



# Implications of the Expanding Use of Cash for Monetary Policy

Daniel Gros

## Summary

Financial innovation seems to have had little impact on the oldest medium of transaction, namely cash. The ratio of currency in circulation to GDP has increased in most countries, independently of the continuing spread of cashless transactions. Currency is part of the monetary base. Its increase thus leads to an automatic increase in central banks' balance sheets. This becomes relevant when the size of a central bank's balance sheet becomes a policy instrument. Taking account of the increase in cash holdings can lead to a different view of the monetary policy stance over longer periods of time. Holding the size of the overall balance sheet constant is equivalent to a gradual exit when currency holdings continue to increase.

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## Executive Summary

- Financial innovation, especially in the form of electronic payments systems, was supposed to mean the end of (paper) currency, but the opposite has been the case in reality. The use of cash, especially banknotes, has increased in most developed economies. The only two exceptions among OECD member countries are Sweden and Denmark.
- This phenomenon of increasing ‘cash-intensiveness’ is difficult to explain.
- The largest banknotes constitute a large share of the overall amount in circulation, but they are manifestly not used for transactions purposes. More recently, the share of the largest euro bank note (500 euro) in circulation has fallen. Most of the increase in the overall cash in circulation has thus come from the 50 euro note.
- The existing empirical literature has difficulties explaining this continuous increase in cash holdings in most advanced countries. Interest rates seem to have played a marginal role. Electronic transactions have advanced everywhere, but with no discernible shift away from cash holdings, at least in countries other than Sweden and Denmark.
- It is widely assumed that cash in general is used in the underground economy and that large-denomination banknotes play an important role in organised crime. But there is little cross-country evidence to support this hypothesis (cash holdings are particularly high in Japan, which has a low level of criminal activity). Moreover, there is little sign that the underground economy has expanded everywhere.
- Increasing cash holdings would have led to larger central bank balance sheets even in the absence of large-scale asset purchase programmes (quantitative easing (QE)). In technical terms, one should thus look at excess reserves as a better indicator of the policy stance under zero interest rates.
- Given the gradual nature of the increase in currency, the balance sheet expansion through QE has dominated the evolution of overall central bank balance sheets in the short run. This is also the case for the European Central Bank at the present time.
- In the long, however, an increasing part of the balance is explained by cash holdings.
- One conclusion is that the impact of QE (and other forms of unconventional monetary policy) on the expansion of balance sheets has been overestimated if one looks at the last decade (in the sense that the increase in excess reserves has been considerably lower than the total asset purchases).
- Another, related conclusion is that the US de facto already started a gradual exit, as it keeps its nominal balance sheet constant, while excess reserves are declining continuously. Since the end of its last large-scale asset purchase (LSAP) operation, excess reserves on the balance sheet of the Federal Reserve have declined from 20% of GDP to about 15%.

# Implications of the Expanding Use of Cash for Monetary Policy

Daniel Gros

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## 1. Introduction

Some 17 years ago, Drehmann and Goodhart (2000) asked: “Is cash becoming technologically outmoded?” This indeed has been widely expected for some time, but the reality is different.

Holdings of cash in the form of banknotes have increased trend-wise, relative to GDP or income, in most OECD countries over the last decade, including in particular the euro area, the US and Japan. It is difficult to explain why currency in circulation should have increased so much when by all accounts electronic payments and other cashless transactions have become ever-more prevalent.

Low interest rates might be one factor, which appears to have played a role in the US, but in other countries the trend towards large holdings of banknotes, especially large-denomination banknotes, has predated the low interest rate environment that started in 2007-08.

Banknote holdings by the public are both very large and difficult to trace. In the euro area total cash in circulation (excluding coins) amounts to over €3,000 per capita, or over €12,000 for a four-person household. However, few households hold such large amounts in cash. Surveys (and everyday experience) suggests that less than 10 % of existing cash in circulation is used for daily transactions. Most euro area residents have never seen the 500 euro note although statistically speaking, there are more than two of them in circulation for everybody. There can thus be little doubt that most cash is ‘hoarded’, i.e. is used as a store of value, rarely used for large transactions. One reason is that large cash transactions have to be reported by the intermediaries (banks in the first instance) and in many countries transactions above a certain size must be done via bank account or in another electronic, traceable way.

This suggests that large value transactions in cash belong to the underground economy or even outright criminal activity. It is this presumption that has led to calls to ban cash for all transactions (Rogoff, 2014) or the more limited measures mentioned above. However, there is very limited hard evidence that banning cash or just limiting high-value banknotes reduces illegal activities; see the discussion in Rogoff (1998).

While there can be little doubt that large-value transactions in cash are motivated at least in part by the desire to operate outside the law, it is less clear whether large cash holdings are driven by a similar motive.

Many analyses of cash holdings have focused on microeconomic aspects, such as the substitution of cash transactions with electronic ones and the importance of large-

denomination banknotes for criminal activities and the underground economy in general. The latter has attracted some public attention recently. In India the government has recently even taken the step of withdrawing the two largest denomination banknotes from circulation to fight corruption.<sup>1</sup> The ECB has taken a less radical step with its decision to stop the printing the 500 euro notes.<sup>2</sup> The 1,000 rupee note, which was withdrawn from circulation in 2016, was equivalent to about 1/100<sup>th</sup> of the GDP per capita, which would be equivalent to about €350 in the euro area, less than but comparable to the €500 note.

