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## 20 years of euro cash in Austria

Security through stability.

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# Call for applications: Klaus Liebscher Economic Research Scholarship

Please e-mail applications to *scholarship@oenb.at* by the end of October 2022. Applicants will be notified of the jury's decision by end-November 2022.

The Oesterreichische Nationalbank (OeNB) invites applications for the "Klaus Liebscher Economic Research Scholarship." This scholarship program gives outstanding researchers the opportunity to contribute their expertise to the research activities of the OeNB's Economic Analysis and Research Department. This contribution will take the form of remunerated consultancy services.

The scholarship program targets Austrian and international experts with a proven research record in economics and finance, and postdoctoral research experience. Applicants need to be in active employment and should be interested in broadening their research experience and expanding their personal research networks. Given the OeNB's strategic research focus on Central, Eastern and Southeastern Europe, the analysis of economic developments in this region will be a key field of research in this context.

The OeNB offers a stimulating and professional research environment in close proximity to the policymaking process. The selected scholarship recipients will be expected to collaborate with the OeNB's research staff on a prespecified topic and are invited to participate actively in the department's internal seminars and other research activities. Their research output may be published in one of the department's publication outlets or as an OeNB Working Paper. As a rule, the consultancy services under the scholarship will be provided over a period of two to three months. As far as possible, an adequate accommodation for the stay in Vienna will be provided.[1]

Applicants must provide the following documents and information:

- a letter of motivation, including an indication of the time period envisaged for the consultancy
- a detailed consultancy proposal
- a description of current research topics and activities
- an academic curriculum vitae
- an up-to-date list of publications (or an extract therefrom)
- the names of two references that the OeNB may contact to obtain further information about the applicant
- evidence of basic income during the term of the scholarship (employment contract with the applicant's home institution)
- written confirmation by the home institution that the provision of consultancy services by the applicant is not in violation of the applicant's employment contract with the home institution

[1] *We are also exploring alternative formats to continue research cooperation under the scholarship program for as long as we cannot resume visits due to the pandemic situation.*

# Editorial: 20 years of euro cash in Austria

*Gerhard Fenz, Ernest Gnan*

The introduction of the euro in 1999 and of euro banknotes and coins in 2002 marked important milestones in European integration. A common European currency serves as a powerful symbol of the freedom, convenience and opportunities made possible by the European Union (EU). Today, the euro offers essential benefits, including price transparency, to more than 340 million people in 19 EU member states. The common currency has helped enhance competition, increase productivity and dampen prices. Over the past two decades, the euro area has weathered several storms ranging from the global financial crisis and the great recession of 2008/2009 via the European sovereign debt crisis in 2012 to the COVID-19 pandemic, and is now faced with the war in Ukraine. The Eurosystem, which consists of the European Central Bank (ECB) and the national central banks of the euro area countries, has played an important role in mastering these crises. Importantly, the euro has also served as a catalyst of reforms in other policy areas, such as fiscal and structural policies.

The past two decades have also witnessed big changes in global and European payments systems. Electronic payments have increasingly gained in importance, and innovative forms of electronic payments have entered the scene. Other factors that have amplified this trend include the rising popularity of internet shopping and – more recently – the COVID-19 pandemic. We have also seen private crypto assets such as bitcoin and large internet companies ("big techs") enter the payments market. In light of this transformation, the Eurosystem and central banks worldwide have started to consider developing central bank digital currencies (CBDCs). Cash thus faces competition from both private-sector payments solutions and digital payments. At the same time, cash has retained its role as an indispensable physical means of payment, notably for retail payments. As the design of CBDCs is being worked out, tradeoffs and limitations become apparent. Indeed, cash has properties which may be difficult to replicate electronically. It stands for financial inclusion, helps people keep better track of their spending, protects privacy and is crisis-proof in the event of payments system failures or power outages.

Offering different payment methods to people enhances competition and also helps contain undue concentration of data for commercial purposes with the operators of private or public electronic payments systems. Ultimately, the question which payment methods are available to citizens is not only about market competition; it should also be an active policy choice. Cash has legitimate benefits for specific groups in society, which warrants conscious action by policymakers. The latter should preserve its circulation and use – even if this comes at a financial cost, e.g. for operating automated teller machines (ATMs) and providing other cash handling and logistics services. Irrespective of whether they issue CBDCs, central banks should in any event keep circulating cash also in future.

The contributions to this special issue zero in on the various types of money and payments solutions which have developed over the past 20 years and may lie ahead of us in the next 20 years: from public to private money and from physical cash to electronic payments. The authors reflect on key monetary issues from different angles, exposing possible tradeoffs in the policy choices to be made. They remind us of externalities and that we should also consider the repercussions policy choices may have on vulnerable groups in society. Last but not least, we must

bear in mind that the euro is a global currency that people use as a means of payment and store of value beyond the euro area. Ultimately, cash is "coined liberty," as Fyodor Dostoevsky reminds us in "The House of the Dead." In other words, money and means of payments clearly reach beyond the realm of economics; they also bear on democracy and citizens' rights.

# Editorial: 20 Jahre Euro-Bargeld in Österreich

*Gerhard Fenz, Ernest Gnan*

Die Umstellung auf den Euro als Buchgeld im Jahr 1999 und die Einführung des Euro-Bargelds im Jahr 2002 waren wichtige Meilensteine im Zusammenwachsen Europas. Eine gemeinsame europäische Währung symbolisiert die Freiheiten eines Binnenmarkts und all die Möglichkeiten, die uns die Europäische Union (EU) im Alltag gebracht hat. Heute profitieren über 340 Millionen Menschen in 19 EU-Ländern von den Vorteilen des Euro – unter anderem können wir Preise innerhalb des Euroraums unmittelbar miteinander vergleichen. Die gemeinsame Währung hat auch den Wettbewerb gefördert und dazu beigetragen, dass die Produktivität zugenommen hat und die Preise weniger stark gestiegen sind. In den letzten zwei Jahrzehnten war der Euroraum mit einer Reihe von Krisen konfrontiert, angefangen von der weltweiten Finanzkrise und der starken Rezession 2008/2009, über die europäische Staatsschuldenkrise 2012 bis zur COVID-19-Pandemie ab 2020. Und nun wirft der Krieg in der Ukraine seinen Schatten auf Europa. Bei der Bewältigung dieser Krisen haben das Eurosystem, also die Europäische Zentralbank (EZB) und die Notenbanken der Euroraum-Länder, eine bedeutende Rolle gespielt. Der Euro diente zudem als Katalysator für Reformen in anderen Politikbereichen, wie in der Fiskalpolitik und der Strukturpolitik.

Auch in der Zahlungsverkehrslandschaft hat sich in den letzten zwei Jahrzehnten global und europaweit sehr viel getan. So hat der elektronische Zahlungsverkehr an Bedeutung gewonnen und viele Innovationen hervorgebracht. Andere Faktoren, die diese Entwicklung verstärkt haben, sind der Trend zum Einkaufen im Internet und zuletzt auch die COVID-19-Pandemie. Außerdem hat sich der Zahlungsverkehrsmarkt mit dem Aufkommen privater Kryptowerte wie Bitcoin und großer Internetfirmen („Big Techs“) verändert. Angesichts dieser Veränderungen befassen sich das Eurosystem und Zentralbanken weltweit damit, wie digitales Zentralbankgeld funktionieren würde. Konkurrenz bekommt das Bargeld damit sowohl von Zahlungsverkehrslösungen außerhalb des Zentralbanksystems als auch von der voranschreitenden Digitalisierung. Zugleich ist das Bargeld als physisches Zahlungsmittel unverzichtbar und insbesondere aus dem Kundenzahlungsverkehr nicht wegzudenken. Die bisherige Arbeit daran, wie ein digitaler Euro oder etwa ein digitaler Dollar aussehen könnten, zeigt, was technisch machbar ist und wo Abstriche gemacht werden müssen. So hat das Bargeld Eigenschaften, die elektronisch schwer replizierbar sind. Im Sinne der finanziellen Inklusion bietet Bargeld allen Menschen Zugang zu Finanzdienstleistungen. Bargeld hilft uns, unsere Ausgaben gut im Blick zu behalten. Bargeld schützt auch unsere Privatsphäre. Und es ist krisensicher – wer Bargeld hat, kann auch dann einkaufen und bezahlen, wenn Zahlungssysteme oder Strom ausfallen.

Ein breites Angebot an Zahlungsmethoden ist wettbewerbsfördernd und schützt auch vor einer zu großen Konzentration von Nutzerdaten bei den Betreibern privater oder öffentlicher elektronischer Zahlungslösungen. Letztlich sollte die Frage des Zahlungsmittelangebots aber keine Frage des Wettbewerbs sein – wie wir zahlen, muss aktiv von der Geldpolitik mitbestimmt werden. Bestimmte Bevölkerungsgruppen brauchen aus nachvollziehbaren Gründen Zugang zu Bargeld, und dem muss die Geldpolitik bewusst Rechnung tragen. Es ist daher Aufgabe der

Notenbanken dafür zu sorgen, dass der Bezug von Bargeld und das Barbezahlen weiterhin möglich bleiben, auch wenn dies einen finanziellen Mehraufwand bedeutet, etwa im Zusammenhang mit dem Betrieb von Bankomaten oder im Bereich der Bargeldbearbeitung und Bargeldlogistik. Egal ob ein digitaler Euro oder andere digitale Währungen kommen oder nicht – die Bargeldversorgung werden die Zentralbanken auch weiterhin gewährleisten müssen.

Die Beiträge zu diesem Sonderheft beleuchten, welche Geldformen und Bezahllösungen in den letzten 20 Jahren entwickelt wurden und was in den nächsten 20 Jahren kommen könnte. Es geht also um das ganze Spektrum von privatem und staatlichem Geld, und um das ganze Spektrum des Barzahlens und des bargeldlosen Zahlens. Die Autorinnen und Autoren betrachten das Thema Geld aus unterschiedlichen Blickwinkeln und zeigen das Spannungsfeld auf, in dem die Geldpolitik agiert und Weichenstellungen zu treffen hat. Die Beiträge führen Externalitäten vor Augen und erinnern uns daran, dass die anstehenden Entscheidungen auch auf die Bevölkerungsgruppen Rücksicht nehmen müssen, die ohne Bargeld nicht zurechtkommen würden. Zudem müssen wir bedenken, dass der Euro eine internationale Währung ist, die auch außerhalb des Euroraums zum Bezahlen und zur Wertaufbewahrung verwendet wird. Letztlich ist Bargeld „geprägte Freiheit“, um eine Anlehnung an Fjodor Dostojewski und seine „Aufzeichnungen aus einem Totenhaus” zu nehmen. Mit anderen Worten: Beim Thema Geld und Zahlungsmitteln geht es nicht nur um ein wirtschaftliches Thema, hier geht es auch um demokratische Werte und unsere Bürgerrechte.

# Nontechnical summaries in English and German

# Nontechnical summaries in English

## Past and future development of euro cash in Austria – resilience in light of technological change and economic crises

***Anton Schautzer, Helmut Stix***

In this article, we discuss how the demand for and the use of cash has changed in Austria since the euro cash changeover in January 2002 and what can be expected for the future.

Given the enormous technological innovations, it comes as no surprise that cash use for payments has declined in the last 20 years. But cash payments are still dominating in Austria, both in value and number. In 2000, 93% of all payment transactions were conducted in cash; in 2020, the percentage dropped to 63%.

In contrast, the overall circulation of euro cash in the euro area has increased substantially over the past 20 years, with increased hoarding and foreign demand as main reasons. Estimates indicate that more cash is being held than 20 years before, showcasing the importance of cash in times of crises as a safe haven with the financial crisis 2007/2008 and the COVID-19 pandemic being a case in point. Moreover, low interest rates during the past years might have increased the demand for cash as well.

In international comparison, Austria is among the more cash-affine countries; however, there are several other European countries with comparable levels of cash use. But are Austrians just lagging the development in countries with lower cash use? The authors say no. Cash use depends on many different factors. Survey data show that Austrians value and use cash for its properties: it is still an easy to use, economical, safe and inclusive means of payment and store of value. Thus, it is in the public's interest to safeguard the role of cash as a key payment instrument. Therefore, adequate access to cash for consumers and to cash deposit facilities for merchants should be maintained. Also, paying in cash at any point of sale (POS) should remain possible, and measures ought to be taken to ensure cost efficiency along the supply chain of cash.

Owing to progressive digitalization, a downward trend in cash use can be expected for the next years; albeit the decline might be less pronounced in certain population groups who will continue to predominantly pay in cash. Though cash use is expected to decrease, overall, cash will likely remain a very important payment instrument.

## From SEPA to the digital euro: payments past, present and future

***Johannes Asel, Simone Mingione, Petia Niederlaender, Georg Nitsche***

With this study, we address the growing relevance of electronic payments in Austria and in the euro area 20 years after the introduction of euro cash in 12 EU countries at the time.

In this respect, we discuss the impact of innovations on electronic payments, the role of electronic payments in the European Union, the role of European companies in the current market environment, the impact of the COVID-19 pandemic on payment behavior and, last but not least, possible scenarios for the future.

In particular, we provide an overview of payments-related trends and regulatory developments. Furthermore, we offer an overview of recent empirical studies that underlines the rising importance of electronic payments for economic competitiveness and for economic growth in general.

With a view to recent changes in payment behavior in Austria and in the euro area, we outline two scenarios for the future of retail payments in the euro area, some 15 to 20 years ahead. Ultimately, these scenarios are meant to support policy-making decisions. The most likely scenario we expect to see ourselves in builds on the assumption that electronic payments will continue to rise in importance. An alternative scenario, which is more pessimistic, rounds off the picture.

As a service for our readers, we provide an annex with background information on relevant characteristics of electronic payments, for instance with regard to the value chain in retail payments. A number of industry and market classifications and information on market developments complete the overview.

## How much cash is in crypto?

***Beat Weber***

In its 2008 white paper, bitcoin is called "electronic cash." Bitcoins exist only in digital form and are generated by computer networks. The white paper also mentions that bitcoin operates on a "peer-to-peer" basis, suggesting that people may exchange bitcoins without any third parties in between. Such third parties are also referred to as intermediaries. In addition, bitcoins are said to be inflation free because their number will ultimately be limited to 21 million coins.

In contrast, recent EU legislation refers to bitcoin and similar projects as "crypto assets." Since bitcoin's introduction in 2008, thousands of similar crypto projects have come into being. Crypto is short for cryptography. In computing, this term refers to the use of special codes to keep information safe in computer networks. Cryptography plays an important role in the design of bitcoins and similar crypto projects.

The exchange rate between bitcoins and euro cash has been going up and down very much. So, what do we know about the relationship between bitcoins and cash? A closer analysis reveals that the bitcoin white paper – as well as many users of crypto assets – use the terms "cash," "peer-to-peer" and "inflation" in a sense that differs from general usage. This may lead to misunderstandings.

But first things first. Bitcoin does have a few things in common with conventional currencies: (1) bitcoin is also a unit of value, (2) people may own and transfer amounts in this unit of value and (3) bitcoins may be traded against currencies on markets. Yet, when it comes to economic value, we see that bitcoins differ fundamentally from cash, that is banknotes and coins or bank deposits and e-money in official currency. Official currencies are issued and backed by official responsible bodies that work to keep the value stable and ensure that the currencies are generally accepted. Therefore, the term "cash" applies to bitcoin, which has been praised for being anonymous, only in a very limited sense, if at all.

Another big difference is that official currencies are used as money in a given economy or economic area. Money provides people with what is called purchasing power, that is they can buy goods and services for money. If the purchasing power of a currency decreases over time and people get fewer goods or services for their money, we talk of "inflation." In the bitcoin white paper, however, "inflation" is used to define the increase in the number of bitcoins. For lack of information on an economy in which bitcoins may be used in a predefined and predictable way as money, information about changes in the number of bitcoins does not provide any clues about how the value of bitcoins will develop.

As to "peer-to-peer," this term is applicable to cash because people may exchange cash among themselves without any help from intermediaries or tools. This is not the case with bitcoins, however. People wanting to transfer bitcoins to another person cannot do so without third parties, or intermediaries, checking the transfer. Based on a system of competing volunteers, such intermediaries validate bitcoin transactions while controlling for counterfeits and register all bitcoin transactions in a record-keeping system called "blockchain." In fact, the crypto sector is teeming with intermediaries offering services, some of which are widely used.

To sum up, having analyzed the abovementioned key terms, we may conclude that whenever terms associated with money are used in the context of bitcoin and similar crypto projects, we should always bear in mind that crypto differs importantly from official currencies and therefore cash.

## A digital euro and the future of cash

***Martin Summer, Hannes Hermanky***

Should the European Central Bank (ECB) offer a new digital means of payment to all citizens in the euro area, namely a digital euro? This question has started to attract more and more attention – not only among experts, but also in the wider public. What plays an important role in the public debate is the fear that the launch of a digital euro might ultimately abolish cash. Yet, the question is really about what role central banks will and should play in the monetary system in the digital age.

First, we provide an overview of the institutional architecture and the current monetary system. This system is made up of two tiers: (1) the central bank at the top issues cash on behalf of the state and provides commercial banks with accounts. By conducting monetary policy, the central bank ensures that money, as the legal tender in a specific economic area, retains its value over time. This type of money is called central bank money. (2) Commercial banks create private money by extending credit to companies and households. In addition, commercial banks obtain money from the central bank in cashless form in exchange for securities. Companies and people may pay either with cash, i.e. central bank money, or digitally via their banks and bank accounts.

Next, we discuss the topical literature on digital central bank money – frequently referred to as central bank digital currencies (CBDCs). We also highlight the views of key institutions, such as the ECB and the Bank for International Settlements (BIS). Overall, the following strategic question plays a pivotal role: In an increasingly digital future, how can central banks withstand the competition from new issuers of private money, above all international big techs in the platform-centered internet economy? As a side benefit, CBDCs might increase price competition in the market for card payments that is dominated by a few big players. Another argument is the aim to guarantee universal access to central bank money in a world that has an increasing need for digital payments. Importantly, not one of the documents we examined refers to cash as a technologically outdated means of payment. Instead, the issuers of central bank money voice their commitment to ensure cash supply also in the future.

Arguments why it might be a good (or bad) idea to offer digital central bank money that is accessible to all are bound to be very abstract. This is why we also discuss the technological and institutional ways in which a digital euro could be implemented: (1) as deposit accounts, in the same vein as conventional bank accounts, (2) as digital bearer instruments, much like cash, just in digital form, or (3) blockchain technology, known from bitcoin and similar models. Each of these possible implementations has advantages and disadvantages; so we concentrate in particular on the issues of transaction data privacy, monetary and financial stability as well as security.

We conclude by explaining why cash, irrespective of a future digital euro, will continue to play an important role. For users, cash offers practical advantages that cannot be fully replicated digitally. Cash has a central and important legal function in the payment system; changing that would have serious consequences. Last but not least, cash is a robust means of payment that requires no internet availability, fully operational end devices or permanent energy supply.

## Should the use of cash be limited?

***Matthias Schroth, Mara Vyborny, Lisa Ziskovsky***

In 2021, the European Commission proposed to introduce an EU-wide upper limit for cash transactions, namely EUR 10,000. In this study, we examine arguments for and against putting a ceiling on cash payments. We also consider current legislation on cash limits. Some EU countries have already restricted cash transactions at the national level. In addition, we highlight the importance of cash and the critical functions it fulfills as legal tender.

We find that national cash ceilings have had little effect so far. For this reason, it remains questionable if an EU-wide cash ceiling would help achieve the goal of the European Commission – to combat money laundering and illegal activities, including terrorism financing. A uniform cash ceiling might, however, distort competition in the internal market. According to the proposal of the European Commission, the EU member states would still be able to apply different, i.e. stricter, national cash limits.

One aspect deserves special attention in the debate about cash limits. Cash is the only legal physical means of payment. As such, it fulfills indispensable economic functions in payments and as a store of value. Moreover, cash promotes financial inclusion and protects privacy. The COVID-19 pandemic has driven home that, in times of crisis, people trust and rely on cash.

