

## The banknote cycle and banknote recycling in Germany

In its capacity as a central bank, the Bundesbank ensures a smooth supply of currency to the economy, even in crisis situations, and safeguards the authenticity and high quality of the banknotes in circulation. In doing so, it fulfils its statutory mandate, which was confirmed in a judgement by the Regional Court of Frankfurt am Main in 2007. Through the issuance and destruction of banknotes, the Bundesbank is the point at which the cash cycle starts and finishes. The volume of German euro banknotes in circulation has been increasing steadily since the introduction of the euro and had risen to €367 billion at the end of the period under review. Only 10% to 15% of the issued banknotes are used in domestic payments, which circulate between the various cash-handling parties. In 2009, the Bundesbank issued banknotes with a total value of €449 billion into the national cash cycle and received lodgements to the amount of €430 billion.

Until a few years ago, the majority of banknotes in circulation were processed and checked for authenticity and fitness by the Bundesbank before being reintroduced into the cash cycle. In 2006, the Bundesbank decided, as part of its cash management strategy, to give the market players the opportunity to take on a share of up to 50% of the total banknote recycling volume in accordance with the European regulatory framework. A major prerequisite for this was that, in the course of technological advances, cash processing systems be developed that would also allow private cash handlers, such as credit institutions or cash-in-transit (CIT) companies, to carry out automated checks on banknotes and reissue them. Widescale use was already being made of this option in 2009, particularly by the banking industry. Private cash handlers processed and reissued banknotes to the value of €240 billion, of which €45 billion was by machine and €195 billion manually at the bank counter. Relative to the total recycling volume of €670 billion, the recycling rate for the banking industry was 36%, and 64% for the Bundesbank.

The return frequency is often cited as an alternative key indicator for measuring a central bank's involvement in the banknote cycle. It becomes apparent that – owing to conceptional weaknesses – this indicator does not provide a realistic picture of the situation. As an alternative, a modified return frequency is presented here, which only takes account of those banknotes which are actually in circulation (cash used for transaction purposes).

Private banknote recycling which has grown in significance, primarily as a result of the customer-operated combined deposit and withdrawal systems (cash-recycling machines) in operation at credit institutions, will result in a shortening of the cash processing chain. Nevertheless, the Bundesbank will continue to fulfil its statutory mandate for cash payments in the future, too, by taking an active role in banknote processing.

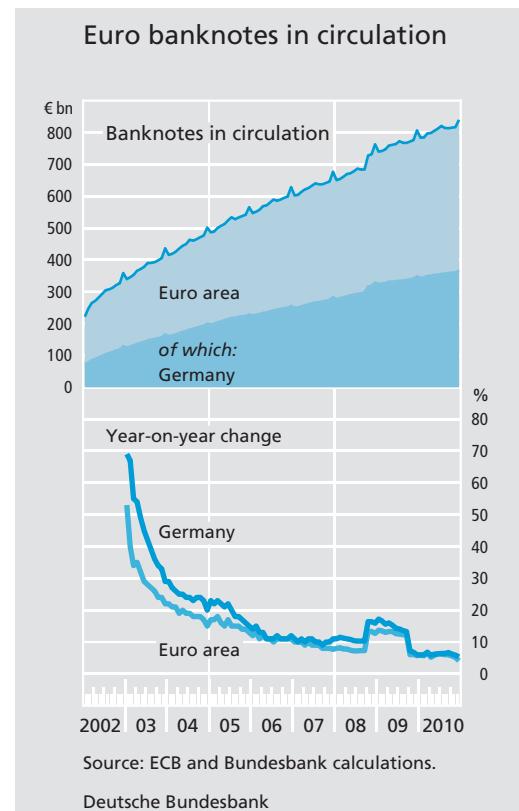
## The circulation of euro banknotes in Germany

*Steady increase in the volume of euro banknotes issued in Germany*

The volume of euro banknotes in circulation in Germany, at around €367 billion at present (see adjacent chart), is defined, in purely mathematical terms, as the difference between the total amount of lodgements and withdrawals at the Bundesbank since 2002 (cumulated net issuance).<sup>1</sup> The volume is characterised by the fact that it has been increasing steadily since the introduction of the euro, albeit at decelerating annual growth rates. The financial crisis at the end of 2008 led to significantly higher growth rates in the short term, which then returned to normal again during 2009. Bundesbank studies suggest that the large volume of outpayments made by the Bundesbank – owing, in particular, to foreign demand – led to a steady rise in the volume of banknotes in circulation in Germany.<sup>2</sup>

