Current and projected development of coin circulation in Germany

The individual member states of the European monetary union have the prerogative to issue coins. The calculated volume of coins in circulation in Germany, ie the coins issued by the Bundesbank less those paid in at its branches, rose more or less continuously from €3.8 billion (11 billion coins) in January 2002 to €6.8 billion (30 billion coins) in December 2012. This means that, on average, every member of the general public is in possession of around 345 coins with a value of €79.85, most of which (175 coins) consists of 1 and 2 cent coins.

Every year in January and September, the Bundesbank, as part of the coin requirement planning, forecasts the change in the circulation of euro coins for each denomination. The demand for coins is influenced positively by the volume of consumer goods settled in cash (as a transaction variable) and the percentage of people aged over 65 in the population as a whole (as a socio-economic factor). Conversely, an increase in the use of the e-purse as an alternative means of payment to coins leads to a decline in the volume of coins in circulation.

A further aspect which influences the issuance of euro coins is coin migration. In 2012, around 37% of all euro coins in circulation in Germany were issued abroad. It is apparent that, all other things being equal, coins issued in Germany's neighbouring countries have, on average, a 5 percentage point greater probability of ending up in Germany than those issued in countries which do not share a border with Germany. For coins originating in those countries which are Germany's most popular holiday destinations (Spain, Austria and Italy), the probability is, on average, 6 percentage points greater than for coins from other euro-area states.

In the euro area, two countries – Finland and the Netherlands – have introduced a rounding rule in order to achieve greater efficiency in cash payments. This involves the final amount at the point of sale being rounded commercially either up or down to the nearest 5 cents. The general public in Germany appears to have a positive attitude towards small coins and is not in favour of introducing a rounding rule like in the two countries mentioned. The fear is that this could have an inflationary effect. According to the interim results of a cash study conducted on behalf of the Bundesbank, which has yet to be published, the inflationary effect due to the introduction of a rounding rule appears to be very small. In the case of commercial rounding of the sum on the cash receipt, the rounding-up and rounding-down effects largely balance each other out. Even in a scenario where retailers round up all transaction amounts to the nearest 5 cents, the one-off effect of the price increase would equate to no more than about 1‰.

Legal framework

Pursuant to Article 128 (2) of the Treaty on the Functioning of the European Union, the member states have the prerogative to issue coins in the euro area. The volume of coins to be issued is subject to approval by the European Central Bank (ECB). The Council may, on a proposal from the Commission and after consulting with the European Parliament and the ECB, "adopt measures to harmonise the denominations and technical specifications of all coins intended for circulation to the extent necessary to permit their smooth circulation within the Community". This ruling came into force with Regulation (EC) No 975/98 of May 1998, which was amended by Regulation (EU) No 566/2012. This Regulation also contains specifications for the design of the national sides of regular issue euro coins.

Coin issuance is the task of the member states

In Germany, the manufacture, issuance and the obligation to accept and exchange coins is governed by the Coinage Act (*Münzgesetz*). Under this Act, the German Federal Government is responsible for the minting of German euro coins (coinage prerogative). In Germany, the Federal Ministry of Finance (BMF) decides which coins are to be produced and in what quantities. The Bundesbank acts as a fiscal agent[1] on behalf of the BMF and brings the German euro coins into circulation.

Euro coins are limited legal tender

Both regular issue euro coins and German commemorative euro coins are legal tender, with the latter, however, being legal tender solely in Germany. When making a single payment in German commemorative euro coins, no party is obliged to accept an amount in excess of €200. If a single payment is made using both regular issue euro coins and German commemorative euro coins, no party is under obligation to accept more than 50 coins; this also applies if the total amount is less than €200. Pursuant to the Coinage Act, the Bundesbank is obliged to accept an unlimited number and amount of regular issue and German commemorative euro coins as payment for the account of the Federal Government or to exchange them for other legal tender. Coins which are no longer fit for circulation are reimbursed by the Bundesbank or exchanged for other legal tender. The Bundesbank does not, however, reimburse euro coins which have been altered either deliberately or by a process that could be reasonably expected to have the effect of altering them.

Countervalue of issued coins credited to account of Federal Government

German euro coins are produced by five coin mints throughout the country[2] on behalf of the Federal Government. Once the coins have been transferred to the Bundesbank, the nominal value of the coins is then credited to the account of the Federal Government. In order to preclude the risk of hidden government financing, the maximum credit amount for the transfer of coins is limited. Coin holdings which exceed 10% of the total volume of coins in circulation nationally are debited to the account of the Federal Government.

The following remarks relate solely to regular issue euro coins and DM coins that are still in circulation. DM coins are a useful variable for quantitatively estimating the level of hoarding and losses for euro coins, too.

