Cash	0.008	0.001	0.008	1	93
<b>RETAILERS</b>					
Cash	0.344	0.075	0.269		78
Cheques	0.016	0.004	0.012		76
Cards	0.099	0.048	0.050		51
- Debit cards	0.038	0.014	0.023		62
- Credit cards	0.023	0.014	0.009		40
- Combined cards	0.004	0.000	0.004		100
- Not split	0.034	0.020	0.013		40
Direct debits	0.053	0.011	0.042		80
Credit transfers	0.073	0.010	0.064		87
<b>Total</b>	<b>0.586</b>	<b>0.148</b>	<b>0.438</b>	<b>46</b>	<b>75</b>
<b>Overall</b>	<b>1.112</b>	<b>0.152</b>	<b>0.960</b>	<b>100</b>	<b>86</b>

Source: European System of Central Banks.

**Table 6 Social costs per stakeholder and payment instrument**

(average of sample countries in percent of total GDP)

	Central bank	Banks and infrastructures	Cash-in-transit companies	Retailers	Total
Cash	0.02	0.19	0.01	0.27	0.49
Cheques	-	0.02	-	0.01	0.03
Cards	-	0.16	-	0.05	0.21
- Debit cards	-	0.08	-	0.02	0.10
- Credit cards	-	0.08	-	0.01	0.09
- Combined cards	-	-	-	0.02	0.02
Direct Debits	-	0.05	-	0.04	0.09
Credit transfers	-	0.07	-	0.06	0.13
<b>Total</b>	<b>0.02</b>	<b>0.49</b>	<b>0.01</b>	<b>0.44</b>	<b>0.96</b>

Source: European System of Central Banks.

Table 7 Summary of social costs statistics per payment instrument

(average of sample countries in percent of total GDP)

Measure	Cash	Cheques	Cards <sup>1)</sup>	Debit cards	Credit cards	Direct debits	Credit transfers	Total social costs
Minimum	0.25	0.01	0.11	0.01	0.04	0.01	0.04	0.42 <sup>2)</sup>
Median	0.51	0.07	0.21	0.11	0.08	0.03	0.17	0.93
Maximum	0.76	0.16	0.41	0.24	0.27	0.28	0.35	1.35
Average	0.49	0.08	0.23	0.12	0.10	0.06	0.17	0.94
Weighted average	0.49	0.03	0.21	0.10	0.09	0.09	0.13	0.96

Source: European System of Central Banks.

Note: 1) Cards include figures for debit and credit cards. These figures may not add up to the total of cards since retailers in some countries were not able to distinguish between the different types of card payments. 2) The country with the lowest total social costs reported cash and debit card figures only; the second lowest figure is 0.68%.

Table 8 Summary of social costs statistics per stakeholder

(average of sample countries in percent of total GDP)

Measure	Central bank <sup>1)</sup>	Banks and infrastructures	Cash-in-transit companies	Retailers	Total social costs
Minimum	0.01	0.21	0.00	0.19	0.42 <sup>2)</sup>
Median	0.03	0.46	0.04	0.41	0.93
Maximum	0.03	0.73	0.07	0.64	1.35
Average	0.02	0.50	0.04	0.40	0.94
Weighted average	0.02	0.49	0.01	0.44	0.96

Source: European System of Central Banks.

Notes: 1) Denotes that central bank costs are based on an estimate calculated using the average level of central bank costs reported by cost study participants, which is about 0.027% of GDP (see Table 2 for more details). 2) The country with the lowest total social costs reported cash and debit card figures only; the second lowest figure is 0.68%.

## 6.2 UNIT SOCIAL COSTS AND ECONOMIES OF SCALE OF PAYMENT INSTRUMENTS

The division of the total social costs by the total number of retail payments yields the unit social costs. Table 9 summarizes the average unit (i.e. per transaction) social costs across countries per payment instrument.<sup>19</sup> On average, the results show that cash payments have the lowest unit social costs of €0.42, followed by debit cards with unit costs of €0.70. In other words, on average cash transactions seem to be the cheapest among all payment instruments. This does not necessarily mean that cash is the most cost-efficient payment instrument, because low unit costs may be due to the high volume of cash payments. Other possible explanations for cash dominance in retail payments include economies of scale, maturity of the cards market, low number of electronic POS devices in some countries preventing non-cash payment instruments from emerging, and slowly changing

payment habits and behaviour. In a cross-country comparison, it is interesting to observe that despite the wide usage of cash, cash does not always yield the lowest unit costs. In contrast, in five of the 13 participating countries, the unit social costs of debit card transactions are lower than those of cash transactions.

Direct debits cost society €1.27 per transaction and credit transfers, €1.92. Most costly to society are cheques, with €3.55 per transaction, followed by credit cards with €2.39. The weighted averages displayed in the table are corrected for outliers – i.e. data points that exceed the average by more than two standard deviations.

The second part of Table 9 provides the results of the social costs per euro of sales; that is, the division of the total social costs by the total

19 It shall be noted that no distinction is made between transactions of different sizes.



**Table 9 Unit social costs and social costs per euro of sales of retail payment instruments per country**

Measure	Cash	Cheques	Cards	Debit cards	Credit cards	Direct debits	Credit transfers
<b>Unit social costs</b>							
Minimum	0.13	2.39	0.22	0.18	0.48	0.14	0.30
Median	0.39	3.46	0.63	0.45	1.97	1.14	1.01
Maximum	0.78	6.10	8.07	3.40	8.65	2.49	12.07
Average	0.41	3.86	1.34	0.81	2.79	1.07	2.22
Weighted average	0.42	3.55	0.99	0.70	2.39	1.27	1.92
<b>Social costs per €1 of sale</b>							
Minimum	0.013	0.000	0.008	0.008	0.018	0.002	0.000
Median	0.020	0.002	0.016	0.012	0.030	0.004	0.002
Maximum	0.034	0.012	0.081	0.035	0.137	0.011	0.006
Average	0.023	0.004	0.024	0.017	0.052	0.005	0.002
Weighted average	0.023	0.002	0.017	0.014	0.034	0.004	0.002

Source: European System of Central Banks.

sales (turnover). It shows that cheque, credit transfers, and direct debits score lowest. This is not surprising, as these payment instruments are mostly used for highly denominated transaction values. Cards and cash payments are very similar with respect to their social costs per euro of sales. For example, per euro spent, the cost of a cash payment is €0.023, and that of a card payment, €0.017. In the case of debit cards only, card transactions score lower than cash.

Chart 2 plots each country's unit social costs against payments per capita for each payment instrument. In theory, a downward trend would suggest that there are economies of scale involved for each of the payment instruments as well as the underlying processing infrastructure. Overall, although statistically not confirmed, a downward trend can be observed in each chart for cash, debit and credit cards, and credit transfers. For example, the downward curve for cash results from the fact that the costs incurred by cash usage in a few countries are spread over a lower volume. Another observation is that among all payment instruments, cash has the steepest slope. However, when interpreting the charts, one should bear in mind that it cannot be directly concluded that economies of scale are the strongest for cash payments simply by comparing the slopes of the curves.<sup>20</sup> Due to the limited number of observations, no clear trend exists for cheque payments. Direct debits show almost a flat trend line, indicating low economies of scale.

Furthermore, Chart 3 displays the unit social costs of cash payments and the number of card payments per capita. As shown by the positive slope, countries with relatively low unit social costs of cash typically do not seem to have many card payments per capita. Apparently, these countries have a high cash usage and costs are spread over many cash transactions so that the unit social costs are low by comparison with other countries. However, in some of the other countries, the unit social costs of cash remain quite high although cards are not widely used. In addition, there is another group of countries in which card payments are used extensively but which still incur relatively high unit costs for cash. Finally, yet another group of countries combines high card usage with low unit social costs for cash.

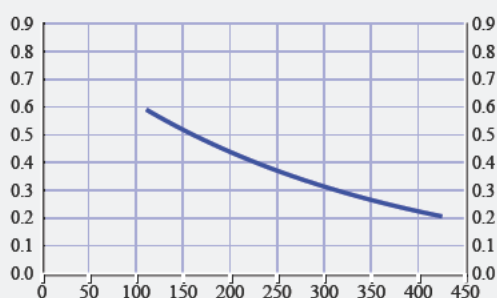
A similar picture exists when considering the relation between the unit social costs of cash and the availability and diffusion of point-of-sale technologies as shown in Chart 4. Without claiming any causality, cards are barely used in some countries because of a low degree of card acceptance at the point of sale. Given their underdeveloped point-of-sale technologies, these

<sup>20</sup> To draw further conclusions regarding the statistical significance of economies of scale among retail payment instruments, one would need to study these effects by conducting a more detailed econometric analysis. However, this would require detailed data to be available over a longer time period and a larger number of sample countries.