This contribution takes a macroeconomic view. It looks at the impact of cash in circulation on the accounts of central banks. Considering the impact of cash holdings on the balance sheet of central banks leads to the conclusion that unconventional policies should be judged by the amount of excess reserves created, not the increase in the overall balance sheet.

Increased cash holdings lead to larger central bank balance sheets even in the absence of any monetary policy action. The impact of ‘unconventional’ monetary policy measures taken with the aim of increasing the balance sheet appear to have been overestimated, if one accounts for this impact of the increased demand for banknotes on the balance sheet of central banks. The balance sheet of the central bank increases automatically when it satisfies passively an increased demand for currency. An increase in the size of the balance sheet thus does not necessarily indicate an active measure of the central bank’s willingness to increase the amount of highly liquid assets held by the financial system. Cash, especially high-denomination banknotes, which make up the bulk of currency in circulation, is in reality rather illiquid due to various regulatory restrictions on its use in high-value transactions. Cash (held outside the banking system) is thus not a good substitute for deposits held by commercial banks at the central bank.

The amount of excess reserves created by asset purchases thus constitutes a better measure of unconventional monetary policy measures than the increase in the overall balance sheet. If one concentrates on the period of asset purchases, the increase in the overall balance sheet has exceeded that of excess reserves by about 10% in both the US and the euro area. Accounting for cash thus makes only a small difference. If one looks at the period since the end of QE in the US, however, the continuing increase in banknotes makes a substantial difference in how one judges the stance of monetary policy. The Federal Reserve has kept its balance sheet roughly constant since the end of its bond purchase programme in the summer of 2014. This was meant to imply a roughly constant accommodative stance. But the amount of excess reserves has in the meantime fallen from about 20% to 15% of GDP. Judged by this standard, there has been a substantial tightening.

As an aside, we note that the issuance of cash used to be a source of large profits for the monetary authorities, but this is no longer the case with negative interest rates. The ECB in particular has been affected by this situation. It still reports a considerable ‘monetary income’,

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<sup>1</sup> <https://www.rbi.org.in/Scripts/FAQView.aspx?Id=122>.

<sup>2</sup> For the official announcement see <https://www.ecb.europa.eu/press/pr/date/2016/html/pr160504.en.html>.

but most of this comes from activities that are typical of investment banks, namely maturity transformation, as the ECB finances its purchases of long-term government bonds by issuing very short-term deposits (Gros, 2016).

The remainder of this note discusses first, in section 2, potential reasons for the observed increase in currency (banknotes) in circulation. Section 3 then turns to a consideration of how one judges unconventional, or balance sheet operations, when cash use is increasing trend-wise. Section 4 concludes.

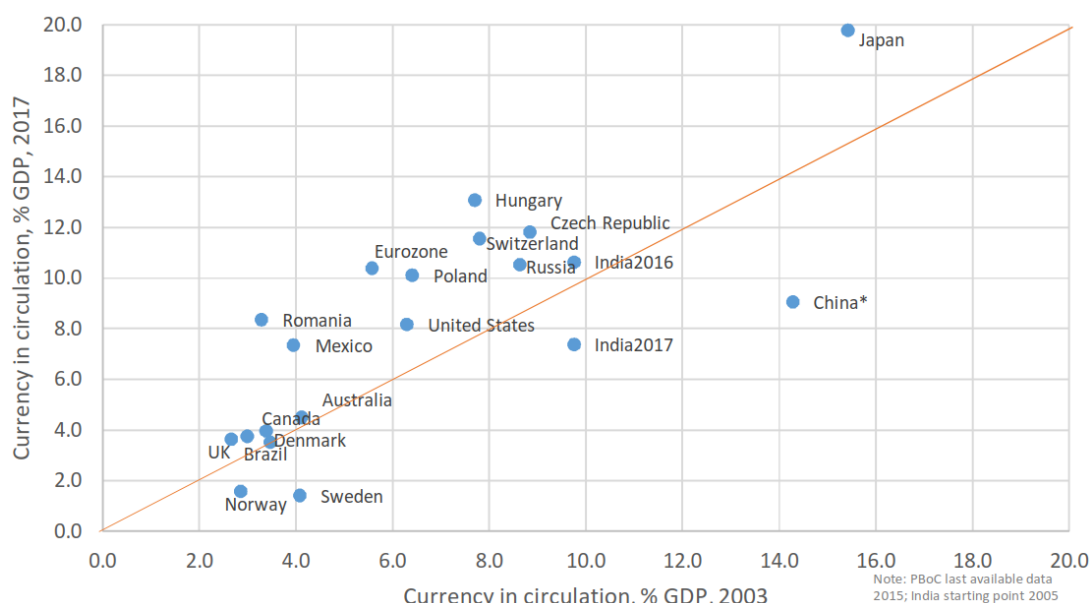
## 2. The mystery of increasing cash holdings

There are large cross-country differences in the amount of banknotes held, relative to income. Attempts to explain these difference by differences in the diffusion of electronic payment systems and/or indicators of the dangers of holding cash, such as the prevalence of violent crime, have not been successful; see for example Drehmann and Goodhart (2000). Moreover, the cash-to-GDP ratio is highest (and has increased the most over the last decade) in Japan, which is generally regarded as having a low level of criminality, corruption and resort to the black economy.