Coin circulation[3]

Volume of coins in circulation is rising continuously, …

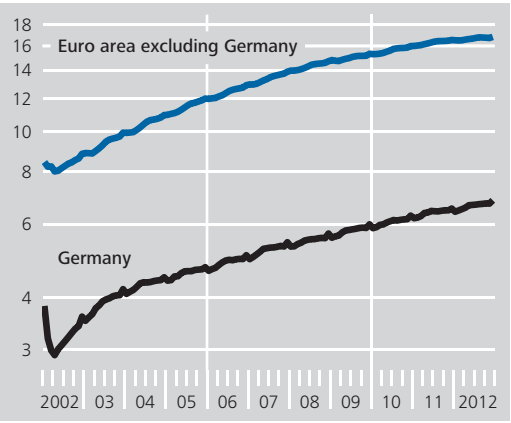
The calculated volume of coins in circulation in Germany, ie the coins issued by the Bundesbank less those paid in at its branches, rose more or less continuously from €3.8 billion (11 billion coins) in January 2002 to €6.8 billion (30 billion coins) in December 2012. It was only shortly after the introduction of euro banknotes and coins in 2002 that there was a sig-

1 Financial service provider to the German Federal Government.
2 The German coin mints are located in Berlin, Hamburg, Karlsruhe, Munich and Stuttgart.
3 It is not possible to determine accurately the circulation of coins in the individual euro-area member states. The term "coin circulation" is used to define the cumulated net issuance (the coins issued by the Bundesbank less those paid in at its branches).

nificant decline, with the volume of coins in circulation reaching its lowest level to date of €2.9 billion (8.6 billion coins) (see adjacent chart). The reason for this was that retailers and credit institutions were supplied with euro coins in 2001 in preparation for the launch of the euro currency in the following year. This frontloading of euro cash was supported financially by the Bundesbank. At the same time, consumers were also able to acquire euro coins prior to the introduction of euro cash, with the result that shortly afterwards there was a considerable surplus of coins on the market; this was then later reduced once the coins started being paid back in at the Bundesbank. It was not until 2003 that the volume of euro coins in circulation regained a level similar to that at the beginning of 2002. This distinctive feature of developments in coin demand would lead to a distortion in the forecast models, which is why data on the volume of coins in circulation up until the end of 2003 are not used.

Coin circulation in Germany and in other euro-area countries

€ billion, monthly, log scale



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… but not as sharply as banknotes

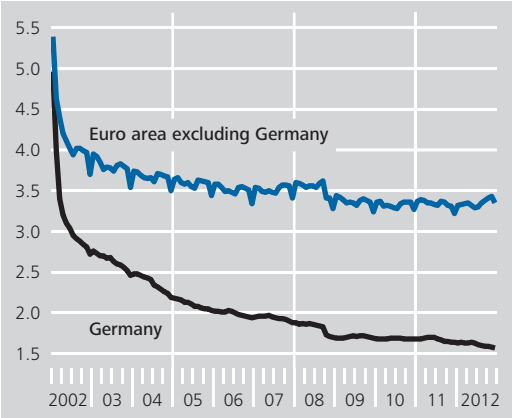
The growth rate in the value of coins in circulation is slower than for banknotes. As a result, the percentage of coins in the total volume of cash in circulation has declined significantly since the introduction of euro banknotes and coins, both in Germany and in the rest of the euro area. This decline is much more pronounced in Germany than in the other euro-area countries, however. This is due to demand for euro banknotes from countries outside the euro area, a considerable part of which is served by the Bundesbank.[4] Furthermore, a typical seasonal pattern is also evident in the euro-area member states (excluding Germany), which is characterised by a heightened demand for banknotes and a slower increase in demand for coins in the Christmas trading period. This leads to a decline in the percentage of coins in the total volume of cash in circulation during this period. This is not the case for Germany, however, where growing demand for banknotes at the end of the year nearly matched the increase in the volume of issued coins. This means that there is no marked seasonal pattern in the percentage of coins in the total volume of cash in circulation (see upper chart on page 32).

How the percentages of the individual denominations are spread across the volume of coins in circulation is largely identical in both Germany and the rest of the euro area (see lower chart on page 32). In terms of value, the €2 coin accounts for the largest share of the total volume of coins in circulation. In relation to the other euro coins, the €2 coin accounts for a much greater share in Germany than in the other euro-area member states, however. Conversely, there are fewer coins of the other denominations in circulation in Germany, especially the €1 coin. In terms of the number of individual coins in circulation, the small-denomination coins account for the largest part of the total volume. This applies to Germany to much the same extent as the other euro-area countries. The 1 and 2 cent coins are, however, overrepresented in Germany compared with the other euro-area countries.

4 See Deutsche Bundesbank, Foreign demand for euro banknotes issued in Germany, Monthly Report, January 2011, pp 29-41.

Euro coins in relation to the total volume of banknotes and coins in circulation

As a percentage, monthly



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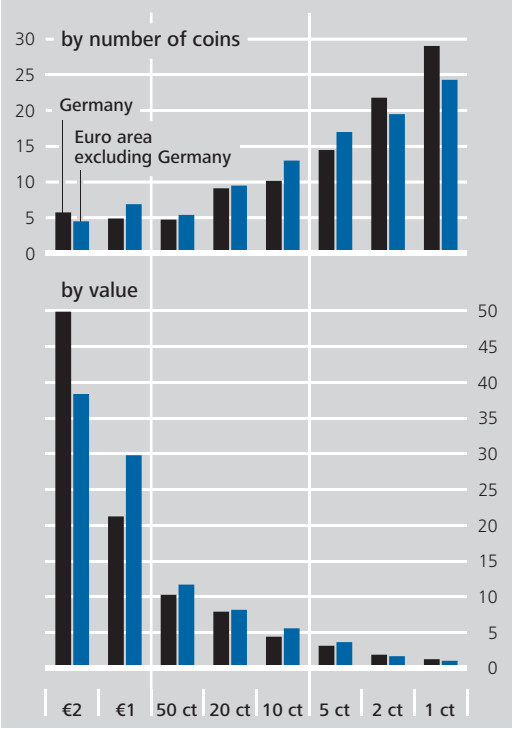
Breakdown of euro coins in circulation by denomination

