Florin, crown, schilling and euro: an overview of 200 years of cash in Austria

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This article provides an overview of the supply and demand for cash in Austria over the past 200 years. After looking at the government, mint and central bank as cash providers and tracing the composition of cash supply, the article presents several stylized facts about the long-run evolution of cash demand. Results show a relatively stable currency-to-GDP ratio, which is remarkable, given the structural changes in the economy and advances in payment technologies over the past 200 years. Among possible explanations is that innovations have significantly increased the use of close cash substitutes like deposits without, however, reducing the currency-to-GDP ratio. Second, factors like the increasing monetization of the economy during the 19th century might have compensated for the cash-saving impact of financial innovations. Moreover, most of the demand for cash might not be susceptible to payment innovations as it is driven by hoarding. Finally, large political disruptions i.e. times of elevated economic uncertainty, and systemic banking crises exert strong and persistent effects on the use of cash.

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Providing a means of payment that is generally accepted is one of central banks' key functions. The issuance of banknotes was already the prime objective of the *privilegirte oesterreichische National-Bank* when it was founded in 1816 and has remained a core task ever since. The actual use of money issued by the central bank is in turn driven to a large extent by demand, whose level not only reflects the quality of the money issued and the availability of substitutes, but also the overall evolution of the economy and the financial system in particular. Tracking the role of cash thus not only provides valuable insights into one of the prime "products" offered by central banks, but serves as a mirror of developments in the economy and society as a whole.

Against this background, the paper offers a descriptive overview of the role of cash in the Austrian economy over the 200 years since the foundation of the Nationalbank.[2] This period was marked by enormous historic changes. Income per capita multiplied, and with it the demand for means of payment. With the shift from a predominantly agricultural to an industrial, and later a service economy, a bigger share of income was earned in markets where transactions had to be paid for in money, thereby further increasing the need for a means of payment. At the same time, the evolution of a modern banking system led to the introduction of new cash substitutes and made these substitutes available to a wider range of society. The past 200 years thus provide a good perspective for studying how these structural shifts and technological innovations have affected the use of cash. Today, some observers believe that electronic money will lead to the complete disappearance of cash

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[2] *We concentrate here on the role of cash in the economy and avoid any discussion of the technical aspects of the production of cash or the role of the Nationalbank in its distribution, processing and authentication. For a history of banknote design and production, see Kranister (1989). On the role of the OeNB in cash logistics today, see Schautzer (2007), and Koch and Schneeberger (2012).*

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sooner rather than later.[3] At the same time, the substantial per capita holdings of cash observed in the major economies are hard to reconcile with the use of cash purely for domestic transactions, a phenomenon termed "cash enigma" (Feige, 2012). Over the last decade, we have even seen the weight of cash relative to nominal income actually increasing rather than decreasing in many economies.

Most (macroeconomic) historical accounts of money concentrate on larger aggregates, notably M1 or M3, and discuss cash only as a subcomponent of M1.[4] This paper focuses on cash.[5] Cash is of particular interest for central banks as the monopoly they command over its creation is their key lever for influencing broader economic developments. But cash has also several additional characteristics that distinguish it from other forms of narrow money represented in M1: its legal tender status, the absence of interest and its accessibility, together with the limited technological requirements for storage and transaction when compared with a bank account, for instance.[6] Moreover, cash payments are fast, allow payments to be settled immediately, can be used in person-to-person transfers and provide anonymity. The use of cash for tax evasion and illegal activities has led to calls to phase out large-denomination banknotes or to eliminate cash altogether (Rogoff, 2014). In times of uncertainty and low confidence in financial institutions, however, cash can serve as a store of value. Taken together, these characteristics help explain not only the historical role, but also the continuing importance of cash as a means of payment and store of value.

This paper is structured as follows: Section 1 looks at the supply of cash. Here it is important to also consider coins, which for a long time constituted an important part of currency in circulation. Section 2 then provides an estimate of total currency in circulation and compares these figures with the volume of transactions in the economy. The major finding is a surprising stability in the relative importance of cash over the past 200 years. Section 3 then looks at some conjectures to explain this stability. Section 4 provides the conclusion.

1 Who supplies cash in Austria?

The right to issue currency has long since been the prerogative of the sovereign. During the 19th and 20th centuries in Austria, the sovereign exercised this right both directly, notably through the minting of coins but also occasionally through the issuance of government paper money, and indirectly by delegating the right of issue to a dedicated institution.[7] After 1816 this institution was the Nationalbank. Today the issuance of banknotes is administered at the level of the euro area, while coinage remains a national domain, albeit under common rules.

[3] *See e.g. the discussion in Wolman (2013) or The Economist (2007).*

[4] *See e.g. Friedman and Schwartz (1963) on the U.S.A. or Capie and Webber (1985) on the U.K. For Austria, the historical evolution of monetary aggregates has been analyzed by Komlos (1983, 1987) and Zipser (1997).*

[5] *For the U.S.A., a chapter in Cagan (1965) provides some hypotheses on the relative demand for cash and cash substitutes.*

[6] *The zero bound on the nominal interest rate that is created by the existence of cash has been seen as an impediment in the current economic situation (e.g. Argawal and Kimball, 2015; Rogoff, 2014; Beer et al., 2016). See also Financial Times (2015). The present article does not discuss the pros and cons of eliminating cash.*

[7] *For more information on the resulting seignorage earnings and the mechanisms for their distribution, see Prammer et al. (2016).*

1.1 Coins

Since the Middle Ages, the right to mint and issue coins in the Holy Roman Empire – a traditional prerogative of the Emperor – had in practice been exercised by the territorial rulers; in the Habsburg lands, thus, under the authority of the Habsburg rulers. While in the 17th century a large number of mints still existed in the different territories under Habsburg reign, minting was increasingly concentrated in Vienna as well as Kremnica during the 18th century. In the 19th century, Vienna already accounted for the bulk of coins minted in the Austro-Hungarian Empire, with production also taking place in Prague, Alba Iulia and Kremnica, as well as Milan and Venice (Koch and Jungwirth, 1989). After 1918, the only mint in the First Austrian Republic was located in Vienna. The mint was run as a division of the Ministry of Finance up until 1989, when it was spun off as a joint stock company and became a wholly owned subsidiary of the Oesterreichische Nationalbank (OeNB) (Ertl, 1989).

The introduction of euro cash in 2002 led to significant changes in the role of the Austrian mint. Today, denominations and technical specifications of coin production are laid down by the Council of the European Union, and the ECB approves the volume and value of coins to be issued each year. While banknote issuance within the euro area is centralized at ECB level (see below), it is the individual euro area countries that continue to be responsible for the issuance of coins (ECB, 2007). Typically, the issuing body is the treasury in the national finance ministries, while the national mints physically produce the coins and the national central bank puts them into circulation. In Austria, the issuing body is the mint itself, which also holds reserves to cover the costs of a possible withdrawal of coins should public demand for coins ever decrease. In case the mint's reserves would not suffice to withdraw the surplus coins, there is an additional government guarantee.[8]

1.2 Paper money issued by the government

The first paper money was put into circulation in Austria in 1762 by the Wiener Stadtbanco, a government finance vehicle run under the auspices of the City of Vienna.[9] The first issuance of paper money was meant to temporarily help finance Austria's participation in the Seven Years' War (1756–1763) and was due to be withdrawn after the end of the war. However, the new paper money, use of which was voluntary, satisfied a general demand and at times was even quoted above its nominal value in circulating silver coin. As a result, the government decided to make paper money a permanent feature of the Austrian monetary system. The amount of paper money in circulation increased rapidly during the Napoleonic wars. Rampant inflation ensued.

One of the key objectives of the financial legislation introduced in 1816 was the withdrawal of the depreciated paper money and its replacement by new florin (fl.) notes convertible into silver. The issuance of the new notes was to be entrusted to the newly founded independent central bank. From then on, the Nationalbank had a monopoly of note issuance, at least in principle. In reality, the notes issued by the Nationalbank and the government circulated in parallel for long periods of

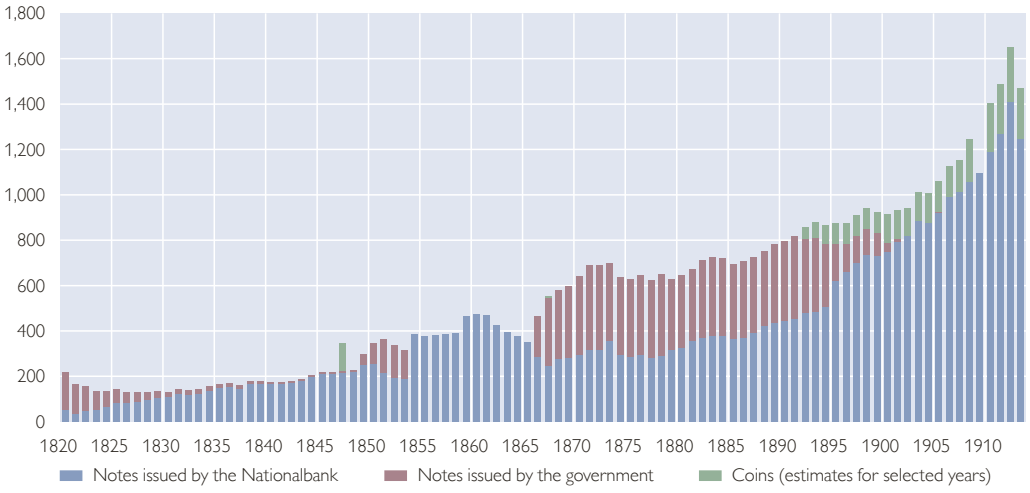
[8] *Austrian Coinage Act 1988.*

[9] *For details on the following historical account, see Jobst and Kernbauer (2016).*

Chart 1

Composition of currency in circulation

Fl. million (after 1900: values in crowns converted into florin)



Source: See data annex.

the 19th century (chart 1). In the years immediately after 1816, the old government-issued notes were still in circulation, but were gradually retired or exchanged for notes of the Nationalbank, so that by the 1830s the major part of total paper money in circulation consisted of Nationalbank notes.[10] Due to war and financial pressures, the government reverted to issuing its own notes after 1848, and again after 1866. The notes issued to finance the suppression of the 1848 revolution were relatively quickly retired by being converted into Nationalbank notes in 1853, while the government notes issued during the Austro-Prussian War of 1866 remained in circulation for 40 years and at times accounted for more than half of total paper money in circulation in the Habsburg empire.