An even more puzzling aspect is that cash holdings have tended to increase although most observers would have expected the opposite. Drehmann and Goodhart (2000) asked 17 years ago: “Is cash becoming technologically outmoded?”

But the opposite seems to be the case. Figure 1 below shows that in most countries the cash-to-GDP ratios have increased trend-wise over the last two decades.

Figure 1. Cash-to-GDP ratios in selected OECD countries



Source: Own calculations based on data from the IMF (IFS), Bank of England, People’s Bank of China, European Central Bank, Swiss National Bank, Reserve Bank of India and Bank of Japan.

The reasons for this trend-wise increase in banknote holdings across so many different countries are not quite clear. As non-cash payments have become increasingly prevalent, one would expect cash-to-GDP ratios to decline. The advance of electronic and other cashless payments has been uneven across countries, but the direction has been the same almost everywhere. Kireyev (2017) reports the results from surveys of several countries, which generally find a 10-fold increase in non-cash transactions over the last decade. Innovations like debit cards and so-called mobile apps, which allow for cashless payments, have achieved a wide coverage, especially over the last few years, which would lead one to expect that cash holdings should have fallen rapidly, especially more recently. But the opposite has happened in reality.

Most of the cash is not used in transactions since more than one-half of the value of euro banknotes is in the form of notes with a value of €200 and €500, which are rarely used in daily transactions. It is widely assumed that these denominations are used in activities where anonymity is prized, i.e. the underground or grey economy.

As mentioned above and as discussed further in Box 1 below, cross-country studies have not been able to uncover a strong link across countries between indicators of criminal activity and cash holdings, and it seems unlikely in any event that the sharp increase in the cash-to-GDP ratio for the euro area, for example, is due to a sharp increase in the underground economy. Estimates of the size of the underground economy are necessarily imprecise, but there is no indication that it has increased in size.

The increase in the cash-to-GDP ratio for the euro area and the US is often explained by large foreign holdings. But this is difficult to prove rigorously and survey evidence on holdings of euro and dollar banknotes abroad is not strong. Moreover, the cash-to-GDP ratio has increased in a number of countries whose currencies are not widely held abroad, such as in Japan, for example.

Sweden and Denmark constitute the only significant exception by showing low and decreasing cash-to-GDP ratios. Their example shows that it is possible to have well-functioning payment systems that are mostly cashless. The cash-to-GDP ratio of Sweden is almost 8 times lower than that of the euro area. If the euro area were to achieve the same cash-to-GDP ratio as Sweden, the total value of banknotes in circulation would fall by almost €1 trillion and the balance sheet of the ECB would shrink by this amount.

*Box 1. Prohibiting cash?*

The argument that the elimination of cash should be considered to combat illegal activity has been criticised recently by Das (2017), who argues that the experiment in India showed that most of the large-denomination banknotes withdrawn from circulation were deposited into legitimate bank accounts without any increase in tax revenues.

Moreover, cash continues to be important in retail transactions (which one presumes to be legitimate).

For the US, Schuh and Stavins (2015) report: “Debit cards and cash continued to account for the two largest shares of consumer payments in 2013 (31.1 and 26.3 percent, respectively), and the share of credit cards reached 22.5 percent.”

In the EU, the situation varies so strongly from country to country that a common regulation limiting or eliminating cash would seem to be impossible. The careful study by Schmiedel et al. (2012) shows that cash transactions dominate the retail market in most Member States. Moreover, their study investigates the crucial question of whether the private and social cost of cash transactions is higher or lower than that of alternative, (cash-less) means. They find that “on average, cash payments show the lowest social costs per transaction, followed closely by debit card payments”. Schmiedel et al. further observe, however, that this finding must also be qualified given the diversity across Member States: “In some countries, cash does not always yield the lowest unit social costs. In fact, in more than one-third of the sample countries, debit card transactions have lower unit costs than cash transactions.”

All one can say at this point is that cash remains in most Member States the dominant means of payment for retail transactions and the social cost of using alternatives is in many cases still higher. Technological progress might lower the cost of non-cash payments and could lead to a situation where cash no longer represents the lowest cost means of payments. At that point the balance of argument might change, but at present it appears that the prohibition of cash would lead to significant costs.

## 2.1 Large-denomination banknotes

There have been proposals to eliminate cash or at least large-denomination banknotes. (And the government of India has recently withdrawn its largest denomination note from circulation.)

