▌Cash demand in the shadow economy

Cash payments are simple, secure, efficient and anonymous, which is why consumers use cash to pay for almost three-quarters of their purchases at the point of sale. At the same time, these characteristics also make cash a focal point for potential illegal uses. An oft-voiced opinion in the public debate is that cash promotes the shadow economy and is used as a means of financing crime. There are calls for regulatory measures to restrict the use of cash in view of what is presumed to be its widespread use for illegal purposes. Against this backdrop, the present article makes an empirical study of the use of cash in the shadow economy as well as in connection with related areas such as money laundering, terrorist financing and other criminal activities.

The illegal nature of such activities means that it is very difficult to provide hard research-based evidence about the scale of the cash demand resulting from the shadow economy and criminality. Empirical studies of the shadow economy are therefore subject to more than average uncertainty, meaning that all results should be interpreted with caution. It is often the case that anecdotal evidence is drawn on, taking as its direct starting point the volume of cash in circulation or the demand for large-denomination banknotes. The currency demand approach is a model framework for the empirically founded study of the scale of illicit cash usage. Our own econometric estimations adopting this approach examine whether cash lodgements made at the Bundesbank's branches and the estimated domestic demand for euro banknotes in Germany are linked to activities in the shadow economy.

However, cash is not the sole payment instrument used either in the shadow economy or to finance crime. As part of the general trend towards digitalisation, alternative payment instruments are gaining significant ground, particularly in connection with settlement via the internet or darknet.
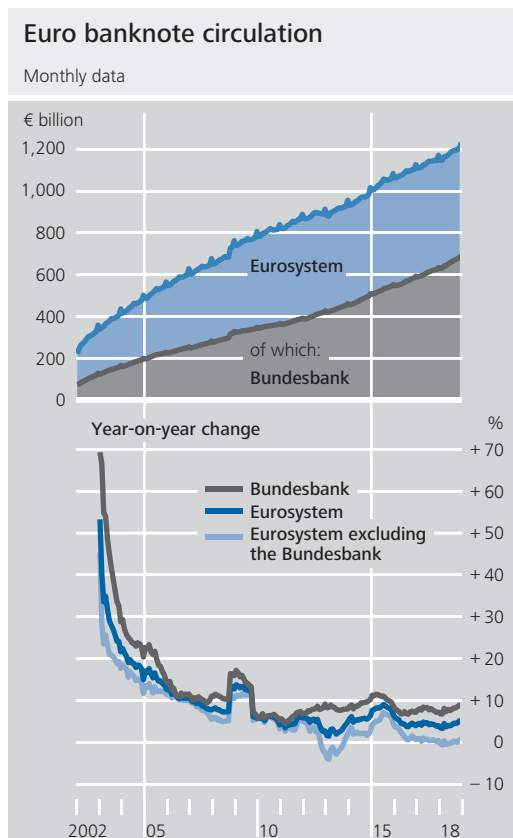
■ Cash use in Germany

Reasons for and scale of cash use cannot be fully observed

The Bundesbank and the other central banks of the Eurosystem are collectively responsible for the issuance of banknotes in the euro area. At the end of 2018, the volume of euro banknotes in circulation totalled around €1,230 billion, of which approximately €690 billion was issued by the Bundesbank (see the chart below).[1] On an average of the past decade, the volume of euro banknotes in circulation increased by 4.9% per annum and therefore at a faster pace than nominal economic output in the euro area. Over the same period, the Bundesbank's cumulative net issuance increased each year by as much as 7.7% on average. Economic agents are thus demanding cash on a significant and growing scale. However, since cash can be used without documentation, there are naturally no complete statistical data available on the reasons for and scale of the use of cash as a payment instrument and a store of value.[2]

As a first step, the motives behind the demand for euro banknotes at the Bundesbank can be investigated by breaking them down into the components of foreign demand, domestic transaction balances and domestic hoarding.[3] An estimated two-thirds of the Bundesbank's cumulative net issuance of euro banknotes were in circulation abroad at the end of 2017. According to estimates, domestic cash users were hoarding just over 20% of cumulative net issuance, while slightly less than 10% was being held as transaction balances. Studies of payment behaviour among the general public in Germany are also available.[4] 74% of transactions at the point of sale are performed with cash, and a further 19% by debit card. In terms of turnover, cash payments account for a share of 48%, while debit card payments account for 35%. At present, therefore, cash is the most used instrument in consumers' everyday payments, but cashless payment instruments are becoming increasingly important for conducting transactions at the point of sale.

Comprehensive studies on cash use in Germany, …

These studies do not make a distinction between the legal and illegal use of cash. However, it is vital to have information on the significance of illicit motives for cash demand, as cash demand in the shadow economy has been in the spotlight for some time. The belief that cash is being used on a large scale for illegal purposes is used for justifying regulatory

… but little information on the significance of illegal motives

Euro banknote circulation

Monthly data

Sources: ECB and Bundesbank calculations.
Deutsche Bundesbank

1 The volume of euro banknotes in circulation corresponds to the difference between cumulative outpayments and cumulative lodgements.
2 At end-2018, the cumulative net issuance of regular-issue euro coins accounted for a mere 1.2% of the Bundesbank's total cumulative net issuance of euro banknotes and regular-issue euro coins, meaning that statements relating to banknote demand are also likely to be valid for the demand for euro banknotes and coins as a whole.
3 See Deutsche Bundesbank, The demand for euro banknotes at the Bundesbank, Monthly Report, March 2018, pp. 37-51, and N. Bartzsch and M. Uhl, Domestic and foreign demand for euro banknotes issued in Germany, in Deutsche Bundesbank (ed., 2017), International Cash Conference 2017 – War on cash – is there a future for cash?, pp. 250-287.
4 See Deutsche Bundesbank (2018), Payment behaviour in Germany in 2017 – fourth study of the utilisation of cash and cashless payment instruments.

Shadow economy activities

Activities	Monetary transactions	Non-monetary transactions
Legal activities	Not declaring income from the production or sale of legal goods (e.g. car repairs, services of skilled trades-people, household services, VAT fraud in restaurants and catering or in trade)	DIY work; odd jobs for neighbours
Illegal activities	Producing, smuggling or selling drugs; trading in stolen goods	Producing or smuggling drugs for personal use

Sources: Author's compiled information and F. Schneider (2015), Schattenwirtschaft und Schattenarbeitsmarkt: Die Entwicklungen der vergangenen 20 Jahre, Perspektiven der Wirtschaftspolitik, 16(1), pp. 3-25.

Deutsche Bundesbank

measures to restrict the use of cash.[5] One concrete policy measure restricting the use of cash consists in ceilings for cash payments, which have been introduced in a number of European countries to combat the shadow economy, money laundering and terrorist financing (see the box on p. 46). Against this backdrop, this article examines the illegal use of cash.[6]

Illegal use of payment instruments

Shadow economy

"Shadow economy" refers to covert economic activities

Illegal uses of payment instruments refer to those uses where the surrounding circumstances are not consistent with established law. This includes the use of cash in what is known as the shadow economy. According to one common definition, the shadow economy encompasses the production of goods and services that is concealed from the authorities in order to avoid financial or other burdens.[7] The table above shows examples of activities in the shadow economy. Here, the differing forms taken by the shadow economy are distinguished along two dimensions: the legal status of an activity, which is either legal when taken in isolation or already illegal in itself, and the kind of consideration received, which may, for example, be a monetary transaction in cash or a non-monetary transaction (e.g. helping neighbours).