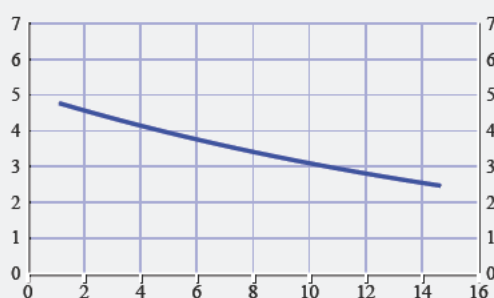
Chart 2 Unit social costs versus retail payments per capita

x-axis: payments per capita  
y-axis: unit costs (euro)

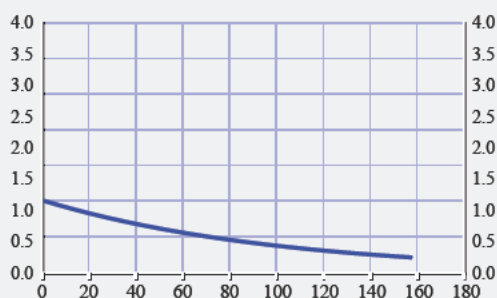
a) Cash



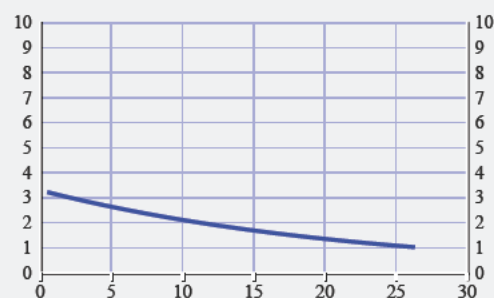
d) Cheques



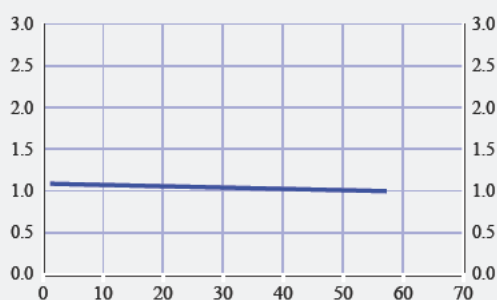
b) Debit cards



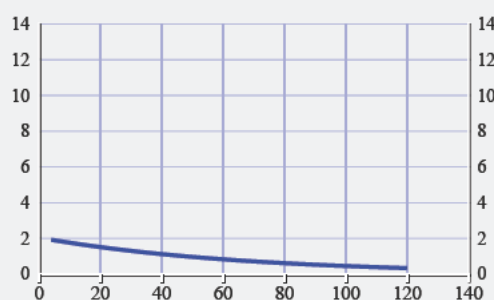
e) Credit cards



c) Direct debits



f) Credit transfers

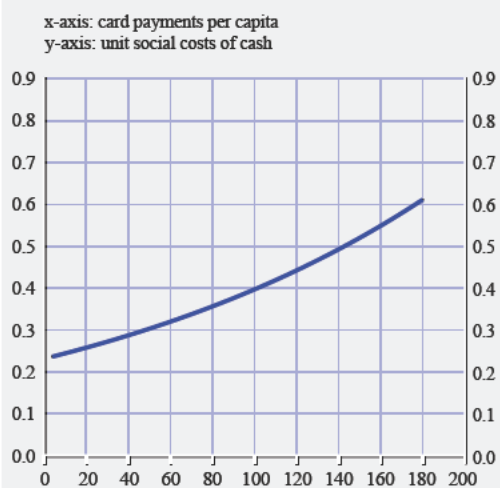


Source: National central banks.

countries mostly rely on cash payments, which in turn drive down unit costs as the volume of cash payments is high. Hypothetically, this phenomenon becomes even more relevant and pronounced in rural or less developed geographic regions. In contrast, there are other countries which incur higher unit social costs for cash coupled with low card usage, even though point-

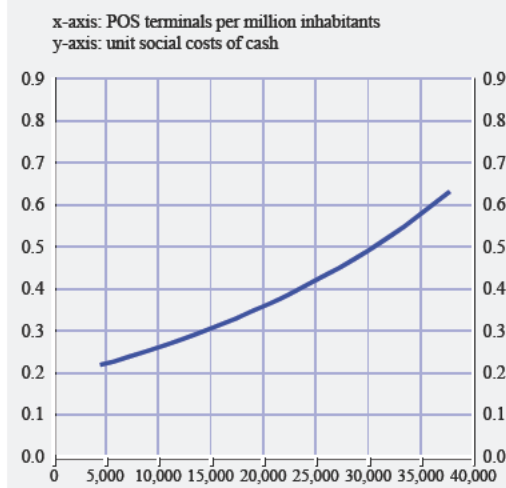
of-sale payment technologies are well developed and exist widely across the country. It needs to be taken into consideration that in some countries the large number of POS terminals per million inhabitants could also reflect the fact that there is more than one payment terminal per point-of-sale, possibly because of an unconsolidated terminal infrastructure.

**Chart 3 Unit social costs of cash versus the number of card payments per capita**



Sources: ECB Statistical Data Warehouse and European System of Central Banks.

**Chart 4 Unit social costs of cash vs. POS terminals per million inhabitants**



Sources: ECB Statistical Data Warehouse and European System of Central Banks.

### 6.3 DIRECT VERSUS INDIRECT COSTS AND PAYMENT ACTIVITIES

The Activity-Based-Costing (ABC) method is herein the preferred concept to analyse the costs incurred from the provision of payment services. This is because stakeholders in the payment transaction chain incur a non-negligible proportion of indirect costs and there are a number of differences in the way resources are used for the provision of payment services. The ABC methodology also allows for identifying the relationship between costs and payment instruments and for breaking down activities performed by all stakeholders into activities directly related to payment instruments and activities not directly related to payment instruments. The relevant activities for each payment instrument and stakeholder have been identified in the questionnaires. Based on these activities, the observed direct and imputed indirect costs for each activity have been summed up.

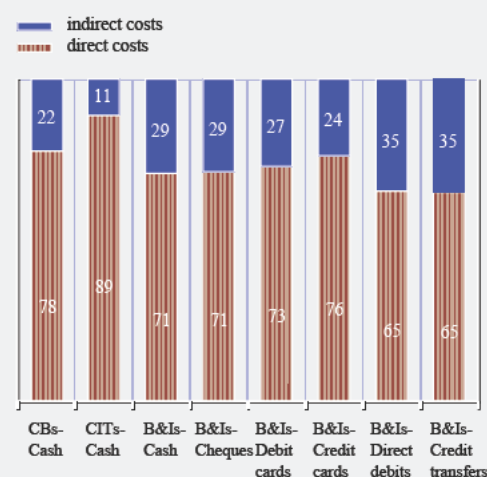
Analysing the costs by activity confirms that the retail payments industry is characterised by

a relatively high proportion of indirect costs. In broad terms, the split of costs for all payment instruments is about one-third of indirect and about two-thirds of direct costs. Ignoring indirect costs would leave aside an important proportion of the overall costs for the provision of payment services. The split of direct and indirect costs per stakeholder and payment instrument is summarised in Chart 5. It shows that cash has a slightly higher share of direct costs compared with non-cash payment instruments. For example, the costs for cash incurred by cash-in-transit companies are almost 90% direct, while the direct costs of non-cash payment instruments incurred by banks are between 65% and 76% depending on the payment instrument. Among all payment instruments, direct debits and credit transfers show the highest percentage of indirect costs, at about 35%.

Considering private costs for all payments and all stakeholders by activity provides additional insights into the main cost drivers. Depending on the payment instrument, up to 18 different activities have been considered in the questionnaire. It is important to note that

**Chart 5 Share of direct and indirect private costs per payment instrument and stakeholder**

(percentages)

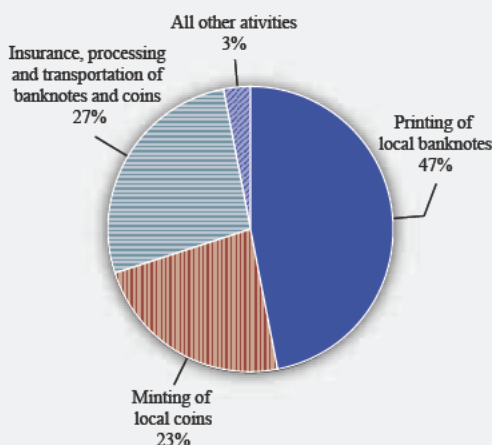


Source: European System of Central Banks.

Notes: "CB", "CIT", "B&I" stands for central banks, cash-in-transit companies, banks and infrastructures respectively.

**Chart 6 Private costs by activity for central banks**

Central banks: Cash



Source: European System of Central Banks.