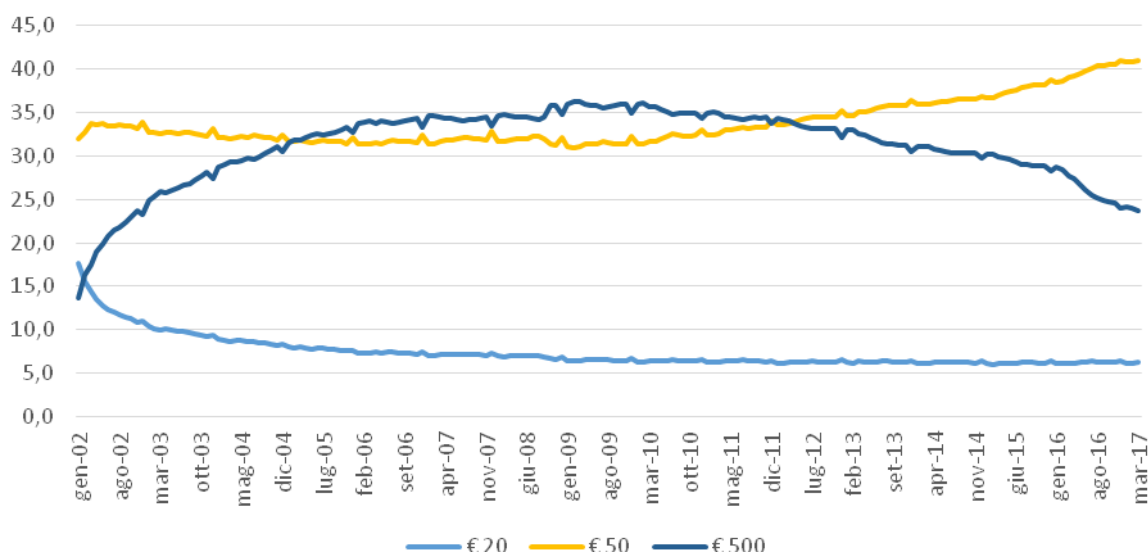
Large-denomination banknotes have attracted particular attention owing to their association with the underground economy and organised crime. It is debatable whether this association is actually as strong as is often asserted, as little actual evidence exists. Moreover, the share of 500 euro notes in total circulation has actually fallen since 2009, whereas that of the 50 euro note has considerably increased.

Figure 2 shows the shares of the 5, 50 and 500 euro banknotes of the total in circulation. There have been important shifts, especially for the two most important components, namely the 50 and 500 euro notes. The smallest euro note, the 5 euro, has never played an important role



and it now constitutes only slightly less than 1% of the total value of euro banknotes put into circulation. This was different at the beginning. When notes were first introduced in 2002, the larger denominations were little known and the 500 euro note constituted only 15% of the total. Its share then rose to over 35%, but has since then declined to about 25%. The 50 euro note, whose share had initially been around one-third, has now become, at 40%, by far the most important component of the total in circulation. This makes it even more difficult to interpret recent trends in cash holdings because the 50 euro note serves both for transactions and as a store of value. This qualitative finding corresponds to the results of Bartzsch, Seitz and Setzer (2015), who used state-of-the-art econometric techniques but were unable to find a good explanation for the evolution of the holdings of medium-sized banknotes.

Figure 2. Shares of total value of 5, 50 and 100 euro banknotes in circulation in the euro area, 2002-17



Source: Author's configuration based on ECB data ([http://www.ecb.europa.eu/stats/policy\\_and\\_exchange\\_rates/banknotes+coins/circulation/html/index.en.html](http://www.ecb.europa.eu/stats/policy_and_exchange_rates/banknotes+coins/circulation/html/index.en.html)).

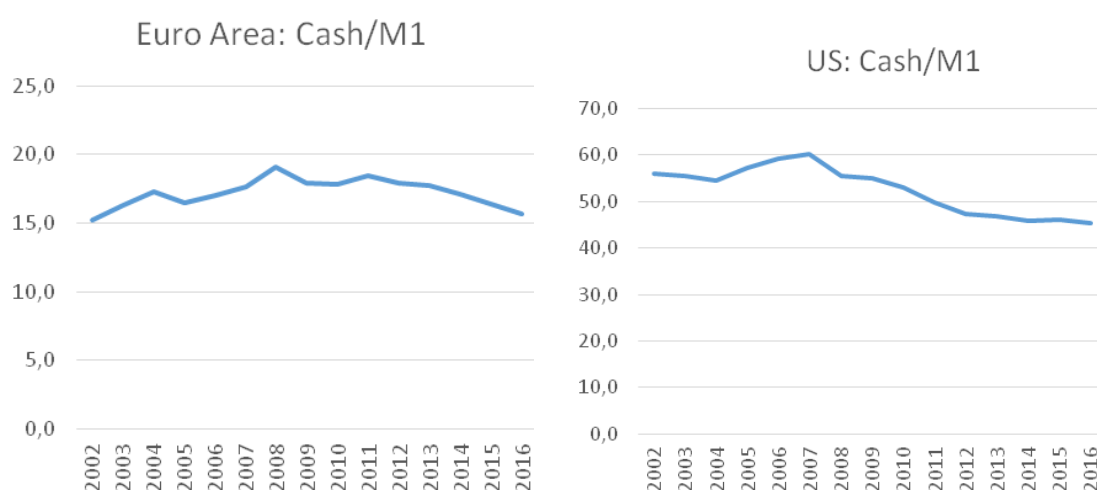
Another aspect of these longer-term trends that is difficult to explain with conventional arguments is that the share of the 500 euro note has had almost exactly the opposite evolution one would have expected if one considers interest rates as a major determinant of the holding of cash as a store of value. The share of the 500 euro note increased between 2002 and 2007-08, while interest rates generally increased during the period. The share of the 500 euro note then started to decline at almost exactly the same time as interest rates fell, and it has continued to fall although interest rates have remained low, and continue to fall even though interest rates have remained low and turned even negative recently.