The volume of paper money increased dramatically during the World War I (WW I) and the early years of the First Austrian Republic, but this time the government refrained from issuing its own notes. The last instance of government-issued paper money was the short-lived Allied military schillings printed by the United States as a substitute currency for Allied troops entering Austrian territory in 1944. These notes were withdrawn and replaced by Austrian schilling (ATS) notes issued by the re-established OeNB in December 1945.

1.3 Paper money issued by the Nationalbank

In Austria, the second most important issuer of paper money after the government was the Nationalbank. The imperial decrees founding the Nationalbank in June 1816 and the bank's first statutes in 1817 granted the bank the right to issue banknotes that enjoyed the privilege of being accepted in all payments to the state at par with silver coin. In 1841 the Nationalbank became the sole bank to receive that right. This

[10] *The old notes had no fixed exchange rate versus Nationalbank notes, but their market price was kept stable by the Nationalbank's continuous conversion operations.*

effectively legalized the bank's de facto monopoly. As a result, and despite voices favoring some version of free banking, Austria – unlike many other countries – never saw the co-existence of several note-issuing banks.[11]

From the very beginning, the Nationalbank faced various restrictions regarding its note issue. Under the pegs to silver, and later gold, the de jure and de facto convertibility of banknotes into precious metal provided a check to the overissue of notes. Independent of this convertibility, the bank was at times also subject to statutory limits. The first quantitative rule was established in 1858, limiting note issuance to three times the available stock of silver.[12] Following the English example, the charter of 1862 established a maximum fiduciary (i.e. not covered by silver) issue of fl. 200 million, while the amount of banknotes surpassing this threshold had to be fully covered by the Nationalbank's silver (and later also gold) reserves.[13] With the growth of the economy, the limit on the fiduciary issue proved overly restrictive and was replaced by a more flexible limit in 1887, which emulated the rules of the German Reichsbank. Now fiduciary issuance was allowed to exceed fl. 200 million, with any excess amount issued subject to a tax of 5%. The new rules allowed for a more flexible management of note issue, as temporary spikes in demand could be accommodated by paying a tax, while the payment of the tax limited incentives for the Nationalbank to overly increase its permanent issuance. In 1911, the limit was raised by 50%. With the onset of WW I, all cover requirements were suspended.[14]

After the post-WW I hyperinflation, in 1923 the legislator returned to prewar principles with some modifications. As before 1914, banknotes in circulation (as well as all other sight liabilities) had to be covered by at least 40% in gold and other specified foreign assets. Unlike before 1914, however, coverage was allowed to drop below 40% subject to a progressive tax on the excess issue.[15] Cover requirements thus no longer imposed any absolute limit on note issuance. The note issuance tax was finally abolished in the Nationalbank Act of 1955. From then on, the cover requirements no longer acted (primarily) as a break on the note issuance on the central bank's liability side, but as restrictions on the composition of the central bank's assets.[16]

With the introduction of euro banknotes and coins in 2002, the Eurosystem assumed control over cash

[11] *Hungarian demands for the establishment of a separate Hungarian note-issuing bank, which followed the conclusion of the Compromise in 1867, were settled by reorganizing the Nationalbank as a dualistic institution, the Austro-Hungarian Bank (Oesterreischisch-ungarische Bank), giving the Austrian and the Hungarian parts of the dual monarchy equal representation in the bank's decision-making bodies. See Jobst and Kernbauer (2016).*

[12] *Note that cover requirements evolved over the 19th century and were specified only relatively late. Article 14 of the 1816 statutes stipulates simply that "the Bank should never issue more notes than the funds assigned to their conversion would allow." Article 15 of the 1841 statutes states, "It is incumbent upon the directors of the Bank to set from time to time such a ratio between note issue and specie reserves that complete fulfillment of this duty [to pay the face value of banknotes in legal silver coin on demand is assured." (authors' translation; see Pressburger (1959)).*

[13] *The fiduciary issue had to be covered by specified domestic income-generating assets, but this did not impose a constraint on increasing the value of banknotes in circulation.*

[14] *The issuance limit had also been suspended in the wake of the 1873 stock market crash (May 13, 1873, until October 11, 1874). See Jobst and Kernbauer (2016).*

[15] *40% coverage was to apply after the resumption of specie payments, which were never introduced, however. In the meantime, lower but gradually rising percentages were to be applied. See Articles 85–89 Nationalbank Act 1922.*

[16] *Article 62, paragraph 1 Nationalbank Act of 1955.*

in circulation. While in practice the national central banks (NCBs) continue to be responsible for the physical issuance and management of cash, the circulation of currency is no longer attributed to individual countries within the euro area. Today, the number of banknotes in circulation reported on the OeNB's balance sheet refers to a fixed percentage of the circulation of banknotes in the entire euro area (Krsnakova and Oberleithner, 2012).

2 Secular trends in the demand for cash

In the short run, the government and the central bank, as suppliers of cash, can increase or decrease the amount of cash in circulation at will, at least in principle. In the long run, however, the price level adjusts, and currency in circulation mainly reflects the demand for cash and the relative attractiveness of other assets that can be used as a means of payment or store of value. Over the last 200 years, both the price level and the volume of transactions potentially to be concluded in cash have increased sharply. To understand the role of cash in the economy it is thus useful to look at real cash balances (i.e. adjusted for inflation) or the ratio of currency in circulation to nominal income (i.e. adjusted for inflation and income growth). Before doing so, however, we have to discuss the quality of data on currency in circulation, notably the limited evidence available on coins in circulation for the 19th century.

2.1 What role did coins play in 19th-century Austria?

Paper money in circulation can be relatively well measured, as the amount put into circulation is known and the holdings of financial institutions and government, even though not always recorded, are unlikely to have been sufficiently large and volatile to affect the long-term trend in paper money circulation. The situation is different for coins, where data on production is available but estimations of actual circulation are affected by a lack of evidence on the initial stock as well as the statistical problems created by the fact that full-bodied coins could be melted down for industrial purposes or imported and exported without being properly recorded. Add to that the possibility, at least for the earlier years, that foreign coins were used in domestic transactions, for which no information is available either. These knowledge gaps are unfortunate. Evidence for other countries indicates that before the 20th century, coins accounted for an important part of total cash in circulation, so the omission of coins creates a potentially large bias in any time series for currency in circulation. The problem is aggravated by the fact that estimates for other countries vary enormously, so that national statistics are highly idiosyncratic and generalizations difficult to make. Around 1910, the share of coins in total currency in circulation (always outside the central bank) ranged from 79% in the U.K. to 11% in Canada, while Germany occupied the middle ground with 62%. In addition, ratios differed not only between countries but could also change significantly over time, as e.g. in the U.S.A., where the share of coins increased from 5% immediately after the Civil War to 30% before WW I.[17]

As in the U.S.A., the turbulent monetary history in Austria very likely affected the composition of the country's

[17] *Data on the U.K. from Capie and Webber (1985), and on Germany from the Deutsche Bundesbank (1976). For the U.S.A. and Canada, see Metcalf et al. (1998).*