As a percentage, as at 30 December 2012



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Possession of euro coins

In unadjusted terms, every member of the general public[5] in the euro area (excluding Germany) is in possession of around 277 coins with a value of €65.87. The largest part (119 coins) is accounted for by 1 and 2 cent coins. For Germany, this figure is around 345 coins with a value of €79.85. In this case, too, 1 and 2 cent coins account for the lion's share, with each member of the general public possessing, on average, 175 of these coins.

Coin requirement planning

The Bundesbank has, since the D-Mark era, traditionally advised the German Federal Government on the expected demand for coins in the coming year. In this connection, the Bundesbank published a study in 2003 on developments in coin circulation in Germany.[6] Furthermore, the Bundesbank also incorporates coin-related issues into its studies on payment behaviour in Germany which appear regularly.[7]

Coin requirement planning procedure

Given that coins have a lifespan of 20 to 30 years, the need to replace euro coins which are no longer fit for and withdrawn from circulation is currently not as important as the need arising from a growing demand. Every year in January and September, the Bundesbank forecasts the change in the circulation of euro coins for each denomination (in million coins). The January forecast is used to determine the remaining minting requirement for the current year and also serves as an initial estimate of the revenues from the issuance of euro coins in the following year (budget estimate of the Federal Ministry of Finance (BMF)). The September forecast determines the minting requirement for the following year and updates the BMF's budget estimate. The forecast models are described in the box on page 35.

5 The population figures are based on Eurostat data for 1 January 2012 (http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=tps00001). For reasons of consistency, the coin figures for the same period were used as the data basis.

6 See Deutsche Bundesbank, Münzgeldentwicklung in Deutschland – Eine empirische Studie über den Münzgeld- und Banknotenumlauf in der Bundesrepublik Deutschland mit einer Prognose der Münzgeldnachfrage bis 2007, June 2003.

7 See Deutsche Bundesbank, Payment behaviour in Germany – An empirical study of the selection and utilisation of payment instruments in the Federal Republic of Germany, July 2009; and Payment behaviour in Germany 2011 – An empirical study of the utilisation of cash and cashless payment instruments, October 2012.

Impact of underlying institutional conditions on coin circulation

The volume of coins in circulation is also influenced by changes in the underlying institutional conditions, which then necessitate an adjustment to the forecast models. On 1 January 2011, for example, the Bundesbank introduced the standard container[8] as the only free-of-charge standard service for coins, both for lodgements and withdrawals. Until further notice, the Bundesbank will continue to accept – for a fee – lodgements and withdrawals of coins that do not meet the filling requirements of a standard container. This change in the range of services was designed to place greater emphasis on the Bundesbank's role as a wholesaler in coin operations. The Bundesbank expected that this would lead to coin clearing taking place directly between service providers and customers, ie without the involvement of its branches. The standard container has now become established among the market participants. At the end of October 2012, around 96% of all coin withdrawals at the Bundesbank were made using standard containers. With regard to inpayments, the figure has been fluctuating between 59% and 78% over the past few months. Market participants primarily use lodgements to transfer their surplus coin stocks to the Bundesbank. The volume of coin lodgements and withdrawals at the Bundesbank's branches has declined by around 28%. This means that the market has assumed at least part of the function of balancing supply and demand, which used to be performed by the Bundesbank's branches.

The changes in the underlying institutional conditions have also been reflected in the demand for coins and suggest the following interpretation.[9] Between the beginning of January and the end of April 2011, cash handlers built up working volumes in the form of external coin depots. These were required as part of the preparations for private coin recycling in order for the cash handlers to be able to balance out the supplied and demanded quantities of coins, including lodgements and withdrawals not meeting the filling requirements of a standard container.[10] During this period, the volume of coins in circulation was higher than would normally be expected. It was not until May 2011 that private coin recycling started to take off on a sizeable scale. Since then, growth in the volume of coins in circulation has been significantly slower. In line with this, demand for newly minted coins is also declining.