Note: This chart is based on the central bank data of those countries which provided central bank cost figures by activity, i.e. Denmark, Estonia, Finland, Hungary, Latvia, and Romania. Shares are calculated based on the sum of costs per activity for all countries as a percentage of the total costs for all countries. It is important to note that there might be big differences from country to country depending on the role of the national central bank in the national cash cycle.

the present analysis does not allow for drawing conclusions on cost efficiencies in the provision of payment services, but it identifies the activities which trigger most of the costs. The charts below show the top three cost activities per stakeholder and per payment instrument, while the remaining costs are grouped and represented under "All other activities".

Central bank-related costs for the provision of cash are mainly driven by the printing of local banknotes and minting of local coins. These account for more than two-thirds of the total central bank costs. Costs for issuance, processing and transportation of banknotes and coins account for 27% of the total costs. All remaining activities<sup>21</sup>, as identified in the central bank questionnaires of Annex VII, account for 3%. When interpreting these results, one should take

into account that the central bank-related costs are estimated based on six sub-sample observations.

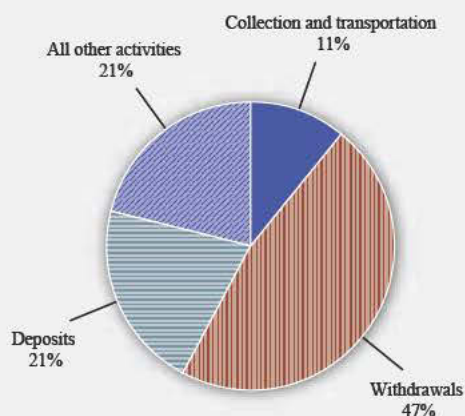
Private costs for banks and infrastructures and cash-in-transit companies differ considerably, as the various payment instruments are based on different cost structures and activities. The top three cost drivers for the provision of cash are cash withdrawals (47%), deposits (21%) and the collection and transportation of cash (11%). There are 14 activities considered to analyse the costs related to card payments. Overall, the costs seem to be relatively equally distributed across the different activities. Therefore, it is not entirely obvious which activity drives most of the costs. Against this background, it turns out

<sup>21</sup> These include: 1) Design, security features, quality control and preparatory work; 2) Banknotes protection, coins protection, combating counterfeiting; and 3) Outsourcing of cash services.

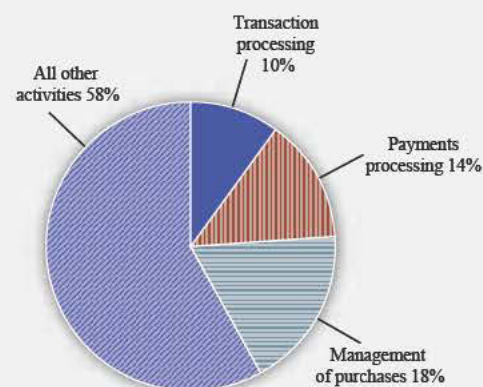


Chart 7 Private costs by activity for banks and infrastructures and cash-in-transit companies

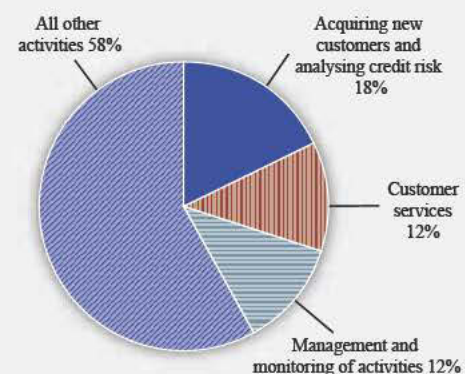
**B&I and CITs cash**



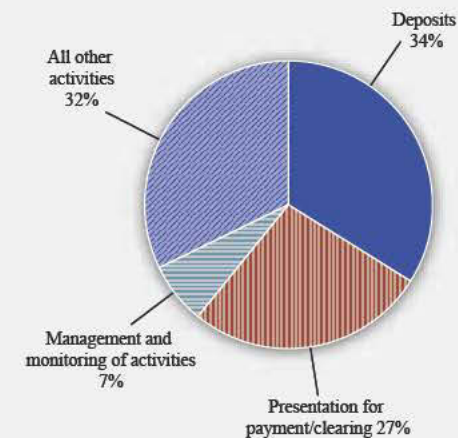
**B&I Debit cards**



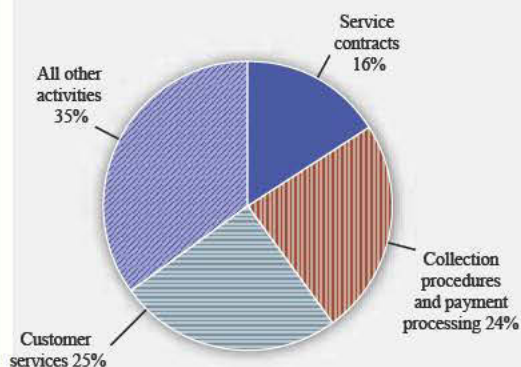
**B&I Credit cards**



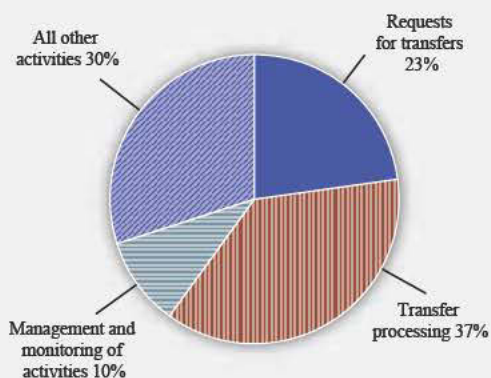
**B&I Cheques**



**B&I Direct debits**



**B&I Credit transfers**

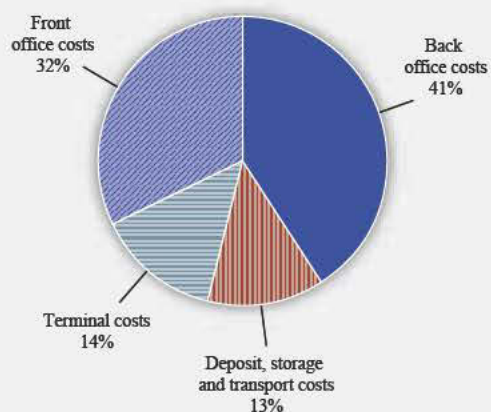


Source: European System of Central Banks.

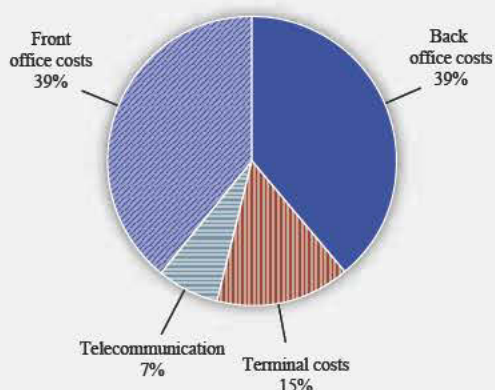
Note: Shares calculated are based on the sum of costs per activity for all countries as a percentage of the total costs for all countries.

Chart 8 Private costs by activity for retailers

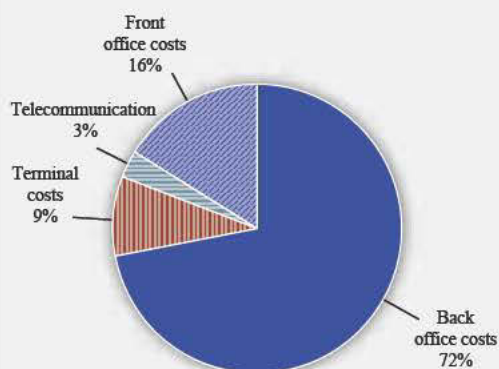
**Retailers: Cash**



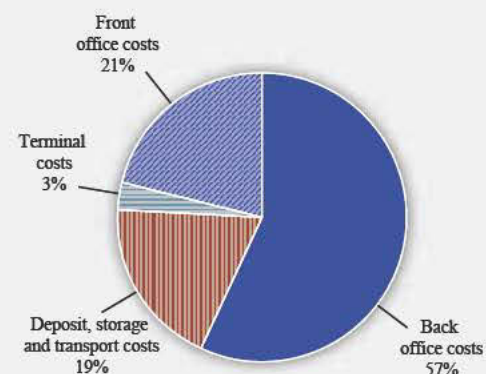
**Retailers: Debit Cards**



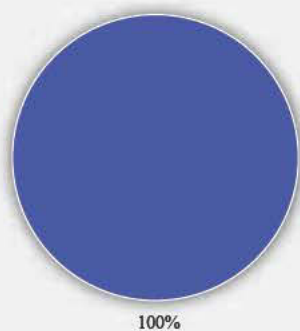
**Retailers: Credit cards**



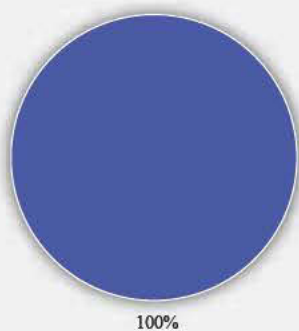
**Retailers: Cheques**



**Retailers: Direct debits**



**Retailers: Credit transfers**



Source: European System of Central Banks.