Activities in the shadow economy are carried out covertly and are thus, at least partly, not captured in the official statistics. Various estimation methods are used in the literature to determine the size of the shadow economy.[8] The table on p. 47 provides an overview of estimates of the size of the shadow economy in

Size of the shadow economy

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5 See P. Bofinger (2015), Bargeld ist ein Anachronismus, in Der Spiegel, 21, p. 56, K. Rogoff (2016), The curse of cash, Princeton University Press, and P. Sands (2016), Making it harder for the bad guys: The case for eliminating high denomination notes, M-RCBG Associate Working Paper 52.
6 Our own empirical analyses were conducted in collaboration with Professor Friedrich Schneider of the Johannes Kepler University Linz.
7 There is no standard definition of the shadow economy. For the concept of the shadow economy, see F. Schneider and D. Enste (2000), Shadow economies: Size, causes, and consequences, Journal of Economic Literature, 38(1), pp. 77-114, and F. Schneider (2015), Schattenwirtschaft und Schattenarbeitsmarkt: Die Entwicklungen der vergangenen 20 Jahre, Perspektiven der Wirtschaftspolitik, 16(1), pp. 3-25.
8 See F. Schneider and D. Enster (2000), op. cit., and F. Schneider (2015), op. cit. Some of the methods used have been hotly debated in the economic literature, see J. Thomas (1999), Quantifying the black economy: "Measurement without theory" yet again?, Economic Journal, 109(456), pp. 381-389, F. Schneider (2015), op. cit., E. Feige (2016), Reflections on the meaning and measurement of unobserved economies: What do we really know about the "shadow economy"?, Journal of Tax Administration, 2(1), pp. 5-41, and G. Kirchgässner (2017), On estimating the size of the shadow economy, German Economic Review, 18(1), pp. 99-111.

Ceilings for cash payments

Cash payment ceilings are restrictions which limit the amounts that can be paid in cash; above these threshold values it is no longer permissible to conduct transactions in cash, and cashless payment instruments have to be used instead. As cashless payment instruments are more easily traceable, ceilings for cash payments are designed to help in combating tax evasion in the shadow economy, money laundering and the financing of terrorism.[1]

So far, 12 EU Member States have introduced national restrictions on cash payments which differ, above all, in the amount of the threshold value. The ceilings range at present from €500 in Greece to the equivalent of around €15,000 in Poland and Croatia. However, the categories of persons as well as the sectors affected by the restrictions differ from country to country. At present, they chiefly affect transactions between businesses or transactions between businesses and private individuals. No EU Member State imposes restrictions on the possession of cash. Moreover, in some Member States differing restrictions for residents and non-residents apply. For (tax) residents in France, for example, there has been a cash payment ceiling of €1,000 in force since 2015 (previously €3,000); non-residents, on the other hand, can conduct cash transactions up to €15,000.

The European Commission recently looked into the introduction of an EU-wide standard ceiling for cash payments with the aim of combating the financing of terrorism. The European Commission came to the conclusion that EU-wide cash payment ceilings would not, at present, suitably address the problem of terrorist financing and, in June 2018, announced that any plans for an EU-wide restriction on cash payments were not going to be taken any further at the present time.[2] It based its decision on two public consultations it conducted/commissioned[3] which also involved affected professional groups and institutions.[4] At just under 95% of those surveyed, a broad majority of the general public came out against an EU restriction on cash payments.[5] Doubts about its effectiveness were among the arguments cited by the participants in the survey. All things considered, the European Commission came to the conclusion that ceilings on cash payments will not, as a rule, deter criminals from committing a criminal act, especially in the case of offences in connection with tax evasion or terrorist financing.[6]

When assessing restrictions on cash payments in terms of combating criminal activity, consideration should be given not only to their effectiveness but also to other aspects.[7] For instance, the introduction of a ceiling for cash payments represents an encroachment on consumers' freedom to choose the method of payment and risks a possible loss of confidence in the currency on the part of the general public.

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1 Restrictions on the use of cash are also considered in Deutsche Bundesbank, Policy options for cash payments, Annual Report 2015, pp. 36-38.
2 See European Commission (2018), Report from the Commission to the European Parliament and the Council on restrictions on payments in cash.
3 See European Commission (2017), Outcome of the open public consultation on potential restrictions on large payments in cash.
4 See Ecorys (2017), Study on an EU initiative for a restriction on payments in cash, Final Report.
5 This was a self-selected survey and not a representative sample. Of the respondents, 92% came from Austria, France or Germany.
6 See European Commission (2018), op. cit.
7 Up to now, very few data have been available for an empirical analysis of the effectiveness of cash payment ceilings. International comparisons are also made more difficult by the fact that cash payment limits have been introduced, in particular, by countries with a large shadow economy.

Size of the shadow economy in Germany*

As a percentage of GDP

Study	Method	2001 to 2005	2006 to 2010	2011 to 2015
L. Feld and C. Larsen[1]	Public survey	3.6	2.4	–
M. Hassan and F. Schneider[2]	Structural equation modelling	16.5	15.0	15.7
L. Onnis and P. Tirelli[3]	Electricity consumption approach	10.9	–	–
M. Pickhardt and J. Sardà Pons[4]	Currency demand approach	15.2	–	–
M. Pickhardt and J. Sardà[5]	Cash coefficient approach	9.8	9.6	–
F. Schneider[6]	Structural equation modelling	16.6	–	–

* The table shows the average of the figures recorded for the period under review in each study. Where a study employs more than one method, the data are based on a single selected approach. The definition of the shadow economy is not the same in each study. **1** L. Feld and C. Larsen (2012), Das Ausmass der Schwarzarbeit in Deutschland, The Rockwool Foundation Research Unit, University Press of Southern Denmark. **2** M. Hassan and F. Schneider (2016), Size and development of the shadow economies of 157 countries worldwide: Updated and new measures from 1999 to 2013, Journal of Global Economics, 4(3), pp. 1-14. **3** L. Onnis and P. Tirelli (2010), Challenging the popular wisdom. New estimates of the unobserved economy, University of Milan-Bicocca, Department of Economics, Working Paper Series 184. **4** M. Pickhardt and J. Sardà Pons (2006), Size and scope of the underground economy in Germany, Applied Economics, 38(14), pp. 1707-1713. **5** M. Pickhardt and J. Sardà (2011), The size of the underground economy in Germany: A correction of the record and new evidence from the modified-cash-deposit-ratio approach, European Journal of Law and Economics, 32(1), pp. 143-163. **6** F. Schneider (2005), Shadow economies around the world: What do we really know?, European Journal of Political Economy, 21(3), pp. 598-642.

Deutsche Bundesbank

Germany. The studies are based on different definitions of the shadow economy, which means that the results they produce are not always directly comparable. Across the various studies, these estimates show the size of the shadow economy ranging between 2.4% and 16.6% of gross domestic product (GDP) in Germany. Relative to a GDP of around €3,300 billion in 2017, all other things being equal, these estimates reveal the size of the shadow economy to be between approximately €80 billion and €550 billion. The considerable range of estimation results thus far reflects their sensitivity to the chosen method of calculation. Overall, estimates based on public surveys[9] are significantly lower than macroeconomic estimates using, say, the currency demand approach[10] or structural equation modelling.[11] The size of the shadow economy is possibly underestimated in studies based on public surveys, as respondents may be unwilling to disclose information. A widely-held opinion in the literature, on the other hand, is that macroeconomic procedures could overestimate the size of the shadow economy.[12] One reason for this, for instance, is that some analyses do not take into account foreign demand or the function of cash as a legal store of value.