In light of these arguments, we should relieve the pressure on cash instead of imposing legal restrictions on cash payments. Importantly, consumers should always be free to choose the means of payment.

## The use of euro cash as a store of value in CESEE

***Marc Bittner, Thomas Scheiber***

Ever since euro banknotes and coins were first issued in early 2002, euro cash has also been circulating outside the euro area. In fact, the use of euro cash outside the euro area has been on the rise. According to a study by the European Central Bank (ECB), as much as 30% to 50% of the total value of euro banknotes in circulation is held by people outside the euro area. Individual savings account for a large part of euro holdings abroad – also in Central, Eastern and South-eastern Europe (CESEE). In 2002, the euro largely replaced the Deutsche mark, US dollar and Austrian schilling as a safe and trusted store of value in CESEE. In the region, people had been using foreign currency in addition to the local currencies for a long time, given that, in the 1990s, currency crises, banking crises or hyperinflation had destroyed their trust in the local currencies.

Yet, even after the economic systems had stabilized, rebuilding trust took time. So, why do people in CESEE continue to save in euro? What does this imply for the effectiveness of national monetary policy or for financial stability? The OeNB started in 1997 to seek answers to these questions by commissioning representative surveys of individuals in CESEE. In this study, we summarize the findings from these surveys of the past two decades and analyses that drew on the survey data. This allows us to shed light on the use of euro cash in CESEE from 2002 to the end of 2021. In Southeastern Europe, euro cash is mostly held for saving purposes. People in Poland, Czechia and Hungary mainly hold euro cash for traveling to the euro area. In most CESEE countries, the euro is only rarely used for payments, which is why we focus on the role of euro cash for saving purposes.

Holding euro cash as a store of value is still widespread in Albania, Croatia, North Macedonia and Serbia. At a median amount of some EUR 600, Croatia reports the highest amount, followed by Romania and Serbia, with around EUR 450 each. Since 2007–08, the share of euro cash in total currency in circulation has decreased visibly in the ten CESEE countries under review. Nevertheless in 2020–21, about as much euro cash as local currency was reportedly circulating in both North Macedonia and Serbia. In Central and Eastern Europe, by contrast, the euro's share had already dropped below 10% in 2007–08. At the individual level, euro cash continues to play an important role in Southeastern Europe – especially for the relatively large group of individuals with small savings. Even among the relatively small group of banked savers in Southeastern Europe, between 27% and 48% of survey respondents on average said that they hold more than half of their savings in cash – and mostly in euro.

We found that the demand for euro cash in CESEE is still mainly driven by (1) a lack of credibility of the long-term stability of the local currency, (2) network effects, i.e. the use of euro cash is widespread in the country, and (3) a lack of trust in the stability of the banking system. We therefore assume that, also in the foreseeable future, euro cash will continue to play a role as a safe haven asset in CESEE.

# Nontechnical summaries in German

## Vergangene und zukünftige Entwicklung des Euro-Bargelds in Österreich – Beständigkeit in Zeiten technologischen Wandels und wirtschaftlicher Krisen

***Anton Schautzer, Helmut Stix***

In diesem Artikel wird der Frage nachgegangen, wie sich die Nachfrage nach und die Nutzung von Bargeld in Österreich seit der Euro-Bargeldeinführung im Jänner 2002 entwickelt hat und welche zukünftige Entwicklung erwartet werden kann.

Angesichts der enormen technologischen Innovationen ist es nicht verwunderlich, dass die Verwendung von Bargeld für Zahlungen in den letzten 20 Jahren gesunken ist. Während im Jahr 2000 noch 93 % aller Zahlungstransaktionen bar durchgeführt wurden, waren es 2020 etwa 63 %. Dennoch überwiegen Barzahlungen in Österreich nach wie vor, auch wertmäßig betrachtet.

Bei der Nachfrage nach Bargeld sieht es anders aus: Der umlaufende Bargeldbetrag ist im Euroraum in den letzten 20 Jahren deutlich gestiegen – hautsächlich wegen der zunehmenden Bargeldhortung und Auslandsnachfrage. Schätzungen zufolge wurde in Österreich zuletzt mehr Bargeld gehalten als vor 20 Jahren. Diese Entwicklung spiegelt die Bedeutung von Bargeld in Krisenzeiten wider. Die Finanzkrise 2007/2008 und die COVID-19-Pandemie haben gezeigt, dass Bargeld als sicherer Hafen angesehen wird. Zudem dürfte sich die Bargeldnachfrage auch durch das über längere Zeit sehr niedrige Zinsniveau erhöht haben.

Im internationalen Vergleich zählt Österreich zu den bargeldaffinen Staaten. Allerdings gibt es im Euroraum etliche andere Staaten mit einer vergleichsweisen Bargeldverwendung. Doch hinkt Österreich jenen Ländern hinterher, die deutlich weniger Bargeld benutzen? Die Autoren sagen nein. Die Verwendung von Bargeld hängt von vielen verschiedenen Faktoren ab. Umfragedaten zeigen, dass die Österreicherinnen und Österreicher Bargeld wegen seiner Eigenschaften schätzen und verwenden – es ist und bleibt ein einfach zu verwendendes, günstiges, sicheres und inklusives Zahlungs- und Wertaufbewahrungsmittel. Aus diesem Grund liegt es im öffentlichen Interesse, für eine weiterhin starke Rolle des Bargeldes einzutreten. Das bedeutet, dass für Konsumentinnen und Konsumenten ein adäquater Zugang zu Bargeld beibehalten werden muss und dass für den Handel entsprechende Möglichkeiten für Bargeldeinzahlungen benötigt werden. Zudem muss gewährleistet werden, dass Bargeld nach wie vor universell akzeptiert wird und dass der Bargeldkreislauf kosteneffizient gestaltet wird.

Aufgrund der fortschreitenden Digitalisierung ist in den nächsten Jahren mit einer abnehmenden Bargeldverwendung zu rechnen. Bei manchen Bevölkerungsgruppen wird die Bargeldnutzung deutlich sinken, andere werden weiterhin vorwiegend bar bezahlen. Der zu erwartende rückläufige Trend dürfte jedoch nichts daran ändern, dass Bargeld insgesamt ein sehr wichtiges Zahlungsmittel bleiben wird.

## Zahlungsverkehr im Wandel: von SEPA zum digitalen Euro

***Johannes Asel, Simone Mingione, Petia Niederlaender, Georg Nitsche***

20 Jahre nach der Einführung von Euro-Bargeld in zunächst 12 EU-Staaten untersuchen wir die steigende Bedeutung des unbaren Zahlungsverkehrs in Österreich bzw. im Euroraum.

Insbesondere thematisieren wir Auswirkungen von Innovationen auf den unbaren Zahlungsverkehr, die Rolle des unbaren Zahlungsverkehrs in der Europäischen Union, die Rolle von europäischen Unternehmen im aktuellen Marktumfeld, die Auswirkungen der COVID-19-Pandemie auf das Zahlungsverhalten und mögliche Szenarien für die Zukunft. Wir beschreiben hierzu zahlungsverkehrsrelevante Trends und regulatorische Entwicklungen. Mit einem Überblick über aktuelle empirische Studien unterstreichen wir weiters die große Bedeutung des unbaren Zahlungsverkehrs für die Wettbewerbsfähigkeit und das Wirtschaftswachstum von Volkswirtschaften im Allgemeinen.

Im Hinblick auf aktuelle Veränderungen im Zahlungsverhalten in Österreich und im Euroraum wird anhand von Szenarien dargelegt, wie die Entwicklung des Zahlungsverkehrs im Euroraum für die nächsten 15 bis 20 Jahre aussehen könnte. Letztlich geht es darum, entsprechende Implikationen für Entscheidungsträger abzuleiten. Neben einem Basisszenario, das von einer zunehmenden Bedeutung des elektronischen Zahlungsverkehrs ausgeht, wird auch ein Alternativszenario mit einer deutlich negativeren Entwicklung skizziert.

Ein Anhang bietet den Leserinnen und Lesern abschließend zusätzliche wichtige Hintergrundinfos zu relevanten Charakteristika des unbaren Zahlungsverkehrs, im Besonderen zur Wertschöpfungskette im elektronischen Kundenzahlungsverkehr. Eine Reihe von Branchen- und Marktklassifizierungen und Angaben zu Marktentwicklungen runden das Bild ab.

## Wieviel „Bargeld“ steckt in Krypto?

***Beat Weber***

Bitcoin wird in seinem ursprünglichen Konzeptpapier aus dem Jahr 2008 als elektronisches Bargeld („electronic cash“) bezeichnet. Bitcoins existieren nur in digitaler Form und werden von Computernetzwerken erzeugt. In dem Papier wird auch behauptet, dass Privatpersonen Bitcoins untereinander ohne zwischengeschaltete Mittler – also ohne Intermediation bzw. Intermediäre – nutzen können („peer-to-peer“). Außerdem seien Bitcoins vor Inflation sicher („inflation-free“), weil ihre Stückzahl auf 21 Millionen begrenzt ist.

Ein neues EU-Regelwerk für den Krypto-Sektor spricht hingegen von Kryptowerten – auf Englisch „crypto assets“. Bitcoin hat mittlerweile einige Tausend Nachahmer gefunden. Krypto leitet sich von dem Wort „Kryptografie“ ab, mit dem in der Informatik die Entwicklung und Bewertung von Verfahren zur Verschlüsselung geheimer Daten bezeichnet wird. Kryptografie spielt in der Konstruktion von Bitcoin und ähnlichen Projekten eine wichtige Rolle.

Der Umtauschkurs von Bitcoin in Euro-Bargeld schwankt sehr stark. Wie steht es also um das Verhältnis von Bitcoin und Bargeld? Eine genauere Analyse zeigt, dass die Begriffe „cash“ (Bargeld), „peer-to-peer“ (von Hand zu Hand, also von Privatperson zu Privatperson und damit ohne Intermediär) und „inflation“ im Bitcoin-Konzeptpapier – und von vielen Nutzerinnen und Nutzern von Kryptowerten – anders als allgemein üblich gebraucht werden. Das kann zu Missverständnissen führen.

Bitcoin hat einige Gemeinsamkeiten mit einer Währung im üblichen Sinn: (1) Es weist eine eigene Werteinheit auf, (2) Beträge in dieser Werteinheit können von Menschen besessen und übertragen werden und (3) auf Märkten gegen andere Währungen gehandelt werden. Bezogen auf den wirtschaftlichen Wert besteht allerdings ein wesentlicher Unterschied zwischen Bitcoins und Bargeld (Münzen, Scheinen) sowie elektronischen Bankguthaben in offizieller Währung. Hinter offiziellen Währungen stehen offizielle verantwortliche Stellen, die den Wert dieser Währungen stabil halten und für seine allgemeine Akzeptanz sorgen. Auf den vor allem für seine Anonymität gepriesenen Bitcoin passt der Begriff „Bargeld“ daher nur sehr eingeschränkt.

Ein weiterer fundamentaler Unterschied ist, dass offizielle Währungen in einem bestimmten Wirtschaftsraum Geld darstellen. Dieses Geld besitzt damit Kaufkraft und kann zum Erwerb von Gütern und Leistungen verwendet werden. Nimmt die Kaufkraft einer Währung über die Zeit ab – bekommt man also weniger Güter oder Leistungen für sein Geld, spricht man von „Inflation“. Im Bitcoin-Konzeptpapier wird der Begriff „Inflation“ hingegen als Zuwachs der Menge an Bitcoins definiert. Ohne Informationen über eine Wirtschaft, die Bitcoin in einer bestimmten vorhersagbaren Art und Weise als Geld verwendet, sagt die Mengenentwicklung aber nichts über die Wertentwicklung aus.

Der Begriff „peer-to-peer“ ist auf Bargeld in offizieller Währung insofern anwendbar, als es zwischen Personen von Hand zu Hand ohne zusätzliche Hilfsmittel übertragen werden kann. Damit Bitcoins zwischen zwei Personen sicher übertragen werden können, müssen jedoch Dritte die Übertragung überprüfen. Solche Intermediäre führen im freiwilligen Wettbewerb Fälschungskontrollen durch und verbuchen die Übertragung in einem Bitcoin-Register, der „Blockchain“. In der Praxis sind zahlreiche Intermediäre im Krypto-Sektor tätig und bieten zum Teil vielfach genutzte Leistungen an.

Aus der Analyse der drei genannten zentralen Begriffe lässt sich folgendes Fazit ziehen: Wann immer bestehende Begriffe aus dem Geldwesen auf Bitcoin und ähnliche Kryptoprojekte angewendet werden, sollten diese wichtigen Unterschiede zu offiziellen Währungen nicht übersehen werden.

## Digitaler Euro und die Zukunft des Bargelds

***Martin Summer, Hannes Hermanky***

Soll die Europäische Zentralbank (EZB) in Zukunft einen digitalen Euro als Zahlungsmittel für alle Menschen im Euroraum anbieten? Diese Frage wird nun immer öfter nicht nur in Expertenkreisen, sondern auch in der breiteren Öffentlichkeit diskutiert. Eine große Rolle in dieser Diskussion spielt die Befürchtung, dass es sich bei einem solchen Schritt um eine Initiative zur Abschaffung des Bargelds handeln könnte. Tatsächlich geht es aber vielmehr darum, wie sich Zentralbanken vor dem Hintergrund der digitalen Transformation im Geld- und Finanzwesen strategisch positionieren sollen.

Zu Beginn bieten wir einen Überblick über die institutionelle Architektur und die Funktionsweise des aktuellen Geldsystems. Dieses System besteht aus zwei Stufen: (1) Die Zentralbank an der Spitze gibt im Auftrag des Staats Bargeld aus und stellt den Geschäftsbanken Konten zur Verfügung. Sie stellt durch ihre Geldpolitik sicher, dass das Geld als gesetzliches Zahlungsmittel seinen Wert behält. Hier spricht man von Zentralbankgeld. (2) Die Geschäftsbanken schaffen

privates Geld, indem sie Unternehmen und Privatpersonen Kredite gewähren. Außerdem besorgen sich Geschäftsbanken gegen Sicherheiten unbares Zentralbankgeld von der Zentralbank. Unternehmen und Privatpersonen können entweder bar mit Zentralbankgeld bezahlen oder über ihre Banken und Bankkonten unbare, sprich digitale Zahlungen tätigen.
Als Nächstes diskutieren wir die aktuelle Literatur und Stellungnahmen der wichtigsten Institutionen, wie etwa der EZB und der Bank für Internationalen Zahlungsausgleich (BIZ), zu digitalem Zentralbankgeld. Insgesamt spielt folgende strategische Überlegung eine zentrale Rolle: Wie können sich Zentralbanken in einer zunehmend digitalen Zukunft gegenüber neuen, privaten Anbietern von Zahlungsmitteln, vor allem gegenüber international tätigen, großen Internetplattformen, positionieren? Eine untergeordnete Rolle spielen Überlegungen, durch einen solchen Schritt auch den Preiswettbewerb im oligopolistischen Markt für Kartenzahlungen – d. h. wenige Anbieter stehen vielen, relativ kleinen Nachfragern gegenüber – zu verbessern. Und auch die Sicherung des universellen Zugangs zu Zentralbankgeld in einer zunehmend digitalen Zukunft ist ein Argument. Die Abschaffung von Bargeld als einer vermeintlich überholten Zahlungstechnologie wird in den untersuchten Dokumenten kein einziges Mal angeführt. Ausdrücklich angeführt wird hingegen die Absicht, auch in Zukunft die Bargeldversorgung sicherzustellen.
Die Grundsatzdiskussion, ob digitales Geld für alle von der Zentralbank angeboten werden soll oder nicht, ist zwangsläufig sehr abstrakt. Wir gehen deshalb auch darauf ein, wie ein digitaler Euro in technologischer wie auch institutioneller Sicht konkret ausgestaltet werden könnte: (1) Als Kontenmodell, wie bei den jetzt gebräuchlichen und bekannten Bankkonten, (2) als digitales Inhaberinstrument, ähnlich wie Bargeld, nur in digitaler Form oder (3) mit einer Technologie, die Anleihen bei technologischen Komponenten von Bitcoin und ähnlichen Modellen nehmen würde. Jede dieser möglichen Umsetzungsvarianten hat Vor- und Nachteile; wir konzentrieren uns insbesondere auf die Themen Transaktionsdatenschutz, Geldpolitik- und Finanzmarktstabilität sowie Sicherheit.
Abschließend erklären wir, weshalb Bargeld unabhängig von einem digitalen Euro auch in Zukunft wichtig bleibt. Bargeld besitzt aus Sicht der Nutzerinnen und Nutzer praktische Eigenschaften, die nicht vollständig digital repliziert werden können. Bargeld hat eine zentrale und wichtige rechtliche Stellung im Zahlungssystem, die nicht ohne Weiteres und folgenlos geändert werden kann. Der Zahlungsverkehr profitiert außerdem von der Verfügbarkeit eines Zahlungsinstruments wie Bargeld, das nicht von Internetverfügbarkeit, funktionierenden Endgeräten oder einer permanenten Energieversorgung abhängig ist.

## EU-weite Obergrenzen für Barzahlungen – Für und Wider

***Matthias Schroth, Mara Vyborny, Lisa Ziskovsky***

Vor dem Hintergrund eines Vorschlags der Europäischen Kommission aus dem Jahr 2021, eine EU-weite Obergrenze für Barzahlungen in der Höhe von 10.000 EUR einzuführen, untersuchen wir, was für und gegen eine Deckelung von Barzahlungen spricht. Dabei berücksichtigen wir auch die aktuelle Rechtslage: In einigen EU-Mitgliedstaaten gelten nämlich bereits nationale Beschränkungen für Barzahlungen. Weiters gehen wir auf die essenziellen Funktionen von Bargeld als gesetzliches Zahlungsmittel ein.
Die derzeitigen nationalen Barzahlungsobergrenzen haben bisher wenig Wirkung gezeigt – so lautet das Fazit unserer Analyse. Es ist daher zu hinterfragen, ob eine EU-weit einheitliche Obergrenze, wie von der Europäischen Kommission beabsichtigt, Geldwäsche und illegale Aktivitäten wie etwa Terrorismusfinanzierung wirksam bekämpfen kann. Das Problem von Wettbewerbsverzerrungen im Binnenmarkt wird durch eine einheitliche Obergrenze für Barzahlungen wohl nicht gelöst. Schließlich sollen laut dem Vorschlag der Europäischen Kommission die unterschiedlichen nationalen Barzahlungsobergrenzen weiterhin bestehen dürfen.
Was häufig übersehen wird: Bargeld ist das einzige gesetzliche Zahlungsmittel, das physisch verfügbar ist. Es erfüllt unverzichtbare wirtschaftliche Funktionen – sowohl im Zahlungsverkehr als auch als Wertanlage. Bargeld steht darüber hinaus für finanzielle Inklusion und schützt die Privatsphäre. Die COVID-19-Pandemie hat deutlich gemacht, dass die Menschen insbesondere in Krisenzeiten Bargeld vertrauen und schätzen.
Angesichts dieser Argumente darf Bargeld nicht weiter verdrängt werden. Gesetzliche Beschränkungen von Barzahlungen würden dem Vorschub leisten. Verbraucherinnen und Verbraucher sollen stets die Möglichkeit haben, ihr Zahlungsmittel frei zu wählen.