Forecast models for coin circulation

Time series and structural models

In general, there are two different model approaches for explaining and forecasting demand for German-issued coins. The explanation can largely be based on demand observed in the past, without reference to any additional economic factors. This approach involves RegARIMA time series models.[11] Such reduced-form models are, however, insufficient for investigating the impact of economic factors on coin circulation. Structural models are well suited to this purpose as these capture the individual motives behind the demand for coins. These include, in particular, domestic transaction balances and hoarding. Domestic transaction balances comprise cash held for buying goods and services and therefore have a direct relationship with transactions in the real economy. Hoarding can essentially be understood as the holding of currency as a store of value. The hoarding of coins, however, can be defined more broadly as the traditional form of saving, such as in money boxes, and includes specifically collecting coins without the intention of spending them on consumer

8 Bundesbank coin containers, which are filled with a standardised quantity of coin roll packs of a single denomination. These containers weigh between 625 kg and 700 kg depending on the denomination.
9 This interpretation is based on the (highly significant) positive estimates for the coefficients *c5* and *c6* as well as the negative estimate of the coefficient *c7* from equation (1) in the detailed comments on the forecast model on page 35.
10 The content of a standard container is between 300 coin roll packs (€150,000) for €2 coins and 500 coin roll packs (€2,500) for 1 cent coins.
11 RegARIMA or ARIMAX models are ARIMA models with exogenous input. The input can be either deterministic (eg dummy variables) or stochastic and exogenous.

goods in the short term or placing them in an interest-bearing account. One distinctive feature in the case of coins, which also has a considerable impact on the minting requirement, is the large number of coins that go missing over the years. It can be assumed that it is mainly small-denomination coins that are hoarded or irretrievably lost. The demand for coins from countries outside the euro area also has an impact on the minting requirement.

Modelling of transaction balances, …

The transaction motive of holding coins can be modelled using different variables. Cash consumption, for example, is a suitable variable for this, ie that part of private consumption which is paid for mainly with banknotes and coins. Furthermore, there are a large number of vending machines in Germany from which goods and services can be purchased in cash. This applies, in particular, to cigarette vending machines, which are frequently coin-operated, and where changes in the price of cigarettes directly affect the structure of demand for coins. This is why cigarette consumption is a suitable variable for estimating coin demand. By contrast, real GDP is less suitable as a transaction variable as it contains a number of components that are paid for without using cash.

… hoarding …

The hoarding motive of coin demand is difficult to model as, given the small amounts involved, it is not, strictly speaking, a true form of classical saving. The interest rate for short-term investments can, however, be used as a measure of the opportunity costs for classical forms of saving.

… and other factors

Furthermore, coin demand is dependent on the availability of alternative means of payment and technological innovations. These factors can be modelled using, among others, the following variables: payment card top-up amounts, number of ATMs, number and value of card payment transactions as well as the number of bank accounts. In addition to these direct variables, the impact of technological innovations can also be modelled using a deterministic time trend. Finally, coin demand is also influenced by socio-economic factors. For example, younger and older persons use cash more frequently than persons in other age groups.[12]

Estimation results

Estimations of coin demand that were carried out a number of years ago using structural models failed to provide consistently satisfactory results, however. This was due primarily to the inadequate availability of analysable data and, in particular, to the small number of observations. An attempt to incorporate coin circulation data prior to the year 2002 (D-Mark era) into the estimations in order to obtain a longer observation period and thus more degrees of freedom proved to be unsuccessful. There was too great a difference in coin circulation during the D-Mark and euro areas for a robust cross-period specification to be obtained. Furthermore, there are hardly any appropriate transaction and opportunity cost variables for the small cent denominations. It was therefore not possible to estimate large and small-denomination coins (eg euro and euro cent coins) separately from one another. The outcome was that it was possible to estimate only the total volume of German-issued euro coins in circulation as a single equation in first differences. Consequently, coin circulation is influenced positively by the percentage of consumer goods settled in cash (as a transaction variable) and the percentage of people aged over 65 in the population as a whole (as a socio-economic factor). Conversely, an increase in the use of the e-purse as an alternative means of payment to coins leads to a decline in the volume of coins in circulation.

Against this backdrop, the reduced-form models at present therefore remain an indispensable tool for detailed forecasting of the demand for German-issued coins (see box on page 35).

12 See Deutsche Bundesbank, Payment behaviour in Germany 2011 – An empirical study on the utilisation of cash and cashless payment instruments, October 2012.

Forecast model

Forecasts of the volume of coins in circulation are based on statistical time series models with monthly data as well as on expert knowledge. The statistical forecasting models are RegARIMA models. All denominations in circulation display a stochastic trend. The estimation is therefore performed in the first difference of the (logarithmic) circulation, which is to say in growth rates. In the following, the specification of the models is explained using the €1 denomination as an example.

$$
\begin{aligned}
(1)\ \Delta \ln(y_t) = {} & a_0 + a_1 \Delta \ln(y_{t-12}) + c_1 EASTER \\
& + c_2 SEAS(1) + c_3 SEAS(5) \\
& + c_4 SEAS(12) + c_5 DUM1101 \\
& + c_6 DUM1104 + c_7 DUM1105 \\
& + \varepsilon_t + \beta_1 \varepsilon_{t-1}
\end{aligned}
$$

Here, the process (y_t) denotes the €1 coins in circulation that were issued in Germany (in million coins) and (ε_t) stands for white noise. The ARMA part of the model (1) is an MA(1) model with a seasonal AR term. *SEAS(i)* stands for a seasonal dummy variable for the month *i*. For instance, the rise in demand for coins in December because of Christmas is denoted by *SEAS(12)*. The variable *EASTER* represents the increased demand for coins at Easter. Since the Easter holidays do not fall in the same month every year, they cannot be represented by a seasonal dummy variable. The three dummy variables *(DUM11..)* refer to the months January, April and May 2011 respectively. They are used to model the effect of institutional changes with regard to coin recycling.