Cash facilitates simple, secure, quick and anonymous payments, which also makes it a convenient payment instrument for clandestine economic activities. The exchange of goods plays a role in the shadow economy, too, however. When producing fake invoices as a smokescreen for illicit work, a combination of cash and cashless payments is used.[13] Alongside illegal labour, the non-disclosure of income from goods trading represents a further form of shadow economy activity. In this context, income is likely to be predominantly in the form of cash if stationary points of sale or invoices

Actual percentage of cash payments in the shadow economy unclear

9 See A. Isachsen and S. Strøm (1985), The size and growth of the hidden economy in Norway, Review of Income and Wealth, 31(1), pp. 21-38, and L. Feld and C. Larsen (2012), Das Ausmaß der Schwarzarbeit in Deutschland, The Rockwool Foundation Research Unit, University Press of Southern Denmark.
10 See V. Tanzi (1983), The underground economy in the United States: Annual estimates, 1930-80, International Monetary Fund Staff Papers, 30(2), pp. 283-305, and F. Schneider (1986), Estimating the size of the Danish shadow economy using the currency demand approach: An attempt, Scandinavian Journal of Economics, 88(4), pp. 643-668.
11 See B. Frey and H. Weck-Hanneman (1984), The hidden economy as an 'unobserved' variable, European Economic Review, 26(1-2), pp. 33-53, and F. Schneider (2005), Shadow economies around the world: What do we really know?, European Journal of Political Economy, 21(3), pp. 598-642.
12 See U. Thießen (2011), Schattenwirtschaft: Vorsicht vor hohen Makroschätzungen, Wirtschaftsdienst, 91(3), pp. 194-201, and G. Kirchgässner (2017), op. cit.
13 See Federal Ministry of Finance (2017), Dreizehnter Bericht der Bundesregierung über die Auswirkungen des Gesetzes zur Bekämpfung der illegalen Beschäftigung: Die Bekämpfung von Schwarzarbeit und illegaler Beschäftigung in den Jahren 2013 bis 2016.

are manipulated in order to evade taxes. Such illegal goods trading could become increasingly internet-based given the general trend towards digitalisation, meaning that these transactions would be settled without cash. VAT fraud in online trading supports this view.[14] The fact that the level of online drug trafficking recorded by the police in Germany in 2017 showed a 24% increase on the year and accounted for as much as 5% of all recorded offences in this area is a further sign of increasing digitalisation in the shadow economy.[15] Payments in the shadow economy can also be made via the official banking system – for example, in cases where anonymity is created through the use of letterbox companies. This seems to happen often in carousel transactions involving the transfer of apparently legal money flows and input tax refunds. Alongside cash, cashless forms of settlement also play a role in the shadow economy.

Other potential illegal uses of payment instruments

Other areas of crime should also be studied for a holistic analysis of the illegal use of payment instruments

Further unlawful uses of payment instruments occur, for example, in connection with undeclared income from capital (e.g. dividends, interest),[16] property crime (e.g. theft of payment instruments), various forms of white-collar crime (e.g. financing, insolvency, labour, competition and contribution-related offences), and corruption or cybercrime (e.g. phishing in online banking). Another term which is often discussed in connection with criminal activities is "money laundering". This refers to illegally acquired assets – such as illicit earnings from criminal activities – being channelled into the legal financial and economic cycles.[17] In addition, the rise of Islamist terrorist groups has thrust the financing of terrorism further into the spotlight.[18] Owing to the sparse availability of data, however, empirically reliable statements on the scale of these other illegal areas can be made only to a very limited extent, if at all.

Other payment instruments used alongside cash

In some of the areas mentioned, cash plays only a partial role or is not used at all. In cases of unreported income from capital, for example, illegal money frequently appears to be channelled into countries which constitute an attractive destination on account of comparatively low rates of taxation, a high level of confidentiality and secrecy and/or less-developed financial market supervision/regulation. It is estimated that 8% of the financial wealth of households worldwide, totalling US $7.6 trillion, is held in such tax havens.[19] Corruption represents another illegal use of payment instruments. 70% of all corruption cases recorded by police in 2017 were committed using cash.[20] Non-cash benefits or other monetary assets accounted for just under 7% each. Cash therefore plays a significant role, although the use of cash is subject to major fluctuations over

14 See A. Kartschall and M. Pohl (2017), Bundesregierung verzichtet auf Hunderte Millionen Euro, comments by M. Steier on the television show "Kontraste", Rundfunk Berlin-Brandenburg (rbb).

15 See Federal Criminal Police Office (2018), Bundeslagebild Rauschgiftkriminalität 2017.

16 Besides illicit work, illegal trading of goods and undeclared income from capital, other forms of tax fraud or evasion are conceivable – for instance, income from the assignment of intangible assets, such as licences or rights. The evasion of other forms of tax, such as corporation tax or local business tax, is also possible, alongside the aforementioned evasion of income tax and VAT.

17 See J. Walker (1999), How big is global money laundering?, Journal of Money Laundering Control, 3(1), pp. 25-37, E. Dreer, W. Riegler and F. Schneider (2006), Geldwäsche: Formen, Akteure, Größenordnung – und warum die Politik machtlos ist, Gabler, and J. Walker and B. Unger (2009), Measuring global money laundering: "The Walker gravity model", Review of Law and Economics, 5(2), pp. 821-853.

18 Even though the sum total of terrorist financing is, by its very nature, unknown both on a global scale and in terms of Germany alone, a conceptual distinction needs to be made between the financing of individual terrorist attacks and that of entire terrorist groups. Significant sums primarily arise in the case of the latter. The planning and implementation costs of the most recent terrorist attacks in Europe are estimated to have been somewhere between less than €2,000 and €82,000. See Ecorys (2017), Study on an EU initiative for a restriction on payments in cash, Final Report.

19 See G. Zucman (2013), The missing wealth of nations: Are Europe and the US net debtors or net creditors?, Quarterly Journal of Economics, 128(3), pp. 1321-1364, and G. Zucman (2014), Taxing across borders: Tracking personal wealth and corporate profits, Journal of Economic Perspectives, 28(4), pp. 121-148.

20 See Federal Criminal Police Office (2018), Bundeslagebild Korruption 2017.

time (2016: 35%, 2015: 77%).[21] In the context of terrorist activities, cash generally seems to be used for payments or smuggling.[22] However, the formal financial system may also play an important role, such as when it comes to making credit transfers or taking out loans. The use of prepaid cards is often observed, too.[23] Added to these are informal banking systems (such as hawala) and crypto-tokens.

Holistic analysis of payment transactions appropriate

The impression that it is mainly or even exclusively cash that is used for criminal purposes – and that, as a consequence, cash is typically used at the start of the money laundering process to infiltrate the financial system – therefore has to be modified to account for all aspects. First, money laundering comprises not only cash-driven activities in the shadow economy, but also, for instance, the repatriation of assets resulting from the evasion of tax on capital income or from cybercrime. Second, to undertake shadow economy activities, electronic payment processes are increasingly coming into question as described above, especially for settlement over the internet or darknet. In general, it seems that money laundering methods are also becoming more digital, for instance through the use of cryptocurrencies or "offshore instruments".[24] Since bank accounts serve as an interface between cash and cashless payments and offer the possibility of converting cash into book money by making a deposit, or converting book money into cash by making a withdrawal, it is likely that, in many cases, illegal money will change its form multiple times during the money laundering process. When evaluating the role of various payment instruments in the money laundering process, it therefore seems appropriate to take an all-encompassing view of payment transactions.