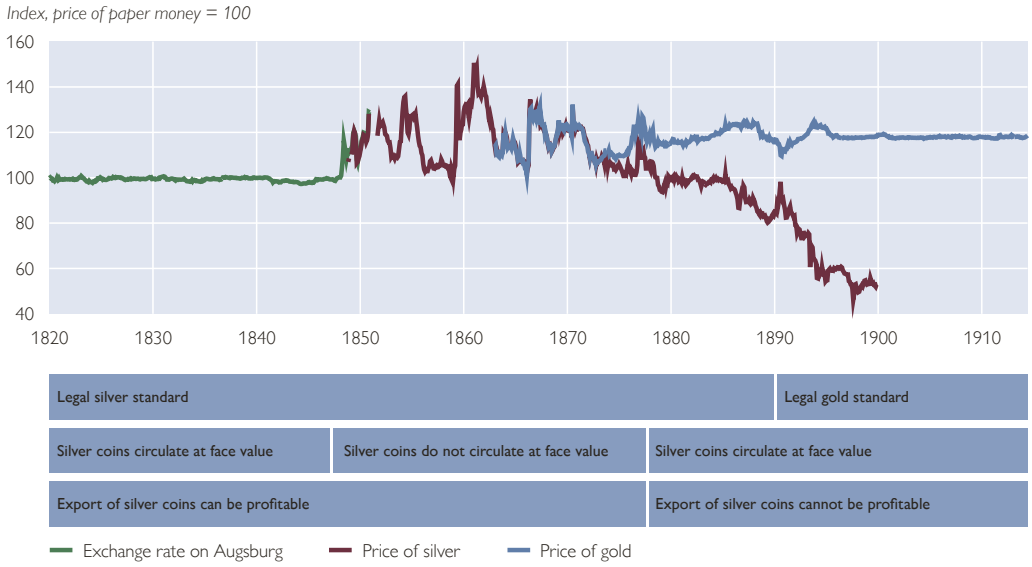
currency in circulation. Repeatedly, heavy issuance of paper money and the suspension of the convertibility of paper money into silver or gold led to the emergence of a premium on full-bodied coins and the likely disappearance of full-bodied coins from circulation (chart 2). The effect was potentially even more disruptive, as even silver coins of relatively small denominations had (proportionally) the same fine silver content as the fl. 1 silver coin. Following the Austro-Bavarian mint convention of 1753, which formed the basis for the Austrian coinage system until 1857, all coins down to the groschen (= 3 kreuzer or fl. 0.05) contained proportionally the same amount of fine silver, with only the denominations below 3 kreuzer being minted in copper (Rieder, 2011). The high silver content meant that even small divisional coins faced the risk of disappearing from circulation as soon as silver traded at a premium. In order to facilitate trade, Austria and the German Customs Union (*Deutscher Zollverein*) concluded a coinage treaty in 1857, harmonizing their circulation of silver coins (Willis, 1896). Austria slightly lowered the silver content of its currency and introduced a new florin ö.W. (*österreichische Währung*, i.e. Austrian currency) to replace the former florin *Conventionsmünze* (CM). While the treaty prescribed full silver content only down to the fl. 0.25 piece, the smaller denomination silver coins down to fl. 0.05 continued to be minted with a relatively high silver content and were only about 10% underweight (Rieder, 2011). As a result, when in the wake of massive issuance of government paper money in 1866 the premium on silver increased sharply, Austria again faced a dearth of divisional coins. In 1868, the government tackled the consequences by sharply reducing the silver content of the 20, 10 and 5 kreuzer pieces. The gold standard legislation of 1892, introducing the gold crown as the new currency unit minted as K 10 and K 20 pieces, finally established a truly fiduciary divisional coinage. The K 5 and K 1 coins were minted in silver, but the decline in the market value of silver made their withdrawal or hoarding highly unlikely, and lower denominations were minted in low-value nickel and bronze (Rieder, 2011). From 1903 onward, the Nationalbank also put gold coins into circulation, which were never used widely, however, and in fact were soon largely redeposited with the central bank and the treasury.

Whether silver coins circulated or not thus critically hinged on whether the Austrian currency traded at par with silver. With the exception of a few months in early 1859, this was not the case for any of the years between 1848 and 1878. On the face of it, the premium on silver, which averaged 16% over the thirty-year period, would imply that no silver coins circulated. At the same time, there are several known instances where the silver florin was used as a unit of account, e.g. in the denomination of bonds or share capital and the setting of railroad freight rates. It is not known whether actual payments in these transactions were done using actual silver coins or paper money, by taking the daily premium on silver into account. The premium on silver thus gives no clear indication of whether silver coin circulated or not.[18] In 1873, however, the price of silver in international markets began to decline gradually, so that by 1878 the premium

[18] *In k. k. Finanzministerium (1892, p. 258), it is argued that after 1848 silver remained initially in circulation and only disappeared with the issuance of large silver-denominated loans in the 1850s.*

Chart 2

Legal monetary standards, actual exchange rates and their effects on coins in circulation



Source: Wiener Börse (1786–1858, 1858–1861, 1861–1875), Der Tresor (1872–1918), authors' conversion into percentage of par value.

on the silver florin disappeared and soon turned into a discount, i.e. the silver florin coin traded at a premium relative to the commodity value of its silver content. This meant that silver coins could circulate again at face value. The government resumed the minting of silver coins. No information, however, is available on how many of the florins minted before 1878 had remained in circulation (trading at market prices) or had returned after 1878 from hoardings or from abroad.

While the hoarding and export of coins that accompanied episodes of monetary turbulence renders standard techniques for the estimation of the coin stock unworkable, events that led to the sudden disappearance of coins as well as monetary reforms which within a short period of time replaced all circulating coins with newly issued money allow at least some educated guesses for selected benchmark years (chart 1).

In the late 18th century, the circulation of paper money increased rapidly without initially causing paper florins to trade at a discount to silver. In 1799, a premium on silver appeared, which implies that by then paper money must have crowded out the bulk of coins. As paper money issuance in 1799 amounted to fl. 140 million, the value of coins in circulation must have been something around fl. 150 million during the 1780s, when paper circulation was still very low. For 1847, the last year before the monetary turmoil caused by the revolution of 1848, estimates based on a similar method would yield coins in circulation worth approximately fl. 100 million to fl. 120 million, which would amount to around 30% of total currency in circulation (including banknotes) of fl. 320 to fl. 340 million.[19]

With the florin inconvertible into silver during most of the second half of the 19th century, the share of coins in

[19] *The fl. 100 million to fl. 120 million range is also in line with the direct estimates in k. k. Finanzministerium (1892, p. 258).*

total cash in circulation certainly declined, even though it is difficult to put an exact number on it. Some indications can be gleaned from the changeover from florins to crowns. For 1892, contemporary economists estimated that roughly 10% of total cash consisted of coins, which then presumably increased to reach about 15% to 20% before WW I, depending on whether gold is assumed to have circulated or not.[20] Compared to Germany, the U.K. or France, Austria-Hungary was thus definitely placed among the high-banknote, low-coin countries at the beginning of the 20th century, but was no outlier compared with the U.S.A. and Canada, for example. This means that paper money in circulation should give a reasonable approximation both for the amount and the trends in currency in circulation, at least after 1850.

Due to rampant inflation during and after WW I, higher denomination coins disappeared. After WW I, the OeNB also collected and regularly published data on coins in circulation. In 1930, (divisional) coins accounted for 8% of total currency in circulation. By 1999, this share had declined to 4%.

2.2 Currency in circulation shows no clear trend

Chart 3 shows the long-run evolution of cash per capita starting from the early 19th century. To account for changes in price levels, cash holdings are deflated using a consumer price index. Chart 3 shows that since the 1820s, real per capita cash holdings have increased at a remarkably steady rate of about 1.7% per year. The picture is little affected if we include our (admittedly rough) estimates for coins in circulation.

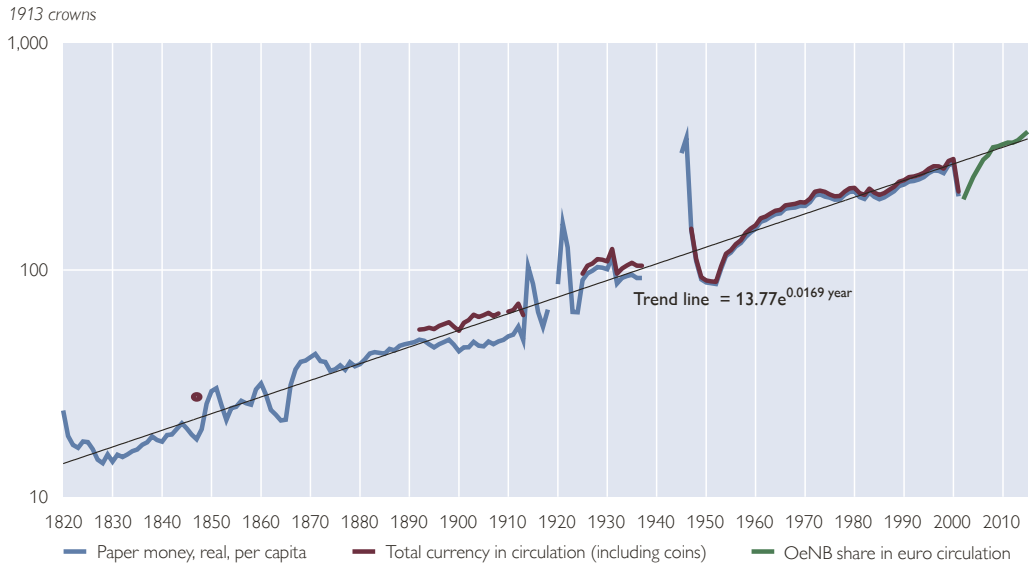
Deviations of cash holdings from the long-run trend coincide with clearly identifiable shocks. Wars in 1848/49, 1859 and 1866 led to temporary increases in cash per capita, while austerity policies in the early 1860s led to a sharp decline in cash per capita. When the substitution of lower-denomination notes by new crown coins is taken into account, growth during the 1890s and 1900s is no longer below average, but back on trend. Not surprisingly, real cash holdings per capita fluctuated widely during WW I and the ensuing hyperinflation, with balances first increasing in 1914 and 1915 and then declining when inflation accelerated toward the end of the war. After WW I, real per capita cash holdings increased again as the issuance of banknotes outpaced inflation, at least at the beginning of the hyperinflation period. With the stabilization of the Austrian currency in 1923, per capita cash holdings returned to their long-run trend. The monetary overhang after World War II (WW II) was rapidly eliminated by a combination of monetary reforms and the release of inflationary pressures that had built up during wartime rationing. After dropping well below the long-run trend, real per capita cash holdings had reverted to trend by the 1960s.