Equation (1) was estimated using data from January 2004 up to and including August 2012. The observations from the years 2002 and 2003 were disregarded due to distortions following the introduction of euro cash. When making the specification, in addition to a good fit, particular care was taken to ensure that the residuals were uncorrelated and the coefficient estimates were stable. Of importance when selecting the forecast model were the pseudo out-of-sample forecasts of the annual increase in coins in circulation in the period from April 2010 to August 2012.

Unobserved component models as developed by Andrew Harvey generally offer a suitable alternative to the RegARIMA models. However, the number of observations is not yet sufficient to be able to use them. Unlike with RegARIMA models, the coefficients in these models are not fixed but vary over time. This means that the seasonal structure to be observed, which changes over time, could be better represented using unobserved component models.

Estimation results[1]

Coefficient	Estimate	
a_0	0.0007	(0.0005)
a_1	0.4783**	(0.0857)
c_1	0.0114**	(0.0024)
c_2	– 0.0272**	(0.0022)
c_3	0.0151**	(0.0036)
c_4	0.0144**	(0.0047)
c_5	0.0069**	(0.0011)
c_6	0.0118**	(0.0012)
c_7	– 0.0099**	(0.001)
β_1	– 0.2729*	(0.1244)

1 Newey-West robust standard errors are shown in parentheses; one asterisk (*) denotes significance at the 5% level, two asterisks (**) denote significance at the 1% level. Adjusted R-squared = 0.86.

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Coin migration

Coin migration influences demand

Unlike in the case of banknotes, the issuing country of a coin can be identified by looking at its reverse side. This means that it is possible to analyse the cross-border movements of coins – known as coin migration. This allows identification of the cash payment flows within the euro area owing, say, to tourism or cross-border workers. These cash flows can have an impact on coin issuance and thus on the resulting profit (seigniorage), which is credited to the account of the respective national governments. That said, the member states have no way of actively influencing coin migration and thus the resulting seigniorage.

Coin mixing increases in the long run

With regard to the mixing of €1 coins, Seitz et al (2012)[13] estimate that, based on the current coin circulation growth rates in the individual euro-area member states, every year approximately 5% of German-issued euro coins flow to other countries and around 1.8% of non-German-issued coins flow to Germany. In the long term, this would lead to a 47% share of non-German-issued coins in circulation in Germany and an 11% share of German-issued coins in circulation in the other euro-area countries.

In order to determine the degree of current coin mixing, the Bundesbank took a sample of 2,000 coins (20 cent to €2 coins) at each of 30 different branches and sorted them according to their country of origin. In 2012, around 37% of all euro coins in circulation in Germany were issued abroad.

Coins from neighbouring countries and holiday destinations overrepresented

The table on page 37 shows the origin of non-German-issued coins in Germany according to country of issue.[14] The largest shares in terms of coin numbers come from Italy, France and Spain (column 1). The main reason for this distribution pattern is that these countries account for the largest percentage of the total volume of coins in circulation in the euro area as a whole and that their coins therefore occur more frequently (column 2). Furthermore, looking at the difference between the distribution of foreign coins in circulation in Germany compared with that in other euro-area countries, there is a greater mixing with coins from Austria, Belgium, Italy, Luxembourg, the Netherlands and Slovenia (columns 3 and 4). A similar pattern can be observed in a comparison with the capital key shares, which reflect the economic strength of the member states (columns 5 to 7).

What is striking is that those countries which are overrepresented are primarily neighbouring countries and popular holiday destinations. A regression analysis was additionally carried out to quantify the role of these two explanatory factors, taking account of the net issuance volumes, proximity to the border, and Germans' travel behaviour as the explanatory variables. It becomes apparent that, all other things being equal, coins issued in Germany's neighbouring countries have, on average, a 5 percentage point greater probability of ending up in Germany than those issued in countries which do not share a border with Germany. For coins originating from Germany's most popular holiday destinations (Spain, Austria and Italy),[15] the probability is, on average, 6 percentage points greater than in the case of coins from other euro-area member states.

Greater mixing at Bundesbank branches in border regions

The location of the Bundesbank's branches, ie whether they are located close to a border region, is likewise significant for the degree of mixing of coins. Branches in German federal states located bordering on another euro-area member state have a greater degree of mixing from those neighbouring countries. For example, coins originating from Luxembourg are 2.7 times more likely to migrate to the German

13 F Seitz, D Stoyan and K H Tödter (2012), Coin Migration and Seigniorage within the Euro Area, Journal of Economics and Statistics (Jahrbücher für Nationalökonomie und Statistik), 232: 1, pp 84-92.
14 For the sake of simplicity, the following data are based on the assumption that the shares of the individual countries in the total volume of foreign coins in circulation in Germany are identical for all denominations. This was largely the case in 2012.
15 See ADAC Reisemonitor 2012.