Note: Due to limited information, no split of retailer costs by activity for direct debits and credit transfers was available. Shares calculated are based on the sum of costs per activity for all countries as a percentage of the total costs for all countries.



**Table 10 Transaction time per payment instrument**

(in seconds)

Payment instrument	Observations	Average	Min	Median	Max
Cash	13	22	10	17	46
Cheques	3	89	25	120	121
Debit cards	13	29	15	26	52
Credit cards	13	31	15	33	52

Source: European System of Central Banks.

that for debit card payments, the management of purchases<sup>22</sup> (18%), payments (14%) and transaction processing (10%) are the top three activities which generate the most costs. For credit cards, the top three are the acquisition of new customers and analysis of credit risk (18%), management and monitoring of activities, and customer services (each 12%). The biggest cost driver for cheques is depositing cheques (34%), for direct debits it is customer services (25%), and for credit transfers it is transfer processing (37%).

The private costs for retailers<sup>23</sup> are composed of front office, back office, terminal, telecommunication and deposit, storage, and transportation costs. Front office costs are calculated by multiplying the time needed to do one transaction by the actual retailer's average employee wage rate at the point of sale<sup>24</sup>, thus estimating the labour costs for making a payment. Table 10 presents an overview of the transaction times needed to perform one transaction per payment instrument.<sup>25</sup> It shows that cash payments require on average 22 seconds, while debit card payments need 29 and credit cards 31 seconds. Cheque payments at the point of sale take longest, with 89 seconds.

Irrespective of the payment instrument considered, it turns out that back office costs are the main cost element for retailers. However, back office costs vary substantially among payment instruments. For example, back office costs for cash and debit cards are about 40%, while for credit cards they account for 72%. It should be noted that the back office costs for card payments are comprised of labour costs for related activities, fixed periodic card subscription charges charged by banks or

card acquirers, and fraud prevention costs. In view of the back office costs for debit and credit cards, the proportion of fees and subscription charges seems to be substantially higher for credit than for debit cards. Moreover, fixed periodic subscription charges are one component of back office costs that do not vary with transaction volumes. Given the relatively lower volume of credit cards compared with debit cards, back office costs are therefore a higher proportion of the total costs for credit cards. Front office costs are another main cost component at retailers. For example, the proportion of front office costs is highest for debit card (39%) and cash (32%) payments.

<sup>22</sup> These include the costs of managing purchases carried out with POS terminals, e.g. costs associated with IT and communications, interbank fees or other commissions, etc.

<sup>23</sup> Please take note that the split of retailers' costs data for direct debits and credit transfers by activity was not available and is therefore reported as total costs.

<sup>24</sup> Front office costs of retailers at the point of sale refer to the retailer's labour cost associated with the actual payment transaction at the counter. The labour time is measured from the moment when the customer is told the amount to be paid by the cashier until the customer has received the change, receipts and, if applicable, loyalty cards. The time of a transaction is measured in seconds. The total front office time for a specific payment instrument is obtained by multiplying the median processing time by the total annual number of payment transactions. The yearly front office cost is obtained by multiplying the median front office time measured in hours by the number of payments made with that specific payment instrument and by the average hourly wage for people working at the point of sale. Front office costs are an important cost item for retailers. Differences in front office time between payment instruments may be small in some countries, but because of the large number of payment transactions, small differences in settlement time can yield large differences in front office cost. Therefore, it was necessary to collect reliable data on front office costs.

<sup>25</sup> Please note that the data in Table 10 is based on the average transaction times per payment instrument in each country. Therefore, they do not consider transaction values, which are particularly important for cash payments since the size of a cash transaction has a direct impact on the time needed for its completion.

#### 6.4 EXTRAPOLATION AND INTERNATIONAL COST COMPARISON OF RETAIL PAYMENT INSTRUMENTS

Overall the study comprises data from 13 participating countries and it is representative for 45% of the European cash payments market and 30% of the non-cash payments market. For a better understanding of the social costs from a European perspective, an attempt was made to extrapolate the key findings of the study to all EU27 Member States. For this purpose three extrapolation methods have been used, as shown in Table 11. Using the sample unit costs per payment instrument and data from the SDW for the out-of-sample countries, the total, mean, and median unit costs for the out-of-sample EU Member States have been calculated. Those unit social costs are multiplied by the respective payment instrument's volume. Then the costs for all payment instruments within a country are summed up to arrive at the final figures as reported in Table 11. The extrapolation results show that the average EU27 social costs for retail

payment instruments are comparable to the sample results and are close to 1% of GDP, which amounts to €130 billion. It can also be seen that there are substantial country-specific differences in the social costs of retail payment instruments across the countries. The results are robust irrespective of the extrapolation approach chosen.

To show how the results of the present cost study fit into the context of the existing literature, Table 12 summarizes the methodology, scope and results of previous national studies. It directly compares the social costs to GDP for the different stakeholders and payment instruments of those studies to the results of the current European study.<sup>26</sup> Before making any

26 Although the figures in the columns labelled "ECB's cost study equivalent" aim to fully match the scope of the corresponding national studies presented in the columns "Social costs/GDP", this is not always permitted by the data. Therefore, before comparing the figures from national studies and those from the present European study, one must take into account the differences in coverage.

Table 11 Extrapolation of social costs of study participants to EU27 Member States

(in percent of total GDP)						
Cost study participants		EU non-participating countries				Average social costs of the 3 approaches
Country	Social costs percentage of GDP	Country	I Total <sup>2)</sup> unit costs <sup>3)</sup>	II Mean unit costs <sup>3)</sup>	III Median unit costs <sup>3)</sup>	
1	0.42 <sup>1)</sup>	14	0.54	0.73	0.56	0.61
2	0.68	15	0.77	0.97	0.79	0.84
3	0.68	16	0.78	1.03	0.77	0.86
4	0.69	17	0.85	1.07	0.88	0.94
5	0.78	18	0.88	1.10	0.90	0.96
6	0.93	19	0.90	1.16	0.90	0.99
7	0.93	20	1.00	1.24	1.03	1.09
8	0.96	21	1.01	1.29	1.03	1.11
9	1.02	22	1.04	1.21	1.10	1.12
10	1.19	23	1.13	1.40	1.16	1.23
11	1.30	24	1.14	1.52	1.24	1.30
12	1.32	25	1.13	1.48	1.31	1.31
13	1.35	26	1.20	1.54	1.39	1.37
Weighted average of costs, study participants	0.96	27	1.26	1.64	1.41	1.43
		Weighted average of EU27	1.03	1.22	1.07	1.11

Sources: ECB Statistical Data Warehouse and European System of Central Banks.

Notes: 1) Means that this figure is only based on cash and debit card payments, as no further details were provided. 2) Per payment instrument, the sum of all costs for the 13 participants to the sum of their GDPs. 3) Purchasing power parity (PPP) adjusted unit social costs data from the cost study is used together with transaction volumes from ECB's Statistical Data Warehouse and cash volume estimates (see note to Table 3 for more details) in order to calculate the total social costs per payment instrument for each EU27 member country not participating in the present study. The total volumes of cash, cheques, debit and credit cards and direct debits are considered, while only 2/3 of the credit transfer volumes (the average proportion of retail payment credit transfers reported by cost study participants). The unit social costs for each payment instrument from the cost study are multiplied by the respective payment instrument's volume. Then the costs for all payment instruments within a country are summed up to arrive at the final figures as reported above. The weights used for calculating weighted averages are country GDPs for 2009 as reported in the ECB's Statistical Data Warehouse.