The changeover from Austrian schilling to euro cash led to a sharp drop in currency in circulation. Since January 1, 2002, Austria has been part of a single currency area, which means that cash circulation can no longer be observed at the national level. Per capita

[20] *Menger (1892, p. 653) calculated the amount of currency in circulation as up to fl. 936 million for 1891; of this, fl. 834 million were banknotes and state notes in circulation, fl. 50 million silver and gold coins, and fl. 52 million divisional coins.*

Chart 3

Real cash per capita



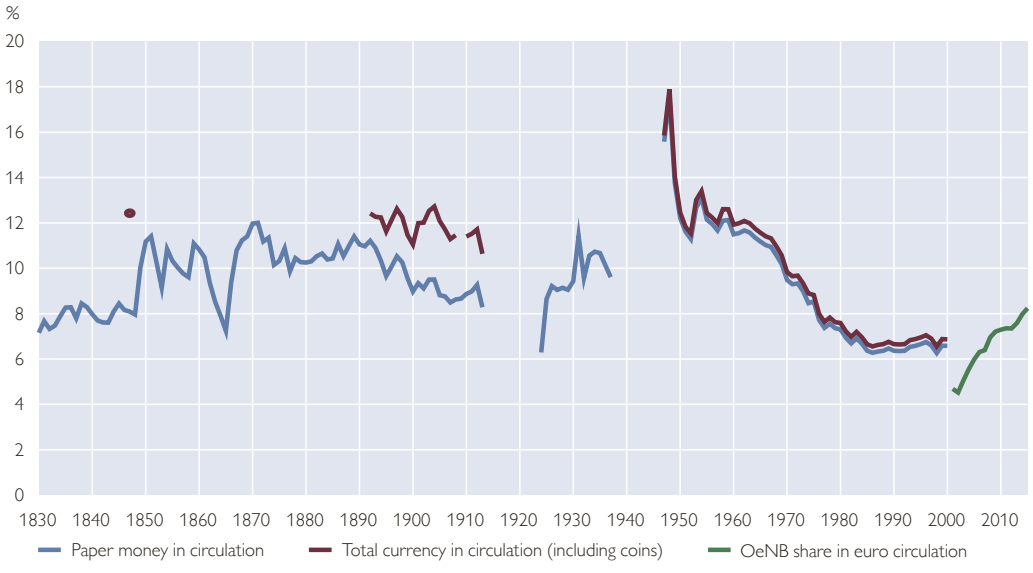
Source: See data annex.

cash holdings based on the OeNB's share in total euro area cash circulation, which in turn depends on Austria's share in euro area population and GDP, however, show a quick recovery after the changeover. Today, per capita cash holdings seem to be back to the long-run trend.

The secular increase in per capita cash holdings is essentially due to rising incomes. When tracking the evolution of transaction volumes, the underlying

Chart 4

Currency in circulation in relation to nominal GDP



Source: See data annex.

driver of cash demand, standard money demand functions therefore include not only prices, but also real income. However, reliable estimates of nominal income or nominal GDP are only available for much more recent periods than population and price series. Chart 4 shows currency in circulation as a percentage of nominal GDP starting in 1830. Note that the values for nominal GDP before 1870 are linear interpolations between ten-year benchmark estimates and that even after 1870, when estimates for real GDP improve, the deflators used are rather crude. Therefore, only the long-run trends in chart 4 can be interpreted with some confidence.

The single most remarkable observation from chart 4 is the long-run stability of the ratio between currency in circulation and nominal GDP, which for most of the time fluctuated between 8% and 12% without any clear trends and is probably even more stable if estimates for coins are included. Chart 4 thereby confirms the evidence gleaned from real cash per capita in chart 3, which likewise showed remarkable stability around a long-term trend. Again the big outlier is the immediate post-1945 period. In contrast to real cash, however, cash as a percentage of nominal GDP remains at historically high levels well into the 1960s. This means that the below-trend values of real cash can be explained by the low level of real GDP after WW II. By the mid-1960s, the ratio of currency in circulation to nominal GDP started to decline, reaching what seems to have been a new equilibrium level of about 6% in the 1980s. Again, the drop caused by the euro cash changeover is clearly visible and so is the recovery afterward. Today, the ratio of currency in circulation to nominal GDP is back at 8%.

For the euro area as a whole, the EUR 1,035 billion of currency in circulation translate into per capita cash holdings of roughly EUR 3,000. As in the case of the U.S. dollar, part of these surprisingly high per capita figures can be explained by circulation outside the monetary area. Estimates for the euro area that are based on banknote shipment data put the share of euro banknotes circulating outside the euro area at around 18% of the total stock. However, even if this estimate constitutes a lower bound due to flows of currency outside the banking system, for example via workers' remittances or tourism, it implies that roughly EUR 2,500 per capita are circulating domestically.[21] Domestic circulation in Austria seems to be even higher. The OeNB's internal estimates based on information from its cash logistics activities put domestic circulation in Austria at EUR 28.3 billion or EUR 3,300 per capita. The importance of cash therefore seems undiminished.

3 Stability of cash demand is puzzling in light of fundamental structural changes

The long-run stability in the relationship between currency in circulation and nominal GDP is surprising given the fundamental economic changes in the economic and institutional structure of the economy over the 200 years under observation. Section 3 looks at

[21] *On the international circulation of the euro, see ECB (2015). Feige (2012) puts the share of U.S. dollar banknotes held abroad at between 30% and 37%. Accordingly, of the USD 2,950 per capita in circulation in 2011, between USD 1,850 and USD 2,000 were effectively held inside the U.S.A.*

three important aspects that exemplify these changes, with the aim of gaining a better understanding of the (changing) role of cash in the economy.

3.1 Changing use of cash – evidence from its denominational structure

One aspect of banknotes and coins concerns their usability for settling average transactions. Table 1 is an attempt to relate per capita cash in circulation to an economically meaningful measure of the transaction volume of the average population.

Specifically, we collected monthly wages for selected years (table 1, column 1) whose computation, however, requires some clarification. For the 19th century in particular, reliable evidence on money wages is difficult to come by. Before 1890, when accident insurance statistics became available, very little data on wages were systematically collected.[22] From the available evidence it is not clear exactly which profession and activity they relate to, whether payments in kind were included, and finally how daily or weekly wages could be converted into a monthly or an annual wage, as indications on the annual length of employment and seasonal patterns in wages and hours worked are missing (Sandgruber, 1982). While these limitations create significant challenges for studies on the standard of living, they seem less important for our purposes, as we are mainly interested in rough orders of magnitude.

The monthly wages reported in table 1 were thus calculated as follows. First, until 1910 we only have information on daily wages, while wages for 1930 are weekly. These daily or weekly wages are converted to monthly wages by

Table 1

What can which banknotes pay for? The different denominations of currency in circulation

Year	Currency unit	Average monthly wage	Currency in circulation					Circulation of banknotes with a face value of 1,000		
			Value of banknotes in circulation per capita	Value of coins in circulation per capita	Value of currency in circulation per capita	Share of coins in total value of currency in circulation in %	% of banknotes in circulation that can be used to pay out an average monthly salary	% of currency in circulation	Per capita supply (value)	Number of monthly wages equivalent to one banknote
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1840	Florin Conventionsmünze	6	5	≈4	9	≈35	23	16	1	158
1880	Florin ö. W.	16	17	n.a.	n.a.	n.a.	43	16	3	61
1910	Crown	54	48	12	60	19.6	50	18	9	19
1930	Austrian schilling	310	163	14	177	7.8	91	9	16	3.2
1960	Austrian schilling	2,159	2,657	99	2,756	3.6	100	45	1,263	0.5
1980	Austrian schilling	12,495	10,172	390	10,562	3.7	100	73	7,754	0.1

Source: Wages: see text. Circulation and population: see annex. Denominations: Lucam (1861), Lucam (1876) and OeNB (1818–1938, 1957–2015).

Note: Column (1) summarizes estimates of average monthly wages as discussed in the text. Columns (2) to (4) summarize per capita values of banknotes and coins in circulation. Column (5) shows the share of coins in the total value of currency in circulation (data for 1840 report the estimate for 1847). Column (6) shows the value of denominations with which monthly wage bills could be settled as a percentage of the overall value of cash in circulation. Column (7) refers to the circulation of banknotes with a face value of 1,000. Column (8) shows the per capita supply of banknotes with a face value of 1,000. Column (9) expresses the number of monthly wages required to buy a banknote with a face value of 1,000.

[22] *The most important data sources are the annual statistical handbooks, which contain regionally differentiated day wages. For a comprehensive list of sources, see Cvrcek (2013).*

assuming 25 working days per month and 52 working weeks for weekly wages. Second, wages for 1840 and 1880 refer to – presumably agricultural – minimum day wages, whereas the figures for 1910 and 1930 refer to wages in the metal industry. The figures for 1960 and 1980 refer to gross industry wages. Third, the wages quoted for 1840, 1880 and 1910 refer to wages in Bohemia outside Prague. Bohemia was selected as providing a sort of middle ground between high-wage regions in the west and low-wage regions in the east of the Habsburg monarchy. In 1840, for example, Galician wages were 50% lower than wages in Vienna. Again, the main purpose is to obtain a rough order of magnitude.

To assess the usability of cash for "normal" transactions, we analyze the denominational structure of banknotes over time and relate it to monthly wages. Column 6 shows the total percentage share of all denominations small enough to be used to settle a one-month wage bill.[23] For example, in 1840 the only banknote available for putting together a monthly wage of fl. 6 was the fl. 5 banknote, as no smaller denominations were in circulation. The fl. 5 banknote accounted for 23% of the overall value of banknotes in circulation. In 1880, three denominations (fl. 10, fl. 5 and fl. 1) were suitable for the payment of a monthly wage of fl. 16. Together, these denominations accounted for 43% of total banknotes in circulation. In other words, in 1840 only about one-quarter and in 1910 still only one-half of the value of cash was circulating in denominations that were within potential reach of broader strata of the population. Table 1 shows that the denominational structure of banknotes changed substantially over time – the respective share was 100% in 1960.