Extent of illegal use of cash in Germany

Based on these considerations, cash is – alongside other means of payment and forms of money – also used for criminal purposes. However, as a result of the clandestine nature of illegal activities, the precise extent of this can only be estimated and is subject to an above-average degree of uncertainty.

Difficult to determine the extent of illegal cash use

Estimates of illegal cash holdings based on volume of cash in circulation

It is often argued that the overall volume of cash in circulation as well as the demand for large-denomination banknotes are greater than might be expected if cash were used solely for legal purposes. Conversely, this would suggest that the illegal use of cash is a widespread phenomenon. To illustrate this argument, the table on p. 50 shows cash in circulation per inhabitant as well as the percentage of large-denomination banknotes in circulation for a range of currency areas. The demand for euro banknotes by denomination is shown in greater detail in the chart on p. 50.

Estimates based on volume of cash in circulation are widespread

For a large number of currency areas, the figures for cash in circulation per inhabitant cannot be explained by the information available for each currency on the foreign demand or on

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21 See Federal Criminal Police Office (2017), Bundeslagebild Korruption 2016.
22 Many of the transactions are low-value and thus differ only slightly, if at all, from ordinary transactions. As a result, they attract little attention ahead of terrorist attacks, irrespective of the payment instrument used. See E. Oftedal (2014), The financing of jihadi terrorist cells in Europe, Norwegian Defence Research Establishment, and H. Mai (2016), Cash, freedom and crime: Use and impact of cash in a world going digital, Deutsche Bank Research.
23 See U. Dalinghaus (2017), Keeping cash: Assessing the arguments about cash and crime, International Currency Association.
24 The role of cryptocurrencies is discussed in U. Dalinghaus (2017), op. cit., and Ciphertrace (2018), Cryptocurrency anti-money laundering report 2018 Q2. In many methods of money laundering, it appears that interactions with non-residents play a key role. For example, particularly by using "brass-plate companies", illegal money is often shifted back and forth between different countries before coming back into the possession of its true owner; for more information, see also H. Merten (2017), Vertreibung aus dem Paradies: 100 Jahre Steueroasen zwischen Nummernkonten, Briefkastenfirmen und Karibikinseln, FBV.

## Cash in circulation per inhabitant and percentage of large-denomination banknotes*

Country/ country group	Cash per capita in US dollar	Percentage of large-denomination banknotes	Lowest-value large-denomination banknote
Australia	2,379	43	AUD 100
Brazil	346	39	BRL 100
Canada	1,788	51	CAD 100
Euro area	3,579	48	EUR 100
Hong Kong	7,341	45	HKD 1,000
India	151	49	INR 2,000
Japan	7,214	88	JPY 10,000
Mexico	565	6	MXN 1,000
Russia	989	72	RUR 5,000
Saudi Arabia	1,678	81	SAR 500
Singapore	5,242	57	SGD 100
South Africa	131	32	ZAR 200
South Korea	1,584	78	KRW 50,000
Sweden	689	5	SEK 1,000
Switzerland	9,516	74	CHF 200
Turkey	444	27	TRY 200
United Kingdom	1,429	21	GBP 50
United States	4,671	77	USD 100

Source: Bundesbank calculations and the Bank for International Settlements (2017), Statistics on payment, clearing and settlement systems in the CPMI countries: Figures for 2016. * The figures are for 2016. As a rule, the distinction between "large" banknotes and other banknotes is drawn so that the smallest "large" banknote of each currency largely corresponds in value to the €100 banknote.
Deutsche Bundesbank

Share of banknote denominations as a percentage of banknotes in circulation

End-2018
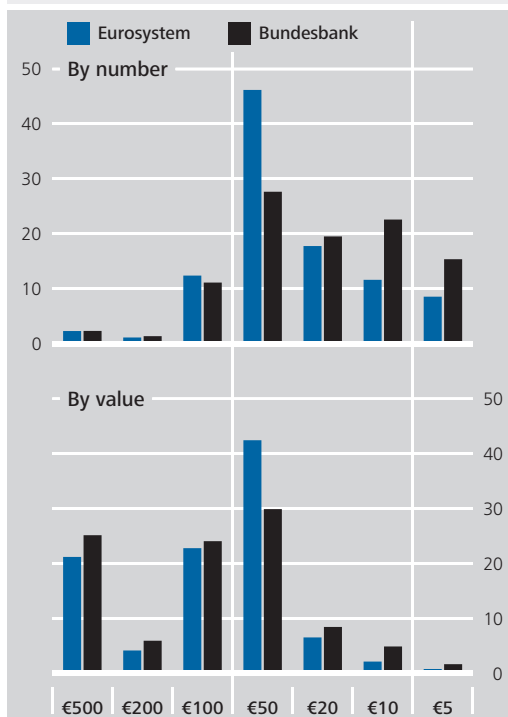
Source: ECB and Bundesbank calculations.
Deutsche Bundesbank

cash holdings for transaction purposes.[25] By way of an example, subtracting the estimated foreign demand from the value of Bundesbank-issued euro banknotes gives a domestic demand of around €200 billion, or €2,500 per inhabitant, at the end of 2016. The available figures on credit institutions' cash holdings (€26 billion), households' estimated cash holdings for transaction purposes (€13 billion),[26] and retailers' estimated cash holdings (€2 billion) only partially account for this volume of cash in circulation.[27] The remaining unexplained cash holdings could be held both as a legal store of value as well as for illegal purposes.[28] Without knowledge of the stock of cash held legally as a store of value, it is impossible to draw any conclusions about illegal cash holdings in this way.[29]

Not directly possible to separate the demand for cash into legal and illegal holdings