Coin migration in the euro area*

Figures in per cent

Country	Individual countries' share in the total volume of foreign coins in circulation in Germany	Individual countries' share in the total volume of coins in circulation in the euro area (excluding Germany)	Absolute deviation of the distribution of foreign coins in Germany from that in the euro area	Relative deviation of the distribution of foreign coins in Germany from that in the euro area	Capital key shares in 2011 (excluding Germany)	Absolute deviation of the distribution of foreign coins in Germany from the capital key shares	Relative deviation of the distribution of foreign coins in Germany from the capital key shares
Austria	14.41	7.65	6.77	88.47	3.80	10.61	278.85
Belgium	11.56	5.40	6.17	114.32	4.75	6.81	143.33
Cyprus	0.10	0.45	– 0.35	– 77.17	0.27	– 0.17	– 61.63
Estonia	0.07	0.15	– 0.08	– 55.29	0.35	– 0.28	– 80.43
Finland	1.10	1.86	– 0.76	– 41.05	2.46	– 1.36	– 55.30
France	17.43	22.10	– 4.66	– 21.11	27.86	– 10.43	– 37.44
Greece	2.71	3.69	– 0.98	– 26.56	3.85	– 1.14	– 29.58
Ireland	1.68	6.38	– 4.70	– 73.64	2.18	– 0.49	– 22.73
Italy	22.10	19.36	2.74	14.15	24.49	– 2.39	– 9.74
Luxembourg	1.82	0.92	0.90	98.05	0.34	1.48	431.29
Malta	0.07	0.24	– 0.18	– 71.93	0.12	– 0.06	– 44.56
Netherlands	8.85	3.92	4.93	125.72	7.81	1.04	13.30
Portugal	1.65	3.38	– 1.74	– 51.33	3.43	– 1.78	– 51.97
Slovakia	0.51	0.60	– 0.09	– 14.47	1.36	– 0.84	– 62.11
Slovenia	0.34	0.27	0.07	27.30	0.64	– 0.30	– 46.73
Spain	15.58	23.62	– 8.04	– 34.04	16.27	– 0.69	– 4.25

* The percentage shares of the individual countries in relation to the total volume of coins in circulation and the distribution of foreign coins refer to the number of coins.

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federal states of Rhineland Palatinate and the Saarland than to the rest of the country. This factor fluctuates between 1.3 and 1.5 for the other federal states that share a border with another euro-area member state. This effect tends to be stronger, the closer a branch is located to a neighbouring euro-area country.

In order to gain a complete picture of the phenomenon of coin migration, it would be useful to have data not only on the origin of coins migrating to Germany but also some clues as to the whereabouts of the coins that migrate from Germany. No information of this kind is available at present, however, as there are no comparable current data on the distribution of coins abroad. Nor can any reliable conclusions be drawn on the speed at which coin migration occurs as longer time series would be required for this. There is also a lack of information about net inflows and outflows of coins between the euro-area member states. If such information were available, it would be possible to draw conclusions as to the migration of coins and the impact which this has on seigniorage among the individual euro-area countries. Furthermore, information on coin migration would probably also be useful for planning the coin requirement, especially if this is not a uniform process across the member states of the euro area.

Public opinion on small coins

No clear trend in public opinion on small coins

The European Commission carries out regular surveys on the attitude of the general public in the euro area towards banknotes and coins. The Bundesbank performed more detailed research on this subject in its 2011 study on payment behaviour in Germany.[16] The more detailed results of the survey differ substantially

16 See Deutsche Bundesbank, Payment behaviour in Germany 2011 – An empirical study on the utilisation of cash and cashless payment instruments, October 2012.

D-Mark coin circulation

The analysis of DM coins in circulation represents a good opportunity for estimating the percentage of coins that have been hoarded over the longer term or have been lost. At the time when demand was at its highest in 1999 (or 2000), ie well in advance of the introduction of euro cash, 48.3 (or 48.8) billion individual coins[1] were in circulation (see chart below). For logistical reasons, some inactive, hoarded coins were removed from circulation and paid in at the central bank as a result of a special campaign[2] well before euro cash was introduced. This meant that the circulation of DM coins had fallen to 37.2 billion prior to the changeover date. In the following years, DM coins continued to be paid in at the Bundesbank, albeit at declining return rates.

In 2012 alone, DM coins in the amount of DM21.5 million were exchanged for euro. There are currently still 23.5 billion individual DM coins with a value equivalent to almost €2.4 billion in circulation. At 56%, small coins[3] account for the largest percentage share in DM coins still in circulation. Given that both the number and the value of the submitted coins change to only a minor extent, it may be assumed that most of these coins are being hoarded long-term or have been irretrievably lost (see table above). The results shown for DM coins suggest that most of the coins are not being used in payments – particularly in an ageing coin cycle. As part of the launch of euro cash, in order to estimate the logistical implications of return flows of DM cash, a loss in the amount of DM2.4 billion or 19.5 billion individual coins was calculated. Compared with the DM coins currently still in circulation, this figure was underestimated due to the fact that no robust information on hoarding and transaction stocks was available when euro cash was introduced.