*Composition of the banknotes in circulation*

The composition of the volume of banknotes in circulation is determined by both the ‘transaction’ motive, which mainly plays a role in withdrawals of smaller denominations at cash dispensers, and the ‘store of value’ motive, which is reflected in the demand for larger denominations (see chart on page 19). This is why small and medium-sized denominations, especially the €50 note (29%), play a dominant role in terms of the total number of banknotes in circulation. In terms of value, however, €50 notes form a smaller part of the total volume of banknotes in circulation (30%) than €500 notes (35%).



The volume of banknotes actually in circulation in Germany differs considerably from the cumulated net issuance. This is due, first, to the demand for currency from countries outside the Eurosystem and, second, to the migration of banknotes between Eurosystem member states, say, through cash transfers by tourists and foreign workers. Yet, only a small percentage of the banknotes in circulation in Germany is actively used for payment purposes, while a considerable percentage is hoarded. It is estimated that only 10% to 15% of the total volume of German banknotes is actually used in the banknote cycle.<sup>3</sup>

*Only small percentage of banknotes in circulation used for transaction purposes*

<sup>1</sup> Memo item: €6.3 billion coins.

<sup>2</sup> Details and estimates of the amount of these cash flows may be found in Deutsche Bundesbank, Foreign demand for euro banknotes issued in Germany, Monthly Report, January 2011, pages 29-41.

<sup>3</sup> See Deutsche Bundesbank, Foreign demand for euro banknotes issued in Germany, op cit.

## The banknote cycle in Germany

### Description of the banknote cycle

The banknote cycle is the outcome of the banknote flows between the Bundesbank, credit institutions, consumers and retailers. In simple terms, the central bank issues banknotes to the commercial banks, which, in turn, provide the banknotes for withdrawals by their customers. The banknotes are used by consumers for their day-to-day purchases and are then deposited at the central bank by retailers, either directly or via the commercial banks. The role of the CIT companies in this cycle is essentially the transport and service provider function between the central bank and the commercial enterprises.

### Withdrawals at the Bundes- bank account for only a small percentage of...

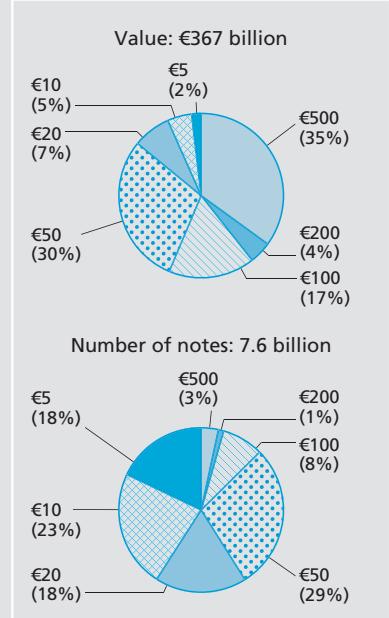
The value of the total amount of banknotes issued by the Bundesbank in 2009 was around €488 billion (see chart on page 20). These banknotes were issued almost exclusively to credit institutions (€476 billion). The credit institutions used roughly €39 billion of this amount to cover demand from countries outside the Eurosystem. The residual amount was purchased primarily by public authorities (€11 billion). The Bundesbank therefore placed a total of €449 billion into the national banknote cycle.

### ...the banknotes made available to consumers

The banking industry, for its part, paid out €319 billion via cash dispensers and €371 billion over the counter to its customers.<sup>4</sup> In addition to the amounts paid out by the Bundesbank to retailers and other parties (public authorities, in particular), around €702 billion was made available to consumers through the national banknote cycle.

### Banknotes in circulation in Germany

As at 31 December 2010



Deutsche Bundesbank

Consumers use the banknotes for consumption, hoarding, transfer payments abroad or for lodgements at credit institutions. For reasons of simplicity, the migration of banknotes between Germany and other countries, as well as the hoarding of banknotes in Germany, are left aside in the remainder of this analysis.<sup>5</sup>

According to a survey conducted in 2008,<sup>6</sup> roughly €542 billion of consumer purchases in 2009 was settled in cash.<sup>7</sup> Of this inflow of

Retailers largely  
deposited  
banknotes  
at credit  
institutions...