25 See K. Rogoff (1998), Blessing or curse? Foreign and underground demand for euro notes, Economic Policy, 13(26), pp. 263-303, K. Rogoff, Costs and benefits to phasing out paper currency, in J. Parker and M. Woodford (eds., 2015), NBER Macroeconomics Annual 2014, 29(1), pp. 445-456, and K. Rogoff (2016), op. cit.
26 This estimate of households' cash holdings for transaction purposes can, in part, even comprise illegal uses of cash as it is based on responses to the Bundesbank's payment behaviour study regarding the cash withdrawals; see Deutsche Bundesbank, The demand for euro banknotes at the Bundesbank, op. cit. This provision of cash could partially serve illegal purposes.
27 See Deutsche Bundesbank, The demand for euro banknotes at the Bundesbank, op. cit.
28 Economic agents could hold a part of their assets in cash, probably for reasons of liquidity and security; see Deutsche Bundesbank, Cash as a means of payment and a store of value, Annual Report 2015, pp. 25-45. Some consumers could form cash reserves in order to cover expenses even in the event of unforeseen circumstances. Certain investors could doubt the stability of the banking and financial system and set aside cash for this reason. Cash is secure central bank money and is therefore fundamentally immune to any default risk. One example of the fact that cash is held legally as a store of value on a substantial scale can be seen from developments in the demand for cash during the escalation of the financial crisis following the Lehman Brothers crisis in September 2008. October 2008 saw an immense increase in the Bundesbank's net outpayments of €500 banknotes, which totalled €11.4 billion in that month. By comparison, cumulative net outpayments of that denomination in 2008 as a whole, excluding the month of October, amounted to €10.3 billion. See Deutsche Bundesbank, Demand for banknotes during the financial crisis, Monthly Report, June 2009, pp. 52-53.
29 In addition, estimates of illegal cash holdings as a residual are unlikely to be very robust, as estimation errors in the other components have a knock-on effect on the estimated scale of illegal cash holdings.
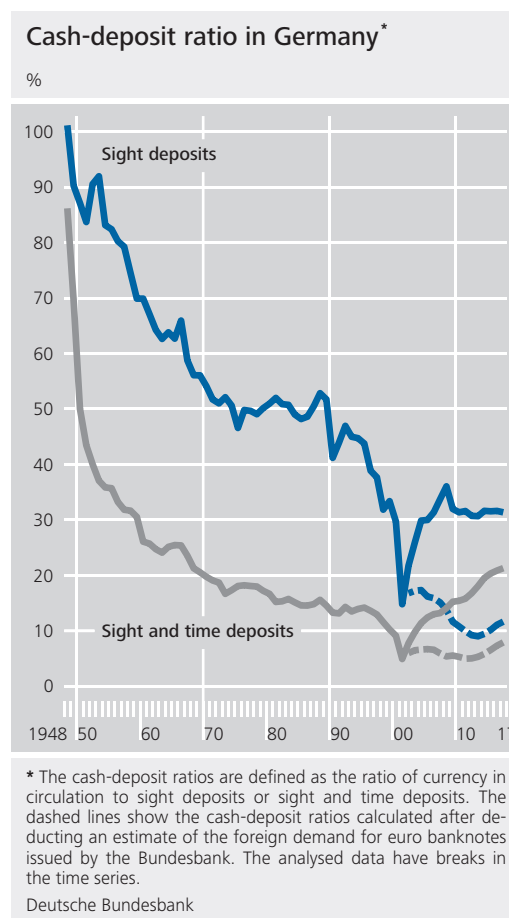
On the basis of demand for large-denomination banknotes, it is also not possible to draw any direct conclusion about the use of cash in the shadow economy

The table and chart on p. 50 suggest that large-denomination banknotes comprise a significant part of cash in circulation in the euro area as well as in other currency areas. However, the demand for large denominations alone cannot be used to support the conclusion that cash is being used for illegal purposes, since these denominations are equally suitable as a legal store of value or for legal and illegal high-value payments. In particular, interpreting the Bundesbank's cumulative net issuance is made more difficult by the fact that the banknotes that it issues also circulate abroad. In summary, anecdotal evidence drawn from the volume of cash in circulation or the demand for large-denomination banknotes is not appropriate for quantifying illegal cash holdings.

Cash-deposit ratio approach not satisfactory either

One variant of the estimates that use the volume of cash in circulation as a starting point looks at what is known as the "cash-deposit ratio", which is usually defined as the ratio of cash in circulation to sight deposits. This approach assumes that, excluding the impact of the shadow economy, cash is held in constant proportion to sight deposits. Unexplained rises in this cash-deposit ratio – compared with a "natural" cash-deposit ratio defined using a given base year – are interpreted as pointing to an illegal holding of cash.[30] When applying this approach, choosing a base year is a particular challenge. Additional problems arise because a range of determinants – such as the interest rate, the level of economic output as well as innovations in payments and banking – can, over time, change the ratio of cash in circulation to sight deposits.[31] Specific examples of relevant determinants are an increasing volume of cashless wage payments as well as the emergence of ATMs.[32] The cash-deposit ratio could, in principle, also rise following an increase in legal use of cash as a store of value. The chart above shows that variously defined cash-deposit ratios have been tending to decline in Germany over the past few decades. As a result, unexplained rises in the cash-deposit ratio, too, cannot be used to draw any conclusions regarding the use of cash in the shadow econ-

Cash-deposit ratio in Germany*

%

* The cash-deposit ratios are defined as the ratio of currency in circulation to sight deposits or sight and time deposits. The dashed lines show the cash-deposit ratios calculated after deducting an estimate of the foreign demand for euro banknotes issued by the Bundesbank. The analysed data have breaks in the time series.

Deutsche Bundesbank

omy.[33] At least without adjustments, the cash-deposit ratio is therefore also unlikely to offer a suitable method for estimating the illegal cash demand.

30 The cash-deposit ratio approach dates back to P. Cagan and P. Gutman, see P. Cagan (1958), The demand for currency relative to the total money supply, Journal of Political Economy, 66(4), pp. 303-328, and P. Gutmann (1977), The subterranean economy, Financial Analysts Journal, 33(6), pp. 26-34.
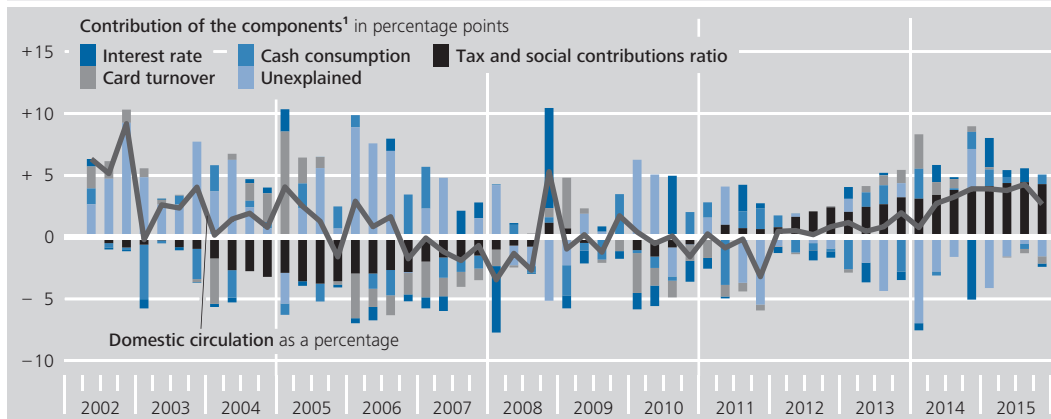**31** See P. Cagan (1958), op. cit.
32 The factors cited above are also likely to influence the development of the ratio of cash in circulation to GDP; see Deutsche Bundesbank, Circulation of the Deutsche Mark – from currency reform to European monetary union, Monthly Report, March 2002, pp. 19-34.
33 See M. Pickhardt and J. Sardà (2011), The size of the underground economy in Germany: A correction of the record and new evidence from the modified-cash-deposit ratio approach, European Journal of Law and Economics, 32(1), pp. 143-163.

Composition of growth in the domestic demand for banknotes*

Quarter-on-quarter change, seasonally adjusted

Contribution of the components[1] in percentage points

■ Interest rate ■ Cash consumption ■ Tax and social contributions ratio
■ Card turnover ■ Unexplained

Domestic circulation as a percentage

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

* Based on the estimation of the static long-run equation for the regression model of the domestic demand for banknotes. **1** The components were adjusted by their mean values during decomposition.