**Table 12 European comparison of the results of selected central bank studies on the cost of payment instruments**

Country, Study and Scope	Data and Methodology	Payment chain participants	Social costs / GDP (percentages)	
			National report	European study
Country: Belgium	Survey-based	1) Banks	0.35	
Banque Nationale de Belgique (2005)	Year: 2003	2) Retailers	0.37	
Scope: Social costs	Social costs and revenue, fixed and variable costs	3) Issuing institutions	0.02	
		<b>Total</b>	<b>0.74</b>	
Country: Denmark	Survey-based	1) Banks and infrastructures	0.29	0.30 <sup>1)</sup>
Danmarks Nationalbank (2012)	Year: 2009	2) Households	0.23	
Scope: Social and private costs	Activity Based Costing	3) Retailers	0.46	0.46
		4) Cash-in-transit companies	0.01	0.01
		5) Central bank	0.01	0.01
		<b>Total</b>	<b>1.00</b>	<b>0.78<sup>1)</sup></b>
Country: Finland	Various sources	1) Banks		
Takala and Virén (2008)	Various years	2) Issuing institutions		
Scope: Private costs	Collection of information on different cost components	3) Subcontractors		
		<b>Total</b>	<b>0.30</b>	<b>0.34</b>
Country: Hungary	Survey-based	1) Banks and infrastructures	0.70	0.71
Turján et. al. (2011) <sup>1)</sup>	Year: 2009	2) Households	0.18	
Scope: Social and private costs	Activity Based Costing	3) Retailers	0.48	0.50
		4) Cash-in-transit companies	0.07	0.07
		5) Central bank	0.03	0.03
		6) Public sector	0.01	
		<b>Total</b>	<b>1.49</b>	<b>1.30</b>
Country: Netherlands	Survey-based	1) Banks	0.31	0.21
Brits and Winder (2005)	Year: 2002	2) Retailers	0.32	0.19
Scope: Social costs	Social cost and revenue, fixed and variable costs	3) Central bank and Royal mint	0.02	0.03
		<b>Total</b>	<b>0.65</b>	<b>0.42</b>
Country: Norway	Survey-based	1) Banks	0.22	
Gresvik and Haare (2009)	1) Merchants	2) Households	0.10	
Earlier studies (in 1988, 1994, and 2001) with different scope.	2) Banks	3) Retailers	0.07	
Scope: Social and private costs	3) Households	4) Subcontractors	0.10	
	Year: 2007	5) Central bank	0.01	
	Activity Based Costing	<b>Total</b>	<b>0.49</b>	
Country: Portugal	Survey-based	1) Banks	0.77	0.73
Banco de Portugal (2007)	Year: 2005			
Scope: Private costs	Activity Based Costing	<b>Total</b>	<b>0.77</b>	<b>0.73</b>
Transactions below €100,000				
Country: Sweden		1) Banks	0.17	0.27
Bergman, Guibourg and Segendorf (2007)	Year: 2002, 2009	2) General public	0.05	
Scope: Social and private costs	Social and private costs of cash and cards	3) Retailers	0.07	0.24
		4) Subcontractors	0.04	0.05
		5) Central bank	0.01	0.01
		<b>Total</b>	<b>0.35</b>	<b>0.52</b>
Segendorf and Jansson (2012)	Survey-based, Activity Based Costing	1) Banks and infrastructures	0.31	0.31
		2) Retailers	0.31	0.31
		3) Cash-in-transit companies	0.05	0.05
		4) Central bank	0.01	0.01
		<b>Total</b>	<b>0.68</b>	<b>0.68</b>

Source: ECB.

Note: 1) Please note that the GDP estimate used in this study was the most recent one at the time of publication of the national report. In the meantime, the GDP data has been revised and the updated GDP data has been used in this report.

## 6 COSTS OF RETAIL PAYMENT INSTRUMENTS

Payment instruments	Social costs / GDP (percentages)		Unit costs (euro)	
	National report	European study	National report	European study
- Cash	0.58		0.53	
- Debit cards	0.11		0.55	
- Credit cards	0.04		2.62	
- e-purse	0.02		0.54	
- Cash	0.35	0.27	0.99	0.78
- Debit cards	0.19	0.14	0.49	0.36
- Credit cards	0.03	0.04	2.85	3.86
- Credit transfers	0.28	0.19	6.21	4.13
- Direct debits	0.15	0.15	1.97	1.93
- Cash			0.30	0.28
- Payment cards			0.26	0.22
- Cash	0.80	0.74	0.26	0.25
- Debit cards	0.12	0.11	0.72	0.68
- Credit cards	0.08	0.08	2.84	2.80
- Direct debits	0.03	0.03	0.36	0.31
- B2B direct debits	0.00		3.28	
- Credit transfers	0.29	0.35	0.97	0.60
- Postal inpayment money orders	0.15		0.51	
- Postal outpayment money orders	0.03		1.08	
- Cash	0.48	0.31	0.30	0.39
- Debit cards	0.12	0.11	0.49	0.33
- Credit cards	0.04		3.59	
- e-purse	0.02		0.93	
- Cash	0.15		1.53	
- Payment cards	0.24		0.74	
- Credit cards				
- Debit cards				
- Giro				
- Direct debits	0.01		0.33	
- Credit transfers	0.09		0.58	
- Other transfers	0.00		0.24	
- Cash	0.13	0.23	1.85	0.15
- Cheques	0.22	0.14	1.45	1.54
- Credit cards	0.18	0.13	2.44	1.58
- Debit cards	0.21	0.17	0.23	0.34
- Direct debits	0.01	0.02	0.09	0.15
- Credit transfers	0.02	0.03	0.28	0.36
- Cash	0.27	0.28	0.52	0.78
- Debit cards	0.06	0.19	0.34	0.42
- Credit cards	0.01	0.09	0.50	1.15
- Cash	0.28	0.28	0.78	0.78
- Debit cards	0.19	0.19	0.42	0.42
- Credit cards	0.09	0.09	1.10	1.15
- Direct Debits	0.02	0.02	0.31	0.28
- Credit transfers	0.10	0.10	1.03	1.03

inferences about the differences in the figures from the national studies and those from the ECB's cost study, one needs to consider the differences in the methodology and scope, as well as in the timing of data collection. Since payment habits change over time, it is likely that social costs may also change due to a shift from paper-based to electronic payment instruments.

When comparing the results of the present European study with those of previous national studies, a number of observations are worth mentioning. In the case of Portugal<sup>27</sup>, the social costs of payment instruments to banks slightly decreased, from 0.77% in 2005 to 0.73% of GDP in 2009. In Sweden<sup>28</sup>, the social costs for cash and cards increased from 0.35% in 2002 to 0.52% of GDP<sup>29</sup> in 2009. Considering the timespan between the examined periods, it is common to observe a change in payment habits and cost structures over time. The social costs of cash have not changed significantly. However, a larger proportion of these costs are presently incurred by retailers. On the other hand, the social costs of cards have more than tripled, reflecting the trend towards higher card usage.

The social costs of cash in the Netherlands<sup>30</sup> have decreased since 2002 (from 0.48% to 0.31% of GDP), while those of debit cards have only slightly changed (from 0.12% of GDP in 2002 to 0.11% of GDP in 2009). Therefore, the sum of the social costs of cash and debit cards has slightly decreased, indicating higher efficiency overall. Similarly, the costs of cash have increased from €0.30 to €0.39 per transaction. At the same time, the costs of debit cards have decreased from €0.49 to €0.33 per transaction, possibly due to economies of scale. The decrease in the total costs of cash is mainly due to the fact that cash usage decreased considerably between 2002 and 2009<sup>31</sup>, resulting in a considerable reduction in costs, especially for merchants. It is impossible to compare the social costs of credit cards and e-purses in 2002 and 2009, since current data for those two payment instruments is unavailable.

In Finland<sup>32</sup>, the social costs of cash and payment cards over an extended period of time are estimated to be about 0.30% of GDP. This

result is similar to the 0.34% of GDP seen in 2009, based on the data collected for the present European study. In addition, the unit costs of cash for banks, issuing institutions and subcontractors in Finland have decreased from €0.30 to €0.28 per transaction. Those of cards have decreased as well, from €0.26 to €0.22 per transaction.

The Hungarian<sup>33</sup>, Danish<sup>34</sup>, and Swedish<sup>35</sup> studies in Table 12 are based on the methodology and the data collected for the European social costs of payment instruments study initiated by the ECB. The differences in the results between these studies and the present one are due to the fact that the two national studies explore the social costs of households for making payments, which are out of the scope of the European study. In addition, there are two payment instruments in Hungary, business-to-business (B2B) direct debits and postal outpayment money orders, which account for less than 5% of the volume of payments in the country and are, therefore, out of the scope of the present study. Finally, postal inpayment money orders, which are a major means of payment in Hungary, are treated as credit transfers in the European study – a classification also used by the ECB's Statistical Data Warehouse.

## 6.5 SIMILARITIES, DISTANCES AND CLUSTERS OF RETAIL PAYMENT MARKETS

So far, it is apparent that all cost study-participating countries, as well as each EU27 Member State, have unique retail payment markets and feature their own market characteristics. Even though this holds for all countries, it appears that some payment markets are more similar or closer to each other than to other payment markets. In

27 See Banco de Portugal (2007) for more details

28 See Bergman et al (2007) for more details

29 This figure does not include the social costs to the general public, which were estimated to be about 0.05% of GDP in 2002

30 See Brits and Winder (2005) for more details

31 From about 7 billion payments in 2002 to about 4.6 billion in 2009

32 See Takala and Viren (2008) for more details

33 See Turján et al (2011) for more details

34 See Danmarks Nationalbank (2012) for more details. The Danish study presents the total social costs with and without household costs

35 See Segendorf and Jansson (2012) for more details



other words, the retail payment markets in some countries exhibit similar characteristics with respect to the social costs of payment instruments, market development, and payment behaviour. With the goal of better understanding the economics of payments in each country, this study explores the similarities and dissimilarities of the payment markets in the EU27 by using cluster analysis.