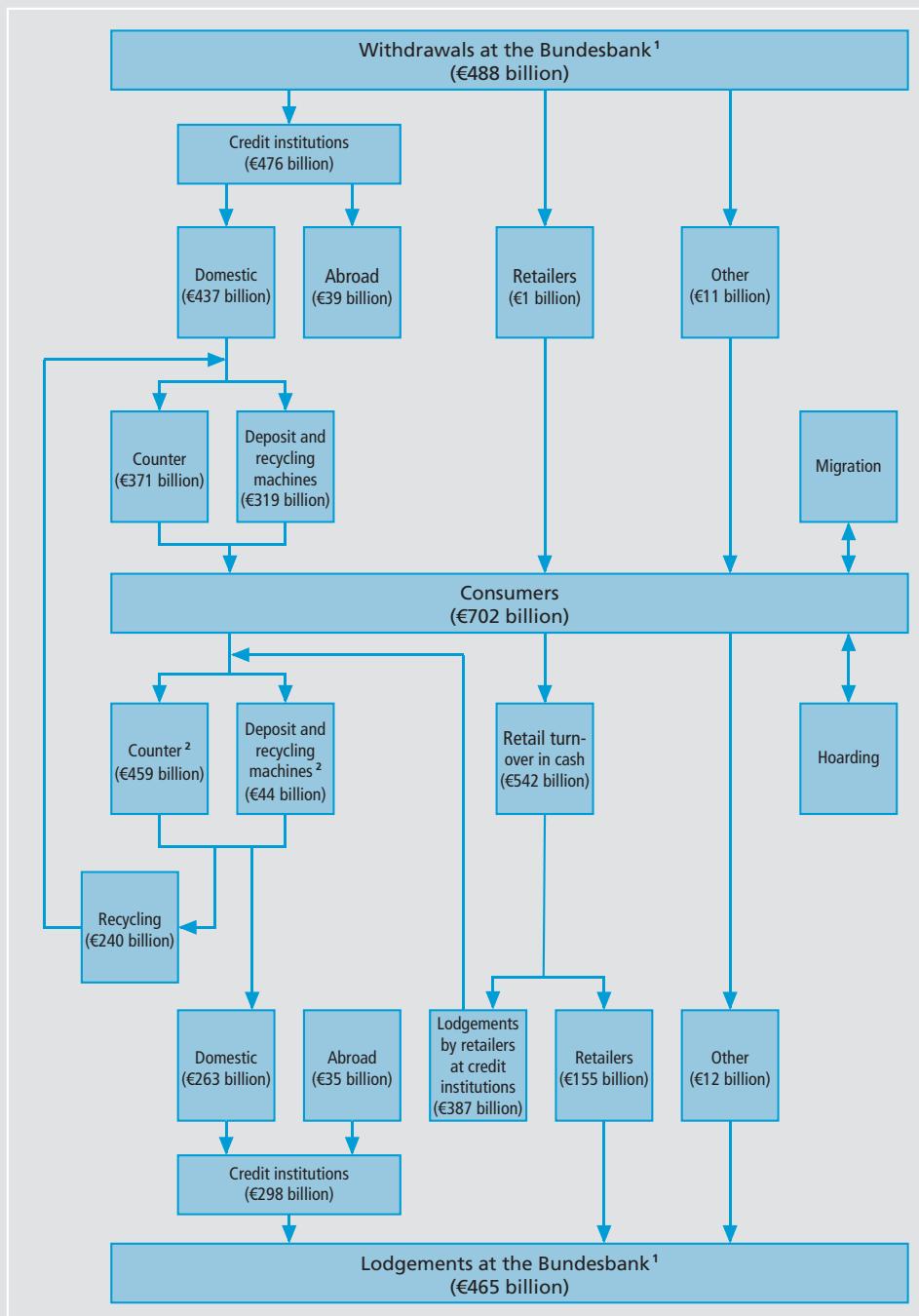
<sup>4</sup> Deutsche Bundesbank, Payment and securities settlement statistics 2007-2009, August 2010.