All in all, cash holdings remain a puzzle. Technological innovations seemed not to have had an important impact (except in three Scandinavian countries) and low interest rates do not seem to have stimulated the holdings of the larger banknotes.

## 2.2 Cash/M1

Currency is often considered a close substitute for demand deposits, as both are legal tender and both usually offer a zero nominal return. As cash expands, especially in medium denomination notes, one might expect that the ratio of currency in circulation to deposits increases. But this is not the case. As Figure 3 below shows, the ratio of cash-to-total M1 (which is equal to the sum of currency plus demand deposits) has actually fallen. This implies that the demand for all means of payments (and zero yielding stores of value) has increased over the last years, with the demand for the electronically traceable part (demand deposits) increasing even more than that for cash.

Figure 3. Ratio of cash-to-total M1 in the euro area and in the US, 2001-16



Source: Author's configuration based on IMF and IFS data.

The scale in the two figures is very different because total currency in circulation in the US is approximately the same size as checkable deposits, whereas in Europe demand deposits are five to six times larger than cash. This is just one illustration of the bank-centric character of the European financial and transactions system.

## 3. Cash, unconventional monetary policies and the central bank balance sheet

Before the financial crisis, the size of the balance sheet of central banks was of little concern. Central banks accommodated passively the demand for currency, which had implications for their balance sheet, but this was irrelevant as policy consisted of changing a (short-term) policy rate with the aim of steering financing conditions in the money market. The irrelevance of the size of the balance sheet under 'normal' monetary policy conditions can be seen from the fact that the balance sheet of the ECB (or to be more precise that of the Eurosystem) increased by €300 billion, or by almost 40%, between 2001 and 2006, but this was never commented on in the context of discussions of the policy of the ECB.

Balance sheet considerations came to the fore when policy rates reached zero and central banks wanted to provide further stimulus. At this point they had to resort to ‘unconventional’ measures.

As an aside, one should note that the analytical framework for assessing the efficacy of a balance sheet expansion is surprisingly weak. There is a large empirical literature on the impact of various forms of ‘QE’ on interest rates and inflation, but there is no widely accepted theoretical model why an exchange of short-term central bank deposits should have an important impact on financial market conditions, at least outside an acute financial crisis. This uncertainty about the transitional channels of balance sheet policies was expressed succinctly by the former governor of the Federal Reserve, Ben Bernanke, who is reported to have quipped: “The problem with QE is that it works in practice, but it doesn’t work in theory.”<sup>3</sup>

There is a considerable gap between the academic studies on the impact of asset purchases by central banks and the interpretation of the size of the balance sheet in policy discussions. The academic literature is usually based on highly stylised and simplified models of the balance sheet of a central bank so that asset purchases are equivalent to changes in the balance sheet. This has carried over into the policy discussions where the two concepts are also often treated as equivalent. President Draghi has at times justified the asset purchase programme of the ECB with reference to the fact that the balance sheet of the ECB had been shrinking for some time.

In reality, however, asset purchases and balance sheet size do not always coincide. A key reason is that cash holdings also have an impact on the balance sheet. Another reason, mainly for the euro area, is that central bank balance sheets sometimes contain other items that have little to do with monetary policy.

### 3.1 The balance of the Eurosystem: A case apart

The balance sheet of the Eurosystem is a particularly imperfect indicator of the stance of monetary policy, as only part of it relates to monetary policy operations (Bini-Smaghi and Gros (1999)). The balance sheet of the Eurosystem results from the aggregation of the balance sheets of the ECB proper and those of the now 19 national central banks in the euro area. Many of the national central banks had been performing other functions for their governments and had often rather large balance sheets themselves. With the start of EMU, all the assets and liabilities carried over from the past, the so-called ANFA (Agreement on Net Financial Assets) holdings, had to be managed independently of monetary policy. To achieve a clearer separation of the monetary policy function of the NCBs from their residual asset management services on behalf of their governments, it would in principle have been preferable to run the ANFA holdings down to zero by repaying liabilities as the original assets matured. But this was not done. This is one of the reasons why one has to be careful in comparing the balance sheet of the Eurosystem to that of the Federal Reserve, for example.