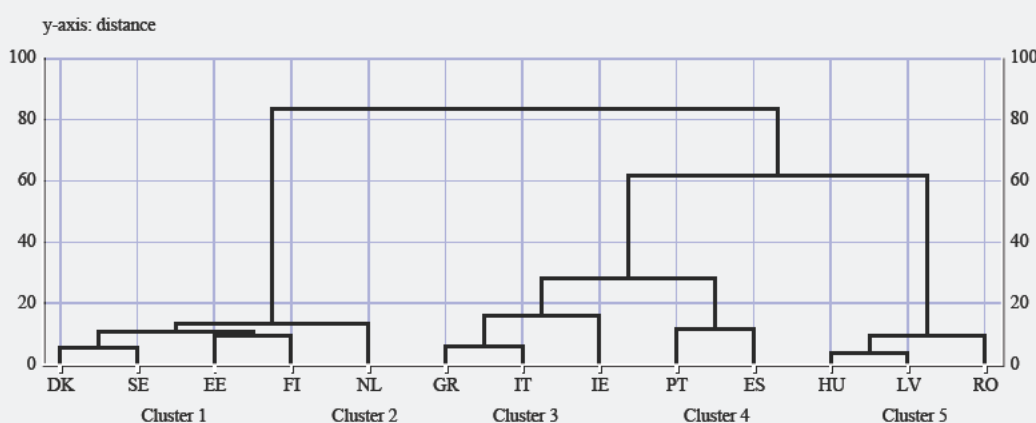
In general terms, cluster analysis divides data into groups (clusters) that are meaningful, useful, or both, so that the items in the same cluster are more similar (in some sense or another) to each other than they are to those in other clusters. Typically clusters include groups with low distances among the cluster members, dense areas, intervals or particular statistical distributions. Clustering is therefore a multi-objective optimisation problem. The appropriate clustering algorithm and parameter settings depend on the individual data set and the selection of variables.

In the context of the social costs of retail payment instruments, the objective of performing cluster analysis<sup>36</sup> is to find groups of countries with similar payment markets. Based on the data used in this study, the following retail payment and economic development variables have been selected and used in the analysis:

- social costs to GDP;
- average card transaction value;
- cash payments per capita;
- cheque payments per capita;
- card payments per capita;
- direct debit payments per capita;
- credit transfer payments per capita;
- payment cards per capita;
- POS terminals per million inhabitants;
- ATMs per million inhabitants;
- GDP per capita.

36 Cluster analysis, which aims to find natural groupings of data observations, is usually split into partition clustering and hierarchical clustering. In partition clustering each data point is assigned to a separate cluster, while in hierarchical clustering a set of nested clusters is organised as a tree. Partition clustering requires some knowledge of the number of clusters present in the dataset as well as the means of each cluster, which makes it unsuitable for the purposes of our analysis. On the other hand, hierarchical clustering does not require any prior information about the clusters present in the data, which is why it is the more appropriate option for the present exploratory analysis. In hierarchical clustering, there are different methods for calculating distances (similarities or dissimilarities) between data points: single linkage clustering calculates the distance between two groups by considering the closest data points in each group; complete linkage clustering, on the other hand, takes the farthest data points in each group; average and weighted average linkage clustering estimate the average distances among all pairs of data points in the groups; centroid linkage clustering calculates the distance between group means; median linkage clustering calculates the distance between group medians; and Ward's linkage calculates the distance between two groups as the increase in variance when the groups are merged.

Chart 9 Dendrogram of in-sample countries

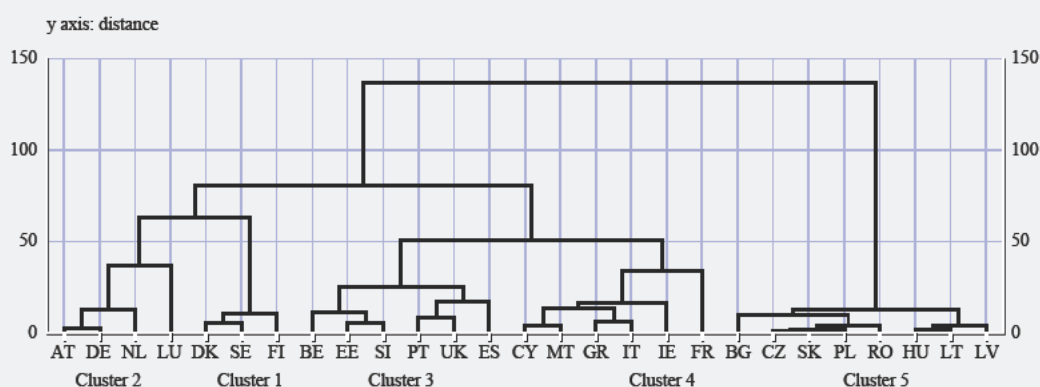


Sources: ECB Statistical Data Warehouse and European System of Central Banks.

Notes: Using Ward's hierarchical clustering approach. Based on the following variables: social costs to GDP, GDP per capita, payment cards per capita, average card transaction value, cash payments per capita, cheque payments per capita, card payments per capita, direct debit payments per capita, credit transfer payments per capita, POS terminals per capita, ATMs per capita. All variables are mean standardised in order to avoid scaling problems.



Chart 10 Dendrogram of EU27 countries



Sources: ECB Statistical Data Warehouse and European System of Central Banks.

Notes: Using Ward's hierarchical clustering approach. Based on the following variables: social costs to GDP, GDP per capita, payment cards per capita, average card transaction value, cash payments per capita, cheque payments per capita, card payments per capita, direct debit payments per capita, credit transfer payments per capita, POS terminals per capita, ATMs per capita. All variables are mean standardised in order to avoid scaling problems.

Table 13 Overview of European retail payments clusters

	<i>Cluster 1</i> <b>Denmark</b> <b>Sweden</b> <b>Finland</b>	<i>Cluster 2</i> <b>Austria</b> <b>Germany</b> <b>Netherlands</b> <b>Luxembourg</b>	<i>Cluster 3</i> <b>Belgium</b> <b>Estonia</b> <b>Slovenia</b> <b>Portugal</b> <b>United Kingdom</b> <b>Spain</b>	<i>Cluster 4</i> <b>Cyprus</b> <b>Malta</b> <b>Greece</b> <b>Italy</b> <b>Ireland</b> <b>France</b>	<i>Cluster 5</i> <b>Bulgaria</b> <b>Czech Republic</b> <b>Slovakia</b> <b>Poland</b> <b>Romania</b> <b>Hungary</b> <b>Lithuania</b> <b>Latvia</b>
Social costs to GDP (%)	0.80%	0.92%	1.11%	1.20%	1.01%
Average card transaction (euro)	38	58	41	75	38
Cash payments per capita	154	358	266	306	270
Cheque payments per capita	1	0	6	23	0
Card payments per capita	171	64	83	59	17
Direct debit payments per capita	25	77	31	16	5
Credit transfers per capita	98	102	55	24	35
Cards per capita	1.5	1.6	1.8	1.4	0.9
POS terminals per million inhabitants	25,072	14,034	20,628	25,643	7,722
ATMs per million inhabitants	480	868	1,156	766	484
GDP per capita (euro)	34,782	42,904	20,526	24,380	8,620
Number of countries	3	4	6	6	8

Sources: ECB Statistical Data Warehouse and European System of Central Banks.

Notes: Clusters obtained using Ward's hierarchical clustering approach. Based on the following variables: social costs to GDP, GDP per capita, payment cards per capita, average card transaction value, cash payments per capita, cheque payments per capita, card payments per capita, direct debit payments per capita, credit transfer payments per capita, POS terminals per capita, ATMs per capita. All variables are mean standardised in order to avoid scaling problems. Countries in **bold** are the 13 participants in the European cost of payment instruments study. Cost data for countries not in bold have been extrapolated.

All variables are mean standardised to avoid scaling problems. Ward's linkage<sup>37</sup> hierarchical cluster analysis is performed on the standardised measures. Charts 9 and 10 present the dendrograms<sup>38</sup> resulting from the above analysis considering the 13 cost study participants and all EU27 Member States respectively. A three- or a five-cluster solution results from the analysis.<sup>39</sup> The countries that belong to each group of the five-cluster solution are listed in Table 13. In the three-cluster solution, clusters 1 and 2 and clusters 3 and 4 are merged. In short, the countries in the five clusters can be described as follows:

- Cluster 1 countries have relatively low social costs of payment instruments, a low number of cash transactions per capita, low or no cheque usage, average direct debit payments per capita and high card and credit transfer payments per capita. They have a high number of POS terminals and a low number of ATMs. The number of cards per capita is about average, while the average card transaction is low. This group has relatively high GDP per capita.
- Cluster 2 countries show relatively low social costs of payment instruments, a comparatively high number of cash payments per capita coupled with an average number of card payments per capita, high remote payments per capita, and low (or no) cheque usage. The cards per capita are high, while the POS terminals and ATMs per capita, as well as the average size of a card transaction, are about average. This group has a relatively high GDP per capita.
- Cluster 3 countries have medium social costs of payment instruments, an average number of cash transactions per capita, a high number of cheque payments per capita, and an average number of card and remote payments per capita. They have a high number of cards per capita, POS terminals and ATMs, while the value of an average card transaction is relatively low. This group has about average GDP per capita.