<sup>5</sup> Details and estimates of the amount of these cash flows may be found in Deutsche Bundesbank, Foreign demand for euro banknotes issued in Germany, Monthly Report, January 2011, op cit.

<sup>6</sup> See Deutsche Bundesbank, Payment behaviour in Germany, Frankfurt am Main, 2009.

<sup>7</sup> The calculations for retailers, as well as the reported sum of lodgements at credit institutions, cannot be broken down into banknotes and coins.

### The German banknote cycle in 2009



The sum of all withdrawals reported by the banking industry is €13 billion higher than the total value of all lodgements reported by the banking industry. — 1 The fact that the withdrawals at the Bundesbank are higher than the lodgements reflects the growing volume of banknotes in circulation. — 2 The reported sum of lodgements via the counter and deposit and recycling machines at credit institutions is €32 billion lower than indicated in the chart. This could be due, at least in part, to the banknotes used by consumers for migration and hoarding purposes.

cash to the retail trade, some €155 billion was paid in at the Bundesbank directly, mainly by large retailers. By contrast, smaller retailers, in particular, deposited banknotes of around €387 billion at credit institutions. The volume of banknotes kept by retailers for the purposes of giving change is relatively small and can therefore be disregarded in the analysis below.

...which principally use manual cash processes

Credit institutions received lodgements of banknotes from households and retailers to the amount of €459 billion over the counter and to the amount of €44 billion via machine.<sup>8</sup> By contrast, credit institutions paid in just €263 billion of their customers' banknote lodgements at the Bundesbank. Almost the same amount (€240 billion) was directly re-issued by credit institutions to their customers. Furthermore, banknotes from abroad to the value of €35 billion were paid in at the Bundesbank via commercial banks and €12 billion primarily by public authorities. Consequently, the total volume of banknotes paid in at the Bundesbank originating from the national banknote cycle was around €430 billion.

## Banknote recycling

Large processing volume leads to automation and recycling

The growing volume of banknotes in circulation and the Gentlemen's Agreement between the Bundesbank and the German banking industry (for further details, see the adjacent box), under which all banknotes paid out via cash dispensers have to be checked by

<sup>8</sup> Deutsche Bundesbank, Payment and securities settlement statistics 2007-2009, August 2010.

## Development of banknote recycling

### Gentlemen's agreement

In 1994, the Bundesbank and the German Central Credit Committee (*Zentraler Kreditausschuss, ZKA*) made a gentlemen's agreement, with the involvement of the Federal Criminal Police Office (*Bundeskriminalamt, BKA*), that only banknotes checked by the Bundesbank would be allowed to be dispensed from ATMs. The aim of this agreement was to ensure that no counterfeit notes would be paid out from cash machines. Bank cashier transactions over the counter were not affected by this agreement.

### ECB operational framework

In the light of the widely diverging or even non-existing regulations within the Eurosystem regarding the filling of ATMs, the Governing Council of the European Central Bank adopted the Framework for the detection of counterfeits and fitness sorting of euro banknotes by credit institutions and professional cash handlers (framework) in December 2004. The objective of this framework was

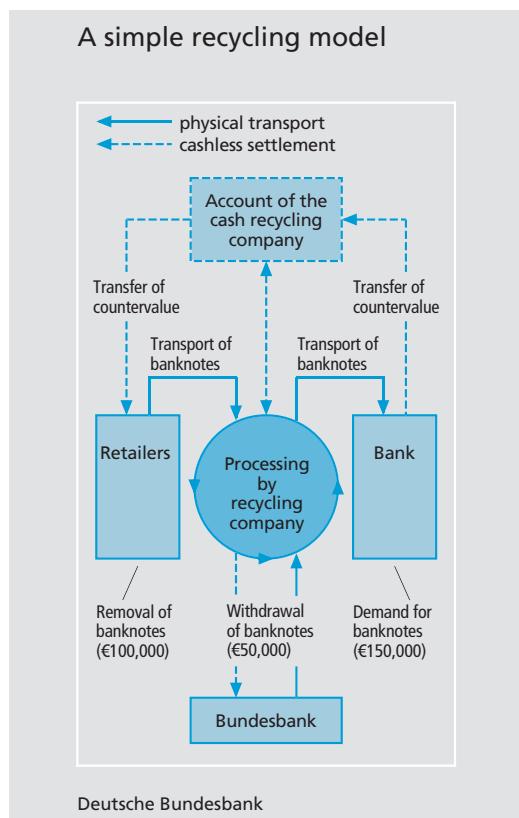
- to create a uniform minimum standard for automated banknote processing by professional cash handlers (hereinafter 'cash handlers') within the euro area, thereby creating legal certainty for all parties concerned, and
- to contribute to the assurance of quality and authenticity of banknotes in circulation

The framework was implemented in Germany in 2007 by means of contracts agreed between the Bundesbank and around 1,450 commercial banks (84% of the relevant institutions).