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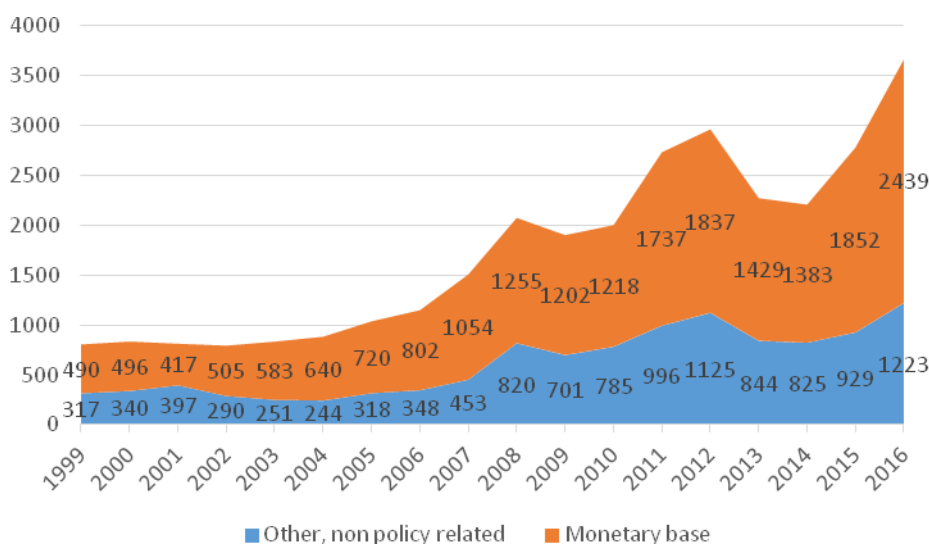
<sup>3</sup> <http://blogs.reuters.com/james-saft/2014/01/16/you-must-be-joking-mr-bernanke/>

Fortunately the balance sheet of the Eurosystem contains a separate line item which is called appropriately “liabilities related to monetary policy operations”. This item corresponds to what other central banks call “reserves, required and excess”. (This separation had to be done because only cash and these liabilities form the basis for the calculation of the so-called monetary income, i.e. the seigniorage.)

The sum of cash in circulation and commercial banks’ deposits at the central banks corresponds to what economists call the ‘monetary base’, which could also be called for the purposes of this contribution the ‘policy relevant’ part of the balance sheet. Figure 4 shows thus the evolution of the balance sheet of the Eurosystem by splitting it into two parts: i) the monetary base, or the part that is ‘policy relevant’ and ii) the part that is not relevant for monetary policy (e.g. capital and reserves, revaluation accounts, liabilities to foreign residents, etc.).

The figure shows that the recent balance sheet expansion, i.e. the increase in excess reserves, constituted the bulk of the increase in the overall balance sheet. But all the other, non-monetary policy-related items (capital, revaluation accounts, foreign exchange reserves, etc.) also made a non-negligible contribution, at least in the longer run. For example, between 2007 and 2016, the overall balance sheet of the ECB increased from €1.5 trillion to €3.7 trillion, an increase of over €2.2 trillion. About one-third of the increase came from items not related to monetary policy and two-thirds from an increase in the monetary base (i.e. items related to monetary policy).

Figure 4. Evolution of the monetary base and other non-policy related items in the ECB’s balance sheet, 1999-2016 (€ billion)



Source: Author’s own balance sheet calculations based on ECB data.

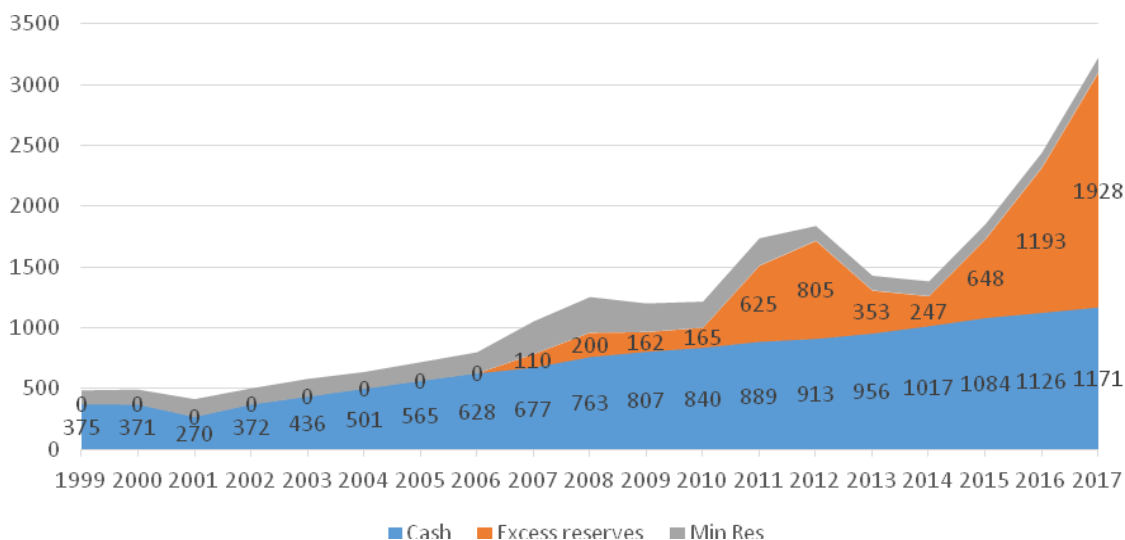
The monetary base can in turn be split up into those parts that are a result of ‘non-standard’ policy measures, i.e. excess reserves on the one hand, and cash on the other, that follow their own evolution, independent of policy measures.

Part of the ‘liabilities related to monetary policy operations’ are required reserves, which existed before the start of ‘unconventional monetary policy measures’. Thus, they should not be counted as part of the balance sheet expansion, which is supposed to provide a monetary stimulus under zero interest rates.