Deutsche Bundesbank

Estimates using the currency demand approach

Econometric modelling of the demand for cash more promising

An alternative to these direct approaches is provided by economic research into the shadow economy in the form of the "currency demand approach".[34] The currency demand approach for analysing the shadow economy enhances traditional money demand models[35] by the addition of variables that are designed to capture the impact of illegal activities on the demand for cash. Since it is not possible to observe the scale of the shadow economy and other unlawful forms of behaviour, indicators that should be connected with the illegal activities under consideration are included as proxies. In the literature, a tax rate is usually incorporated into the currency demand model because the burden of taxation and social contributions is considered to be a key motive for production in the shadow economy.[36] Other variables, such as the rate of unemployment and indicators of criminality, can also be included in empirical modelling.[37] Provided that the selected indicators explain parts of the currency demand, this ultimately points to an illegal use of cash.

Currency demand approach widely used

Studies for Germany based on the currency demand approach do, in fact, find that measures for the tax burden have a statistically significant

influence on the demand for cash.[38] This is one indication that the shadow economy has an impact on currency demand in Germany. One application quantifies the extent of the shadow economy in Germany at 15% of GDP (see the table on p. 47). One criticism levelled at the currency demand approach is that the derived results are crucially dependent on key assumptions.[39] Specifically, the legal function of cash

34 See V. Tanzi (1983), op. cit., and F. Schneider (1986), op. cit.

35 See S. Goldfeld and D. Sichel, The demand for money, in B. Friedman and F. Hahn (eds., 1990), Handbook of Monetary Economics, Volume 1, Elsevier Science Publishers B.V., pp. 299-356.

36 See V. Tanzi (1983), op. cit., F. Schneider (1986), op. cit., and F. Schneider (2015), op. cit.

37 See G. Ardizzi, C. Petraglia, M. Piacenza, F. Schneider and G. Turati (2014a), Money laundering as a crime in the financial sector: A new approach to quantitative assessment, with an application to Italy, Journal of Money, Credit and Banking, 46(8), pp. 1555-1590, G. Ardizzi, C. Petraglia, M. Piacenza and G. Turati (2014b), Measuring the underground economy with the currency demand approach: A reinterpretation of the methodology, with an application to Italy, Review of Income and Wealth, 60(4), pp. 747-772, and H. Herwartz, J. Sardà and B. Theilen (2016), Money demand and the shadow economy: Empirical evidence from OECD countries, Empirical Economics, 50(4), pp. 1627-1645.

38 See G. Kirchgässner (1983), Size and development of the West German shadow economy, 1955-1980, Journal of Institutional and Theoretical Economics, 139(2), pp. 197-214, and M. Pickhardt and J. Sardà Pons (2006), op. cit.

39 See M. Hofreither and F. Schneider (1987), Die Erfassung der Schattenwirtschaft durch den Bargeldansatz: Plausible Ergebnisse mittels unzulässiger Methode?, Wirtschaftspolitische Blätter, 34(1), pp. 99-118, F. Schneider and D. Enste (2000), op. cit., and F. Schneider (2015), op. cit.

Panel analysis of cash lodgements at Bundesbank branches

The motives behind cash use in Germany are investigated by analysing lodgements made at Bundesbank branches. In simplified terms, the central bank issues banknotes to the commercial banks which, in turn, pay them out to their customers. Consumers use the banknotes to make purchases from retailers, who then deposit the cash at the central bank, either directly or via the commercial banks.[1] On balance, while banknotes are also put back into circulation by commercial banks after undergoing checks for authenticity and fitness, it is the Bundesbank which carries out the lion's share of automated banknote processing in Germany. Cash deposits at the Bundesbank's branches thus provide a coherent picture of cash usage in Germany. Here, we examine whether these inpayments are, in part, attributable to the shadow economy. Cash is paid in at the Bundesbank by retailers and banks and therefore stems from legal transactions, in principle. However, it is possible that cash deposits could be indirectly linked to income from the shadow economy without the Bundesbank being able to tell whether a specific lodgement involves cash that has previously been used in a shadow economy transaction.

It is assumed that real cash deposits per inhabitant in region i at time t, Inp_{it}, result from economic output, $GDP_{it}(1+x'_{it}\beta)$, weighted with a share of cash payments η_{it}. This economic output is made up of the real gross domestic product (GDP) per inhabitant, GDP_{it}, plus the shadow economy. To approximate the size of the shadow economy we factor in variables x_{it}, for which a relationship with the size of the shadow economy can be assumed. The scale of the shadow economy in relation to the measured economic output GDP_{it} is denoted by

$x'_{it}\beta$, where β is a coefficient vector. The equation below illustrates the relationship being described.

$$Inp_{it} = \eta_{it}GDP_{it}(1 + x'_{it}\beta),$$
$$i = 1, ..., N, t = 1, ..., T$$

By making use of the approximations $\eta_{it} \approx e^{\alpha_i}e^{\lambda_t}$ and $\log(1+x'_{it}\beta) \approx x'_{it}\beta$, after taking logarithms and the addition of an error term u_{it}, the estimating equation shown below is obtained.

$$log(Inp_{it}) = \alpha_i + \lambda_t + log(GDP_{it}) + x'_{it}\beta$$
$$+ u_{it}, \ i = 1, ..., N, \ t = 1, ..., T$$

This equation represents a static panel regression with fixed effects for regions (α_i) and time periods (λ_t). Panel data for cash deposits broken down by region for the years 1993 to 2015 are used for the empirical investigation. The least squares method is applied to determine the model parameters.[2]

Several variables are taken into account as indicators for the shadow economy x_{it} so as to yield as complete a picture as possible of

1 For a description of the banknote cycle in Germany see Deutsche Bundesbank, The banknote cycle and banknote recycling in Germany, Monthly Report, January 2011, pp. 17-27. When it comes to the coin cycle, the Bundesbank's role is limited to that of a wholesaler.
2 We use panel-corrected standard errors which are robust to panel heteroscedasticity and contemporaneous correlation between panels. See N. Beck and J. Katz (1995), What to do (and not to do) with time-series cross-section data, American Political Science Review, 89(3), pp. 634-647. To adjust for autocorrelation of the residuals the variables are first transformed using the Prais-Winsten approach; see R. Parks (1967), Efficient estimation of a system of regression equations when disturbances are both serially and contemporaneously correlated, Journal of the American Statistical Association, 62(318), pp. 500-509; J. Kmenta (1997), Elements of econometrics, 2nd edition, University of Michigan Press.

Results of panel estimations*

Item	Specification		
	(1)	(2)	(3)
Log real GDP per inhabitant	1.05*** (4.23)	1.14*** (4.62)	1.01*** (4.12)
Self-employment rate	4.76** (2.45)	–	4.07** (2.20)
Drug-related crime	–	0.05** (2.09)	0.04* (1.78)
Number of observations	299	299	299
Coefficient of determination R^2	0.80	0.80	0.81
Cash deposits indirectly attributable to illegal cash transactions as a percentage of total cash deposits	12.2	3.9	13.9

* Looking at a panel of regions for the period 1993 to 2015. The columns of the table show the results from different model specifications in which the selected indicators are first included individually and then collectively. In each case, the dependent variable is log real cash inpayment per inhabitant. *** significant at 1%, ** significant at 5%, * significant at 10%. The coefficient of determination is calculated as the squared correlation between the dependent variable and the values predicted by the model. t-values in brackets.