### EU regulation and ECB Decision

Up until December 2008, the Regulation ((EC) No 1338/2001) laying down measures necessary for the protection of the euro against counterfeiting obliged credit institutions and other professional cash handlers to withdraw euro banknotes and coins from circulation if there was a suspicion that they were counterfeit. In December 2008, the scope of this regulation was extended to include payment service providers (eg cash-in-transit companies) and other economic agents who operate ATMs as an additional activity (eg casinos and retailers). The legal obligation to retain counterfeit money was supplemented by an obligation to check the authenticity of the banknotes.

With regard to banknote checking, the Regulation refers to the ECB framework. On this basis, the ECB adopted a decision (decision with no addressees) on 16 September 2010 which placed the framework on a legally binding basis throughout the Eurosystem. The Decision entered into force on 1 January 2011. All member states are obliged to impose sanctions for infringements of Regulation (EC) No 44/2009 amending (EC) No 1338/2001 and to introduce the necessary regulations into national law by the end of 2011.



the central bank in advance for authenticity and fitness, led, in the past, to a sharp increase in the volume of banknotes to be processed by the Bundesbank. The parallel technical advances in banknote processing had two effects. First, banknote processing machines with a high throughput rate were developed, which led to processing being concentrated at a small number of Bundesbank locations. Second, cash-recycling machines and smaller banknote processing machines are now available which allow decentralised processing. The independent processing of banknotes without the involvement of the Bundesbank can generate macroeconomic efficiency gains by shortening the processing chain. To achieve this, the Bundesbank decided that it needs to process only 50% of the total banknote volume itself in order to

fulfil its statutory mandate – counterfeit prevention, ensuring the high quality of the banknotes in circulation, and crisis prevention. The remaining 50% can be processed and recycled without the involvement of the Bundesbank.

*What is  
recycling and...*

Banknote recycling consists in receiving, processing and reissuing banknotes to households and enterprises. Private cash handlers wishing to offer cash recycling services have to adhere to the provisions stipulated in the European regulatory framework for the independent processing and reissuing of banknotes in Germany, which has been in place since 2006. There is still the alternative possibility of paying in banknotes at the Bundesbank directly. In order to boost overall efficiency, the Bundesbank supports private banknote recycling.

*... how does  
it work?*

The model shown in the adjacent chart shows an example of how private banknote recycling works. In this case, the recycling company offsets the banknote supply and demand of two cash handlers. Typically, banknotes originating from retail transactions settled in cash are accepted and processed in accordance with Eurosystem requirements. These banknotes are then used to refill the cash dispensers of credit institutions. In this model, the Bundesbank's services are used only if supply and demand do not offset each other. In parallel with the physical cash processes, the corresponding credit and debit amounts are settled via the account of the recycling company.

*Large percentage of banknote recycling by credit institutions*

In 2009, banknotes to the amount of €430 billion were paid in and processed at the Bundesbank, not including the inflows of banknotes from abroad. Banknotes to the value of around €240 billion were paid out by the banking industry to its customers in the form of withdrawals, rather than paying them in at the central bank. Relative to the overall recycling volume, the Bundesbank and the banking industry have recycling rates of 64% and 36% respectively.<sup>9</sup>

*Payment Services Oversight Act establishes a legal framework for CITs*

At present, private banknote recycling is carried out, first and foremost, by credit institutions.<sup>10</sup> There are two main reasons: first, on cost grounds, credit institutions are replacing manual cash processing at the bank counter, which currently accounts for the bulk of all processing operations, with automated processing. Second, external CIT companies have not yet offered any alternatives. Pursuant to the Payment Services Oversight Act (*Zahlungsdiensteaufsichtsgesetz*), CIT companies undertaking activities that go beyond the pure commercial transportation of banknotes and coins, including acceptance, processing and handover, require authorisation from the relevant supervisory authority (for further details, see the adjacent box). In specific cases, the provision of payment services requiring authorisation may relate to the settlement of transactions arising from the supply

<sup>9</sup> It is not possible to calculate a recycling rate for the retail sector at present as this sector was not subject to reporting requirements under the regulatory framework. So far, credit institutions have reported only on a pilot scheme with one CIT company, which recycles banknotes for the credit institution.