## Die Rolle des Euro-Bargelds als Wertaufbewahrungsmittel in CESEE

***Marc Bittner, Thomas Scheiber***

Seit dem Beginn der Ausgabe von Euro-Bargeld im Jahr 2002 zirkulieren Euro-Banknoten und -Münzen nicht nur im Euroraum. Der Umlauf von Euro-Bargeld in anderen Ländern ist sogar im Steigen begriffen. Laut einer EZB-Studie aus dem Jahr 2021 entfallen nicht weniger als 30 % bis 50 % des Euro-Bargeldumlaufs nicht auf den Euroraum. Einen großen Teil davon dürften wohl Privatpersonen zu Sparzwecken halten – so auch in Zentral-, Ost- und Südosteuropa (CESEE). Der Euro löste dort 2002 zum Gutteil die Deutsche Mark, den US-Dollar und den österreichischen Schilling als sicheres und vertrauenswürdiges Wertaufbewahrungsmittel ab. Die Verwendung von Fremdwährungen parallel zur heimischen Währung hat in CESEE eine lange Geschichte, da Währungskrisen, Bankenkrisen oder Hyperinflation das Vertrauen der Bevölkerung in die jeweilige Landeswährung in den 1990er-Jahren zerstört hatten.

Doch auch als sich die Wirtschaftssysteme nach den Krisenjahren wieder stabilisiert hatten, kehrte das verlorene Vertrauen nur zögerlich zurück. Warum sparen Menschen in CESEE weiterhin in Euro? Welche Auswirkungen hat das auf die Wirksamkeit der nationalen Geldpolitik oder auf die Finanzmarktstabilität? Seit 1997 untersucht die OeNB diese Fragen und lässt in CESEE repräsentative Umfragen von Privatpersonen durchführen. Die vorliegende Studie fasst die Erkenntnisse aus den Umfragen der letzten 20 Jahre und damit zusammenhängenden Analysen zusammen und beleuchtet die Entwicklung der Euro-Bargeldhaltung in CESEE seit dem Jahr 2002. Während in Südosteuropa Euro-Bargeld hauptsächlich zu Sparzwecken gehalten wird, wird es in Polen, Tschechien und Ungarn vor allem für Zahlungen auf Reisen in den Euroraum verwendet. Da in den meisten CESEE-Ländern nur mehr selten in Euro bezahlt wird, liegt der Fokus der Studie auf der Euro-Bargeldhaltung zu Sparzwecken.

Sparen in Euro-Bargeld ist in Albanien, Kroatien, Nordmazedonien und Serbien noch immer weitverbreitet. Die höchsten Medianbeträge weisen hier Kroatien mit rund 600 EUR sowie Rumänien und Serbien mit jeweils rund 450 EUR auf. Der Anteil des Euro am gesamten Bargeldumlauf in den untersuchten zehn CESEE-Ländern ist seit 2007–08 in Südosteuropa deutlich zurückgegangen. Trotzdem dürften 2020–21 in Nordmazedonien und Serbien in etwa gleich viel Euro-Bargeld wie Landeswährung im Umlauf gewesen sein. In Zentral- und Osteuropa jedoch liegt der Anteil des Euro schon seit 2007–08 unter 10 %. Auf individueller Ebene spielt Euro-Bargeld in Südosteuropa weiterhin eine bedeutsame Rolle – insbesondere für den relativ großen Personenkreis mit geringen Ersparnissen. Aber auch in der relativ kleinen Gruppe von Personen, die sowohl Ersparnisse als auch ein Girokonto oder Sparbuch besitzen, geben in Südosteuropa im Schnitt zwischen 27 % und 48 % der Befragten an, dass sie mehr als die Hälfte ihrer Ersparnisse in bar halten (zumeist Euro-Bargeld).

Die Nachfrage nach Euro-Bargeld dürfte nach wie vor von folgenden Faktoren abhängen: (1) Zweifeln an der langfristigen Stabilität der Landeswährung, (2) dem Umstand, dass Euro-Bargeldnutzung im Land als üblich gilt, und (3) mangelndem Vertrauen in die Stabilität des Bankensystems. Wir gehen daher davon aus, dass Euro-Bargeld in CESEE auch in absehbarer Zukunft eine wichtige Rolle als sicheres Wertaufbewahrungsmittel spielen wird.

# Analyses

# Past and future development of euro cash in Austria – resilience in light of technological change and economic crises

*Anton Schautzer, Helmut Stix*[1]
*Refereed by: Kim P. Huynh, Bank of Canada*

*In this analysis, we discuss how the demand for and the use of cash has changed in Austria since euro banknotes and coins were introduced in January 2002. Cash use for payments has decreased over the past 20 years, which is not surprising given the enormous technological advances. Despite this decline, cash remains the prevalent means of payment at the point of sale (POS) in Austria. Somewhat contrary to the downward trend in the use of cash for payments, the overall circulation of euro cash has increased over the past 20 years. In international comparison, Austrians are among the more cash-affine Europeans; however, there are several other European countries with comparable levels of cash use. We examine how cash use has developed among different sociodemographic groups and how Austrians view cash and noncash payment means.*

*With regard to the likely development in the near future, we discuss the critical factors which will contribute to a reduction of cash use and those which will contribute to maintaining a strong role of cash. We argue that cash has important features that are of value for society, such that it should be in the public's interest to safeguard cash as a key means of payment. This requires maintaining adequate access to cash for consumers and to cash deposit facilities for merchants. Also, paying in cash at any POS should remain possible, and measures should be taken to ensure cost efficiency along the supply chain of cash.*

*JEL classification: E41, E50, D10, G11*
*Keywords: cash demand, euro currency in circulation, hoarding, payments, financial innovation*

On the occasion of the 20th anniversary of the introduction of euro cash, we analyze how the importance of cash has changed and how it might change in the coming years. Any discussion of the development of cash over the past 20 years as well as deliberations about its future need to account for two major developments:

- Technological innovations have increased convenience of electronic payments at a breath-taking speed: Smart phones are now ubiquitous[2], and the technical capabilities of these devices make them ideal for deploying payment solutions. The rollout of the NFC technology, on cards and on mobile devices, has been considered a game changer in retail payments with the potential of challenging the dominance of cash for small-value transactions.
- However, those innovations were superseded by a series of economic shocks. First, the global financial crisis of 2007/2008, which has eroded trust in banks and in the financial system; second, the sovereign debt crisis in the European

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[2] *©Apple Inc.'s iPhone was presented in 2007.*

Economic and Monetary Union (EMU) of 2012; third, a regime of low interest rates in developed economies, in general, and in the EMU, in particular; fourth, the outbreak of the COVID-19 pandemic and lately the war in the Ukraine. All these shocks have had repercussions on the demand and use of cash – e.g. cash demand is higher in times of uncertainty and when interest rates are low – and they might have repercussions on its future.

Where did we start 20 years ago and where do we stand now with respect to Austrians' demand for and use of cash? In section 1, we present evidence about changes in the use of cash for payments and for nontransactional demand (i.e. hoarding). The main finding is that, overall, euro cash circulation has increased considerably over the past 20 years like it has done in many other countries. This development is in line with the fact that cash demand increases during times of heightened economic uncertainty and low interest rates, as it is a highly liquid safe asset that provides stability (with respect to the nominal value).

Detrimental to overall demand, cash use for payments has declined markedly mainly because of an increased take-up of financial innovations. As a case in point, only 66% of Austrian residents possessed a debit card in the first quarter of 2002. Currently, debit card ownership is close to 100%. Back in 2002, 87% of Austrian survey respondents said that they had not shopped online yet. In the meantime, the respective share has plummeted to only 27% in 2020. In addition to these developments, the COVID-19 pandemic has had an adverse effect on the use of cash. However, despite these changes, cash continues to be the most important payment instrument in Austria.

But is Austria's case an exception? An international comparison shows that it is not; however, among the highly developed economies, it is one of the more cash-intensive ones.

In section 2, we take a closer look at how Austrians use and see cash, and how their behavior and opinion regarding cash have changed over time. A key finding of this analysis is a growing gap within society. 20 years ago, cash was used for payments relatively homogenously across sociodemographic groups. However, the ubiquitous availability of electronic payments has had a differential impact on society: while a growing share of the population has been taking up cashless payments, a considerable share of the population is still preferring cash. We expect this heterogeneity to further proliferate in the near future. This begs the question whether less and less Austrians will be using cash for payments.

In section 3, we discuss some of the main pros and cons of a declining cash use. After evaluating the arguments, we formulate what we expect for the next 10 years. A lot depends on how the payment infrastructure and hence relative costs of payment instruments will develop. Whether cash will continue to be easily accessible is central for the future development of cash as well. Moreover, there are unknowns (new technologies, economic and political instabilities) that need to be considered. Overall, we argue that there is a strong case for economic policy to maintain a level playing field across payment instruments and that consumers will still have the freedom of choosing between cash and different payment instruments. Section 4 concludes.

# 1 Cash developments over the past 20 years

## 1.1 Strong increase of euro currency in circulation

At the end of 2021, the total value of euro banknotes circulating outside the vaults of central banks was at EUR 1,544 billion. This compares with an overall value of EUR 358 billion at the end of 2002, the year of the euro introduction. At the end of 2004, euro banknotes in circulation amounted to EUR 508 billion, which probably serves as a better comparison due to cash changeover effects.

Chart 1 relates the development of currency in circulation to income (i.e. nominal gross domestic product), accounting for the fact that prices and income have also increased over the past 20 years. The resulting time series may be a reflection of the public's desire to hold cash, given that they are free to choose cash over bank deposits (or other financial assets) and that central banks accommodate any demand for banknotes.

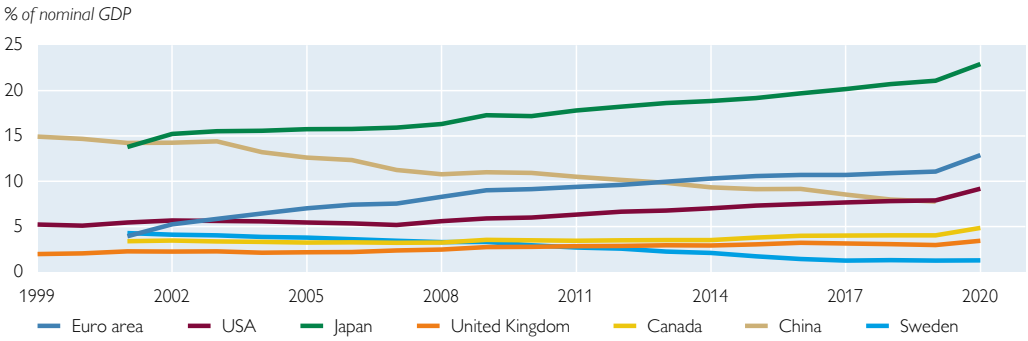
In the euro area, the currency (to nominal GDP) ratio increased from about 4% at the end of 2001 to about 13% at the end of 2021 – meaning it tripled. Its development in the early years of euro cash was influenced by the cash changeover in 2002 and the growing role of the euro as an international currency. As argued by Jobst and Stix (2017), the currency ratio may have risen until 2006 to catch up with the value that the German mark used to have, with the euro taking over the role of the German mark as an international currency.

Despite this peculiarity of the euro area time series, the underlying trend increase can also be observed in other large economies like the United States or Japan (see chart 1). In addition, in many other economies the currency ratio has remained stable or has grown slightly after 2008, for instance in Great Britain or Canada.[3] As shown by Jobst and Stix (2017), only a minority of economies has a downward trending currency ratio, e.g. Sweden, Norway or China.

The takeaway from this analysis is that cash is still being heavily demanded, not only in the euro area but also in many other economies. As discussed by Jobst and Stix (2017), this is related to (i) very low interest rates after the global economic and financial crisis, (ii) increased domestic hoarding, presumably to some extent

Chart 1

**Currency in circulation in various economies**




*Source: IMF, ECB, FRED, authors' calculations.*

[3] *The strong increase in 2020 is mainly due to the sharp drop of GDP in course of the COVID-19 pandemic.*

as a consequence of increased economic uncertainty and (iii) increased foreign demand for euro cash (see also Rösl and Seitz, 2021).[4]

The relative importance of the different uses of cash – most importantly for domestic transactions, for domestic hoarding or for nondomestic circulation – can only be assessed indirectly, though, given the anonymity of cash. According to Lalouette et al. (2021), between 30% and 50% of the value of euro banknotes was circulating abroad in 2019. Lalouette and Esselink (2018) as well as Zamora-Pérez (2021) estimate that roughly 20% of the total value in circulation is used for day-to-day transactions within the euro area and that about 7% are held in bank vaults. The remaining share is either hoarded domestically or, to a much lesser extent, lost. For Australia, Finlay et al. (2018) estimate that about 7.5% of banknotes are lost. All these estimates suggest that about 20% to 40% could have been held as a store of value within the euro area. However, these estimates refer to pre-pandemic times, and it is not clear how the different ways of using cash have since changed.

Chart 2 visualizes the relative share of each denomination in the total value of euro banknotes in circulation in the euro area over time (with the relative shares summing to 100% for each observation). The relative demand for each denomination has not been constant over time. In particular, the demand for EUR 50 banknotes has increased considerably (from 33% in 2004 to 44% of total banknotes in circulation at the end of 2021). The relative importance of the EUR 500 bill, which is assumed to be the banknote that is used most for hoarding, has been decreasing after its peak in 2009 (shortly after the global economic and financial crisis). The ECB Governing Council's decision from May 4, 2016, to discontinue production of the EUR 500 banknote has induced a decrease of its circulation.[5] In turn, the relative importance of EUR 50, EUR 100 and EUR 200 banknotes has increased.

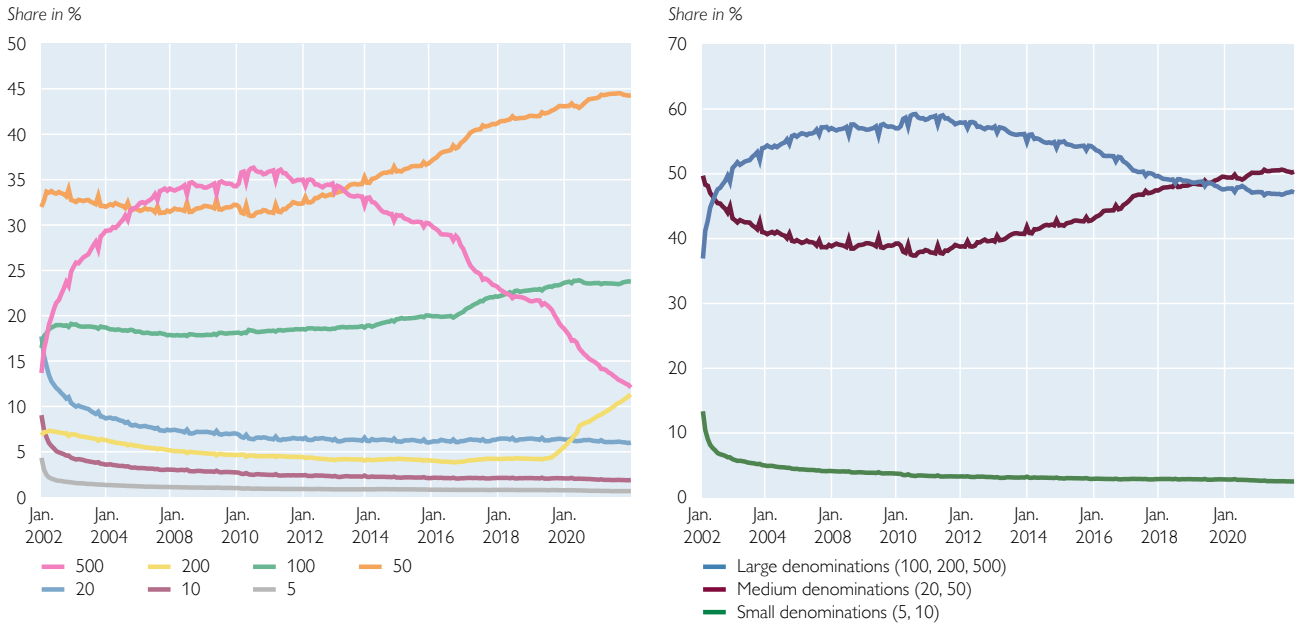
The right panel of chart 2 illustrates the relative share of banknotes grouped by small, medium and large denominations. It shows that the share of small denominations declined from 5% in December 2004 to about 3% in 2021 – these banknotes are mostly used for payments, and their decline likely reflects the increased use of cashless payments. Furthermore, the share of medium denomination banknotes has considerably increased after 2008 and is now higher than the share of high denomination banknotes. We presume that EUR 20 banknotes are mostly used for transactions and that EUR 50 banknotes are both used for transactions and for hoarding.

[4] *Typically, a distinction is made between transactional demand and nontransactional demand for cash. The latter arises from various sources, e.g. foreign demand, hoarding, precautionary demand, demand for shadow economy transactions, demand due to uncertainty, etc. As these two concepts overlap, we prefer to distinguish between domestic transactional demand, foreign demand and domestic hoarding (with hoarding being the residual demand that does not arise from the desire to conduct transactions and that does not arise from abroad). However, this does not solve the problem that the separation between transaction demand and domestic hoarding is difficult conceptually, e.g. if people save in cash for later purchases.*

[5] *The issuance of the EUR 500 banknote was stopped across the euro area at the end of January 2019 with the exception of Germany and Austria, where such bills were issued until the end of April 2019. The EUR 500 banknote remains legal tender, though, and can be exchanged at cash desks of Eurosystem central banks for an unlimited period of time. The decision to discontinue the production and issuance of the EUR 500 banknotes was based on the assumption that they are (also) used for illicit activities (e.g. money laundering, terrorist financing). However, it is difficult to substantiate this assumption or the effectiveness of this measure against illicit activities. See Rogoff (2016) for arguments in favor of the discontinuance and McAndrews (2020) for counter-arguments.*

Chart 2

**Share of denominations in the total value of euro banknotes in circulation**



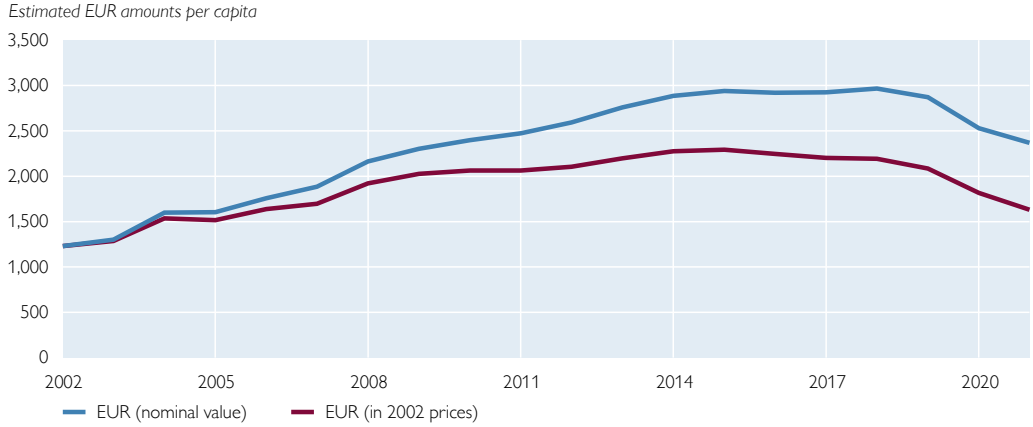

*Source: ECB.*

*Note: This chart shows the relative share of each banknote denomination in the overall value of banknotes in circulation in the euro area. These shares sum to 100% for each observation.*

What about cash circulation in Austria? With euro cash moving freely within the euro area, it is no longer possible to measure the amount of euro cash that is circulating in Austria. Instead, the Oesterreichische Nationalbank (OeNB) computes an approximate estimate of the amount of euro cash that is circulating within Austria, using banknote shipment data and return frequencies of banknote

Chart 3

**Euro currency in circulation in Austria**




*Source: OeNB, Statistics Austria, authors' calculations.*

*Note: This chart shows estimated amounts of euro currency in circulation in Austria excluding cash held in bank vaults. Population of the year 2021 is based on a forecast.*

denominations (see chart 3).[6] Despite the cautious interpretation of the resulting estimates, two observations are evident: First, demand for euro cash went up in Austria as well, both in nominal and in real terms until the end of 2018, and declined somewhat thereafter. Second, the absolute amounts circulating per capita in Austria are relatively high. At the end of 2021, the amounts held by consumers, merchants and companies totaled about EUR 2,400 per Austrian resident. This compares with a euro area average of about EUR 2,100 (EUR 4,200 minus an assumed foreign circulation of 50%).