Deutsche Bundesbank

the influence of the shadow economy on cash lodgements. The burden of taxation and social security contributions is regarded as an important motive for shifting economic activities to the shadow economy. The tax and social contributions ratio is therefore a possible indicator for illegal uses of cash.[3] Other indicators include the unemployment rate, the self-employment rate and the proportions of people employed in the agricultural sector and the construction sector.[4] We also want to cover areas of the shadow economy where the manufacture or trading of the produced goods is illegal. To this end, we investigate the influence of indicators of regional crime levels taken from the police crime statistics.[5] The variables considered are the total number of criminal offences per 1,000 inhabitants, the number of crimes involving brutality and offences against personal freedom per 1,000 inhabitants,[6] the number of offences involving theft per 1,000 inhabitants and the

number of drug-related offences per 1,000 inhabitants. The adjacent table shows selected results from the panel econometric analyses. Only the results for the indicators of illegal cash use that exhibit a statistically significant impact with the expected sign are included.

A common approach in the literature is to ascertain the quantitative extent of illegal cash usage using a model simulation on the basis of the estimated model equations.[7] The value for the dependent variable projected by the model is usually calculated first. This calculation is then repeated under the assumption that the shadow economy indicators take a certain reference value in order to work out what the value of the dependent variable would be without the shadow economy. The difference between these values gives an estimate for the degree to which the dependent variable under consideration (for example, cash in circulation or cash lodgements) is attributable to

3 See L. Feld and F. Schneider (2010), Survey on the shadow economy and undeclared earnings in OECD countries, German Economic Review, 11(2), pp. 109-149. This indicator is chosen, for example, in V. Tanzi (1983), The underground economy in the United States: Annual estimates, 1930-80, International Monetary Fund Staff Papers, 30(2), pp. 283-305, and F. Schneider (1986), Estimating the size of the Danish shadow economy using the currency demand approach: An attempt, Scandinavian Journal of Economics, 88(4), pp. 643-668.
4 See Deutsche Bundesbank, Econometric structural model of banknote demand, Monthly Report, June 2009, pp. 56 f.; G. Ardizzi, C. Petraglia, M. Piacenza, F. Schneider and G. Turati (2014), Money laundering as a crime in the financial sector: A new approach to quantitative assessment, with an application to Italy, Journal of Money, Credit and Banking, 46(8), pp. 1555-1590; H. Herwartz, J. Sardà and B. Theilen (2016), Money demand and the shadow economy: Empirical evidence from OECD countries, Empirical Economics, 50(4), pp. 1627-1645.
5 See Federal Criminal Police Office, Police Crime Statistics – Federal Republic of Germany, Report 2015.
6 This covers, for example, offences involving robbery or bodily injury; see Federal Criminal Police Office, op. cit.
7 See V. Tanzi (1983), op. cit.; F. Schneider (1986), op. cit.; G. Ardizzi, C. Petraglia, M. Piacenza, F. Schneider and G. Turati (2014), op. cit.

the shadow economy. The calculated values for the extent of illegal cash use may depend heavily on the assumptions made and should be interpreted with caution accordingly. For instance, setting a reference value for the shadow economy indicators when there is assumed to be no shadow economy is an arbitrary exercise to a certain extent. Despite these limitations, in the interests of transparent documentation of the possible model implications, the table on p. 54 shows the results of a model simulation following the pattern detailed above for the average share of cash deposits that can be indirectly attributed to the shadow economy.[8] On balance, averaged across the regions and time periods included in the study, around 14% of lodgements can be indirectly ascribed to the shadow economy. After conversion, we end up with deposits of illegal cash totalling around €60 billion for the year 2015. Conceptually speaking, it is not possible to determine the size of the shadow economy on the basis of this value. One reason for this is that we do not know how frequently cash is used for transactions within the shadow economy before it makes its way into the formal economy. This estimate for the volume of illegal cash lodgements would be consistent with high estimates for the size of the shadow economy if cash takings in the shadow economy were primarily and repeatedly reused for payments in the shadow economy before being deposited at the Bundesbank via retailers or credit institutions.

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[8] The calculation is based on a method used in the economic literature; see V. Tanzi (1983), op. cit. The reference value for the shadow economy indicators for which there are only legal cash lodgements is set at zero.

Two new studies on the significance of illegal motives for cash demand

as a store of value as well as foreign demand should also be captured in the currency demand approach. When interpreting the results, due account should also be taken of the fact that the currency demand approach can only investigate the illegal uses of cash that are sufficiently large in scale to be relevant to a national economy and for which suitable indicator variables are available.

The significance of illegal motives for the use of cash in Germany is the subject of two new studies based on the currency demand approach. A panel econometric analysis looks at the impact of the illegal use of cash on cash lodgements at branches of the Bundesbank. Using a time series econometric regression analysis, the significance of illegal motives for the domestic demand for banknotes is investigated. Of the nine indicators of illegal cash use considered in the panel econometric analysis (see the box on pp. 53 ff.), only the coefficients of the self-employment rate and the number of drug-related offences are statistically significantly different from zero with the expected sign.[40] Given a 1 percentage point rise in the self-employment rate or one additional drug-related offence per 1,000 inhabitants, cash lodgements would, depending on the specification, go up by 4% to 5% and thus also on an economically significant scale. The box on pp. 53 ff. discusses the extent to which quantitative estimates of the volume of cash lodgements stemming indirectly from the shadow economy are reliably possible and what results are achieved by doing this.

In addition, the use of cash in the shadow economy is estimated using regression analyses

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[40] The statistical significance of a regression coefficient means that sample data deviate so strongly from the assumption that the coefficient is equal to zero (null hypothesis) that this hypothesis is rejected in accordance with a predefined rule (significance test). The significance test, however, does not provide any information on the strength of the effect, i.e. the economic significance of the regression coefficient.

Estimating the domestic demand for banknotes

The contribution of various determinants to the domestic demand for banknotes can be captured in econometric models. For this purpose, the Bundesbank has estimated dynamic regression models; more specifically, autoregressive distributed lag (ARDL) models.[1] The estimates are made using a real specification and with seasonally adjusted data covering the period from the first quarter of 2002 to the fourth quarter of 2015 (and, for some variables, to the second quarter of 2016). The price-adjusted domestic demand for banknotes to be explained is the real difference between total cumulative net issuance of banknotes by the Bundesbank and estimated foreign demand.[2] This analysis focuses on the shadow economy as an explanatory variable for banknote demand. An increase in shadow economy activities should result in a higher demand for cash. The phenomenon of the shadow economy has a variety of manifestations that can be modelled using the following proxy variables: tax and social contributions ratio, employment rate in the agricultural sector, employment rate in the construction sector, unemployment rate, self-employment rate, drug-related crimes, and crimes in total. These variables represent various aspects of the shadow economy. The first five of these proxy variables can be assigned to legal production and are designated here as the "shadow economy – legal production" group. The last two proxy variables represent illegal activities and form the "shadow economy – illegal" group. To avoid the problem of omitted variables, two proxy variables for the shadow economy were included as regressors in the starting specification of the estimated models; one from the "shadow economy – legal production" group and one from the "shadow economy – illegal" group.[3]

The traditional determinants of the demand for cash are modelled by cash consumption as a transaction variable and interest rate as an opportunity cost variable. Cash consumption refers to those categories of private consumption that are largely settled in cash.[4] The entire interest rate range is incorporated into the analysis by including a shift parameter from an estimated yield curve to represent the generally prevailing interest rate level. Domestic card turnover is used as a control variable for the substitution of cash with cashless payment instruments. The impact of card payments on the demand for banknotes is theoretically uncertain. Girocards and credit cards are a substitute for cash payments, although they are also used to withdraw cash from ATMs. The impact on demand is twofold: on the one hand, lower transaction costs for withdrawing cash reduce the demand for cash. On the other hand, however, they also make it easier to access cash, thus boosting demand.