<sup>10</sup> Pursuant to the Decision of the European Central Bank, cash paid out by retailers as change is not classed as cash recycling.

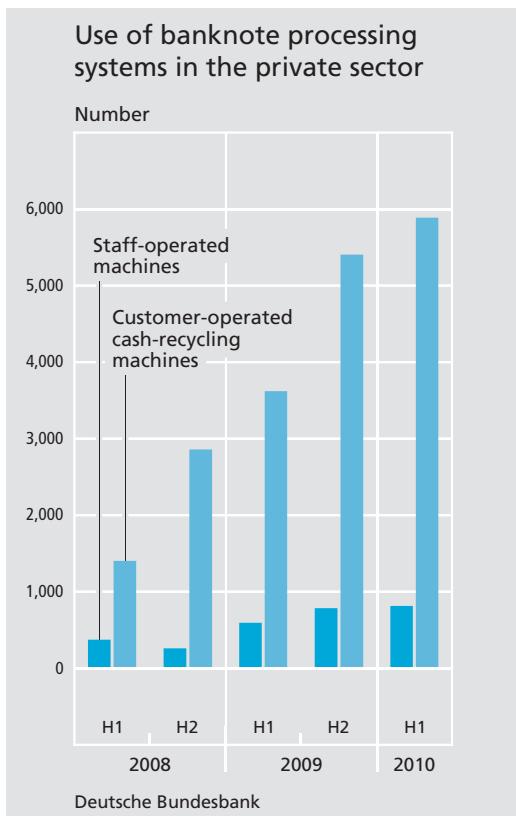
## Payment Services Oversight Act

The prudential provisions set out in the EU Payment Services Directive have been transposed into German law by means of the Payment Services Oversight Act (*Zahlungsdiensteaufsichtsgesetz*). Credit institutions and financial services institutions have, thus, been joined by a third category of institution, namely payment institutions. An enterprise which provides payment services generally requires authorisation pursuant to the Payment Services Oversight Act. Under the Payment Services Oversight Act, payment institutions must, for example, hold own funds, meet the safeguarding requirements regarding customer funds laid down by law, have a proper business organisation and fulfil numerous notification requirements.

The Payment Services Oversight Act provides for exceptions to the authorisation requirement in various cases. For instance, the professional transportation of banknotes and coins, including their collection, handling and delivery, does not constitute a payment service. The activities undertaken by cash-in-transit companies as part of their cash supply and collection operations may be deemed to be a payment service depending on their specific features. In particular, according to the explanatory memorandum to the Payment Services Oversight Act, clearing via the cash-in-transit companies' own accounts usually does not fall under the abovementioned exception for the transportation of banknotes and coins, which means that cash-in-transit companies – depending on their business model – may possibly require authorisation once the transitional arrangement provided for in the Payment Services Oversight Act ends.

The Deutsche Bundesbank has decided that it will, upon request, set up accounts for cash-in-transit companies that have been granted authorisation pursuant to the Payment Services Oversight Act. The aim is to facilitate cash recycling outside the Bundesbank.

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and removal of cash by way of cash recycling via CIT company accounts.

#### High growth rates in machine recycling

Banknote recycling using machines operated either by banks' customers or staff showed a marked year-on-year increase in 2009 (+44%), even though it was still at a low level. In 2009, banknotes with a total value of around €45 billion were machine-processed by the credit institutions and paid out again to customers. For the qualified banknote processing and recycling activities carried out by the commercial banks, some 5,405<sup>11</sup> customer-operated cash-recycling machines and 785 staff-operated back-office machines<sup>12</sup> were in use at the end of 2009. As shown in the chart above, the number of banknote processing systems in use in Germany has increased significantly since the beginning of 2008.