The reasons for the decline in cash circulation in Austria, in particular during 2020 and 2021, are not entirely clear. We suspect that the decrease is partly related to the pandemic-induced sharp drop in tourist visits to Austria. In 2021, it could also be linked to the increase in inflation rates. Furthermore, we presume that the population and the companies were de-hoarding due to short-time work, unemployment or loss of sales. The "normalization" after the COVID-19 pandemic will show whether the drop was related to the pandemic or whether it reflects a more persistent development.

Box 1

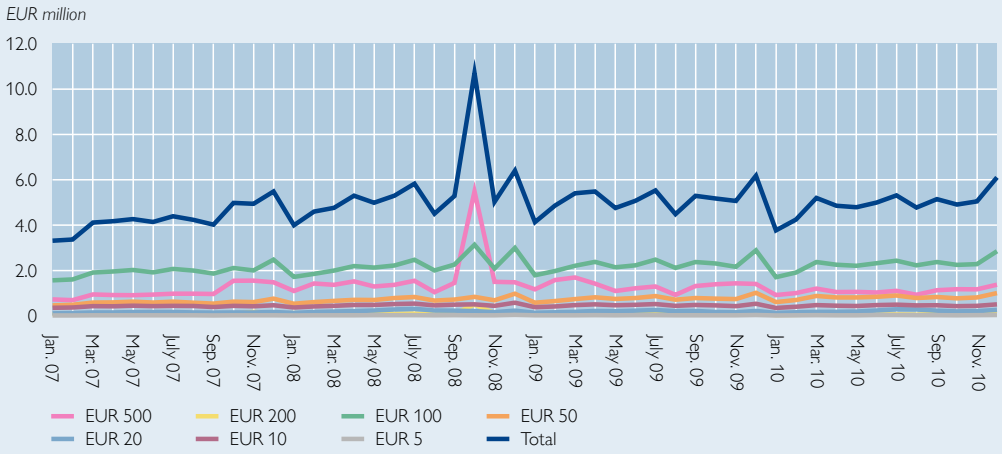
### Euro cash: a safe haven asset in uncertain times

*Cash is the only form of central bank money available to the public. While the nominal return on cash is zero, it offers immediate liquidity and stability with regard to its nominal value. The mere feature of cash being a tangible asset which remains in the possession of the owner and which does not involve a third party (e.g. a bank) might also provide a feeling of security. This is particularly true in times of crises when asset prices fluctuate considerably or when trust in banks is low.*

*During the last 20 years, we have faced several situations of turmoil in Europe, e.g. the global financial crisis (2007/2008), the EU sovereign debt crisis (2012) and, most recently, the COVID-19 pandemic. Following the hypothesis that cash demand grows during crisis situations, the impact should be visible in the books of the central banks. We exemplify this by showing*

Chart B1 1

**Gross issuance of euro banknotes in Austria**




Source: OeNB.

[6] *Cross-border flows (e.g. via banknote wholesale traders) are largely excluded.*

*the temporal development of gross issuance figures, i.e. the value of banknotes brought into circulation in Austria (consisting of the ordinary issuance for transaction and store of value purposes as well as for the replacement of cash unfit for circulation).*

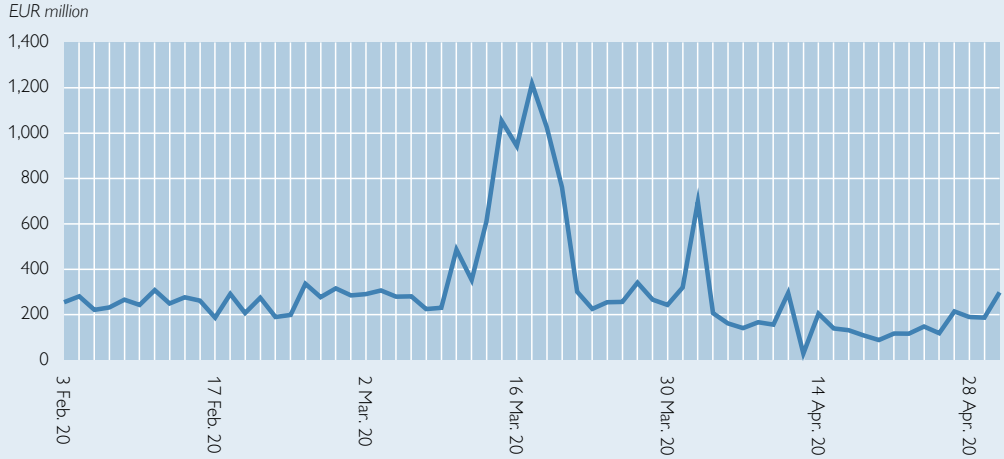
*When looking at the banknote gross issuance in Austria between January 2007 and December 2010, the figures show a striking increase of the issuance of the EUR 500 (pink line) and to some extent also of the EUR 100 (green line) banknotes. This rise was limited to September 2008 (bankruptcy of Lehman Brothers), when financial markets became extremely volatile and trust in banks eroded (Knell and Stix, 2015). In turn, asset holders switched to a low risk, stable and highly liquid asset: cash. In ordinary circumstances, gross issuance of the EUR 500 banknote in Austria was oscillating around EUR 1.5 billion per month. In September 2008, it peaked, reaching almost EUR 5.5 billion, which was four times the usual level at that time.*

*Another example of cash being the payment instrument of choice during times of crises is the beginning of the COVID-19-pandemic. Between January and the first half of March 2020, the OeNB issued on average euro banknotes with a total face value of EUR 200 to 300 million per day. Furthermore, right after the announcement of Austria's federal government to impose a lockdown, people responded with excessive demand for essential products like food and care products – as well as for cash: From March 12 to March 18, 2020, issuance increased sharply. On March 17, the OeNB's cash issuance reached more than EUR 1.2 billion, which is five times the usual level.*

Chart B1 2

**Daily banknote issuance in Austria**

**Between February and April 2020**




Source: OeNB.

## 1.2 Cash use for transactions has declined

How has the use of cash for payments changed over the past 20 years? For its anonymity, cash use for payments can only be estimated. One possibility to do so is to conduct payment diary studies, i.e. large scale surveys among Austrian residents in which the participants record all transactions over a one-week period (excluding recurring payments such as rents, insurance premia, etc.). The OeNB has one of the longest histories of consecutive payment diary studies, with the first conducted in 1996 (Mooslechner and Wehinger, 1997). Later studies were conducted in 2000, 2005, 2011, 2016 and 2020/2021 (Mooslechner et al., 2002, 2006 and

2012; Höpperger and Rusu, 2022). In the following, we will compare results from the studies of 2000, 2011 and 2020.[7]

Chart 4 shows the cash share of payments in terms of the number of transactions and in terms of the value of transactions. Transactions refer to point of sale (POS), remote (e.g. internet purchases) and person-to-person (P2P) transactions. For the sake of temporal comparability, we exclude all transactions that were paid via bank transfers in the studies of 2011 and 2020 (the share of these payments is relatively small).

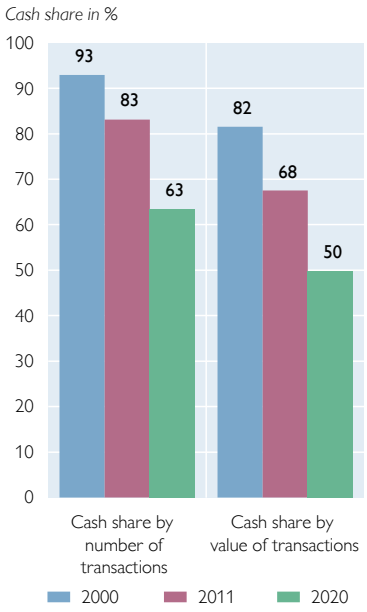
In the year 2000, 93% of all payment transactions were conducted in cash (7% with cards and cheques). This share declined to 63% at the end of 2020. A similar drop can be observed for the value of recorded transactions. In 2020, about half of the value of all payments was conducted in cash.

There are three main takeaways from these results:

- First, cash use has declined significantly. Over the 20 years from 2000 to 2020, the average annual decrease was 1.5 percentage points (pp) per year for the cash share in value terms.
- Second, despite this drop, cash is still of significant importance for everyday payments. In terms of the number of transactions, it is still the most frequently used payment instrument in Austria.
- Third, the decline was not linear, as chart 4 might suggest. In particular, we think that the share of cash payments changed relatively slowly between 2011 and 2019. The COVID-19 pandemic, however, brought about a sudden and significant drop in the use of cash for payments. Box 1 provides an overview of the development from 2019 to 2021.

Chart 4

**Share of cash payments in Austria**




*Source: OeNB payment diary surveys, authors' calculations.*

*Note: Cash shares derived from three Austrian payment diary survey studies. For comparability, bank transfers from the years 2011 and 2020 were excluded. Therefore, the shares might deviate from other publications.*

[7] *For the study in 2016, a different sampling procedure was adopted. Therefore, its results cannot easily be compared with the previous studies. Most survey interviews for the study of 2020/2021 were conducted in fall 2020 and a smaller share in 2021. We will henceforth denote this study as referring to 2020.*

Looking at table 1, two major changes in cash use become evident:

- First, consumers are using payment cards gradually more for smaller purchases. This can be seen in table 1, as the average card payment amount declined from EUR 73 in 2000 to EUR 43 in 2020. In turn, the average amount of cash payment went from EUR 29 in 2000 to EUR 18 in 2020.[8]
- Second, the share of consumers who use payment cards has grown substantially, which becomes apparent when looking at the share of cash-only consumers, i.e. consumers who recorded zero noncash payments in the respective 7-day payment diary study, which decreased from 67% in 2000 to 30% in 2020. In turn, the share of consumers who used noncash payment means for more than half of their transactions increased from 2% to 26%.

The changing demand for noncash payments is also driven by the supply of card accepting payment terminals and vice versa. The number of POS terminals increased from about 40,000 in 2000 to about 134,000 at the end of 2020.[9]

The literature has shown that cash use and cash demand are closely related – a declining share of cash transactions implies that consumers carry less cash in their wallets. We find that the median amount that survey respondents carried with them was EUR 107 in 2011.[10] This value decreased to EUR 81 in 2020. In countries where the cash share of payments is significantly lower than in Austria, e.g. Sweden, Denmark, Canada or Australia, a high share of consumers makes almost all payments by card and carries just small amounts of cash for precautionary reasons. To see whether this behavior is observable in Austria as well, we have computed the share of consumers holding less than EUR 50 in their wallets. This share was 25% in 2011 and increased to 31% in 2020. Thus, holding only small amounts of cash for precautionary reasons is not (yet) a predominant behavior in Austria.

Table 1

**Payment behavior over time**

| | 2000 | 2011 | 2020 |
|---|---|---|---|
| Average cash payment amount (EUR) | 29 | 23 | 18 |
| Average debit card payment amount (EUR) | 73 | 53 | 43 |
| Share of cash-only consumers (%) | 67 | 47 | 30 |
| Share of consumers with more than 50% of noncash transactions (%) | 2 | 7 | 26 |
| Cash holdings in wallet (mean, EUR) | - | 142 | 123 |
| Cash holdings in wallet (median, EUR) | - | 107 | 81 |
| Share of consumers holding less than EUR 50 (%) | - | 25 | 31 |

*Source: OeNB payment diary surveys, authors' calculations.*

*Note: Average cash and debit card payment amounts and cash holdings in wallet amounts from 2000 and 2011 were inflated to prices from October 2020.*

[8] *Transaction values from 2000 and 2011 were inflated with the consumer price inflation index to the respective value of fall 2020 to make the nominal values comparable over time.*

[9] *Source: ECB, "Number of POS EFTPOS terminals - provided by resident PSPs - located in the reporting country - from Austria" (PSS.A.AT.S102.I00.I210.NT.U6.20.Z0Z.Z). This series is only available from 2014. Data for 2000 are taken from "Number of POS terminals - provided by resident PSPs - from Austria" (PSS.A.AT.S102.I00. I200.NT.X0.20.Z0Z.Z), which includes terminals provided by resident payment services providers abroad. Both series omit terminals by nonresident payment services providers in Austria.*

[10] *This means that 50% of survey respondents carried less than EUR 107 with them. The average amount was EUR 142.*

Box 2

## COVID-19 pandemic: sudden and strong decline in the use of cash that rebounded after easing of lockdown measures

*An alternative method to measuring the use of cash for payments via survey data is to refer to payment card transaction data and to cash shipment data. The salient advantage of this approach is that it provides estimates at a high (in our case weekly) frequency. The disadvantage is that it rests on strong assumptions regarding velocity, hoarding and touristic cash flows, which is why a reliable longer time series cannot be constructed. However, with the outbreak of the COVID-19 pandemic, this approach was adopted to monitor the state of the economy, or rather private consumption (for further details, see Fenz and Stix, 2021). As a by-product, these estimates can be used to compute the implicit cash share (in value terms) for POS transactions.*

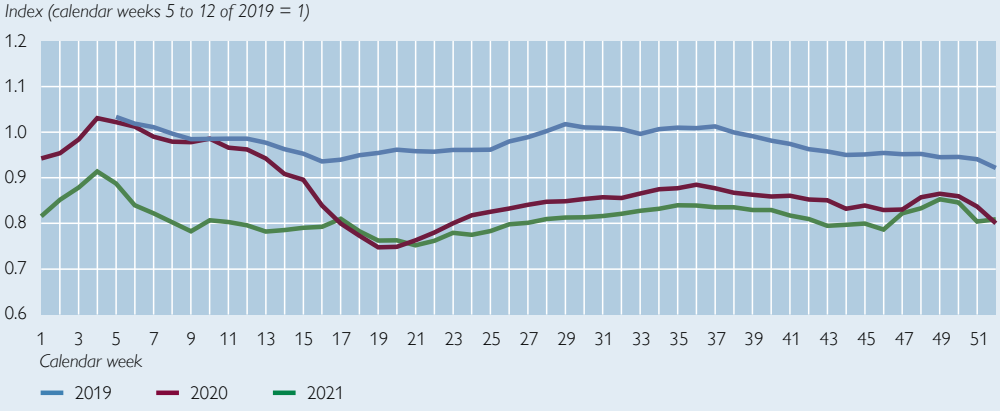
*Chart B2 1 shows our weekly estimates of how the cash share developed in 2019, 2020 and 2021. All values are smoothed (4 week moving average) and indexed by the mean cash shares in calendar weeks 5 to 12 of 2019. Although it should be noted that the uncertainty associated with these estimates is high and that the resulting numbers should only be seen as approximations, the temporal development is informative about the use of cash for POS transactions.*

*The share of cash in payment transactions (in value terms) declined strongly by about 25%, after the lockdown measures were imposed in Austria in spring 2020 (red line in comparison to blue line). The increase in card spending was driven by debit cards, and by contactless debit card payments in particular. For the latter, the limit for payments not requiring a PIN was raised from EUR 25 to EUR 50. Until the end of summer 2020, when lockdown measures were eased, cash use recovered somewhat in line with a "normalization" of consumption patterns (services, restaurants, travel). During the second and third lockdown at the end of 2020 and in the early months of 2021, the cash share dropped again. Overall, after the strong decrease in 2020, the cash share stabilized in 2021 relative to 2020. For example, in summer 2021, when no strong COVID-19 restrictions were in place, the cash share was somewhat lower but close to the respective value in summer 2020 (green line in comparison to red line).*

*The basic pattern that cash use first declined after March 2020 and then rebounded during summer 2020, but not to the same level that had prevailed before March 2020, could also be observed in other countries, e.g. in the Netherlands (Jonker et al., 2020), Italy (Ardizzi et al., 2020) and Canada (Chen et al., 2021a).*

Chart B2 1

### Estimated share of cash at POS (moving averages)




Source: Payment card issuers, OeNB.

Note: The chart shows an estimate of how the value share of cash for POS transactions in Austria conducted with cash, debit or credit cards has changed. The payment cards comprise only domestically issued cards. The values are indexed with the average of calendar weeks 5 to 12 of 2019 defined as 1. The indexation is based on 4 week moving averages.

### 1.3 A country of cash use – is Austria exceptional?

The evidence presented so far shows that cash is still playing a very important role in Austria – both as a store of value as well as a means of payment. This raises the question: how does Austria compare to other countries?

In 2019, the European Central Bank (ECB) conducted a payment diary survey study in (almost) all member countries of the euro area (ECB, 2020). It allows us to provide a harmonized cross-country comparison. Since this study differs in several important dimensions from the OeNB payment diary studies, we stress that the resulting cash shares cannot directly be compared with the cash shares presented earlier.

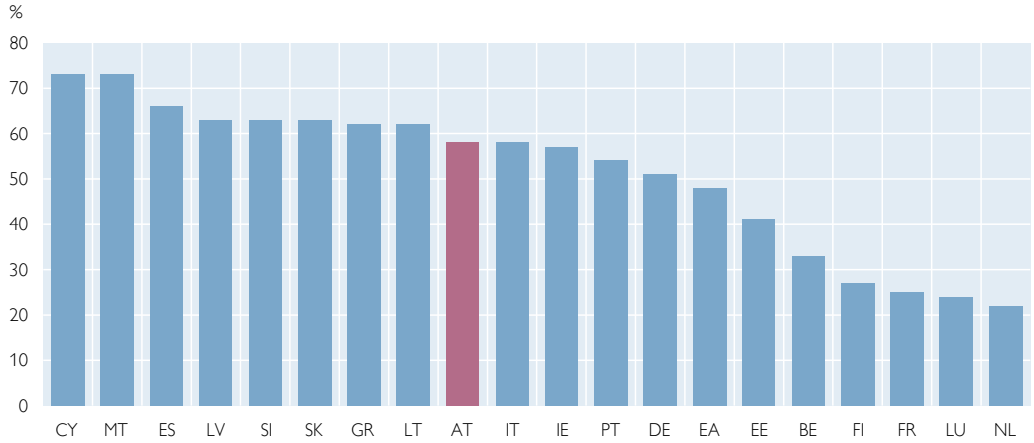
Chart 5 shows that the respective cash share found for Austria (58%) is somewhere in the middle range of all euro area economies but markedly above the euro area average (48%). Cash use in Austria is close to cash use in southern European countries like Italy, Greece, and Portugal but somewhat higher than in Germany (51%). The gist of chart 5 is that Austria is not exceptional regarding the use of cash for payments.

While the figures from the ECB (2020) refer to the pre-pandemic payment behavior, two studies provide insights about the change in payment behavior during the years of the COVID-19 pandemic for Switzerland and Germany (SNB, 2021 and Deutsche Bundesbank, 2021; in both studies, interviews were conducted in fall 2020). These two country results are interesting, as the cash share was rather similar in Switzerland, Germany and Austria before the pandemic.

The Swiss National Bank (SNB) (2021) reported that the cash share (in terms of the number of transactions) had fallen from 70% in 2017 to 42% in 2020. Deutsche Bundesbank (2021) recorded that the cash share had dropped from 74% in 2017 to 60% in 2020. A comparison of the results from the ECB payment diary study from 2019 (ECB, 2020) with the OeNB payment diary study from 2020 for

Chart 5

**Share of cash at POS and P2P (by value)**




*Source: ECB (2020) figure 1 and chart 1; sources cited therein: ECB (2019), De Nederlandsche Bank and the Dutch Payments Association (2020), Deutsche Bundesbank (2017).*

*Note: Cash share in terms of the value of transactions for POS and P2P payments. EA = euro area average.*

Austria reveals a decline of cash share from 79% in 2019 to 63% in 2020. However, this comparison should be considered with precaution, as stated before.[11]

Thus, the cash share fell strongly in all three economies, and contactless card payments were the key force in this development. In Austria and Germany, the decline was quite similar, while in Switzerland, it was considerably stronger. We are unaware of studies that analyze the causes of this divergent development. However, it would be interesting to pursue the question whether the stronger decrease in Switzerland was caused by a higher willingness of Swiss residents to take up payment innovations, by a differential change in consumption behavior during the pandemic or by external circumstances (e.g. whether merchants in Switzerland steered customers away from cash stronger than in the other countries; see Höpperger and Rusu, 2022).