- Cluster 4 countries have high social costs of payment instruments, a high number of cash and cheque transactions per capita, and an average number of card and remote payments per capita. They have a high number of POS terminals and a roughly average number of ATMs and cards per capita. The average card transaction is high. This group has average GDP per capita.
- Cluster 5 countries have about average social costs of payment instruments, an average number of cash transactions per capita, low or no cheque usage, and low card and remote payments per capita. They have a low number of POS terminals, ATMs, and cards per capita. The average card transaction value is low. This group represents the countries with relatively low GDP per capita.

## 6.6 HOUSEHOLD SURVEY

It is important to clarify that consumers and households incur costs when using retail payment instruments. Important cost elements for consumers and households include the cost of time spent on payment transactions; the losses on and risks of holding the payment instruments; and fees paid to payment service providers, for example on withdrawing cash, making credit transfers, accepting direct debits, holding payment cards and account keeping. These costs are not negligible from a social perspective. However, as these costs are difficult to quantify and reliable data is not readily available, it was decided for the purpose of this study to exclude these costs for consumers and households. As shown in the previous section, costs for consumers are typically not included in different studies. However, it is acknowledged

37 The distance between clusters is based on a minimum variance linkage

38 A dendrogram is a tree-like graph which depicts the results of hierarchical cluster analysis. It displays the links within and between groups. The distance between data points or groups is measured by the difference in tree-branch lengths.

39 It should be acknowledged that the results of cluster analysis are exploratory in nature and do not allow for drawing conclusions on their statistical significance.

**Table 14 Social costs of households per payment instrument**

	Denmark		Hungary	
	Million euro	Percentage of GDP	Million euro	Percentage of GDP
Cash	182.0	0.081	71.2	0.078
Debit cards	100.6	0.045	6.4	0.007
Credit cards	2.8	0.001	1.0	0.001
Direct debits	12.4	0.006	3.4	0.004
Credit transfers	223.8	0.100	82.4	0.090
<b>Total</b>	<b>521.2</b>	<b>0.233</b>	<b>164.4</b>	<b>0.180</b>

Sources: Danmarks Nationalbank (2012) and Turján *et al.* (2011).

that these costs are important to consumers in their choice of payment instruments.

Despite the difficulties in estimating or approximating consumer costs, the participating central banks were encouraged to go beyond the scope of the present study in their respective national reports and to also consider the costs for consumers, as these are important to consumers when they choose which payment instruments to use. Danmarks Nationalbank and Magyar Nemzeti Bank performed household surveys to estimate the social costs to households of different payment instruments.

Table 14 above presents a summary of the key findings on the magnitude of households' costs of payment instruments in Denmark and Hungary. The costs to households related to retail payment account for 0.18% of GDP in Hungary and 0.23% of GDP in Denmark. Despite the absence of further cost data on consumers or households, it should be noted that the average level of the presented household social costs seems to be plausible and reasonable and would need to be added to the overall social costs assessment.<sup>40</sup>

<sup>40</sup> In principle, one may argue that if the social costs of payment instruments to households are added to those of all other stakeholders, the production of households (e.g. cleaning, cooking, childcare, etc.) also needs to be added to the GDP.

## 7 CONCLUSION

The European Central Bank (ECB) carried out a study on the social and private costs of different payment instruments with the participation of 13 ESCB national central banks. The overall objective of the study is to enhance the general understanding of the cost of different payment instruments from a European perspective, with the aim of helping policy-makers, banks and retailers in promoting efficient payment services. In particular, the retail payments considered in the study are cash, cheque, debit and credit card, direct debit and credit transfers. Furthermore, this study explores the costs to central banks, banks and infrastructures, cash-in-transit companies and retailers; however, the costs to consumers and households are not considered. The study provides a snapshot of the social and private cost situation in 2009. This represents a first step towards a more dynamic approach to analysing the rapidly moving European retail payment market.

The existing literature shows that, in spite of recent efforts, there is still only limited knowledge and information available for making valid comparisons across European countries of the costs of making payments. This study provides a comprehensive analysis and empirical evidence at the European level.

The results of the study show that social costs of retail payment instruments from a European perspective are substantial and amount to €45 billion in total, i.e. on average 0.96% of GDP considering the 13 participating countries. When extrapolating the sample results from the participating countries to all EU27 Member States, the social costs of retail payment instruments are comparable to those of the sample countries and close to 1% of GDP (€130 billion) irrespective of the estimation method used. Half of the social costs are incurred by banks and infrastructures, while retailers incur 46% of all costs. However, retailers incur higher private costs than do banks, as they face higher external costs to be paid to other payment chain participants. The share of social costs

incurred by central banks and cash-in-transit companies account for 3% and 1% respectively. Due to relatively high usage, the cost of cash is nearly half of the total social costs. On average, cash payments show the lowest unit costs, followed closely by debit card payments. However, in some countries, cash does not always yield the lowest unit costs. In fact, in more than one-third of the sample countries, debit card transactions have lower unit costs than do cash transactions.

Overall, economies of scale seem to be present in the provision of retail payment services for almost all payment instruments. Moreover, the retail payment industry is characterised by a relatively high proportion of indirect costs, in particular for non-cash payment instruments. Limited country-level data suggest that households' costs associated with retail payments amount to about 0.2% of GDP. Although each country features its own unique retail payment market, in a cross-country comparison, the European market for retail payments can be grouped into five distinct clusters with similar payment characteristics.

With these findings, the study intends to provide a sound basis and a comprehensive framework for further policy making and conclusions in relation to the execution and promotion of cost-efficient retail payments for society. Therefore, the results may trigger a fruitful and constructive debate about suitable policy measures and payment instruments for improving social welfare and realising potential cost savings along the transaction value chain.

## ANNEX

### METHODS FOR ESTIMATING CASH PAYMENTS

This Annex provides an overview of alternative methods that were used to estimate the extent of cash usage at the country level, and discusses their strengths and weaknesses. This overview served as a background guide for the participating central banks to help them select and apply the method which seemed most suitable for this study and their national context. The following seven potential methods have been discerned:

1. A consumer survey, enabling the estimation of both the volumes and values of cash payments from a sample;
2. The “cash withdrawal data” approach, to obtain just the total values of cash payments;
3. A retailer survey, enabling the estimation of both the volumes and values of cash payments from a sample;
4. The “cash register statistics” method, to obtain both the volume and values of cash payments from a sample;
5. The “merchant deposit statistics” method, to obtain just the total values of cash payments;
6. The “consumption residual” method, enabling the estimation of just the total values of cash payments; and
7. The “circulation residual” method, enabling the estimation of just the total values of cash payments.

The first two methods, listed above and discussed in more detail below, focus on (reported) consumer behaviour; methods 3 to 5 attempt to exploit statistics collected on the retailer side; and the final two methods use high-level aggregates as their starting point. In the following pages, it is argued that

methods 1, 2, 4 and 5 seem the most promising. The preferred approaches are methods 2 and 5 for obtaining figures for the total values of cash payments, and methods 1 and 4 for estimating the total volumes and average size of cash payments. The volumes and values of person-to-person payments can only be estimated using method 1.

### I A CONSUMER SURVEY

The most straightforward way of quantifying the use of cash in a given country seems to be conducting a survey among a representative sample of consumers over a certain period. This was the approach followed in the studies by the central banks in Belgium, the Netherlands and Norway. In such a survey, respondents are typically asked, by telephone and every evening for a specific period (usually a week or month), to list all of the payments that they made during the previous day. They are also asked to provide details as to the payment instruments used, the payment amounts, etc. An alternative is to ask respondents to keep a “payments diary”.