The widely varying degree of automation in lodgements and withdrawals at credit institutions is striking. While almost 50% of withdrawals from German banks were made using around 58,400 systems, only about 6,200 paying-in systems were available in 2009.<sup>13</sup> The increasing use of customer-operated cash-recycling machines will lead to an improvement, albeit limited, in the degree of automation of lodgements. This is because, as a rule, such systems are deployed or replace standard cash dispensers only if lodgements and withdrawals very largely offset each other.

*Low degree of automation on lodgement side at credit institutions*

*Cash back procedure in Germany still largely undeveloped*

Retailers are likewise contributing towards an increase in the banknote recycling rate outside the Bundesbank. Using the 'cash back' procedure, customers can additionally make a withdrawal of up to €200 in cash when paying for their goods electronically at the checkout. In Germany, the 'cash back' procedure plays only a minor role. However, the situation is different in other countries, such as Norway, where widespread use is made of the option of withdrawing cash when paying for retail purchases.

*Banknote processing volumes at the Bundesbank*

The growing importance of private cash handlers in banknote recycling has already had an impact on the volume of lodgements received by the Bundesbank. The period since

11 At the end of the first half of 2010, 5,888 systems were in use.

12 At the end of the first half of 2010, 814 systems were in use.

13 According to a number of representatives of the Central Credit Committee (CCC), automated cash processes account for around one-third of all cash processes at credit institutions. This is likely to be an average figure for both lodgements and withdrawals.

2009 is the first time that there have been two consecutive years with no year-on-year increase in the volume of banknotes paid in at the Bundesbank (see chart on page 26).

Bundesbank has, with a few exceptions, increased during the same period. The decline in the return frequency cannot therefore be explained by an increase in banknote recycling outside the Bundesbank.

### The return frequency

#### *Meaning of the return frequency*

The return frequency is an easy-to-calculate indicator which is used by many central banks to measure their level of involvement in the banknote cycle.<sup>14</sup> The indicator is used to calculate how often the average volume of banknotes in circulation flows back to the central bank within a given 12-month period. A falling return frequency indicates that the central bank's involvement is declining and that private cash handlers are taking over these tasks. It is therefore sometimes regarded as an alternative to the recycling rate as a measure of the central bank's involvement in the banknote cycle.

#### *Falling return frequency with an increasing processing volume*

Between 2003 and 2010, the return frequency in Germany fell from 5.4 to 2.0 owing to the increasing volume of banknotes in circulation. This means that in 2003, each banknote in circulation was returned to the central bank and processed 5.4 times on average, whereas the figure was just 2.0 in 2010.<sup>15</sup> The return frequency therefore shows that the Bundesbank's involvement in cash processing has been declining since the introduction of the euro. With regard to the actual volume paid in, however, it would be wrong to conclude from the return frequency that there has been a dramatic decline in the Bundesbank's involvement. This is because the volume of banknotes processed by the

The reason lies in the conceptual weaknesses of the return frequency. Hoarded banknotes, just like banknotes located abroad, hardly circulate or do not circulate at all in the national banknote cycle and only rarely flow back to the central bank. Furthermore, banknote migration between euro-area member states affects the return frequency. If, for example, one central bank issues banknotes which are then paid in at another Eurosystem central bank, the volume of banknotes in circulation increases in the first country, while it declines in the second country. The actual volumes of banknotes in circulation nationally therefore do not correspond to the nominal volumes that are recorded. If these aspects are not taken into account, the return frequency gives a distorted picture of a central bank's involvement in the banknote cycle.

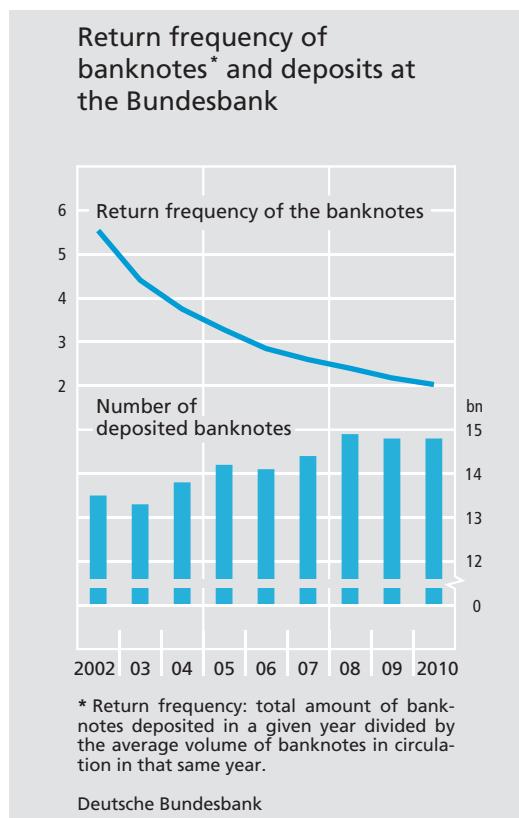
#### *Conceptional weaknesses of the return frequency*