In a broader, international comparison, many English-speaking countries have a considerably lower cash use than the average of European countries (Bagnall et al., 2016). For example, in Australia the cash share (by transactions) decreased from 62% in 2010 to 27% in 2019 (Caddy et al., 2020). In Canada, it declined from 54% in 2009 to 22% in 2020 (Chen et al., 2021b). The USA saw a decrease from 40% in 2012 to 26% in 2019, followed by 19% in 2020 (Greene and Stavins, 2021).

In Europe, several countries have lower cash use than Austria. In the Netherlands, the cash share decreased from 65% in 2010 to 32% in 2019 and further to 21% in 2020 (De Nederlandsche Bank and Dutch Payments Association, n.d.). The Nordic countries are often considered the forerunners of cashlessness. In surveys, Swedish respondents were asked how they had settled their last purchase (before the interview). In 2010, 39% of respondents stated that they had paid in cash; this share dropped to 9% in 2020 (Sveriges Riksbank, 2020).[12]

Regardless of the pre-pandemic level of cash use, these numbers show that the use of cash for payments declined in all said countries shortly after the onset of the COVID-19 pandemic.

In general, economists have identified the main reasons why consumers use and hold cash (Shy, 2022). However, knowledge about and understanding of cross-country differences are much less profound. For instance, the argument that inhabitants of country X use less cash because they are more tech-affine remains a claim unless researchers provide convincing, causal analyses. We presume that a multitude of factors influences how cash-affine a country's population is, including the institutional environment (costs of payment instruments for merchants and consumers, costs of acquiring and depositing cash, density of card terminal network), culture, perceived security (risk of burglary), history, the size of their shadow economy, etc.

[11] *We note that results cannot easily be compared across countries, as the basis upon which the share is computed might differ across countries. Moreover, methodological changes in the interviewing mode (e.g. for Germany) can impede a comparison. In the case of Austria, the ECB study has a different sampling and interviewing mode than the OeNB payment diary study from 2020, making the results barely comparable. Thus, we stress that these results are just indicative and that readers should only consider the broad trend.*

[12] *The basis for this international comparison is taken from figure 2 in Caddy et al. (2020). We thank J. Caddy, L. Delaney and C. Fisher for providing the underlying numbers. We have updated the respective values for 2020 and 2021.*

## 2 How do Austrians use and view cash?

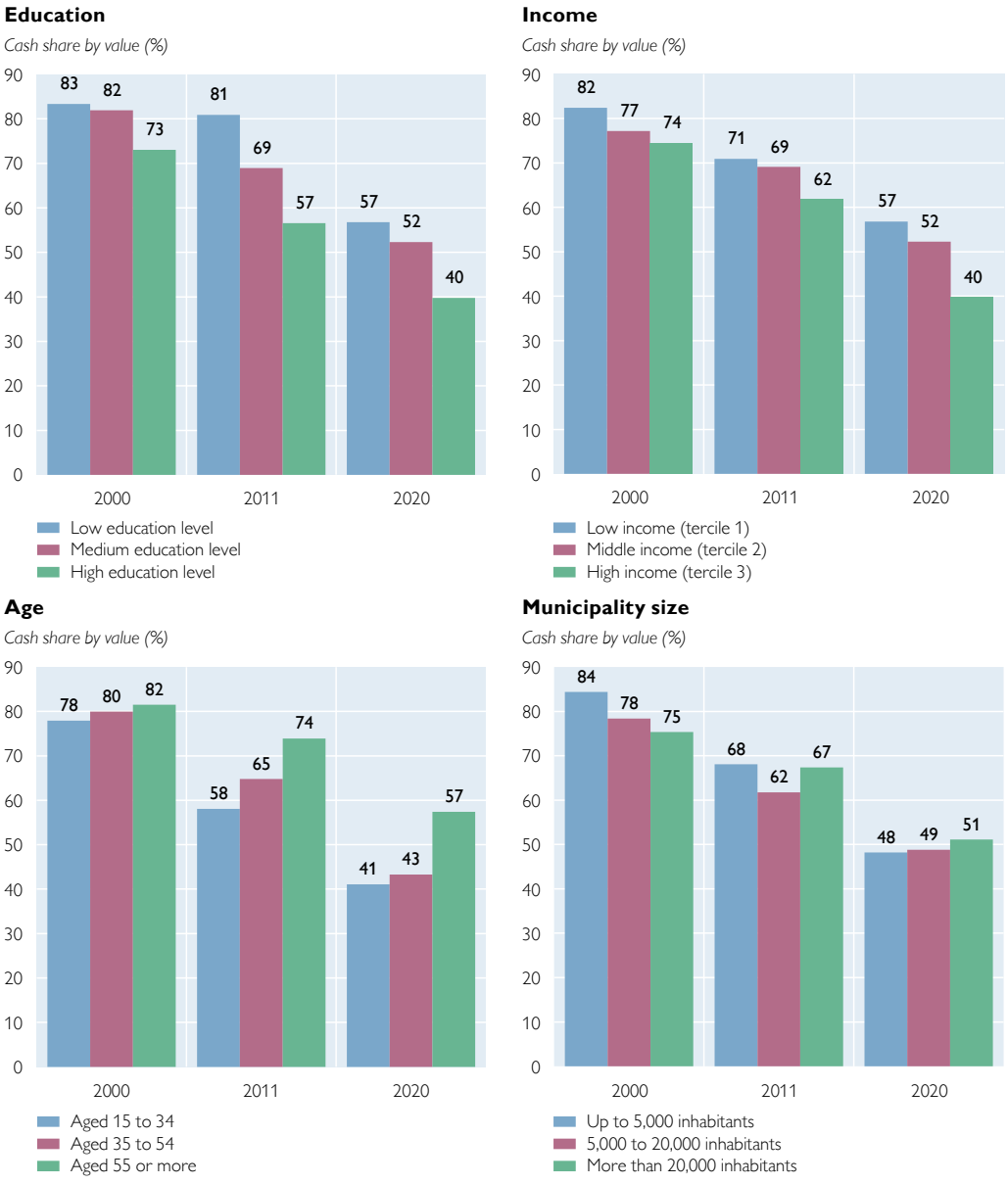
### 2.1 Cash use in socioeconomic groups

Has the decline in the use of cash been homogeneous across socioeconomic groups? To answer this question, chart 6 shows cash shares (in value terms) in 2000, 2011 and 2020 by education, income, age and municipality size.

In Austria, income and/or education are strongly correlated with cash use, conforming to evidence from other countries (Bagnall et al., 2016 and Shy, 2022). For example, in 2020 the cash ratio was at 40% for persons with high income,

Chart 6

**Share of cash payments by sociodemographics**




*Source: OeNB payment diary surveys, Mooslechner et al. (2012), Dorfmeister et al. (2021).*

*Note: For comparability, bank transfers are excluded in 2011 and in 2020. Therefore, the shares might deviate from other publications.*

and 57% for persons with low income.[13] In terms of temporal changes, the cash ratio declined from 2000 to 2020 by 34 pp for persons with high income and by 25 pp for persons with low income.

The chart also shows that cash use in 2020 was rather similar in rural and in urban areas. However, the cash share declined significantly stronger in municipalities with up to 5,000 inhabitants (–36 pp) than in municipalities with more than 20,000 inhabitants (–24 pp). Most likely, this reflects a growing acceptance of payment cards in rural areas.[14]

Cash use differs substantially by age groups. In 2020, the cash share was 57% for persons aged 55 years or older and 41% for persons aged between 15 and 34 years of age. Regarding the former, the cash share had dropped by 25 pp since 2000, and regarding the latter, the decrease was 37 pp. Interestingly, differences between age groups were rather small in 2000 (owing to a lack of alternatives to cash). However, in light of the quicker take-up of new technologies by younger persons, it is remarkable that the cash share is still 41% for persons under the age of 35 years.

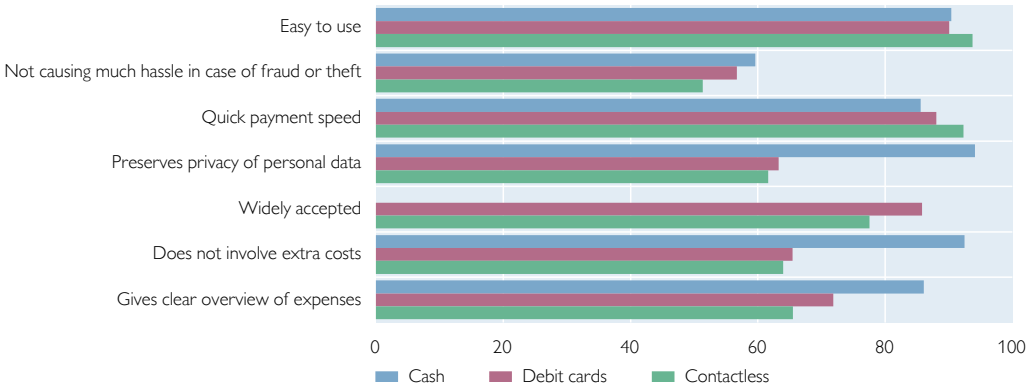
## 2.2 How do Austrians view and rate cash?

Why do Austrians use cash for their payments? The OeNB payment diary study of 2021 elicited the features of payment instruments that are perceived as most important by survey respondents. These features are ranked by their importance in chart 7 (from top to bottom). Subsequently, respondents were asked how cash, debit card payments with PIN code and contactless debit card payments without a PIN code (NFC) fulfilled each of these features in their opinion.

Chart 7

**How consumers rate cash, debit cards and contactless card payments**

*%, share of respondents who considered the respective feature as "very much" or "much fulfilled"*




*Source: OeNB payment diary study 2021.*

*Note: The chart shows how consumers rate cash, debit cards and contactless cards regarding the seven most important properties of a payment instrument. The properties are ranked by importance from top to bottom. Don't know answers were coded as missing, which implies that survey respondents know each payment instrument well enough to provide a rating.*

[13] *Income groups are defined by terciles, meaning that, e.g., high income respondents represent 33.3% of the population and are defined as the third tercile group with the highest income.*

[14] *Presumably, card acceptance was lower in 2000 in rural areas than in urban areas. This has changed with a now high share of POS (merchants, restaurants, etc.) accepting card payments in smaller villages as well.*

Chart 7 shows that Austrians view cash very positively with respect to the seven most important attributes. As regards ease of use, the most important feature, cash and debit cards are rated equally well, though, contactless payments are viewed slightly more favorably; payment speed yielded a similar result. A higher share of Austrians rated cash better than debit cards and contactless payments regarding the following, three attributes: "does not involve extra costs," "preserves privacy of personal data" or "gives clear overview of expenses."

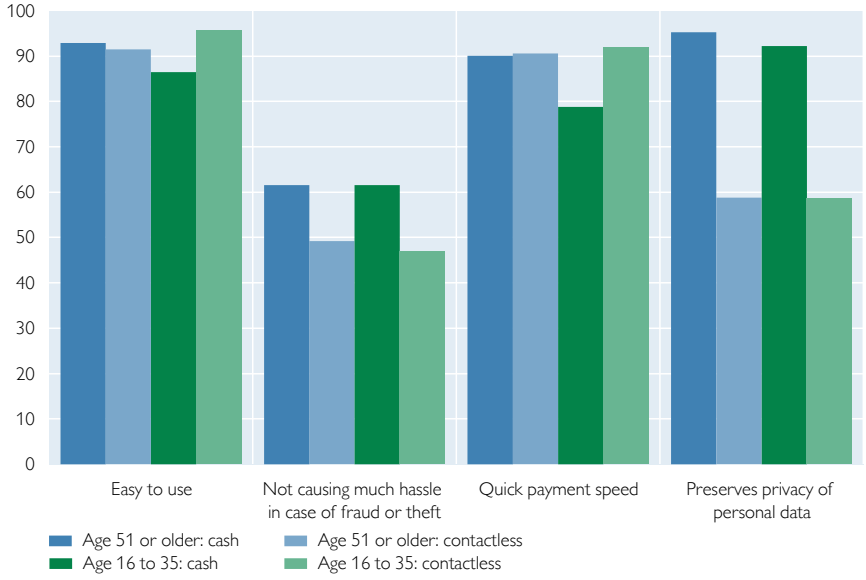
Regarding the results for 2021, readers should note the following: First, the survey in 2011 asked the same set of questions, but back then cash received a more positive rating than debit cards on all features (contactless payments did not exist yet). Thus, the share of people who view cards more positively has considerably increased over time. Second, the fact that don't know answers were treated as missing means that only responses with a rating were considered for the results. This might seem like a technicality but does affect the results, as, e.g., respondents who do not know/use contactless payments would usually not give a rating for an attribute. Therefore, the results are biased towards the view of card users. If don't know answers were not ignored, cash would rank first for all features, with the exception of payment speed.

Moreover, chart 7 represents the *average* rating of payment instruments across the population. It is evident that persons with a cash preference view the various features very differently than persons who prefer payment cards. As these preferences are correlated with age, chart 8 compares the rating of cash and contactless cards for persons aged 51 or older and for persons below the age of 35. We chose to compare cash with contactless card payments, as the latter have grown in importance. Older persons rate cash and contactless card payments almost identical with

Chart 8

**How younger and older consumers rate cash and contactless card payments**

*%, share of respondents who considered the respective feature as "very much" or "much fulfilled"*




*Source: OeNB payment diary study 2021.*

respect to ease of use and payment speed. Younger persons rate contactless card payments higher than cash regarding these two attributes, which is consistent with the lower cash use of younger persons. With respect to the hassle in case of fraud and theft and the privacy of personal data, both younger and older respondents ranked cash better than contactless card payments.[15]

## 3 Factors determining the future of cash: a cautious look ahead

We have seen a decline of cash use in Austria over the past 20 years, which is in line with an apparent international trend. Whereas the trend in cash use in Austria is comparable to other advanced economies, in particular Germany, the decrease was significantly smaller than in other economies, e.g. the Netherlands, Sweden or the English-speaking countries. This raises the question: will Austria move towards substantially more cashlessness, following those countries that are already farther down the road?

We have mentioned that the reasons for these diverging country trends have not been understood comprehensively, and we will also not be able to provide new insights. However, we can elaborate the factors that we perceive as critical for the future development of cash. Based on these factors, we then formulate what we expect for the next 10 years – albeit this outlook is a very cautious attempt: A lot depends on how the payment infrastructure and hence relative costs of payment instruments will develop. Also, the question whether cash will continue to be easily accessible and universally accepted by merchants is central for its future as well. Moreover, there are many unknowns like new technologies, economic instabilities, administrative limits on cash use, how access to cash and privacy preferences will change, etc. Lastly, the inherent difficulty of predicting our future payment behavior is manifested by previous predictions about the demise of cash – which often were quite wrong.

### 3.1 Factors supporting a future decrease in the use of cash

#### 3.1.1 Demographic forces

Younger persons are faster in adopting and using new payment technologies than older persons (e.g. Brown et al., 2021). Chart 9 illustrates how age affects cash use, or more precisely, how payment behavior has changed by birth cohorts since 1996, allowing for a comparison of, e.g., persons who were born in the 1950s with persons who were born in the 1970s. It shows that cash use has decreased for all birth cohorts. However, the decline is stronger among the younger birth cohorts and the weakest among older cohorts.[16] In addition, we have mentioned before that younger consumers rate card payments as more convenient and faster than cash payments. Now, it seems that older persons too see cash and cards as equally convenient.

Overall, these findings suggest that cash use will continue to decline, as the share of younger birth cohorts will grow in the population. Moreover, we expect that the older cohorts too will continue to increasingly shift to noncash payment means, as they will become more comfortable with new payment technologies. A case in point are countries like Denmark, Australia or Canada, where older persons

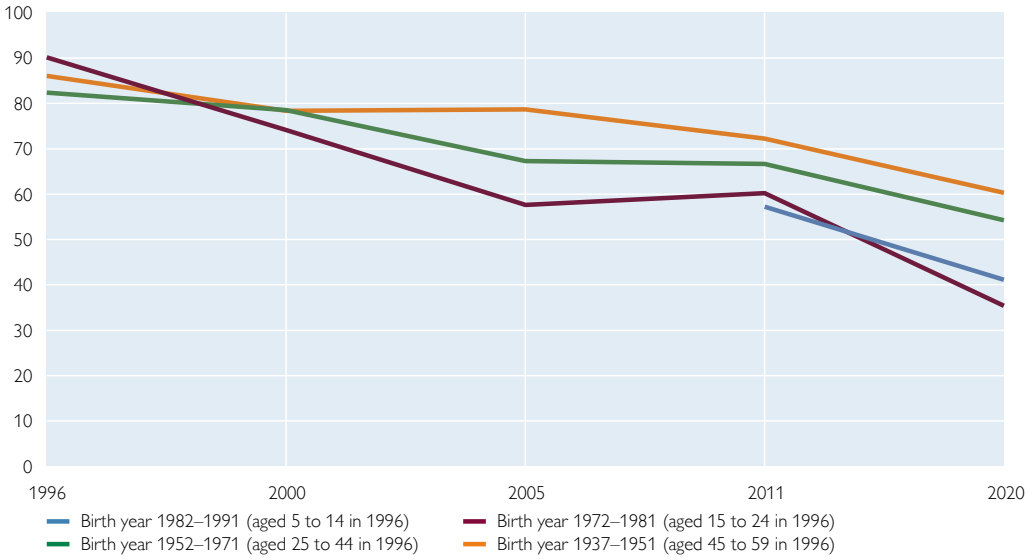
[15] *Chart 8 does not include all features shown in chart 7. The results of the excluded features roughly resemble those of "privacy of personal data".*

[16] *Please note that chart 9 visually exaggerates the decline between 2011 and 2020.*

Chart 9

**Share of cash payments in Austria by age cohorts**

*Cash share in % (in value terms)*




*Source: OeNB.*

*Note: Cash share in value terms derived from five Austrian payment diaries. Payments exclude bank transfers.*

substantially reduced their use of cash, albeit they continue to be less willing to take up new payment technologies than younger persons (e.g. Caddy et al., 2020; Chen et al., 2021b; Danmarks Nationalbank, 2022).

### 3.1.2 Growing importance of new payment technologies

The pace of technological progress in the field of retail payments over the past 20 years has been indeed astonishing, and it is evident that this development has reduced cash use. In particular, the contactless NFC technology, which allows for fast and convenient payments, will further challenge the role of cash for small value payments.

But how big is the impact of new technologies? It is an empirical challenge to separate the causal effect of a new technology like contactless payments from a general trend that is prevailing regardless of this new technology.[17] Brown et al. (2021) use data from Switzerland to provide estimates of the causal effect of contactless payment cards in the early years of their introduction. They show that increasingly convenient card payments (contactless card payments versus PIN-based card payments) cause a sizable growth in the use of payment cards, which is stronger among younger than older consumers. Additionally, the rise in card use is much more pronounced among consumers who had already used payment cards before the new technology existed, whereas previous nonusers of payment cards are still not using cards.

[17] *A general trend towards a cash decline could be driven, for example, by a changing consumer behavior (caused by "comfort with technology effects") or by more merchants offering POS terminals. Both circumstances would induce more card payments, irrespective of the new technology.*

There are three broader conclusions that can be drawn from these results. First, the effect of a new payment technology depends on how convenient consumers assess new payment technologies vis-à-vis other payment instruments, in particular cash. As long as the consumers' perceived convenience of cash payments does not deteriorate much, we expect that the overall use of cash will continue to decline only gradually. Second, some consumers do not perceive new payment technologies as an enhancement and will continue to be cash-affine. Third, Brown et al. (2021) report that, overall, the causal effect that contactless cards had on cash use was relatively modest[18] compared to the general trend away from cash, irrespective of contactless cards. Their estimates suggest that between 2016 and 2018 the annual trend decline in the Swiss cash ratio (in value terms) was around 2 percentage points.