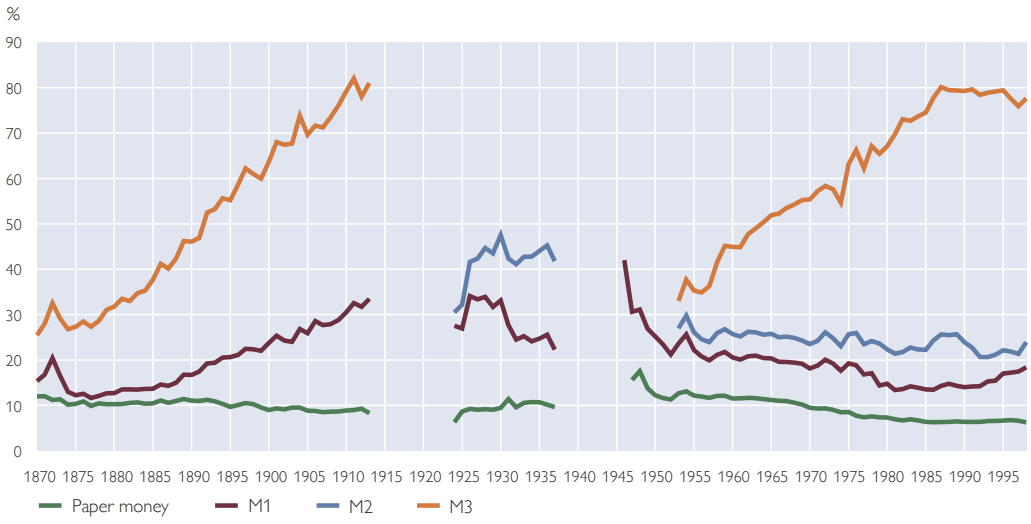
The significant share of very high denomination notes (denominations exceeding the worth of a monthly salary) until 1900 illustrates that cash must have been used to settle not only small-value but also large-value transactions. As discussed by Kernbauer (2016), the giro system for larger companies (mainly via noncash transactions at the Austro-Hungarian Bank) started to grow rapidly around 1890. Around 1900 the postal giro system, mainly used by companies and/or for larger-value private transactions, started to quickly expand and gain importance. Over time, this financial innovation rendered cash less and less important for large-value transactions. This is exemplified by the fact that the denomination of the highest-value banknote was not adapted to the enormous increase in both real and nominal income and remained 1,000 throughout until 1989.[24] As a result, banknotes with a face value of 1,000, out of reach for ordinary households in 1840 when its value corresponded to about 160 monthly incomes, became the staple banknote by 1980, when ATS 1,000 came to only 10% of an average monthly salary. Correspondingly, the relative share of the highest denomination banknote increased from 16% in 1840 to 73% by 1980 (table 1, column 7).

[23] *Although this is clearly only hypothetical for the earlier years, as wages were paid out daily, a monthly wage reflects a larger transaction that potentially could have been conducted by an average wage earner.*

[24] *The only exception here is the hyperinflation period during the early 1920s, which temporarily saw the issuance of notes with denominations up to 500,000. With the introduction of the Austrian schilling (ATS) in 1925, the OeNB reverted to 1,000 as the highest denomination. Starting in 1989, the OeNB issued an ATS 5,000 banknote.*

Chart 5

Monetary aggregates as a percentage of nominal GDP



Source: See data annex.

3.2 Cash and bank deposits

Although currency in circulation has been surprisingly constant relative to GDP, its importance has changed relative to other assets. Therefore, we analyze the evolution of deposits relative to cash.

Chart 5 shows the evolution of monetary aggregates M1 and M3 and of cash as a percentage of GDP.[25] It reveals several noteworthy facts. First, bank deposits rose steadily from the 1880s until WW I, while currency in circulation remained relatively stable. This applies both to M1 and M3. In this period of institutional change in the financial sector, cash lost importance relative to close substitutes. As discussed in Komlos (1983), the foundation of a government-sponsored postal savings system and the strong expansion of the network of bank branches, the rapid spread of the postal giro system, the government's encouragement of the use of demand deposits (in order to economize on gold to back paper money after the adoption of the gold standard in 1892) all fell into this period. This development is driven not only by the expansion of financial institutions but also by interest rates.[26] Saving banks paid an average interest rate of between 3.8% and 4% in all years from 1890 to 1912 and inflation rates were rather low, giving rise to high real interest rates.[27] On balance, however, Komlos (1979) argues that the important driver of deposits was transaction costs. The increasing number of savings banks and credit cooperatives as well as the offer of financial services through the dense network of post offices mobilized the savings of the poorer sections of the population, which had been excluded from banking before. Overall, this induced people to hold deposits rather than cash.

[25] *For the interwar period, we use M2 due to the lack of an M3 measure.*

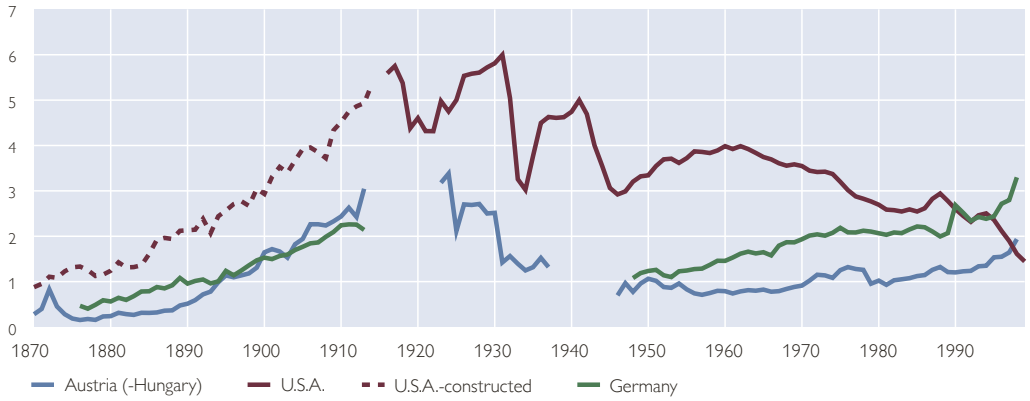
[26] *Komlos (1987) econometrically analyzes demand for M1 in this period. His estimates suggest a structural break caused by financial innovation around 1890.*

[27] *Within these 22 years, inflation was below 1% in 11 years, and between 1% and 2% in 5 years.*

Chart 6

Deposit-to-currency ratio: comparison with the U.S.A. and Germany

Ratio = deposits/currency in circulation, where deposits = M1–currency in circulation



Source: See data annex.

Second, chart 5 illustrates the dramatic consequences of both World Wars for capital formation. In the 1950s, the M3-to-GDP ratio reached only the level of the 1880s and it took until the 1980s to reach the pre-WW I level. Third, somewhat surprisingly, the rapid proliferation of transaction accounts and of other financial innovations after WW II is not reflected in an increase of M1 (relative to GDP), whereas M3 grew substantially. To some extent this is striking given the spread in account ownerships, the growth of noncash giro payments and the continued transformation of the settlement of wage bills from cash to noncash transfers that occurred from 1950 until 1980. However, this period was also marked both by very low interest rates on demand (M1) deposits and by a sizeable interest-rate spread between demand and time (M3) deposits. From 1950 until the 1970s, interest rates on transaction accounts were only 0.75% (with only a few exceptional years with interest rates of 1%). By contrast, interest rates on savings accounts (which are a large component of M3) were 3.5%. Given positive inflation rates that reached 5% in some years, the incentive to hold demand deposits was low. However, regardless of the compositional effects between M1 and M3, a substantial decline in the importance of cash relative to M3 is evident.

To further analyze the extent of substitution between cash and deposits, a somewhat different perspective is provided by the deposit-to-currency ratio (D-C ratio) which expresses the amount of money held in bank accounts relative to one unit of money held as cash (chart 6). The D-C ratio therefore reflects the preferences of the private sector regarding the composition of their financial asset holdings (Friedman and Schwartz, 1963). Chart 6 shows the D-C ratio for M1 deposits for Austria(-Hungary), Germany and the U.S.A.[28]

From 1875 until 1913, the D-C ratio evolved almost parallel in all three economies. This demonstrates that the financial development during this time was an international phenomenon. The

[28] *On the construction of the U.S. series, see data annex.*

international technology transfer is described in Komlos (1983, p. 142): "Officials were sent to Germany to learn more about the technology [giro transfers] … and many of the innovations adopted were, in fact, on the German model." The evolution of this ratio diverged, however after WW I (no data available for Germany). After WW II, the D-C ratio remained substantially lower in Austria and Germany than in the U.S.A.[29]

The D-C ratio is an indicator of the confidence that the public extends toward banks. In 1931, with the banking panic in the U.S.A. and the breakdown of *Creditanstalt* in Austria, the D-C ratio declined sharply. Also, both World Wars led to a considerable decline of the D-C ratio. It is interesting to observe that after major shocks, the D-C ratio tends to remain persistently lower for many years. This is most evident in post-war periods. Moreover, the Great Depression had a lasting effect as well. Even after the imposition of a deposit insurance system in 1932 in the U.S.A., the D-C ratio continued to be lower than before the crisis. This observation fits well with the literature on households' financial behavior after a financial crisis experience (Brown and Stix 2015; Osili and Paulson, 2014), which reports persistent effects. By contrast, the many other instances of smaller banking crises, which can be seen as small spikes in the respective D-C ratios (e.g. the banking crisis of 1912 in Austria-Hungary, see Jobst and Rieder in this volume), did not have persistent effects.