(As an aside, one should note that the ECB now has to limit the use of the ‘required reserves’ account because it pays interest on this account (equal to the MRO rate), whereas the interest rate on the deposit facility is minus 40 basis points. Under ‘normal’ conditions an increase in minimum reserves is considered as a restrictive policy. With negative deposit rates, however, an increase in minimum reserves would expand the balance sheet and would thus be considered an expansionary measure.)

Figure 5 below thus provides the three main items in the balance sheet of the Eurosystem that relate to the euro and monetary policy operations, namely cash (banknotes in circulation), required reserves and excess reserves. The data point for 2017 is of course an estimate of what will remain on the balance sheet of the ECB at the end of this year, taking into account the ongoing asset purchases.

*Figure 5. The composition of the ECB’s monetary base: Cash and liabilities related to (unconventional) monetary policy, 1999-2017 (€ billion)*



Note: 2017 estimated, assuming cash/GDP is constant and excess reserves expand proportional to APP.

Source: Author’s own balance sheet calculations based on ECB data (<https://www.ecb.europa.eu/pub/annual/balance/html/index.en.html>).

It is apparent that excess reserves were negligible until 2007. They then increased until the peak of the euro crisis and subsequently declined until (end-) 2014, just before the start of the Asset Purchase Programme in early 2015. Cash in circulation increased steadily throughout the entire period and thus contributed, over time, a considerable proportion of the entire increase in the monetary base (and thus the overall balance sheet of the Eurosystem). For the

Eurosystem, cash remains the largest part of the monetary base, but excess reserves have been more variable and are rapidly increasing under the continuing asset purchases.

### 3.2 The US case: Tightening by stealth

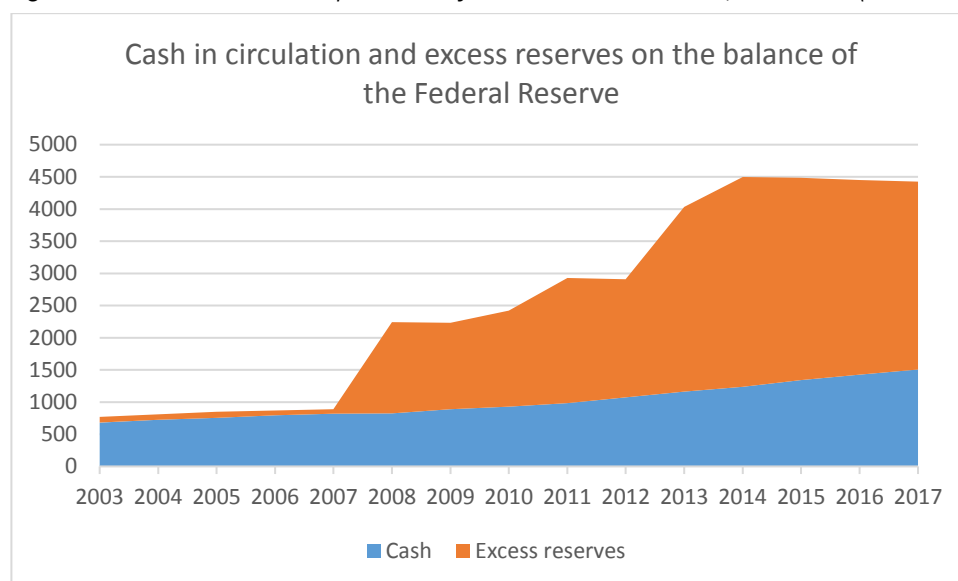
The US case provides an even-starker illustration of the importance of accounting for changes in cash holdings. A closer look at its balance sheet reveals that Federal Reserve has already allowed excess reserves to fall by a considerable amount. In other words, that part of its balance sheet that is relevant for monetary policy (at the zero bound for interest rates) has started to fall, although the overall balance sheet has remained constant.

The Federal Reserve (as all other modern central banks) passively accommodates any demand for currency from the public. Before the advent of ‘unconventional’ policies, the balance sheet of the Federal Reserve used to be small and simple (much simpler than that of the Eurosystem): its liability side, i.e. roughly the monetary base, comprised over 90% of the currency in circulation. The asset side consisted mainly of holdings of Treasury bills. Monetary policy consisted of changing the policy rate.

When the policy rate hit the zero bound the Federal Reserve started to expand its balance sheet by buying longer-term bonds. But it could do this only by inducing banks to hold large amounts of ‘excess’ reserves. It is the amount of these excess reserves (not its overall liabilities), that indicates the degree to which the Federal Reserve is using its balance sheet to support conditions in the financial markets. As long as cash in circulation does not change, a stable overall balance sheet indicates unchanged support. But cash in circulation has grown considerably over time while the balance sheet of the Fed has remained roughly constant in nominal terms. This implies that excess reserves have actually declined since the Fed stopped its asset purchases. The exit from balance sheet policies has in reality started.

Figure 6 below shows the two key components of the overall balance sheet of the Fed, namely cash in circulation and excess reserves. It is apparent that excess reserves increased suddenly with the start of unconventional policies in 2008-09 and continued to increase with the subsequent QE2 and QE3 episodes. Since the end of the asset purchases the overall balance sheet of the Federal Reserve has declined only very little, and the official policy has been that the exit from unconventional policies should proceed in two steps: first, policy rates should be increased (which has already happened to some extent) and only later would the Federal Reserve shrink its balance sheet. As will be shown below, however, the part of the balance sheet that indicates the importance of unconventional policies has already shrunk.