The model's starting specification is as follows:

$$
\begin{aligned}
y_t = {} & c + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \alpha_3 y_{t-3} \\
& + \alpha_4 y_{t-4} + x'_t \beta_1 + x'_{t-1} \beta_2 \\
& + \gamma_1 z_{prod,t} + \gamma_2 z_{prod,t-1} + \gamma_3 z_{illegal,t} \\
& + \gamma_4 z_{illegal,t-1} + u_t, \; t = 1, ..., T
\end{aligned}
$$

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1 No cointegration relationships could be identified.
2 See Deutsche Bundesbank, The demand for euro banknotes at the Bundesbank, Monthly Report, March 2018, pp. 37-51.
3 Due to the relatively low number of observations, it was decided not to include all seven proxy variables for the shadow economy in the regression equation at the same time.
4 These include spending on accommodation and hospitality services, clothing and footwear, leisure, entertainment and culture, food, beverages and tobacco as well as on other purposes, such as healthcare.

where y_t stands for the domestic demand for banknotes as an endogenous variable, c is the constant term, x_t designates the vector of the control variables, $z_{prod,t}$ represents a shadow economy variable from the "shadow economy – legal production" group, $z_{illegal,t}$ represents a shadow economy variable from the "shadow economy – illegal" group, and u_t is the residual. The alphas, betas and gammas are the corresponding coefficients. The final specification of this model was determined using a general-to-specific approach. The most meaningful model in economic terms was selected from the resulting models. This is shown in the adjacent table. With the exception of the tax and social contributions ratio, which is already stationary according to statistical tests, all variables are transformed into stationary variables before being fed into the analysis. The first difference of the interest rate is used for this variable. The remaining variables are transformed using their first logarithmic difference. The test statistics do not point to a misspecification of the regression model. The dynamic regression model explains domestic demand using its lagged values, cash consumption in the previous period, the interest rate, card turnover lagged by one period as well as the tax and social contributions ratio as a proxy variable for the shadow economy. Furthermore, a dummy variable depicts the increase in the demand for banknotes in the wake of the 2008 financial crisis.[5] All estimated coefficients have the theoretically expected signs and are statistically significant; for card turnover, the negative effects on domestic demand predominate. To interpret the results, it is essential to identify the long-term effects on domestic demand caused by permanent changes in the explanatory variables. In order to extract these long-term multipliers, the dynamic regression model in reduced form is transposed into the static long-run equation.

Regression estimation for domestic demand°

Item	Value
ARDL model	
Constant term	− 0.10***
Dummy variable for Q4 2008	0.04***
Domestic demand lagged by one period	0.21**
Domestic demand lagged by two periods	0.22**
Domestic demand lagged by four periods	0.35***
Cash consumption lagged by one period	0.55**
Card turnover lagged by one period	− 0.30**
Interest rate	− 0.005**
Tax and social contributions ratio	0.005***
Number of observations	52 (Q2 2003-Q1 2016)
Adjusted R²	0.71
Prob (F-statistic)	0.00
Breusch-Godfrey autocorrelation test: LM (12) [p value]	15.89 [0.20]
Jarque-Bera test of normal distribution: JB [p value]	1.77 [0.41]
White test of heteroscedasticity: Obs*R² statistic [p value]	34.84 [0.52]
Ramsey RESET test: F-statistic [p value]	0.94 [0.40]
Likelihood ratio [p value]	2.32 [0.31]
Static long-run equation for the regression model	
Constant term	− 0.46*
Dummy variable for Q4 2008	0.19
Cash consumption	2.42
Card turnover	− 1.35*
Interest rate	− 0.02
Tax and social contributions ratio	0.022**

o *** significant at 1% (highly significant), ** significant at 5%, * significant at 10% (marginally significant).

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The long-term multiplier for the tax and social contributions ratio suggests that an increase of 1 percentage point in this ratio pushes up the growth rate of domestic demand by 2.2 percentage points.

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5 See Deutsche Bundesbank, Demand for banknotes during the financial crisis, Monthly Report, June 2009, pp. 52-53.

of the (real) domestic demand for banknotes (see the box on pp. 56 f.). Accordingly, of the seven shadow economy proxy variables used, only the tax and social contributions ratio has a statistically significant (positive) impact on the domestic demand for banknotes.[41] If there is a sustained 1 percentage point increase in the tax and social contributions ratio, the growth rate of the domestic demand for banknotes goes up by 2.2 percentage points over the long term. This long-term multiplier is also economically significant. The quantitative contributions of the various determinants can be compared by decomposing the growth in the domestic demand for banknotes (see the chart on p. 52).[42] Developments in the growth rate of the domestic demand for banknotes can be split into three phases. It was positive from the launch of euro cash until the end of 2006, then negative until the end of 2011, and has been positive again since then with a tendency to rise. Since 2012, the tax and social contributions ratio has made the largest contribution to growth in domestic demand, followed by the growth rates in cash consumption and card payments. This finding highlights the economic significance of the tax and social contributions ratio in the domestic demand for banknotes.

■ Conclusions

Cash payments are made without any technical devices by simply handing over banknotes and coins. As a result, cash transactions can be completed without third parties obtaining knowledge of the parties involved. By using cash in their daily lives, members of the general public can maintain their personal privacy. However, the anonymity of cash can be abused, for instance, in connection with tax evasion or trading in illegal goods.

This possible role of cash in the shadow economy, or as a means of funding crime, has been under increased discussion for some time now. However, estimating the actual scale on which cash is being used for illegal purposes represents a challenge. Direct estimates – such as those that use the volume of cash in circulation or the demand for large-denomination banknotes to conclude that there is, supposedly, an extensive illegal use of cash – seem scarcely appropriate, as they do not take account of the legal function of cash as a store of value. Econometric estimates of the cash demand present a mixed picture overall of the significance of the shadow economy for the demand for cash in Germany. According to the Bundesbank's own empirical studies of the determinants of cash lodgements at Bundesbank branches as well as of the Bundesbank's cumulative net issuance of euro banknotes, no more than a few of the potential indicators of illegal cash use are significant in each case. These are, first, the self-employment rate and the number of drug-related offences, and, second, the tax and social contributions ratio. Generally, studies of the shadow economy refer to an unobservable variable, which means that the results can potentially depend to a large degree on the assumptions made and should be interpreted only with caution.

Finally, there remains the question of how far the shadow economy can be contained by restricting the use of cash. In this regard, there is still a lack of empirical evidence as to whether measures such as abolishing large-denomination banknotes or introducing upper limits for cash payments would, in fact, be an effective means of combating tax evasion and other criminal activities.[43]

41 The terms "domestic banknote circulation" and "domestic demand for banknotes" have the same meaning, as banknote circulation is determined solely by the demand for banknotes.
42 This decomposition of growth is based on the static long-run equation for the domestic demand for banknotes.
43 See Deutsche Bundesbank, Policy options for cash payments, Annual Report 2015, pp. 36-38.