3.3 Structural changes in the economy, payments and hoarding

The previous section described how cash lost importance relative to other assets but remained in fairly stable demand relative to GDP. How can these observations be reconciled?

We suggest two possible explanations. First, the observed stability in the face of significant structural changes in the economy could be due to their countervailing effects on cash demand. Second, the use of cash might be largely driven by motives which are not particularly susceptible to payment innovations.

To explore the first hypothesis, we compare a structural change in the composition of GDP with a countervailing structural change in payment technologies:

- Although quantitative evidence is scarce, it can be presumed that extensive parts of the early 19th-century economy still operated using relatively little cash. It is likely that cash became more important, in particular in agriculture, where the abolition of the last remnants of a feudal system in 1848 should have led to an increase in wage labor. Moreover, an overall shift out of agriculture into industry and services should have increased the importance of cash for economic transactions.[30] These structural changes in the composition of GDP should have led to a secular increase in currency in circulation relative to nominal GDP over the course of the 19th century.

[29] *The fall in the D-C ratio in the U.S.A. after 1960 is due to a shift to M3 deposits and to nonbank financial assets.*

[30] *In the Austrian part of the Habsburg monarchy, the share of agricultural population in the total population was estimated at 75% in 1790 and 48% in 1910. In Hungary the decline in agricultural population started later and was less pronounced (Good, 1984, p. 49).*

- During the same period, substantive innovations in cashless payments occurred. At the beginning of 19th century, bills of exchange (a cash substitute) were important instruments in international payments. We do not have quantitative evidence on the domestic circulation of bills of exchange, but consider it very likely that their use increased over the 19th century. At the same time, the introduction of clearing in large-value stock exchange and interbank transactions should have increased the possibilities for noncash domestic transactions even further (Kernbauer, 2016). In 1893, the Austro-Hungarian Bank forced banks to open a transaction account to access the central bank's lending facilities. On the retail side, the financial innovations in retail banking that started around 1890 democratized cashless payments. These developments should have reduced the demand for cash.

There are many other secular changes that could be put forth for which it is rather difficult to find quantitative evidence. For example, a changing vertical integration of the production chain (i.e. more production steps and the use of more intermediate inputs) could have either increased or decreased cash demand (the direction is not clear a priori), while closer international integration should have decreased cash demand. In addition, strong per capita income growth after WW II enlarged the middle-income group, which in turn should have increased cash demand. The establishment of a comprehensive social security system after WW II also reduced the need to hold precautionary balances, which should have had a dampening effect on cash demand, etc.

Regarding the second major explanation for the stability of cash demand relative to GDP, it should be noted that only a small part of currency in domestic circulation (abstracting from currency that is circulating abroad) is used for transactions (e.g. Feige, 2012). Estimates, partly derived from surveys or indirect methods, show that cash held by households and companies to settle day-to-day transactions accounts for at most one-third of the volume of currency in circulation. In other words, the greater part of cash demand is driven by developments that might not react to payment innovations. Domestic hoarding after WW I and WW II, for instance, could have been driven by the experience of financial crisis and political catastrophes which eroded political and societal institutions and the public's trust in them. Shortly after WW II, a certain percentage of deposits were confiscated, which could have further undermined confidence in banks (Beer, Gnan and Valderama, 2016). It could have taken decades to restore confidence, which would explain the lagging D-C ratios in Germany and Austria relative to the U.S.A. Apart from hoarding, a significant share of the demand for cash might be related to shadow economic activities (e.g. Feige, 2012). A further reason might be that some transactions traditionally done in cash, e.g. the payments to workers and suppliers in the construction sector, continue to be made in this way irrespective of the increasing range of cashless alternatives.

As a final point, we note that cash has advantages for consumers that might not have changed over time. Therefore, the proliferation of cashless payments could have been partly offset by the public's continued desire to hold and to use cash. Results show that in 2011 cash still accounted for the majority of retail payments in Austria (and Germany), both in terms of value and in terms of the number of payments. In

countries that have moved farther toward the use of cashless payments like the U.S.A. or Canada, cash still accounts for almost 50% of the number of transactions but only about one-fourth of their value (Bagnall et al, 2016). It is difficult to find one single explanation for these cross-country differences and we suspect that the high volume of per capita cash holdings in Austria can be traced to a combination of factors: (1) the density of bank branches and ATMs is high in Austria, such that transaction costs for acquiring cash are low; (2) Austria is a safe country and people consider it not as dangerous as in other countries to keep a larger sum of cash at home; (3) low inflation rates after the pegging of the Austrian schilling to the Deutsche mark in the 1970s decreased the opportunity costs of holding cash; (4) cash is most useful for expenditure control purposes (von Kalckreuth, Schmidt and Stix, 2014) and this feature (i.e. the avoidance of debt) could be more important for consumers in Austria (and Germany) than in other economies.

Evidently, some of these characteristics also apply to countries where people use less cash. However, in combination, they might have established a path dependence in the use of cash such that the importance of cash is only slowly decreasing over time, despite massive technological advances. Merchants e.g. might have a lower incentive to accept payment cards if most consumers want to transact in cash. A low level of card acceptance, in turn, reinforces the role of cash for consumers.

Finally, we note that the recent disruptions of the Great Recession have led even to renewed demand for cash in many economies. Evidence in Jobst and Stix (2016) shows that this increase cannot be assigned to lower interest rates alone but also reflects a loss of confidence in financial institutions and increased overall uncertainty. This also suggests that transactions might not be the most important factor determining demand for cash after all.

4 Conclusions

This paper describes how, and by which institution, cash was provided over the past 200 years in Austria. Moreover, the aim has been to provide a descriptive account of the circulation of cash from an economic perspective.

Results reveal remarkable stability of demand for currency relative to GDP. In response to predictions about the imminent demise of cash, one could cite, admittedly somewhat provocatively, that currency in circulation amounted to around 8% of GDP in the first half of the 19th century, but was still around 7% at the end of the 20th century. In recent years, demand for euro cash has even increased to around 10% of GDP. How can this observation be reconciled with the vast structural changes that have occurred over these two centuries and more recently with the enormous technological advances in payment technologies?

First, we have shown that demand for cash is not stable relative to close substitutes, e.g. deposits. The massive innovations in financial intermediation, i.e. the availability of bank deposits and of cashless giro transactions, have led to a sharp rise in deposit-to-currency ratios. This implies that the importance of cash as a store of wealth has decreased over time. Second, we conjecture that the stability of cash relative to GDP is the outcome of forces that balance each other out. For example, changes in how the economy was organized in the 19th century led to increasing demand for cash, while innovations in financial intermediation have reduced demand. Moreover, the greater part of demand

for cash might not be susceptible to payment innovations, as it is driven by hoarding. This role might not have changed much over the past 100 years.

Two observations can be made as regards the future of cash. First, only major financial innovations exert a substantial effect on cash demand (relative to GDP). This assessment is based on those periods during which a sharp decline in cash demand can be observed. These episodes occurred from around 1890 to 1914 and after World War II, and in both cases are related to the spread of bank accounts and the possibility of moving funds without the use of cash. Given that cash demand for transactions accounts for only a small share of overall demand for currency, we expect that the replacement of cash by payment cards and by other innovative payment methods will lead to only a rather slow decline in the importance of cash.

Second, patterns of demand for cash over the past 200 years show that the development is not linear: major political disruptions, i.e. times of elevated economic uncertainty, and systemic banking crises have had a strong and persistent effect on the use of cash. Similarly, the recent increases in cash demand in many economies might be related to the recent financial and economic crisis (Jobst and Stix, 2016). This would concur with the observation of Friedman and Schwartz (1963, p. 673) regarding the cash demand in the 1930s: "After all, the major virtue of cash as an asset is its versatility. It involves a minimum of commitment and provides a maximum of flexibility to meet emergencies and to take advantage of opportunities. The more uncertain the future, the greater the value of such flexibility and hence the greater the demand for money is likely to be." We think this assessment explains why cash will continue to play an important role in the foreseeable future – at least in many economies.

Finally, we have to acknowledge that some of our assessments are not based on hard facts. The lack of knowledge about how the public uses cash is pertinent to all cash studies – most notably when it comes to the use of cash as store of value, which is the key determinant of total cash demand. Very little is known, for instance, about the individual motives behind the high per capita holdings of cash observed in the euro area today or about the distribution of these holdings both within and across borders. This lack of knowledge is even more blatant when it comes to the more distant past. A proper estimation of coins in circulation for the 19th century, including coin migration, is needed here as much as studies on the evolving monetization of the economy. To close these gaps in our knowledge, more research is needed and, given the enduring importance of cash, is well justified.

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Data annex and sources of data used in charts

Currency in circulation

Banknotes: 1820–1860: Lucam (1861); 1861–1863: Lucam (1876); 1863–2015: OeNB (1818–1938, 1957–2015).

Government paper money: 1820–1853: Czörnig (1861); 1866–1906: Jobst and Scheiber (2014).

Coins: 1847 and 1867: see running text; 1892–1913: Compass (1915); 1909 is missing; 1925–2001: OeNB (1923–1938, 1946–1989) and OeNB (1818–1938, 1957–2015).

M1, M2, M3

Austria: 1870–1914: Komlos (1983); 1923–1937: Zipser (1997); 1946–1995: Butschek (1996); 1995–1999: OeNB (1990–2004).