A similar, general trend away from cash in Austria would imply that the cash share (in value terms) would decrease from 50% to 30% in ten years' time. However, the assessment of Brown et al. (2021) has to be put in perspective, as they refer to the pre-pandemic situation. The COVID-19 pandemic could have increased the perceived convenience of contactless cards relative to cash for concerns about hygiene or risk of infection and hence has had a detrimental effect on the use of cash (Alvarez and Argente, 2022; Höpperger and Rusu, 2022; Jonker et al., 2020). In addition, merchants motivated customers to use noncash payment instruments. Both of these circumstances led to a considerable reduction in the use of cash, which seems to have stabilized in 2021 (see box 2).

What can be expected for the coming years? One scenario is that the longer-term, pre-pandemic trend towards a decrease in cash use might not have changed much and will also prevail during the coming years. Another scenario is that the declining trend will be somewhat stronger after the pandemic, reflecting the growing importance of new payment technologies and "comfort with technology effects". On balance, we think that the latter is more likely to happen. But even then, cash will remain an important payment instrument in ten years' time, presuming that there are no strong shifts in how consumers assess the convenience of each payment instrument.

### 3.1.3 Increasing interest rates and inflation

The past years were marked by low interest rates and low inflation rates. During 2021, and much stronger in the first months of 2022, inflation has picked up, and a rise in interest rates cannot be excluded. As cash bears no interest rates, holding it increases opportunity costs[19], thus lowering its attractiveness as a store of value. Hence, the amount of currency in circulation is rather likely to be adversely affected. As regards the use of cash as a payment instrument, the opportunity costs of holding cash for transactions arise from a comparison with the interest rate on transaction accounts. We think that increases in interest rates or inflation, as long as they do not surpass the levels observed during the past 20 years, will not have a large impact on the transactional demand for cash. First, cash balances held for transaction

[18] *Of all the cash payments a consumer makes, only a relatively small fraction was replaced by contactless card payments. In addition, those replaced were small in value, thus limiting the impact on the overall cash share.*

[19] *Opportunity costs are potential benefits that were missed out on because of choosing one alternative over another.*

purposes are not large (see table 1). Second, interest rates on transaction accounts used to be rather low. Third, part of the higher opportunity costs of cash could be cushioned by "optimizing" withdrawals, i.e. by increasing the frequency of cash withdrawals.

#### 3.1.4 Possible introduction of digital currencies by central banks

Central banks worldwide are considering offering a digital alternative to physical cash, commonly referred to as central bank digital currencies (CBDCs) (Hermanky and Summer, 2022). The effect of a digital euro or US dollar on cash use, should it be introduced, depends to a large extent on its concrete design features and how cash-like it will be.

As these features are unknown as of now, it is highly speculative to assess how CBDCs would affect payments in general and the transactional demand for physical cash in particular. It is well conceivable that CBDCs would partly replace card payments and some cash payments as well, especially if they meet people's demand for convenience, privacy, etc. (Huynh et al., 2020). We note that these possible developments are a priori neither positive nor negative; but they foreshadow that the form in which consumers will hold central bank money could change. However, by the very nature of digital money, it will not be possible to replicate all features of physical cash (Shy, 2022; Krueger and Seitz, 2018). We expect that there will always be some demand for cash due to its high degree of privacy (Garratt and Van Oordt, 2021; Kahn et al., 2005).

The effect of CBDCs on cash hoarding will depend on holding limits for CBDCs. Presumably, these could be relatively low such that cash demand for hoarding purposes will not completely vanish.

### 3.2 Factors preventing or slowing a future cash decrease

#### 3.2.1 Dense withdrawal network and no direct withdrawal fees

From the perspective of consumers, the main costs of cash are shoe-leather costs, i.e. the time and effort to withdraw cash. Other matters of cost like the costs of holding cash for payments or the risk of theft can be considered to be relatively small (in Austria). The dense cash withdrawal and cash deposit network in Austria has contributed to the high share of cash payments.[20]

To assess the current status of access to cash, the OeNB estimated travel (route) distances from main residences (i.e. from all populated 100x100 meter grid cells in Austria) to the nearest ATM (Stix, 2020). Results for 2020 show that 67% of Austrian residents have to travel less than 1 km to reach the closest ATM. For 83%, the distance is less than 2 km, and 97,2% have an ATM within 5 km. On average, these findings suggest that the majority of ATMs and bank branches lies within a rather reasonable travel distance. In addition, most ATMs do not charge any withdrawal fees, regardless of whether the ATM operator is associated with the client's bank.

However, this situation could change, thus worsening access to cash, mainly in rural areas. Digitalization and cost pressure have led banks to close branches – a

[20] *We presume that a worsening of access to cash will have detrimental effects on the convenience of cash (vis-à-vis cashless alternatives). Chen et al. (2021c) show that larger travel distances can also induce consumers to plan their withdrawals efficiently, e.g. withdrawing money during their errands.*

trend that can also be observed in other countries. At the end of 2020, about 28% of Austrian municipalities did not have a bank branch, a rise from about 13% in 2002. Among smaller municipalities with less than 2,000 inhabitants, some 43% of municipalities had no bank branch at the end of 2020 (compared with 21% in 2002). Closing the last bank branch in a municipality could mean the removal of the last ATM as well.[21]

In light of this trend, the future development might involve complementary sources to access cash like "cashback" or "cash-in-shop" services[22] via retailers (ERPB, 2021). It remains to be seen how access to cash will change in the coming years. In any case, we consider a dense withdrawal and cash deposit network as vital for the convenience of cash.

### 3.2.2 Universal acceptance of cash

Cash incorporates a number of unique features and functions, both from a user perspective and a payment system perspective. It is inclusive, as it provides payment and savings options for people with limited or no access to digital payment methods. Payments can be made offline without electricity and a payment device, which is an important backup feature, enhancing resilience, e.g. when electronic means of payment are (temporarily) unavailable due to natural disasters, power failures, wars, etc. Moreover, cash allows for instant person-to-person payments and serves as a store of value. As people can keep or spend it without involving a third party for (electronic) verification, autonomy and privacy are favorable characteristics of cash.[23,24] Also, cash provides immediate power to discharge from payment obligations without dependence on central verification. Furthermore, it is a claim on the central bank and therefore does not entail credit risks whereas noncash (digital) money is a claim on a private bank (private money). As public (cash) and private (noncash) money are always exchangeable at par, cash contributes to the public's confidence in private money.

From a payment system perspective, banknotes are the only form of legal tender. This implies mandatory acceptance at full face value of banknotes and coins, unless payer and payee agree on a different payment method (freedom of contract), and the right to discharge payment obligations with cash.[25]

[21] *It is important to note that the absence of an ATM in a given municipality does not necessarily imply that travel distances to the next ATMs are overly large, e.g. if an ATM is in a village nearby.*

[22] *"[C]ashback: A cash withdrawal at the retailer's checkout which is debited to the customer's account and is made in conjunction with a purchase of goods or services. […] [C]ash-in-shop: A cash withdrawal or deposit at the retailer's checkout which is settled through the customer's account and is not being linked to a purchase of goods or services." (ERPB, 2021, p. 41)*

[23] *It is evident that cash is also used for illicit activities due to its high level of privacy. A thorough analysis of the associated issues lies beyond the scope of this paper. For a further discussion, see e.g. Rogoff (2016), McAndrews (2020) and Shy (2022).*

[24] *Garratt and Van Oordt (2021) show that the privacy provided by cash payments improves welfare (see also Kahn et al., 2005).*

[25] *The banknotes issued by the European Central Bank and the national central banks shall be the only such notes to have the status of legal tender within the Union." (Consolidated version of the Treaty on the Functioning of the European Union, Article 128) "Where a payment obligation exists, the legal tender of euro banknotes and coins should imply: (a) Mandatory acceptance: The creditor of a payment obligation cannot refuse euro banknotes and coins unless the parties have agreed on other means of payment. (b) Acceptance at full face value: The monetary value of euro banknotes and coins is equal to the amount indicated on the banknotes and coins. (c) Power to discharge from payment obligations: A debtor can discharge himself from a payment obligation by tendering euro banknotes and coins to the creditor. [Commission Recommendation of 22 March 2010 on the scope and effects of legal tender of euro banknotes and coins (2010/191/EU)]*

Given the abovementioned unique features of cash, its legal tender status and the fact that cash infrastructure constitutes a public good, it must be in the interest of policymakers and decision-making bodies to ensure that cash continues to be universally accepted.[26] The product cash is per se not profit-oriented, contrary to all other forms of private monies, where different stakeholders compete against each other. Hence, said stakeholders may perceive cash as a competitor and could be interested in pushing back the use of cash. Therefore, the universal acceptance of cash in the future is not self-evident but needs to be supported by authorities – although this is currently of no urgent concern in Austria. This means ensuring availability of and access to cash as well as preventing disproportionate restrictions, cost inefficiencies or lack of infrastructure.

### 3.2.3 Valuable characteristics of cash

Cash is safe, simple to use, bears low costs, allows for fast payments, can be used for person-to-person payments, maintains payers' anonymity and might be helpful to control one's budget and prevent overspending. Many consumers – emphasizing many, meaning not all – might stick to using cash not out of habit but because they find the features of cash favorable. Therefore, a fraction of consumers will continue to use cash for its characteristics, though we can expect that card or mobile payers will grow relative to cash payers, as is evident from countries with a much lower cash share such as the Netherlands, Sweden, the UK or Canada.

### 3.2.4 Central banks should take an active role

Central banks take care of the distribution, the safety and the security (e.g. counterfeit resilience) of cash. Typically, they have a neutral stance toward the different means of payment, leaving it to consumers to decide freely which payment instrument they prefer.

Market participants offering noncash alternatives have an interest in expanding their market share among payment instruments. Varying from country to country, certain actions have put availability and acceptance of cash repeatedly under pressure: campaigns for the use of new (digital) means of payment, campaigns against the use of cash (due to the pandemic among others), legislative initiatives (cash payment limits), profitability aspects, etc. In recognition of the important role of cash, the Eurosystem has formulated its cash strategy consisting of four key strategic goals:

- Continue providing an efficient supply of cash;
- Ensure universal acceptance of cash and its broad availability;
- Provide innovative and secure euro banknotes; and
- Reduce the environmental impact of the cash cycle (regarding raw materials, transportation, production, etc.).

[26] *The Eurosystem Cash Strategy highlights the importance of universal acceptance of cash (https://www.ecb.europa.eu/euro/cash_strategy/html/index.en.html).*

In our view, there are additional supportive measures that central banks can undertake:

- Explain as well as promote the public value of cash and take a clear stance against negative branding;
- Cooperate with stakeholders in the cash cycle (banks, cash-in-transit companies, retailers) and encourage innovative ideas about the cash cycle for more efficiency and effectiveness;
- Monitor developments in the cash cycle (bank branch networks, ATM networks, cash lodgment facilities, cashback and cash-in-shop services, etc.) to facilitate policy decisions;
- Support initiatives (legislative or nonlegislative) for safeguarding access to and the universal acceptance of cash; and
- Support research activities to better inform policy decision-making regarding cash.

## 4 Conclusion

We have discussed the main developments regarding the demand for and the use of cash in Austria over the past 20 years. Our main finding is that the use of cash for payments has declined; nevertheless, cash has remained the single most important payment instrument. We have shown that cash is valued by consumers for its characteristics. In international comparison, Austrians are among the more cash-affine Europeans, however, comparable levels of cash use are observed in several other European countries. These facts are in stark contrast to claims about the nearing end of cash, that cash is outdated or that consumers continue to use cash just out of habit, reflecting a passive entrenched behavior.

Are Austrians just lagging the development in countries with lower cash use? In our view, no, because cash use depends on a multitude of influencing factors that differ substantially among countries, e.g. how relative costs change for consumers, merchants and banks. What we have learned through the COVID-19 pandemic is that cash use can decline abruptly. However, during pre-pandemic times the temporal changes were much more modest and gradual. Under predictable circumstances, cash use is likely to drop over the next 10 years, as new technologies will be taken up and used more. Yet, we expect cash to remain important in the near future, although to a varying extent across sociodemographic groups.

Cash is an easy to use, cheap, safe and inclusive means of payment and store of value. From the payment system perspective, there are several distinctive advantages of cash: its resilience to internet failures, power blackouts, cyberattacks as well as its possible functioning in times of natural disasters. Moreover, it is an inclusive means of payment, allowing for access to payments for people with limited or no access to digital payment methods. Cash is currently the only way to hold central bank money. Its convertibility with private money at par contributes to the public's confidence in private money.[27] Not least, it is a tangible representation of national sovereignty – and euro banknotes and coins are the most tangible representation of European Monetary Unification.

[27] *See also the speech by Fabio Panetta, Member of the Executive Board of the ECB, "Central bank digital currencies: a monetary anchor for digital innovation", from November 5, 2021: https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp211105~08781cb638.en.html#:~:text=By%20providing%20a%20monetary%20anchor,protecting%20the%20value%20of%20money.*

The production and distribution of cash involves considerable fixed costs. If cash use were to decline strongly, maintaining the cash infrastructure would drive up the per-transaction costs. In such a scenario, at a certain tipping point self-enforcing trends away from cash could set in, further accelerating the decline[28] – a development not as hypothetical as it may sound, with some low cash use countries being a case in point. In Sweden, regulatory measures have already been taken to maintain access to cash, and in the Netherlands, discussions about safeguarding an adequate cash payment infrastructure have been arising (Spaanderman, 2020).

As cash is of systemic importance and public value, its assessment cannot purely be based on a cost-benefit analysis and gives rise to active policymaking. A case in point: before the pandemic, critics advocated for a reduction of intensive care beds in Austria to cut costs – an assessment now revised. Bearing this example in mind, the relatively high cash intensity in Austria may prove advantageous. Therefore, adequate access to cash for consumers and to cash deposit facilities for merchants should be maintained. Also, paying in cash at any POS should remain possible, and measures should be taken to ensure cost efficiency along the supply chain of cash. Moreover, central banks can take a more active stance in highlighting the public value of cash. Actions like these may support an adequate level of cash use which, in turn, would ensure that consumers who prefer to pay in cash can continue to do so in the future.

[28] *For example, if cash becomes too costly for some merchants, they could try to steer customers away from cash, which would lead to less consumers using and holding cash. If consumers hold less cash, they make fewer cash payments. If consumers make fewer cash payments, cash becomes more costly for some merchants and/or the number of ATMs will be reduced, etc. On the other hand, payment markets are characterized by considerable network effects that may slow down cash demand (Huynh et al., 2020; Huynh et al., 2022).*

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# From SEPA to the digital euro: payments past, present and future

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*This paper investigates the increasing importance of electronic retail payments for the euro area economy, including Austria. Looking back 20 years, we address payments-related developments and regulatory aspects and summarize recent studies and empirical data on selected economies that underline the growing importance of electronic retail payments systems for competitiveness and economic growth. Specifically, we analyze changes in payment behavior over time, most recently under pandemic conditions. Furthermore, we discuss the role of European players in the electronic retail payment value chain and outline success factors for electronic payment systems. Against this backdrop, we provide an outlook on the potential developments of electronic retail payments in the euro area, 15–20 years ahead. We present the most likely baseline scenario and an alternative scenario, and discuss related policy implications and possible solutions, such as the introduction of a digital euro. An annex offers a comprehensive overview of key characteristics of retail payments processes and systems.*

*JEL classification: G20*
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Effective and efficient as well as safe and resilient, electronic payment systems are undisputedly one of the critical backbones of modern market economies all around the globe. After all, we rely on such systems to transfer value between financial institutions in a secure and efficient manner, facilitate capital flows and investments, enable citizens and companies to purchase goods and services and governments to collect and make payments without the involvement of cash (Humphrey, 2019).

Due to the increasing globalization and digitalization of economic activities and the accompanying significant changes in customer preferences, the share of electronic transactions in the euro area, including Austria, has grown steadily relative to cash in recent years. Twenty years after the introduction of euro cash, electronic payment systems are more important than ever as the financial plumbing of the euro area's market economies, highlighting the important roles of payment systems for the financial stability and strategic autonomy of all euro area and EU countries.

In this paper, we seek to answer the following questions: How have innovations and regulations impacted retail payment systems in Europe within the past 20 years? (Section 1.) What is the role of retail payments for the EU economies? (Section 2.) How has COVID-19 impacted customer and payment behavior in Europe and Austria? (Section 3.) What is the role of European players in the retail payment chain? (Section 4.) What are the likely scenarios for Europe's future retail payments

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architecture (Section 5, which concludes the paper). On top of that, an annex provides an overview of today's payment systems infrastructures and services.

## 1 How have innovations and regulations impacted retail payment systems in Europe within the last 20 years?

As a yardstick for analyzing the impact of innovation in payments on European economy, let us first emphasize the benefits retail payment systems are expected to provide. As put forward by Scott (2014, p. 69), the seven desirable benefits of retail payment systems are: "(1) finality and reversibility; (2) universality (ability to use at point of sale (POS) and remotely); (3) recordkeeping; (4) liquidity (maximizing interest earning assets); (5) security and safety; (6) financial inclusion and access; and (7) fungibility and ease of use." Technological progress, financial innovation and changing consumer preferences have raised the importance of points (6) and (7) – access and ease of use – in particular. New market entrants foster innovation but also create lock-in effects and barriers for competition through the network effects they generate. Here is where the need for regulation comes in.

### 1.1 Twenty years of innovation in payments

Without any doubt, technological innovations over the past 20 years have hugely changed the payments landscape in Europe and beyond. Payments have been and continue to be the activity affected most by technological innovation (Petralia et al., 2019). In recent years, new payment methods, numerous new platforms and interfaces have been developed and innovation is ongoing (Bech and Hancock, 2020).

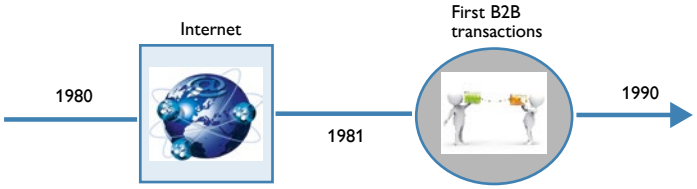
#### Developments before the year 2000

If we look into the history of payment methods, cash has long been the predominant method of payment. When newly emerging plastic, credit and debit cards supplemented the cash-dominated payment landscape from 1950 onward, retail payments in particular started to become more diverse. The biggest game changer in this process has been the development of the internet – the networking infrastructure that connects devices together[2] – from 1960 onward, which opened the door for online shops and online payments. Early milestones (figure 1) include the first ever electronic business-to-business (B2B) transaction made in 1981 (Cashbook, 2020).

In 1990, the World Wide Web (Web 1.0) came into being as a way of accessing information through the medium of the internet. The World Wide Web started as a proposal for a "hypertext project," the idea being to link up large bodies of data to grant universal access to them (Berners-Lee and Cailliau, 1990). Figure 2 below gives a brief overview of the most important payments-related developments between 1994 and 1999.