Calculating the return frequency on the basis of the banknotes actually used for transaction purposes therefore gives a more realistic picture of the Bundesbank's involvement in the banknote cycle. As banknotes used for transaction purposes account for only a small percentage of between 10% and 15% of the total volume of banknotes in circulation, it

#### *Return frequency based on the banknotes used for transaction purposes*

<sup>14</sup> The return frequency in any given year is equal to the sum of banknotes paid in at a central bank during that year, divided by the average volume of banknotes in circulation in that year.

<sup>15</sup> The return frequency calculated using the ECB capital share weightings fell from 5.8 at the beginning of 2003 to 4.0 at the end of 2010.



makes sense to restrict the return frequency to these banknotes.<sup>16</sup> The estimated volume of banknotes used for transaction purposes was between €40 and €60 billion at the end of 2009, which is equivalent to around 1.3 to 1.9 billion banknotes. This gives a return frequency of the banknotes in a range of between eight and 11 times per year. Although this range is relatively broad, it is evident that calculating the return frequency on the basis of banknotes used for transaction purposes clearly reveals a greater involvement of the Bundesbank in the banknote cycle. The return frequency is not a suitable indicator for describing the role of private cash handlers and the central bank in banknote recycling. It makes more sense to calculate the importance of the various cash handlers in banknote

recycling by the banknotes which they process and then reissue.

## Outlook

The German banknote cycle is characterised by a large recycling volume at the Bundesbank and a growing volume at credit institutions. Recycling at credit institutions is often performed by means of manual transactions at the counter. The degree of automation is still very low, especially on the lodgement side. The trend towards a greater use of cash-recycling machines, which is already apparent in the banking industry, is likely to continue in future.

Banknote recycling has already undergone rapid growth over the past two years, especially as a result of customer-operated cash-recycling machines which are being used by credit institutions. This is bringing about a change in the role played by the Bundesbank in the banknote cycle. Besides the continuing impact due to the direct processing of banknotes, new tasks are also arising owing to the need to control and monitor the activities of external market participants. Where it makes economic sense, these external participants can also take on tasks in the banknote cycle. However, as was confirmed in the ruling by the Regional Court of Frankfurt am Main in 2007,<sup>17</sup> this does not imply that the Bundesbank's sovereign task to check banknotes for

*Changing role of the Bundesbank*

<sup>16</sup> See Deutsche Bundesbank, Foreign demand for euro banknotes issued in Germany, op cit.

<sup>17</sup> Frankfurt am Main Regional Court, case number 3-11 O 260/06, of 4 May 2007.

authenticity and fitness will become a private-sector activity. The Bundesbank does not intend to withdraw completely from banknote processing as it still has an obligation to fulfil its statutory mandate, especially in crisis situations, like during the financial crisis or in the event that market participants become insolvent. This includes safeguarding an efficient cash infrastructure, without itself having to supply cash to each individual member of the general public or each individual retailer. Furthermore, the Bundesbank, as the issuer of banknotes, must be in a position – even in the case of a withdrawal from the market by private cash handlers – to process the returning banknotes and reissue them.

The question of whether yet other professional cash handlers, besides credit institutions, will take on a greater role in banknote recycling is still to be answered. The fact that the banking industry's and retailers' confidence in the CIT sector has still not been fully restored is hindering banknote recycling by the CIT companies, despite the regulatory provisions that are now in place under the Payment Services Oversight Act. It therefore remains to be seen whether CIT companies will make a significant contribution of their own to banknote recycling in the short term. Nevertheless, cooperation models with credit institutions could serve as a basis for a larger role for private banknote recycling.

*Future development of banknote recycling uncertain*