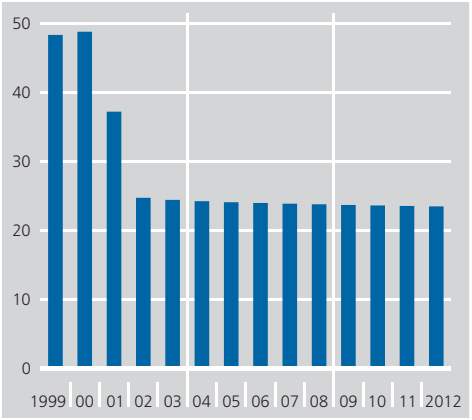
Loss ratios for DM coins

DM coin denominations	Coins in circulation on 31 December 2012	Coins in circulation on 31 December 1999	Loss ratio in %
5	380,233,466	1,135,506,748	33.49
2	358,016,021	1,181,714,585	30.30
1	787,463,725	2,320,859,685	33.93
0.5	929,237,151	2,269,612,933	40.94
0.1	4,482,051,193	10,685,573,002	41.94
0.05	3,306,157,356	6,472,055,011	51.08
0.02	3,480,636,047	7,543,218,469	46.14
0.01	9,766,468,494	16,718,158,677	58.42
Total	23,490,263,453	48,326,699,110	–

Deutsche Bundesbank

Number of DM coins in circulation

Coins in billions

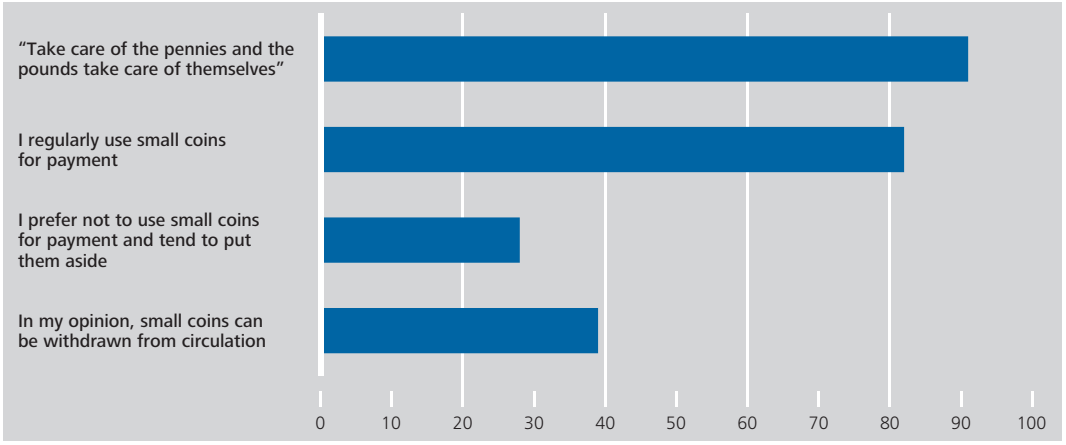


Deutsche Bundesbank

1 All figures on the number of coins and their circulation value refer to all denominations excluding DM10 coins. This denomination is not taken into account in the analysis as it mainly serves collector purposes. As a result, a return flow comparable to that of the other denominations cannot be expected. The aim of excluding this denomination from the analysis is to avoid a false representation of coin return flows and loss ratios.
2 This special campaign encouraged consumers to exchange DM coins that were being hoarded and not used for payment purposes by returning them to the banking industry or to the Bundesbank in order to spread out the changeover to euro cash.
3 1 and 2 pfennig coins are regarded as small coins.

Public opinion of small coins (1 and 2 cent coins)

Expressed as a percentage of the responses; multiple answers possible



Source: Payment behaviour in Germany (2011).
Deutsche Bundesbank

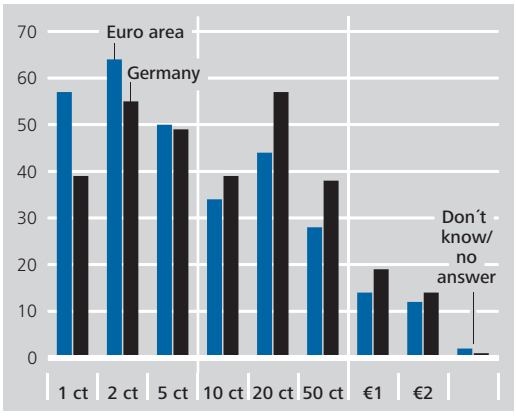
from the Commission's findings, especially with regard to public opinion on small coins, ie 1 and 2 cent coins.[17] This may be due to differences in the way the questions are worded or to the socio-economic traditions of the respondents ("take care of the pennies and the pounds will take care of themselves"). Furthermore, overarching basic attitudes of the respondents to the euro as a symbol of European integration or the D-Mark as its national predecessor and its clear association with the economic miracle might also influence response behaviour. Owing to the different ways in which a question can be interpreted by the respondents, these effects make it very difficult to assess the general public's true attitude towards coins.

Bundesbank study reveals positive attitude towards small coins, …

According to the results of the Bundesbank's 2011 study on payment behaviour, the general public in Germany appears to have a positive attitude towards small coins. They are used by a broad majority of people for making payments and do not appear to cause any major problems in day-to-day use. It is therefore not surprising that only a minority of 39% of respondents were in favour of abolishing small coins (see chart above).

With which coins do you have most difficulties?