Figure 1

**Beginnings of the internet (1980–1989)**

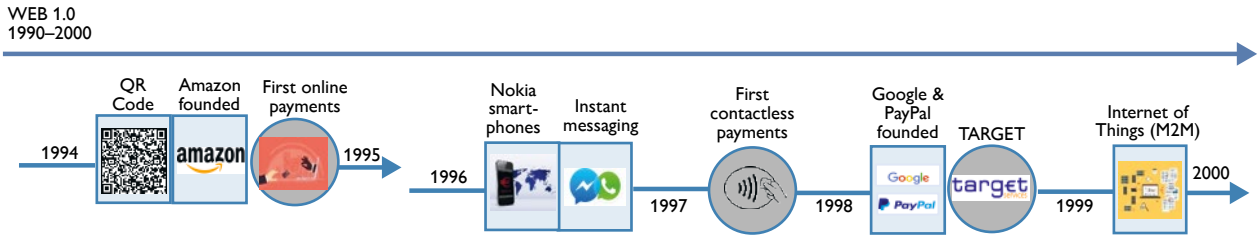



*Source: Authors' compilation (photos from OeNB and ZDNet).*

[2] *See A short history of the internet | National Science and Media Museum.*

Figure 2

**Payments in the context of Web 1.0 (1990–1999)**




*Source: Authors' compilation (photos from LogosMarken, Newsfeed, OeNB, Tagesspiegel, Wikimedia and Wikipedia).*

With the founding of Amazon in 1994, the era of customer online payments started. Also in 1994, the quick response code (QR code) was developed, by the Japanese automotive company Denso Wave, as the next generation of bar codes for accessing online information through scanning.[3] In 1996, Nokia developed the first smartphone, which would usher in the mobile payments revolution. In 1997, US Mobil gas stations started to use "Speedpass," the first ever contactless payment system. It ran on contactless payment devices that clipped onto a key ring (NFC, 2017).

Another milestone in the history of payments was the incorporation of Google and PayPal in 1998. While Google did not start to provide payment services until 2015, PayPal was founded on the very promise of low-cost, almost effortless digital payments for consumers and businesses. The founders' idea was to convince customers to share their emails, banking, and credit card information in return for fast, low-cost payments. Today, PayPal services are available in more than 200 markets worldwide (PayPal, 2022).

The creation of the euro area and the changeover to the euro as the common currency of the euro area economies in 1999 went hand in hand with the creation of the high-value payments system TARGET, which also became operational in 1999 (ECB, 2004). TARGET was meant to further stimulate economic activity, European integration and stability, and designed to ensure safe and efficient payments between national central banks of the euro area. Ultimately, it became the first payments system to exchange final, real-time payments between companies in Europe.

1999 was also the birth year of peer-to-peer (P2P) technology. Within a P2P network, the "peers" are computer systems which are connected to each other via the internet. P2P would later play an important role in the rollout of nearfield communication (NFC) payments.

In 2000, the Internet of Things emerged, which refers to the growing network of noncomputing devices that are engineered to be able to connect and exchange data over the internet.[4]

[3] *History of QR Code | QRcode.com | DENSO WAVE* and Sorensen (2021).

[4] *Internet of Things (IoT) | SUSE Defines*.

### Developments after the year 2000

What came after 2000 was a whole new generation of the web, or Web 2.0 (Pacelt, 2021). Figure 3 below gives a brief overview of the most important developments between 2002 and 2008, as outlined below (electronic payments-related legislation at the EU level is addressed in table 1).

In 2002, the development of NFC technology marked a technological breakthrough for electronic payments. NFC is a radio frequency identification technique (RFID) used for the electronic exchange of data. Yet, it took until 2013 for NFC to be used for contactless payments. More recently, NFC became particularly popular during the COVID-19 pandemic (see section 4).

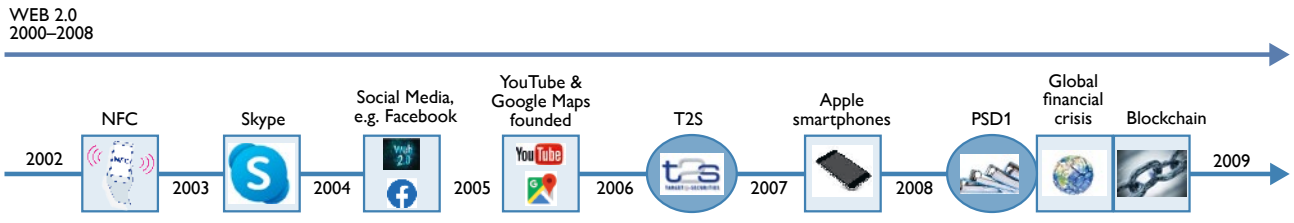
Social media services, in particular Facebook, have almost become a synonym for Web 2.0. Facebook, which was founded in 2004, has its own peer-to-peer payment tool: In addition to its chat function, the Facebook messenger can also be used for sending and receiving funds (Cautero, 2021). Another important innovation of the Web 2.0 era was the video portal YouTube, which was officially launched in 2005 and has been a Google subsidiary since 2006.

With the further development of smartphones and the introduction of Apple smartphones in 2007, payment behavior was lifted to a new level – now, people were able to pay directly via their smartphones without using a PC. This was the beginning of m-commerce, driven by the specific properties that made mobile phones particularly suitable for processing payment transactions, their ease of handling and their high prevalence in the population (Pacelt, 2021).

The transition to Web 3.0 was marked by the development of the blockchain technology in 2008, which constitutes the technical basis for crypto assets such as bitcoin. A blockchain is a continuously expandable list of records in individual blocks and an application of distributed ledger technology (DLT). A financial blockchain is defined as "an open, distributed global ledger that can record transactions between two parties efficiently and in a verifiable and permanent way" (Cashbook, 2020). What the web does for the exchange of information, the blockchain does for the exchange of value.[5] Therefore, the blockchain is also referred to as the "Internet of Value" (Bundesverband ITNM, 2016).

Figure 3

**Payments in the context of Web 2.0 (2000–2008)**

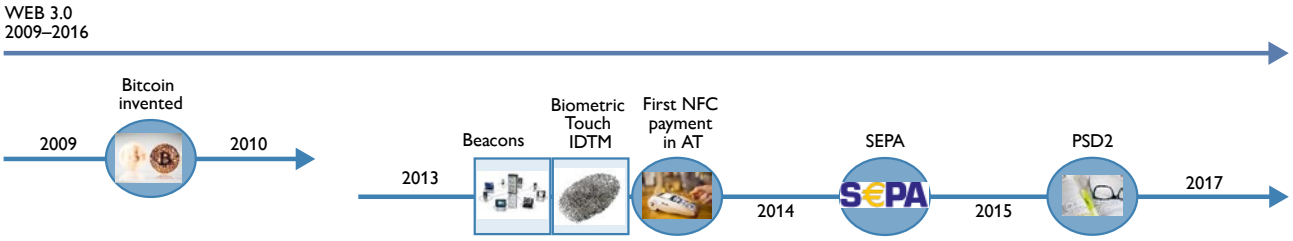



*Source: Authors' compilation (photos from Content-Manager, GoogleWatchBlog, iStock, OeNB, Omnisecure, Wikimedia and Wikipedia).*

[5] *Difference Between Internet of Things and Internet of Value | Difference Between.*

Figure 4

**Payments in the context of Web 3.0 (2009–2016)**




*Source: Authors' compilation (photos from Deutsche Bundesbank, Ocdn, OeNB and Wikimedia).*

Figure 4 above gives a brief overview of the most important developments between 2009 and 2015, as outlined below (electronic payments-related legislation at the EU level is addressed in table 1).

Bitcoin, the world's first and strongest crypto asset, was developed in 2009. It was designed as a decentralized accounting system in which payments are cryptographically legitimized and proceed peer to peer, that is to say without the need for intermediaries such as banks and without the need for a bank account – unlike more recent digital currency designs, such as the digital euro that the Eurosystem is in the process of exploring.

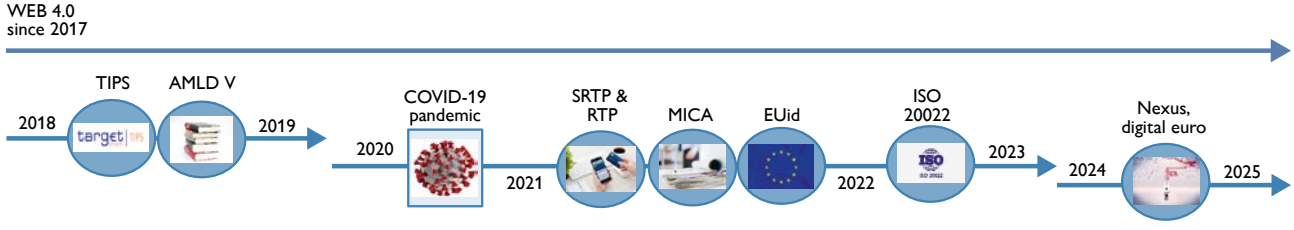
An important technological phase with a positive influence on m-commerce in particular followed in 2013 with the development of beacons and biometric touch. A beacon is a small Bluetooth device that transmits signals that other devices like your smartphone can see. Biometric touch, the use of electronic fingerprint recognition (Touch ID), was established by Apple in 2013 for unlocking devices. By now, both Apple Pay and Google Pay, but also most banking institutions, use Touch ID for payments authentication.

Launched in 2015 as an integrated platform for processing securities against central bank money, TARGET2-Securities (T2S) revolutionized securities settlement in Europe by bringing to an end complex cross-border settlement procedure and the difficulties caused by different settlement practices among countries (ECB, 2022a).

The next paradigm shift, to Web 4.0, started in 2017. Figure 5 below gives a brief overview of the most important developments since 2017, as outlined below.

Figure 5

**Payments in the context of Web 4.0 (since 2017)**




*Source: Authors' compilation (photos from Indellient, OeNB and Pei).*

Web 4.0 is known as the symbiotic web and characterized by a blurring of the boundary between human minds and machines (Pacelt, 2021). Web 4.0 will bring, for instance, virtual reality meetings and artificial systems communicating the way humans do using natural language.[6]

The need for real-time interaction in social and economic terms created the trend toward instant payments systems. The first real-time payments system established in Europe was Faster Payments System (FPS) introduced in the UK (2008), followed by Swish in Sweden (2012), MobilePay in Denmark (2013) and Vipps in Norway (2015). In 2017, RT1 and in 2018 TIPS (TARGET Instant Payment Settlement) Systems were launched as the first pan-European instant payments systems (OeNB, 2022a). TIPS enables payment service providers to offer fund transfers to their customers in real time and around the clock, every day of the year. TIPS was developed as an extension of TARGET2 and settles payments in central bank money – in euro only at the time of writing, but other currencies can be supported as well. TIPS was scheduled to begin settling instant payments in Swedish krona as of May 2022 (ECB, 2022b).

Yet, instant payments have been no effective substitution for cards payments at the point of sale because some issues remain unresolved, in particular payment initiation and requests for payment (also referred to as pull payments, in contrast to push payments).

In June 2021, the SEPA Request-to-Pay (SRTP) rulebook became effective, paving the way for from-account payment solutions at the point of sale (see annex). Growing SRTP use for real-time payment initiation is set to bring benefits for trade merchants, banks, acquirers, billers and consumers.

### 1.2 History of European payment directives and regulations over the last 20 years

Regulatory action to tighten and harmonize payment regulations on the European level has had the single greatest impact on payments in the last 20 years, with heightened requirements driven by changing payment behavior as well as two key events.

The first event were the attacks of September 11, 2001, that led to increased monitoring for banks of anti-money laundering (AML) and terrorist financing (EC, 2022a). The second event was the global financial crisis starting in 2008, which resulted in regulations such as Basel III introduced to help restore the balance in perceived risk versus confidence in leveraged institutions. These two regulations also marked the beginning of the continuous need for banks to adapt to new requirements and dedicate significant resources to compliance (Hocking, 2018), in line with the emerging regulatory framework (see table 1).

[6] *See Story of the Internet. From Web 1.0 to Web 4.0 - Botland.*

Table 1

**Electronic payments-related legislation at the EU level**

| Regulation/ directive | Scope/objectives |
|---|---|
| Payment Services Directive (PSD I) | The PSD I, which was created to foster a more integrated EU payments market, entered into force in December 2007. The directive aimed to increase competition and participation in the payments industry, including nonbanks, and to create a level playing field by harmonizing consumer protection and the rights and obligations for payment service providers and users (EC, 2022b). The PSD I was updated in 2009 and 2012. |
| Single European Payments Area (SEPA) | In 2014, SEPA was implemented in Europe. SEPA refers to the common payments area of 36 European countries, including all 27 EU countries plus the EFTA countries Iceland, Liechtenstein, Norway and Switzerland as well as Andorra, Monaco, San Marino and Vatican City. SEPA enables customers to make cashless euro payments in an easy, efficient and safe way from just one account by using harmonized payment instruments (OeNB, 2022b). |
| Payment Services Directive II (PSD II) | In 2015, the PSD I was replaced by the PSD II. Next to enhanced security requirements, the update also included enhanced data protection (Cashbook, 2020). The new rules are intended to better protect banks from fraud when their customers pay online, promote the development and use of innovative online and mobile payments, and make cross-border payment service providers in Europe more secure (EC, 2015). The PSD II is also intended to strengthen financial start-ups ("fintechs"). |
| Regulation on electronic identification, authentication, and trust services (eIDAS) | While working on the PSD, the European Commission also made efforts to develop a comprehensive European identity (eID). The outcome was a regulatory framework, adopted in 2014, that was to enable all European citizens to use digital identification services across the EU. By September 2018, it was mandatory for every member state to make the service available. However, only 19 member states have introduced an eID to date, and not all eIDs are compatible. |
| 5th Money Laundering Directive (AMLD V) | The AMLD V was published on June 19, 2018. By end-November 2021, all EU member states except Ireland and the Netherlands had reported full implementation. However, infringement procedures were launched against 21 EU member states for the lack or delay of notification of national transposition measures. The AMLD V directive focuses not only on sanctions but also on the redesign of the know-your-customer processes to meet the standards and procedures proposed by the AML and eIDAS regulations (EC, 2020). |
| Regulation on crypto-asset markets (MICA) | As part of the digital finance strategy, the European Commission proposed MICA in September 2021. The regulation supports regulatory safety, enhancing investor protection, innovation, competition and market integrity, reducing market fragmentation and increasing financial stability regarding stable coins. In its proposal, the European Commission differentiates between crypto assets already covered by EU regulations and assets currently exempt from these regulations. For the latter, including stable coins, the European Commission foresees stringent rules for issuers or companies applying for permission to offer services within the common market (EC, 2020). |
| Regulation on a European digital identity (EUid) | Furthermore, in June 2021, the European Commission proposed a European digital identity (eID) framework. In the future, all citizens and companies should be able to provide proof of their identity, pass on documents in electronic form using an eID wallet and use Europe-wide online services (EC, 2020 and BKA, 2021). |

*Source: Authors' compilation.*

## 1.3 Outlook

In the years ahead, the focus in Europe will be on the design and implementation of the digital euro, and on better facilitating cross-border payments and implementing data-reach payment formats such as ISO 20022 to support the digital transformation and the emergence of machine-to-machine payments.

The investigation phase of the ECB's digital euro project is scheduled to run until October 2023. The Governing Council will then decide whether to move to the next phase, which would involve the development of integrated services as well

as testing and possible live experimentation of a digital euro. This phase could take around three years.[7]

With technological change and enhanced cross-border payment systems, subject to enhanced security and data protection, payments will become cheaper and faster. A promising project in this context is Nexus, a model developed for connecting instant national payment systems into a cross-border platform. Nexus is a joint effort of the BIS Innovation Hub, Banca d'Italia, the central bank of Malaysia, BCS in Singapore and PayNet in Malaysia. The project has already moved to the testing phase, connecting the payment systems of Singapore, Malaysia and the euro area in order to provide an experimental proof of concept.[8]

## 2 What is the role of retail payments for the EU economies?

As argued by Yves Mersch, a former ECB Director, retail payments systems make trade easier, increase competition and innovation, foster financial integration and inclusion and complete the single currency project. Furthermore, retail payment systems facilitate the four freedoms of the European Union i.e. free movement of people, goods, services and capital (Mersch, 2014).

According to an ECB study from 2009, banks in countries with more developed retail payment services perform better – both in terms of their accounting ratios and their profit and cost efficiency (Hasan et al., 2009). Due to ease of use, scalability – almost no incremental costs per additional unit – and security, retail payment systems increase competition and innovation by tailoring services toward user preferences and enable e-commerce and m-commerce to thrive. Among all available payment instruments, card payments have been found to be most widespread. This is also confirmed by Scott (2015), who looks into five retail payments instruments, i.e. cash, checks, payment cards, automated clearing house transfers and virtual/digital currencies. His study finds debit and credit cards to be highest in demand, based on a detailed set of characteristics covering diverse interests and objectives of parties involved in payment systems, e.g. finality and reversibility, universality, etc.

### 2.1 Resilience and financial stability over the cycle

Intuitively, the argument that diversifying the sources of banking income, to include commission income, should insulate bank balance sheets better from credit cycle risks has some merits. This "conventional wisdom" was supported by early academic research and sustained by newer research. However, Baselga-Pascual et al. (2018), while showing that income diversification increases profitability, do not find a significant relationship between revenue diversification and bank risk. They analyzed a large sample of euro area banks across the time period of 2000 to 2012, covering two major economic downturns, the first following the burst of the dotcom bubble and the second after the collapse of Lehman Brothers.

The simplified argument that the use of electronic payments fosters financial stability is the following: as efficient and safe electronic payment instruments are easier, smoother and faster to use, they should ideally act as a catalyst for quicker responses to changing economic circumstances. From a policy standpoint, electronic

[7] *See FAQs on the digital euro (europa.eu).*

[8] *See https://www.bis.org/about/bisih/topics/fmis/NEXUS.htm.*

means of payments should have a higher influential impact on the economic behavior of individuals than traditional payment instruments.

In consequence, economic recoveries should happen faster, contractions should be shallower and reverberations on the economy as a whole less harsh. Therefore, the use of more efficient instruments of payment also increases financial stability.

Initial evidence from the first rounds of COVID-19 lockdowns seems to support this argument. After a couple of weeks, demand for cash recovered to normal levels as people experienced uninterrupted consumption, having switched to internet orders and delivery services and NFC payments, with almost no fraud incidents.[9] Observation supports the argument of a higher economic resilience due to lower execution risks of payment processes. However, we are not aware of conclusive academic research on this issue.

## 2.2 Strengthening competition and growth potential

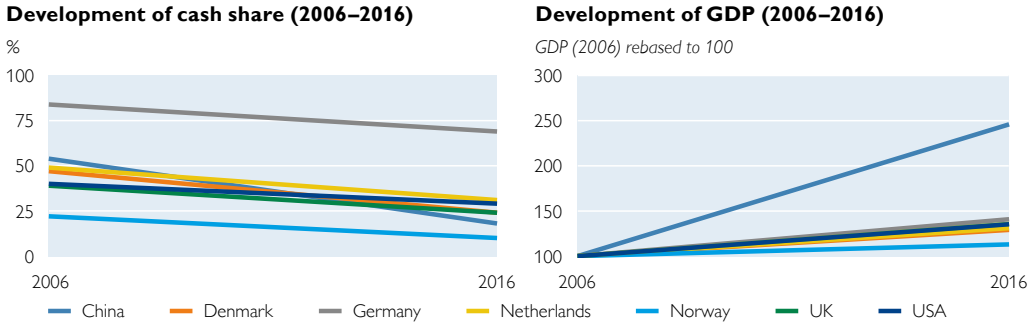
In an international study, Moody's (2016) analyzed the impact of electronic payments on economic growth based on macroeconomic data for 70 countries making up 95% of global GDP. The study suggests that in the period under review, from 2011 to 2015, higher card usage contributed approximately 0.1% of global GDP, or USD 296 billion. The impact of electronic payments on GDP increases with electronic payments penetration rates. Furthermore, increased electronic payments raise efficiency as transaction costs decline and convenience for customers and business rises. Moody's assumed that a higher share of electronic payments also improved government tax collection through more transparent transactions and increased financial inclusion.

The chart below shows the share of cash in payments in seven different countries in 2006 compared to 2016 (IMF, 2019).