Gresvik and Haare (2008, p. 10) argue that the consumer survey approach should yield “the ‘correct’ level of use of cash and other instruments at point of sale”. However, quite apart from the cost involved, this method is not without its shortcomings. First, only households are covered, and respondents may knowingly omit certain “sensitive” payments. Second, care must be taken with the representativeness of the consumer panel. In the study by the central bank in the Netherlands, this was a source of concern. The survey was a computer survey and the results were significantly biased towards electronic payments (De Nederlandsche Bank, 2004, pp. 35–38). As a result, the Dutch study relied on the results of a retailer survey. However, in a later study, Jonker and Kosse (2009) show that the use of a computer survey among Dutch consumers does not have to yield biased results. Third, when considering the timing of the survey, seasonal fluctuations in the use of cash should be kept in mind. The survey should be conducted during a “normal”

month. Gresvik and Haare (2008), Jonker and Kosse (2009), and (more recently) Jonker et al. (2012) collected data in September. Using information on cash withdrawals and card usage may be helpful in determining “representative” months with regard to POS payments. Fourthly, there are certain parts of the economy in which payments are made to a large extent in cash, but infrequently and by a skewed population, such as buying and selling cars and antiques, making purchases at auctions, etc. Fifthly, in some countries, tourist cash flows represent a large proportion of the cash usage. Finally, and perhaps most importantly, experience shows that, even in a well-conducted survey, small-value (cash) payments may be underreported because respondents forget about them. Jonker and Kosse (2009) show that the design of the survey has an impact on the quality of the results, especially where small-value payments are concerned. The use of diaries in which people can record their payments proves helpful when it comes to them registering their payments. Also, the period in which people must register their payments should be limited, otherwise people tend to forget to register some of them. Jonker and Kosse (2009) compare their estimates of the volume and value of cash payments with information supplied by retailers. They show that, when consumers are asked to report one day’s payments in a self-reported transaction diary, their estimates do not differ significantly from the information provided by retailers on cash payments. They consider seven different methodologies for collecting data. They show that respondents who are asked to report in a telephone interview the payments that they made in the previous day and those who have to keep a diary for an entire week report significantly fewer cash payments than the retailers. They especially underreport small-value cash payments.

## 2 THE “CASH-WITHDRAWAL DATA” APPROACH

A second possible approach lies in making use of data on cash withdrawals from bank accounts. Data on ATM withdrawals should be readily available for all countries, but the

same might not be true for OTC withdrawals. In countries where cashback is given at POS, data on this, based on available statistics and/or estimations or samples, should be included. This approach should yield a reasonably accurate figure for the total value of cash payments; however, ascertaining a figure for the volume of cash payments would require information on the average size of POS and person-to-person cash payments. In some countries, where there is an imbalance between cash imports and exports, corrective estimates will be necessary. The figures on cash withdrawals would also need to be corrected to account for withdrawals for hoarding purposes: excluding all withdrawals of €200 and €500 notes, and in some countries also €100 notes, could be a practical solution to this. In countries where salaries are to some extent paid in cash, additional estimates will again be necessary.

## 3 A RETAILER SURVEY

A third possible method consists in adding questions as to the number of payments received, for example in the course of one month, to the retailer and company survey. Norges Bank is one central bank to have adopted this method and, as Gresvik and Haare (2008, p. 25) point out, this “could have provided a good basis for estimating payments at point of sale”. Unfortunately, the response rate to Norges Bank’s survey was very low – a hazard that participating central banks should keep in mind. The experience of other central banks suggests that retailers’ answers are of a better quality than those of consumers, especially if retailers have hard data on POS payments, i.e. they register each purchase electronically, including information on the payment instrument used. In order to gain an indication of the accuracy of the information provided by the retailers, they could be asked what kind of information they are basing their estimate of cash usage on. However, it is not easy to cover all relevant “points of payment”. Also, given the heterogeneity of the population, scaling up the results of a retailer survey will always be somewhat more difficult



than conducting a consumer survey. Moreover, this approach might be practical for small retailers, but the use of the “cash-register statistics” method detailed below seems more applicable to supermarkets and other large retailers who register purchases electronically. Finally, person-to-person payments are not covered by this method. In any case, the figure obtained from a retailer survey can be used to check the figure for the volume of cash payments derived from a consumer survey. In the case of the Belgian study, the two figures proved to be very close to one another, at 2,909 and 2,866 million, respectively (Banque Nationale de Belgique, 2005, p. 24).

#### 4 THE “CASH-REGISTER STATISTICS” METHOD

As far as we know, this method has only partly been applied by EIM (2007), which collected statistics from the cash registers of some large retail chains; but in principle, it is feasible to analyse the data on payments from a sample of cash registers to see how many cash payments have been made, what the average amount is, etc. Unlike the previous retailer-focused method, this approach would yield hard data. But, just like the previous method, the reliability of the results would depend on the use of adequate strata. The fact that not all retailers in all countries will have unit-level data on payments, because they do not have electronic cash registers, raises issues as to the representativeness of this method. However, in several countries, the bulk of payments to merchants (80–90%) are registered in cash registers.

#### 5 THE “MERCHANT-DEPOSIT STATISTICS” METHOD

This novel method proposed by Gresvik and Haare (2008, p. 25) relied on statistics on the cash deposited by commercial banks at Norges Bank and at private depots operated by cash-in-transit companies. If a “single-use cycle” is assumed (i.e. if it is assumed that, during each full cycle of the circulation, a banknote or coin

is used in only one transaction), then statistics on deposits provide an indication of the value of the cash used in society. As Gresvik and Haare stress, this should be viewed as a lower-bound estimate. Indeed, notes and coins can make “loops” among consumers or between consumers and merchants at several stages in the cycle. Cashback at POS represents one such loop. In countries where cashback at POS is prevalent, the figures on deposits should be corrected on the basis of statistics on and/or estimations of the cashback given. When efficient cash logistics are in place, merchants will deposit the whole end-of-day cash balance, but withdraw in the morning a fixed cash start-up balance, which should be subtracted from the deposit figures. Note also that the viability of this method may differ between countries, as the way in which cash handling is organised will probably affect the availability and representativeness of the statistics on deposits. However, employing this method could, together with the “cash-withdrawal data” method, help to estimate the level of hoarding and the imbalances between cash imports and exports.

#### 6 THE “CONSUMPTION RESIDUAL” METHOD

A sixth possibility – at least as far as estimating the value of cash payments is concerned – is to apply a method developed by Humphrey et al. (2000 and 2004) and Snellman et al. (2001). In this method, the value of the cash used at POS is calculated as a residual. The starting point is the value of household consumption as it appears in the national accounts. From this, the value of goods and services commonly paid for by means of credit transfers is subtracted in order to obtain the value of consumption at POS. Subtracting, in turn, the value of POS transactions made by cards and cheques – for which reliable statistics are available – eventually yields an estimate of the value of POS cash payments. Gresvik and Haare (2008, p. 16) point out two limitations of this method. First, household consumption is underestimated because of the existence of the underground economy. Second, goods and services are sold at several stages in the value

chain before being consumed, and some of these transactions might involve cash. Also, it should be kept in mind that although this method focuses on cash usage at POS, it starts from a far broader aggregate and thus might very well overestimate what it is trying to gauge (Gresvik and Haare, 2008, p. 14).

## 7 THE “CIRCULATION RESIDUAL” METHOD

Finally, starting with data on the volume of currency in circulation, one could attempt to isolate the share of the cash stock that is held for making cash payments (either including or excluding the above-ground economy). In concrete terms, this requires an estimation of how much cash is being hoarded, saved, etc. This method was developed by Humphrey et al. (2000) and later replicated by several other authors (see Gresvik and Haare, 2008, p. 5 for

a list, and 2008, p. 32–36 for more details on the method). Given that in the euro area even estimating the stock of cash in a given country – which is the starting point for this method – is fraught with problems, this method does not seem to hold much promise for the purpose of the proposed study.

## METHODS USED FOR THE ESTIMATION OF CASH VOLUMES AND VALUES PER COUNTRY

The overview provided above demonstrates that there is a need to use several methods in parallel in order to obtain reliable estimates. As for collecting information on the costs of payment transactions, ideally the same methodology is used for collecting information on the volumes and values of POS cash payments.

The table summarises the methods selected by each cost study-participating central bank for the estimation of cash volumes and values.

Methods used for the estimation of cash volumes and values per country

Country	Consumer survey	Cash-withdrawal data	Retailer survey	Merchant-deposit statistics	Consumption residual	Other method
Denmark	“X”					
Estonia					“X”	X
Finland		X				“X”
Greece					“X”	
Hungary	“X”				“X”	
Ireland					“X”	
Italy		“X”			“X”	
Latvia	X		“X”		X	
Netherlands	“X”	X	X		X	
Portugal		“X”	“X”	“X”		
Romania	“X”		“X”			
Spain			“X”		“X”	
Sweden	“X”	“X”		X	X	

Source: European System of Central Banks.

Notes: X denotes the method(s) used by each country’s central bank for the estimation of cash volumes and values. Some central banks used various estimation approaches in order to confirm the robustness of figures and then selected the most appropriate estimations based on expert opinions. “X” marks the method(s) used for the final cash volume and value estimations. None of the central banks used the “Cash-register statistics” or the “Circulation residual” methods; therefore, they are excluded from the table.

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