Germany: 1876–1975: Deutsche Bundesbank (1976); 1976–1997: Deutsche Bundesbank (1998).

U.S.A.: 1915–1970: Historical Statistics of the United States, Colonial Times to 1970, Washington, D.C., 1975. Series X-414. 1971–2014: Haver Analytics, Series S111FM1@G10 (Money Stock: M1 SA). Due to unavailability of M1 before 1915, we have constructed a M1 series for this period by linking the M1 series with annual growth rates of M2 (source for M2: 1867–1946: Anderson, Richard G. 2003. Some Tables of Historical U.S. Currency and Monetary Aggregates Data, Working Paper 2003-006A, Federal Reserve Bank of St. Louis).

Nominal GDP

Nominal GDP: 1870–1813: Jobst and Scheiber (2014). Data for the benchmark years 1830, 1840, 1850 and 1860 were projected backward from 1870 by using nominal GDP growth rates for the territory of the later First Austrian

Republic as given in Kausel (1979). The years between benchmark years were linearly interpolated. The resulting estimate is a very rough indicator and should be used with great care only. 1913–1963: Kausel et al. (1965); 1964–2015: Statistics Austria.

CPI

1820–1913: Mühlpeck et al. (1979); 1914–2015: Statistics Austria. The value for 1947 was corrected for a change in currency denomination.

Population

1820–1862: Tafeln zur Statistik der oesterreichischen Monarchie (1828–1863); 1863–1914: Jobst and Scheiber (2014). Years with missing values were linearly interpolated. From 1866 onward, data for Hungary are only available for census years. Missing years were again linearly interpolated. 1914–1918: Missing values for the entire monarchy were extrapolated using the rate of change of the population living in the territory of the later First Austrian Republic. 1918–2015: Statistics Austria.

Table A1

Currency in circulation in Austria(-Hungary) from 1820 to 2015

Year	Currency unit	Total notes in circulation		Coins in circulation		Total currency in circulation	Nominal GDP	Population
			of which issued by the government		of which gold			
		Million currency units						*Thousands*
1820	Florin CM	217.1	165.2	..	..	..	..	30,505
1821	Florin CM	166.7	131.9	..	..	..	..	30,848
1822	Florin CM	156.2	107.9	..	..	..	..	31,219
1823	Florin CM	134.9	83.9	..	..	..	..	31,582
1824	Florin CM	135.9	67.9	..	..	..	..	31,975
1825	Florin CM	142.0	59.9	..	..	..	..	32,378
1826	Florin CM	130.2	47.9	..	..	..	..	32,828
1827	Florin CM	127.2	39.9	..	..	..	..	33,212
1828	Florin CM	127.6	31.9	..	..	..	..	33,551
1829	Florin CM	135.4	27.9	..	..	..	..	34,300
1830	Florin CM	131.9	19.9	..	..	..	*1,843*	34,504
1831	Florin CM	143.8	19.9	..	..	..	*1,875*	34,781
1832	Florin CM	139.8	19.9	..	..	..	*1,907*	34,648
1833	Florin CM	144.9	19.9	..	..	..	*1,941*	34,736
1834	Florin CM	155.6	19.9	..	..	..	*1,974*	35,048
1835	Florin CM	166.0	15.9	..	..	..	*2,009*	35,362
1836	Florin CM	169.3	15.9	..	..	..	*2,044*	35,663
1837	Florin CM	162.1	15.9	..	..	..	*2,079*	35,879
1838	Florin CM	178.8	11.9	..	..	..	*2,115*	36,185
1839	Florin CM	178.4	11.9	..	..	..	*2,152*	36,556
1840	Florin CM	175.0	7.9	..	..	..	*2,193*	36,950
1841	Florin CM	174.5	7.9	..	..	..	*2,267*	35,551
1842	Florin CM	178.3	4.9	..	..	..	*2,343*	35,804
1843	Florin CM	184.3	4.9	..	..	..	*2,423*	35,593
1844	Florin CM	202.6	4.9	..	..	..	*2,504*	36,294
1845	Florin CM	218.6	4.9	..	..	..	*2,589*	*37,037*
1846	Florin CM	218.6	4.9	..	..	..	*2,676*	37,443
1847	Florin CM	223.9	4.9	120	..	343.9	*2,767*	37,780
1848	Florin CM	227.9	4.9	..	..	..	*2,860*	*37,272*
1849	Florin CM	296.5	46.0	..	..	..	*2,957*	*36,765*
1850	Florin CM	343.6	88.2	..	..	..	*3,074*	*36,258*
1851	Florin CM	363.2	147.6	..	..	..	*3,183*	35,751
1852	Florin CM	339.0	144.1	..	..	..	*3,296*	36,100
1853	Florin CM	312.3	124.6	..	..	..	*3,414*	36,435
1854	Florin CM	383.5	×	..	..	..	*3,535*	36,657
1855	Florin CM	377.9	×	..	..	..	*3,661*	*36,922*
1856	Florin CM	380.2	×	..	..	..	*3,791*	*37,186*
1857	Florin ö.W.	383.5	×	..	..	..	*3,926*	37,451
1858	Florin ö.W.	390.5	×	..	..	..	*4,065*	*37,494*
1859	Florin ö.W.	466.8	×	..	..	..	*4,210*	*37,537*
1860	Florin ö.W.	474.9	×	..	..	..	*4,386*	*37,580*
1861	Florin ö.W.	468.9	×	..	..	..	*4,475*	*37,624*
1862	Florin ö.W.	426.9	×	..	..	..	*4,565*	*37,667*
1863	Florin ö.W.	396.7	×	..	..	..	*4,657*	37,710
1864	Florin ö.W.	375.8	×	..	..	..	*4,751*	37,884
1865	Florin ö.W.	351.1	×	..	..	..	*4,847*	38,137
1866	Florin ö.W.	463.7	179.7	..	..	..	*4,944*	35,600
1867	Florin ö.W.	543.9	296.8	8.3	..	552.1	*5,044*	*35,701*
1868	Florin ö.W.	577.5	301.3	..	..	..	*5,146*	*35,803*
1869	Florin ö.W.	598.7	315.0	..	..	..	*5,249*	*35,904*
1870	Florin ö.W.	642.4	345.5	..	..	..	5,366	*36,084*
1871	Florin ö.W.	688.1	370.8	..	..	..	5,733	*36,264*
1872	Florin ö.W.	689.6	371.2	..	..	..	6,169	*36,444*
1873	Florin ö.W.	700.7	341.8	..	..	..	6,174	*36,624*
1874	Florin ö.W.	635.7	342.0	..	..	..	6,264	*36,804*
1875	Florin ö.W.	628.3	342.1	..	..	..	6,084	*36,984*
1876	Florin ö.W.	648.0	352.0	..	..	..	5,955	*37,164*
1877	Florin ö.W.	623.2	340.9	..	..	..	6,316	*37,344*
1878	Florin ö.W.	649.6	360.8	..	..	..	6,217	*37,523*
1879	Florin ö.W.	626.2	309.4	..	..	..	6,095	*37,703*
1880	Florin ö.W.	646.5	317.9	..	..	..	6,308	37,883
1881	Florin ö.W.	670.9	316.7	..	..	..	6,511	*38,231*
1882	Florin ö.W.	712.0	343.3	..	..	..	6,757	*38,578*
1883	Florin ö.W.	726.5	346.1	..	..	..	6,820	*38,926*
1884	Florin ö.W.	719.4	343.7	..	..	..	6,928	*39,273*
1885	Florin ö.W.	692.9	329.3	..	..	..	6,641	*39,621*
1886	Florin ö.W.	708.5	336.8	..	..	..	6,400	*39,969*
1887	Florin ö.W.	722.9	331.8	..	..	..	6,861	*40,316*
1888	Florin ö.W.	751.7	326.0	..	..	..	6,851	*40,664*
1889	Florin ö.W.	781.5	346.8	..	..	..	6,855	*41,011*

Table A1 (continued)