As a percentage



Source: Flash Eurobarometer.
Deutsche Bundesbank

… EU survey results more pessimistic

According to a study carried out in 2011 by the European Commission – differentiated according to the various euro-area countries – 39% of those surveyed in Germany said that they had particular difficulties with 1 cent coins and as much as 55% with 2 cent coins (see adjacent chart).[18] Compared with the 2010 survey, the percentage of persons who said that they had difficulties went up significantly (45% in the case of 2 cent coins). This is therefore not a one-off effect which diminishes over time as

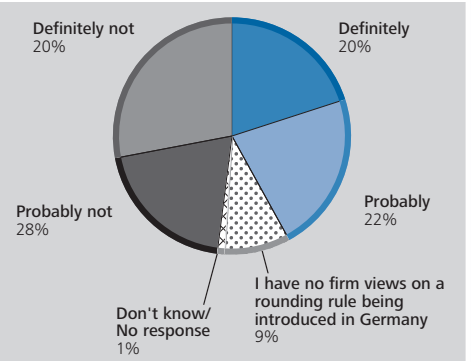
17 In other classifications, the 5 cent coin is sometimes also considered as a small coin.
18 Source: Flash Eurobaromoter, July 2011.

Public opinion on the rounding rule

Regarding the question of a rounding rule, interviewees in the study on payment behaviour in 2011 gave a mixed response: a slender majority were against a rounding rule with 20% responding "definitely not" and 28% "probably not". By contrast, 42% of those interviewed were in favour. 9% of respondents had no firm view. The survey results suggest that the general public does not currently consider the introduction of a rounding rule to be particularly important. A clear trend cannot be deduced from the answers.[1]

Approval of a rounding rule* in Germany

As a percentage of responses



Source: Payment behaviour in Germany (2011). * Commercial rounding of transaction amounts to the nearest 5 cent.
Deutsche Bundesbank

1 See Deutsche Bundesbank: Payment behaviour in Germany 2011 – an empirical study on the utilisation of cash and cashless payment instruments, Frankfurt am Main, October 2012.

soon as consumers have become accustomed to the new coins.

The Bundesbank takes a neutral stance and assumes a moderating role with regard to the use of small coins. By providing information about the benefits and the drawbacks of small coins, the Bundesbank aims to make this somewhat emotional debate more objective.

Advantages and drawbacks of rounding rules

Rounding rule under discussion

The costs involved in producing small coins are almost as high or even higher than their actual nominal value. With further rises in commodity prices, coins might become uneconomical to produce and might also be used for purposes other than their intended ones. Furthermore, considerable costs are incurred by credit institutions and retailers from the counting, preparing (eg rolling) and transportation of coins. In the euro area, two countries – Finland and the Netherlands – have introduced a rounding rule, whereby the final amount at the point of sale is rounded commercially either up or down to the nearest 5 cents. The European Parliament has instructed the European Commission, primarily on the grounds of cost, to assess the feasibility of introducing of a rounding rule (see the above box for further information about public opinion in Germany on the rounding rule).

One frequently cited argument against a rounding rule is that such a procedure or the raising of prices for individual products could have inflationary effects. In order to promote a more objective debate, the Bundesbank commissioned the EHI Retail Institut e.V., a retail industry research institution, to carry out a study on its behalf.

No inflationary effect from commercial rounding

According to the interim results of the EHI study, the inflationary effect appears to be very small. In the case of commercial rounding of

the sum on the cash receipt, the rounding-up and rounding-down effects largely balance each other out. Even if retailers were to round up all transaction amounts to the nearest 5 cents, the one-off effect of the price increase would equate to around just 1‰.

Minimal one-off inflationary effects of individual price rises

Second-round effects, whereby traders round up all prices to the nearest 5 cents after a certain length of time, are theoretically possible as consumers become accustomed to the newly rounded-up prices. Such pricing policies are, however, rather unlikely given the fierce competition that exists in the retail industry and the major importance of signal prices on competitive grounds. A mixture of rounded-up and rounded-down prices is therefore more likely. Given that this mix is very difficult to quantify, it is not possible to make any reliable forecasts regarding the effects on prices. In an extreme scenario, rounding up all prices would generate a one-off inflationary effect of less than 1%.[19]

Conclusion

Since the introduction of the euro, the volume of coins in circulation has been rising continuously. The production, distribution and processing of coins entail considerable costs, which are deducted from the revenue of the Federal Ministry of Finance. A considerable percentage of these coins do not form part of the active cash cycle, however, as they have either been lost irretrievably or are being hoarded on a long-term basis; this is suggested by the still outstanding stocks of DM coins (see box on page 38). The Bundesbank regularly calculates the number of coins required for replacement and any additional demand.

A well-founded forecast and, in particular, an analysis of the reasons that determine the growing demand for coins are dependent on a number of factors. Coin hoarding, a high loss ratio, especially in the case of small-denomination coins, and the migration of coins between euro-area member states make it more difficult to analyse the circulation of coins and to forecast future demand. The analysis of coin migration is impeded all the more by the fact that many member states do not perform any detailed statistical analyses. These would, however, be required in order to quantify the possible effects of coin migration as well as the associated costs for the minting of new coins and the destruction of old ones, which are borne by the national governments. Any outstanding questions relating to coin circulation can therefore very largely be analysed only at the level of the euro area as a whole.

19 The final study results are expected to be available in the second quarter of 2013.