Figure 6. Balance sheet expansion of the Federal Reserve, 2003-17 (\$ billion)



Source: Author's own balance sheet calculations based on Federal Reserve data.

Figure 7 thus zooms in on excess reserves (measured here as a % of GDP) as the key indicator of unconventional or balance sheet policy measures. This figure shows actual data up to the present and a projection for the next decade. The three 'steps' since 2008 correspond to the three episodes of asset purchases (QE I, II and III) which led to a peak that was close to 20% in 2013-14, but excess reserves have now declined to about 15 % of GDP. On this measure one could thus argue that the Federal Reserve has already tightened by stealth as the support it gives through its balance sheet has declined by about one quarter. Another way to describe the situation is that in the absence of any change to the unconventional (or balance sheet) policy measures, the balance sheet would have increased by about \$300 billion. By keeping its overall balance sheet constant, the Fed has allowed the 'unconventional' part to fall by this amount while nominal GDP has increased.

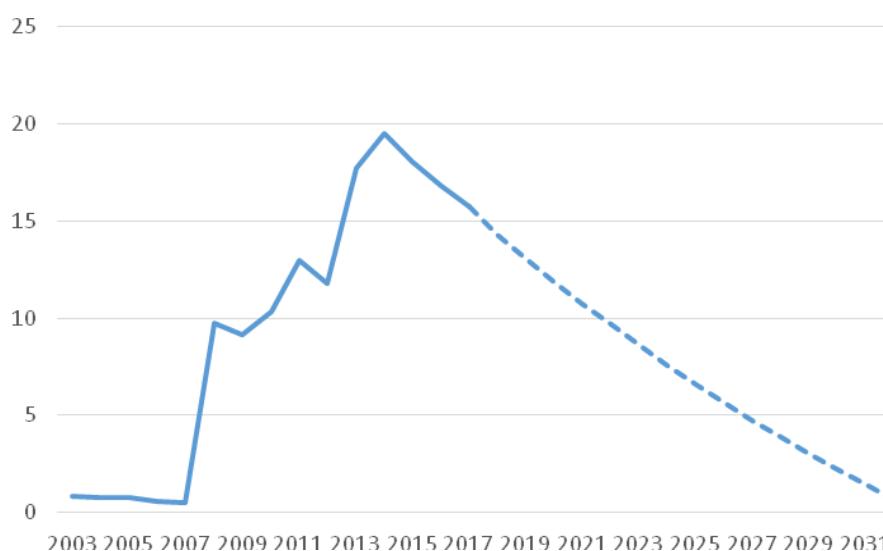
Figure 7 also shows that if the trend in cash holdings were to continue for the next decade and the Federal Reserve were to keep its balance sheet constant, excess reserves would continue to decline continuously as a percent of GDP and go to zero by about 2030. This implies that simply by apparently doing nothing, i.e. by continuing to re-invest the proceeds from any bond coming due, the Fed would achieve a gradual exit over the next decade.

The exact path for future cash holdings is of course uncertain, but there seems to be a consensus about the hypothesis that cash in circulation will continue to increase. Bernanke (2017), Davies (2017) and Credit Suisse (2017) provide similar scenarios for future cash holdings, but they neglect to draw the same conclusions.

The same reasoning also implies that the expansionary effect of the increase of the Federal Reserve's balance sheet during its QE programme has been somewhat over-estimated. Between 2008 and the summer of 2014, when it stopped its programme, the Federal Reserve's holdings of bonds had increased by about \$3.7 trillion. However, cash in circulation had also

increased by about \$300 billion over the same period of time. The increase in excess reserves was thus somewhat smaller than the expansion of the overall balance sheet.

*Figure 7. Excess reserves as an indicator of the balance sheet operations of the Federal Reserve (% of GDP), 2003-31*



Source: Author's own balance sheet calculations based on Federal Reserve data.

#### 4. Conclusions

Financial innovation was expected to lead to a 'cashless' economy, but the opposite has happened. Despite the spread of ATMs, debit cards and, more recently, so-called payment 'apps', the amount of currency in circulation has expanded over the last decades. The reasons for this surprising development are not clear. There is little indication that the importance of the underground economy (as a share of all economic activity) has expanded and cash holdings are largest in some countries where one would expect only a small underground economy (e.g. Japan and Germany).

This contribution has focused on one, hitherto neglected, consequence of increasing cash holdings. Currency in circulation is part of the monetary base and appears among the liabilities of the central bank. Care must thus be taken in judging the size of central banks' balance sheets as an indicator of their policy stance. This seems to be particularly important where a better indicator of the policy stance, namely the amount of excess reserves as a percentage of GDP, suggests that the Federal Reserve has already started a gradual exit.

In the euro area, cash holdings are even more important, relative to GDP, than in the US and have increased even more rapidly. The impact on the balance sheet of the Eurosystem has thus also been important, but gradual. Focusing again on the concept of excess reserves, one finds that the balance sheet expansion of the ECB through its asset purchases has been smaller (as a percent of GDP) than that of the Federal Reserve, although the overall balance of the Eurosystem is much larger as a percentage of the euro area's GDP.



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