Currency in circulation in Austria(-Hungary) from 1820 to 2015

Year	Currency unit	Total notes in circulation	of which issued by the government	Coins in circulation	of which gold	Total currency in circulation	Nominal GDP	Population
		Million currency units						*Thousands*
1890	Florin ö.W.	798.3	352.4	..	..	..	7,224	41,359
1891	Florin ö.W.	819.5	364.2	..	..	..	7,470	*41,763*
1892	Florin ö.W.	807.0	329.0	87.1	3.1	894.0	7,198	*42,168*
1893	Florin ö.W.	810.1	323.5	102.2	4.1	912.3	7,437	*42,573*
1894	Florin ö.W.	784.7	276.8	144.3	3.9	929.0	7,589	*42,977*
1895	Florin ö.W.	785.9	166.0	160.1	4.5	945.9	8,138	*43,382*
1896	Florin ö.W.	786.6	126.9	160.1	5.6	946.7	7,808	*43,787*
1897	Florin ö.W.	817.9	118.0	162.6	5.6	980.5	7,769	*44,192*
1898	Florin ö.W.	850.9	113.4	165.9	7.6	1,016.8	8,291	*44,596*
1899	Florin ö.W.	833.9	104.9	166.3	8.6	1,000.2	8,726	*45,001*
1900	Crown	1,579.8	85.8	363.9	18.8	1,943.7	17,595	45,406
1901	Crown	1,608.3	23.3	456.1	117.4	2,064.4	17,217	*45,811*
1902	Crown	1,639.4	4.2	520.3	204.8	2,159.7	17,986	*46,216*
1903	Crown	1,773.7	2.9	565.2	239.6	2,338.9	18,674	*46,621*
1904	Crown	1,754.0	2.7	593.8	265.4	2,347.8	18,451	*47,027*
1905	Crown	1,849.6	2.6	686.1	350.5	2,535.7	20,987	*47,432*
1906	Crown	1,984.6	2.5	668.9	320.7	2,653.5	22,659	*47,837*
1907	Crown	2,028.0	x	668.0	308.9	2,696.0	23,886	*48,243*
1908	Crown	2,112.9	x	694.0	296.1	2,806.9	24,502	*48,648*
1909	Crown	2,188.0	x	..	..	..	25,273	*49,053*
1910	Crown	2,375.9	x	678.5	236.1	3,054.4	26,782	49,458
1911	Crown	2,541.0	x	719.0	253.9	3,260.0	28,299	*49,864*
1912	Crown	2,815.8	x	743.1	234.8	3,558.9	30,388	*50,269*
1913	Crown	2,493.6	x	710.1	225.6	3,203.7	30,112	*50,674*
1914	Crown	5,136.7	x	..	..	..	..	*50,155*
1915	Crown	7,162.4	x	..	..	..	..	*49,635*
1916	Crown	10,888.6	x	..	..	..	..	*49,115*
1917	Crown	18,439.7	x	..	..	..	..	*48,596*
1918	Crown	35,588.6	x	..	..	..	..	*48,076*
1919	Crown	54,464.6	x	..	..	..	..	6,420
1920	Crown	30,645.7	x	..	..	..	..	6,455
1921	Crown	174,114.7	x	..	..	..	..	6,504
1922	Crown	4,080,177.2	x	..	..	..	..	6,528
1923	ATS	494.8	x	..	..	..	..	6,543
1924	ATS	582.5	x	..	..	..	9,257	6,562
1925	ATS	890.0	x	60.4	..	950.4	10,296	6,582
1926	ATS	947.3	x	76.8	..	1,024.1	10,283	6,603
1927	ATS	1,005.3	x	76.8	..	1,082.2	11,110	6,623
1928	ATS	1,067.4	x	89.2	..	1,156.5	11,678	6,643
1929	ATS	1,094.4	x	92.9	..	1,187.3	12,087	6,664
1930	ATS	1,090.1	x	91.8	..	1,181.9	11,560	6,684
1931	ATS	1,183.3	x	97.8	..	1,281.1	10,360	6,705
1932	ATS	913.8	x	96.8	..	1,010.5	9,550	6,725
1933	ATS	952.4	x	96.2	..	1,048.6	9,020	6,746
1934	ATS	963.9	x	108.6	..	1,072.5	8,980	6,760
1935	ATS	975.6	x	126.2	..	1,101.8	9,140	6,761
1936	ATS	944.2	x	124.3	..	1,068.6	9,316	6,758
1937	ATS	943.9	x	125.0	..	1,068.9	9,822	6,755
1945	ATS	3,740.5	x	..	..	..	..	6,799
1946	ATS	5,656.5	x	..	..	..	22,847	7,000
1947	ATS	4,325.8	x	74.3	..	4,400.0	27,764	6,971
1948	ATS	5,634.8	x	111.7	..	5,746.5	32,111	6,953
1949	ATS	5,721.0	x	123.2	..	5,844.2	41,606	6,943
1950	ATS	6,348.8	x	129.1	..	6,477.9	51,993	6,935
1951	ATS	8,032.0	x	151.2	..	8,183.3	69,190	6,936
1952	ATS	9,048.2	x	203.0	..	9,251.3	80,128	6,928
1953	ATS	10,474.4	x	280.9	..	10,755.3	82,652	6,933
1954	ATS	12,252.5	x	287.9	..	12,540.4	93,574	6,940
1955	ATS	13,026.3	x	314.9	..	13,341.2	107,296	6,947
1956	ATS	14,259.5	x	338.5	..	14,597.9	119,303	6,952
1957	ATS	15,402.6	x	432.7	..	15,835.2	132,068	6,966
1958	ATS	16,598.2	x	699.3	..	17,297.6	137,178	6,987
1959	ATS	17,692.9	x	692.5	..	18,385.4	145,900	7,014
1960	ATS	18,726.8	x	699.0	..	19,425.9	162,893	7,048
1961	ATS	20,878.2	x	778.3	..	21,656.5	180,726	7,086
1962	ATS	22,419.3	x	797.9	..	23,217.3	192,134	7,130
1963	ATS	23,970.4	x	847.8	..	24,818.2	207,083	7,176
1964	ATS	25,740.4	x	906.2	..	26,646.5	226,730	7,224
1965	ATS	27,547.2	x	966.9	..	28,514.1	246,491	7,271

Table A1 (continued)

Currency in circulation in Austria(-Hungary) from 1820 to 2015

Year	Currency unit	Total notes in circulation	of which issued by the government	Coins in circulation	of which gold	Total currency in circulation	Nominal GDP	Population
		Million currency units						*Thousands*
1966	ATS	29,605.7	×	1,027.1	..	30,632.7	268,532	7,322
1967	ATS	31,239.6	×	1,091.1	..	32,330.7	285,593	7,377
1968	ATS	32,449.8	×	1,205.9	..	33,655.7	306,833	7,415
1969	ATS	34,120.8	×	1,284.3	..	35,405.1	335,000	7,441
1970	ATS	35,665.5	×	1,287.4	..	36,952.9	375,885	7,467
1971	ATS	38,998.2	×	1,482.0	..	40,480.1	419,624	7,501
1972	ATS	44,730.0	×	1,681.7	..	46,411.7	479,544	7,544
1973	ATS	48,857.0	×	1,889.9	..	50,746.8	543,458	7,586
1974	ATS	52,365.1	×	2,624.0	..	54,989.2	618,563	7,599
1975	ATS	56,035.9	×	1,858.2	..	57,894.2	656,116	7,579
1976	ATS	58,862.4	×	2,034.6	..	60,897.1	724,745	7,566
1977	ATS	62,194.5	×	2,209.4	..	64,403.9	843,169	7,568
1978	ATS	67,399.7	×	2,389.3	..	69,789.0	891,817	7,562
1979	ATS	71,984.7	×	2,624.1	..	74,608.8	978,249	7,549
1980	ATS	76,795.9	×	2,943.6	..	79,739.4	1,050,724	7,549
1981	ATS	77,730.7	×	3,194.8	..	80,925.5	1,119,680	7,569
1982	ATS	80,536.1	×	3,402.4	..	83,938.5	1,203,367	7,576
1983	ATS	88,676.2	×	3,632.7	..	92,309.0	1,282,178	7,567
1984	ATS	89,889.6	×	3,833.9	..	93,723.4	1,346,333	7,571
1985	ATS	90,485.4	×	4,039.8	..	94,525.2	1,420,861	7,578
1986	ATS	93,900.2	×	4,240.5	..	98,140.7	1,496,456	7,588
1987	ATS	98,387.0	×	4,466.1	..	102,853.1	1,553,728	7,598
1988	ATS	103,725.0	×	4,722.9	..	108,447.9	1,629,442	7,615
1989	ATS	112,761.1	×	5,055.6	..	117,816.7	1,742,967	7,659
1990	ATS	119,263.8	×	5,452.2	..	124,716.1	1,873,265	7,729
1991	ATS	127,534.8	×	5,832.4	..	133,367.2	2,008,306	7,755
1992	ATS	135,004.5	×	6,172.6	..	141,177.1	2,121,684	7,841
1993	ATS	143,215.9	×	6,537.9	..	149,753.8	2,191,666	7,906
1994	ATS	151,449.9	×	6,890.6	..	158,340.5	2,300,980	7,936
1995	ATS	161,412.8	×	7,194.6	..	168,607.3	2,405,221	7,948
1996	ATS	169,224.4	×	7,503.5	..	176,727.9	2,506,201	7,959
1997	ATS	171,125.4	×	7,720.5	..	178,845.9	2,591,198	7,968
1998	ATS	168,822.6	×	7,886.0	..	176,708.6	2,694,655	7,977
1999	ATS	184,389.0	×	8,092.2	..	192,481.2	203,418	7,992
2000	ATS	193,098.0	×	8,350.2	..	201,448.2	213,196	8,012
2001	ATS	141,995.6	×	7,049.3	..	149,045.0	220,096	8,042
2002	EUR	10,237.0	×	..	..	..	226,303	8,082
2003	EUR	11,691.0	×	..	..	..	230,999	8,118
2004	EUR	13,416.0	×	..	..	..	241,505	8,169
2005	EUR	15,128.0	×	..	..	..	253,009	8,225
2006	EUR	16,815.0	×	..	..	..	266,478	8,268
2007	EUR	18,053.0	×	..	..	..	282,347	8,301
2008	EUR	20,297.0	×	..	..	..	291,930	8,337
2009	EUR	20,640.0	×	..	..	..	286,188	8,341
2010	EUR	21,492.0	×	..	..	..	294,628	8,361
2011	EUR	22,687.0	×	..	..	..	308,630	8,389
2012	EUR	23,298.0	×	..	..	..	317,056	8,426
2013	EUR	24,497.0	×	..	..	..	322,878	8,477
2014	EUR	26,237.0	×	..	..	..	329,296	8,544
2015	EUR	27,795.0	×	..	..	..	337,162	8,585

Source: See data annex.
Note: For conversion rates between different currency units see Jobst and Kernbauer (2016).
x = No government notes in circulation this year.
.. = No data available.
Numbers in italics: Authors' estimates and interpolations.