This analysis does not imply that there is a causal relationship between a higher share of electronic payments and, ceteris paribus, higher GDP growth. While China successfully increased its GDP 2.5 times as the use of cash declined from 54% to only 18% in the observed ten years, Denmark did not see a corresponding nexus in economic growth when its cash share use dropped from 47% to 24%. This misalignment does not come as a surprise, considering the differences of the two

Chart 1

**Development of cash share and GDP (2006–2016)**




*Source: Based on IMF (2019).*

[9] *As in other countries, the limit for Austrian NFC payments was increased for convenience to EUR 50 per transaction.*

countries e.g. in geographic size, number of inhabitants, level of economic development and education.

A rough comparison of assumingly economically more similar countries like Denmark, Germany and Netherlands shows kind of similar developments in GDP (+29%, +41% and +31%, respectively, from 2006 to 2016) but widely diverging cash share levels. In fact, looking at these three countries, the counterargument could be made that Germany, the country with the highest cash share in 2006 and 2016 among the three by a margin, also posted higher GDP growth rates (+10% over Denmark and +12% over the Netherlands).

In conclusion, based on the above research, we cannot deduce a substantial and durable statistical relationship between electronic payments and GDP development. Nevertheless, the qualitative and intuitively convincing arguments of higher efficiency, increased velocity of money, lower transaction cost and higher convenience, i.e. higher productivity and higher consumer satisfaction, should not simply be discarded. The results from the analysis may be skewed due to characteristics of business cultures and habits of countries and pricing differences of payments instruments at end-customer level.

### 2.3 Financial inclusion

A study on Latin America and the Caribbean published by the Bank for International Settlements (BIS) suggests that electronic payments "represent a highly potential instrument for fostering financial inclusion as individuals and firms interact in the economy via the payments they make to each other through different instruments and channels" (Morales Resendiz, 2017). Likewise, experts of the United Nations Conference on Trade and Development (UNCTAD) say that mobile money holds the key for financial inclusion in underbanked Africa (UNCTAD, 2018). It is open for discussion whether these findings hold true for developed geographies like the European Union or the United States. One argument for it is that mobile devices – increasingly the entrance gate for ever more services – are so ubiquitous and cheap that even economically weak individuals can afford them. However, the instruments to use services, e.g. mobile devices, are not the only factor that counts for financial inclusion. Therefore, the general case cannot be made in the end.

### 2.4 Future role of retail payment systems

In the future, retail payment systems might increasingly take on the role of a catalyst stimulating the generation of new services, enhancing productivity and efficiency, and alleviating consumer satisfaction. Essential to this idea is the integrating role of retail payment systems, as they are centrally located in the ecosystem of economic transactions.

Crucial for achieving the promises is a frictionless user experience for end consumers, reducing the number of interaction requirements, currently clicks. Furthermore, subject to consumer consent, insights can be gained from the integration of customer loyalty in the payment process and exploration of the vast data volume generated.

Due to their central role in human interaction, payment systems could bring a higher quality of life to people. Because of technological advancements, these benefits can be achieved on an unprecedented scale and speed and at incomparably low costs. Challenges remain, however, with regard to privacy, data protection, safety and financial inclusion.

## 3 How has COVID-19 impacted customer and payment behavior in Europe and in Austria?

The COVID-19 pandemic that dominated developments in 2020 and 2021 has also significantly changed both consumer and payment behavior. With travel and contact restrictions imposed across Europe, people in Austria likewise experienced full lockdowns that paralyzed large parts of the economy and led to an economic downturn while increasing the public debt burden.

The pandemic, inter alia, also sped up the digitalization process, bringing forward changes that would otherwise have taken years to come. According to McKinsey's "Digital Sentiment Survey 2021" for Germany (McKinsey, 2021), the pandemic accelerated the use of digital channels across Europe by an average of 13% across a wide range of areas. Around 80% of European consumers with internet access used digital services in the last six months, and around 74% of respondents in Austria reported to prefer digital channels. The McKinsey study shows that across Europe, after the digital push caused by the pandemic, digital usage is slowly declining again and preparing for a "new normal" – those who used more physical channels before the pandemic will do so again once the pandemic is over. At any rate, digitalization as a driving factor in electronic payment transactions has also strongly impacted payment behavior during the pandemic.

For a detailed analysis of the COVID-19 impact, we will use the data from the payments surveys conducted by the Oesterreichische Nationalbank (OeNB) in 2020/21 (see box 1).

Box 1

### OeNB surveys on payment behavior in Austria

*In addition to surveys conducted every other year on the payment behavior of people in Austria, the OeNB has been running payment diary surveys at four-year intervals since 1996. Both types of surveys are carried out by the Institute for Empirical Social Research (IFES) on behalf of the OeNB. In both surveys, respondents – women and men over the age of 15 – are interviewed via questionnaire. In the payment diary survey, participants are also asked to keep track of their payments during the survey period. The results on the payment behavior of people living in Austria are representative in terms of age, gender and region.*

*The OeNB's payments surveys 2019 and 2021 were conducted without additional payment diary entries in the second half of the year, with interviews of around 1,400 people each. In 2019, the payments survey interviews were made from September to late October 2019. In the gap year between the 2019 survey and the 2021 survey, the OeNB conducted a payment diary study, which started in early September 2020 but was extended to April 2021 (with interruptions). For the payment diary study, a total of 2,552 people were interviewed, almost half of whom (1,260) completed the payment diary for seven days. In view of contact restrictions from mid-November 2020 and the increasing number of infections in Austria, face-to-face interviews were unlikely to be a stable option at some point. From February 2021 onward, the data were therefore collected through telephone surveys, with the diaries being sent by post (Dorfmeister et al., 2022). The payments survey 2021 interviews were carried out in the period from November until December 2021. Due to ongoing pandemic-related restrictions, this survey was conducted mainly online (80%) or through telephone interviews.*

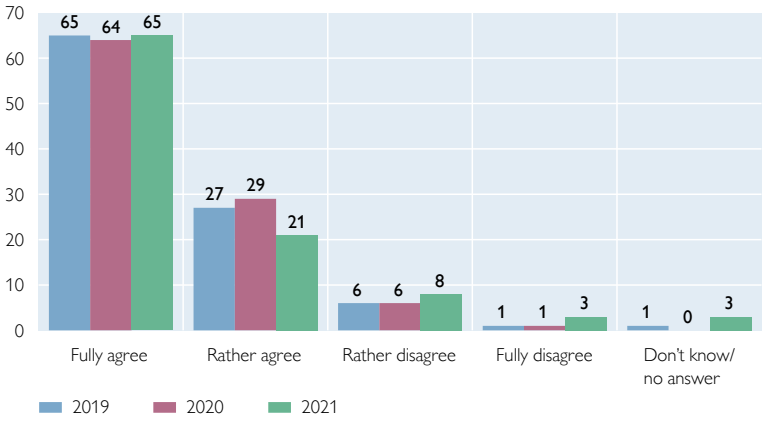
In the payment diary survey 2020/21, respondents were asked whether their payment behavior at the point of sale had changed during the pandemic, since mid-March 2020. Around one quarter responded that they had adjusted their payment behavior during the pandemic, while 70% said they had not. The payments survey in the 2nd half of 2021 again found only 22% of those surveyed to have changed their payment behavior, while 70% responded that they had not changed their behavior.

Ultimately, COVID-19 has accelerated the trend towards cashless payments, but it did not mark a pivotal change. The perceived risk of infection – 69% of the respondents interviewed in 2021 believe that the risk of infection is lowest for contactless payment cards, mobile phones and other devices or instruments that do not require a PIN entry – accelerated existing digital trends, but the trend was not sustained. Only 26% of Austrians said that they were making contactless card payments without entering a PIN or signature more often than before the outbreak of the COVID-19 pandemic (IFES, 2021).

Chart 2

**Perception of cash as optimal means of payment in Austria (2019–2021)**

*Percentage of respondents, year-on-year comparison*




*Source: OeNB payments survey 2019–2021.*

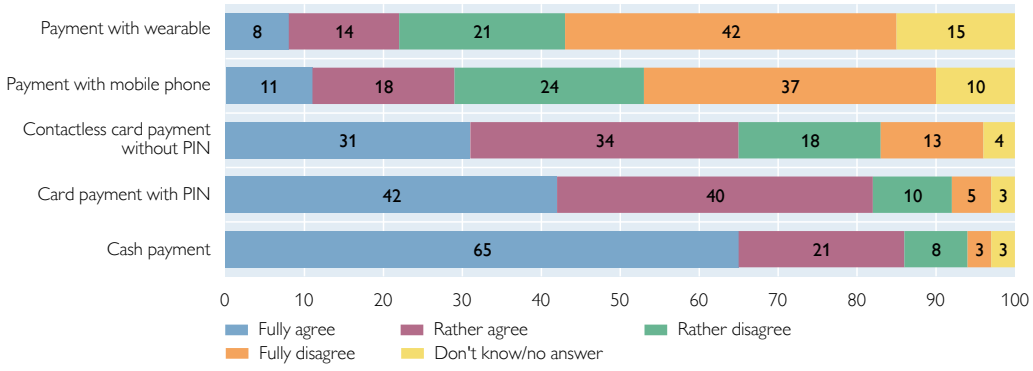
## 3.1 Cash as the optimal means of payment at the point of sale

The results show that cash is still dominating payments at the point of sale in Austria, yet contactless card payments have gained massively in importance. In 2021, 65% of those surveyed in Austria fully aligned with the idea of cash being the optimal means of payment. This figure has been pretty stable in recent years. At the same time, the percentage of those who tend to see cash as fairly optimal ("rather agree") decreased from 29% in 2020 to 21% in 2021.

Chart 3

**Perception of different payment instruments as optimal means of payment in Austria (2021)**

*Percentage of respondents (n = 1400)*




*Source: OeNB payments survey 2021.*

Overall, the pandemic seems to have increased the trend toward card and cashless payments among consumers. While in 2019 most respondents (94%) said they owned one or more payment cards and 93% stated that they had a debit card with a payment function, 69% confirmed that they had already made a contactless payment (not distinguishing between amounts under or over EUR 25) (IFES, 2021). In 2020, 97% of the respondents had at least one payment card; in most cases this was a debit card (94%). Point-of-sale transactions with debit cards in 2020 show a proportional increase from 10% to 27% compared to 2019. In contrast, credit cards facilitated only 2% of point-of-sale payments in 2020.

Ownership of NFC-enabled debit cards and knowledge of how to use them also increased significantly from 31% (2019) to 84% (2020). In 2020, 77% of 60-to-69-year-olds confirmed having an NFC-enabled ATM/debit card. Since 2017, only ATM/debit cards with NFC capability have been issued (IFES, 2020–2021). The higher response rate for NFC-enabled cards can also be attributed to the decision of Austrian banks, together with the Chamber of Commerce, to raise the limit from EUR 25 to EUR 50 for contactless card payments without entering a PIN, as recommended by EBA (EBA, 2020).

### 3.2 E-/M-commerce

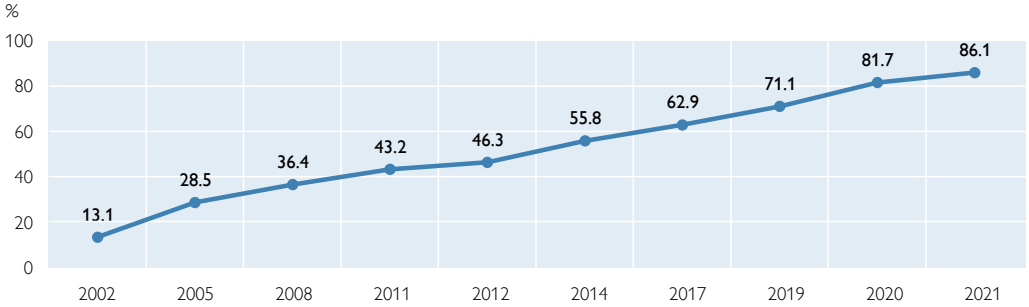
The share of people in Austria who have used the internet for consumption purposes increased steadily over the last two decades from 13% (2002) to 86% (2021) according to the OeNB's payments survey. This is in line with the general trend of the growing share of e-commerce.

In the last 12 months, many respondents (51%) shopped online but not more frequently than in the previous months. The majority of internet purchases were made from large international online platforms such as Amazon (43%). In 2020, 62% of those surveyed stated that they had bought or paid for something online in the last 12 months. The amount varies between over 80% in the group of under 30s and in the 70+ age group. A quarter (27%) of those surveyed said they had never bought anything on the internet. Around a third of those surveyed stated that they had bought significantly (11%) or slightly (19%) more online since the beginning of the pandemic.

When asked which means of payments were used for online purchases in the last 12 months, the following were mentioned most frequently: credit cards (54%),

Chart 4

**Share of people in Austria using the internet for consumption (2002–2021)**

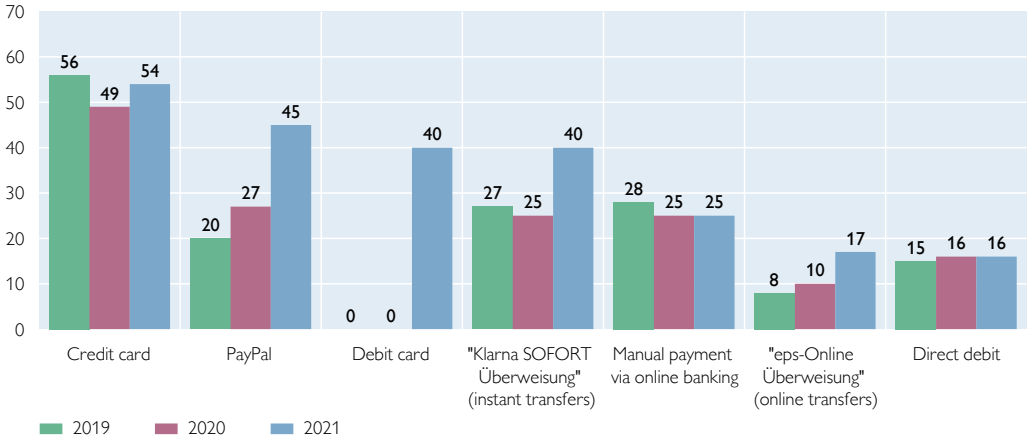



*Source: OeNB payments surveys 2002 to 2021.*

Chart 5

**Means of payments used for online purchases in Austria (2019–2021)**

*Percentage of respondents, year-on-year comparison*




*Source: OeNB payments surveys 2019–2021.*

PayPal (45%), ATM/debit cards (40%), Klarna instant transfers (40%), prepayment via online banking (25%), eps transfers (17%) and direct debit (16%). The least used methods have been cash-on-delivery (9%), Amazon Pay (6%), Apple Pay (4%) and Google Pay (2%). When comparing the figures for 2019 (56%) with those of 2021 (54%), credit card payments for online purchases have decreased by 2%.

As depicted in chart 5, PayPal (+25 percentage points) accounted for the largest increase during the period from 2019 to 2021, followed by Klarna instant transfers (+13 percentage points) and eps transfers (+9 percentage points). With the Mastercard debit scheme introduced in 2019, debit cards can be used for online purchases more easily and more widely than debit cards featuring the Maestro scheme introduced in 1991; the Austria-wide rollout took place in 2021. In 2021, 40% of those surveyed were already using the ATM/debit card for online purchases.

For most respondents (70%), the means of payment of choice for online/app purchases has not changed since fall 2020. 42% of those surveyed who bought something online in the last 12 months said they made the purchase on a mobile phone or tablet. More than half of the respondents (52%) who bought something on the internet via mobile phone in the last 12 months paid by credit card. Further, 37% used their ATM/debit card, 31% Klarna instant transfers, 26% wallet solutions (such as Klarna, Google Pay or PayPal) and 16% used online banking transfers for payments via app. The least widespread payment solutions for app purchases were installment purchase (2%) and prepaid cards (2%) (IFES, 2021).

### 3.3 Outlook

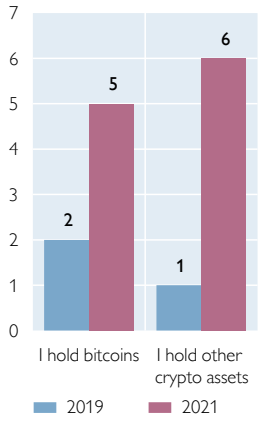
Once the COVID-19 pandemic is over, we expect a "new normal" to set in, with digital usage slowly declining again. However, what will remain is the change in the payment landscape caused by the progress of technology. For example, crypto assets may gain in importance in the coming years – new versions will become faster, and mining will become easier. Currently, the demand for crypto assets in Europe is still rather low. As a part of the Study on the payment attitudes of consumers in the euro area (SPACE), in 2020 only 3.6% of respondents reported having

access to crypto assets, such as bitcoin. The share is highest in Germany (7%) and Cyprus (7%). As with e-payment solutions and mobile payments, crypto assets are more popular among respondents between 18 and 39 years old (6% of respondents in these age groups own crypto assets). Whereas e-payment solutions and mobile payments are distributed fairly evenly between men and women, 73% of the respondents who reported to have access to crypto assets were men (ECB, 2020, p. 64).

Chart 6

**Possession of bitcoins and other crypto assets in Austria (2019 vs. 2021)**

*Percentage of respondents, year-on-year comparison*




*Source: OeNB payments surveys 2019 and 2021.*

Although crypto asset ownership in Austria remains subdued, we see a slight increase (see chart 6). When participants were asked in 2019 how great their interest in bitcoins or other crypto assets was, only 2% of respondents reported to be holding bitcoins at the time and 1% of the respondents reported that they were holding other crypto assets. From 2019 to 2021, bitcoin holdings in Austria more than doubled from 2% to 5% (+3 percentage points). Holdings of other crypto assets in Austria even increased six-fold, from 1% to 6% (+5 percentage points).

What remains is the challenge for Europe to stay competitive in the international payments landscape. Not only will the payment methods change, but so will the actors in the industry. Many of the players are American companies such as PayPal or Google, who scale innovations quicker. Due to the investment and innovations environment we have in Europe, the share of European solutions is currently declining. Although the Austrian banks are very well capitalized and could therefore play an important role, they lack innovations, especially in terms of payment solutions for merchants. As a result, Austrian and European banks may stand to lose revenues and market share or face disintermediation.

## 4 What is the role of European players in the retail payments value chain?

In retail payments, the major distinction in the value chain is between front-end and back-end services (see annex). Whereas front-end services for retail payments address the needs of customers, i.e. payers and payees, back-end payment services are provided for intermediaries such as banking institutions in their function as account providers or payment scheme providers.

With the creation of the Single European Payments Area (SEPA), the European Commission sought to remove remaining barriers for payments in Europe, causing domestic payments and payments between member states to be treated the same. One step toward the harmonization of the payments market was the harmonization of fees between domestic and cross-border payments between EU member states. Thus, value creation in payments was shifted from back-end payment services – such as payment data provision, payment delivery, processing, clearing and settlement,

booking and invoicing, respectively post-payment services such as investigation – toward front-end payment services, such as product design and payments selection (also called overlay services). New entrants such as PayPal and Apple Pay enhanced their offerings to provide a seamless user experience for smartphone users, building upon existing payments means and payments processes (card payments or from-account payments; see annex).

An internal OeNB study, conducted with zeb[10] in 2021, showed that the incumbent players such as banks and card schemes continue to dominate the value chain, capturing more than 85% of the revenues created in Austria, which is slightly below the EU average of 91%. Total payments revenues generated in 2020 in the EU amounted to EUR 2.1 billion or 3% of total payments revenues generated in the EU.[11] Wallets and payment enablers (overlay services such as PayPal) do not play an important role, accounting for around 7% of payment revenues and leaving space for payment providers like PayOne or Ingenico. Only in the Netherlands did the payment enablers reach a more significant share with around 10% of payment revenues. This can be attributed to the long history of overlay services provided to Dutch customers: iDeal, which today holds a 70% share of all e- and m-commerce payments, was launched as early as in 2006 as an online and e-commerce payments solution by a consortium of Dutch banks. Thus, the Netherlands are one of the few countries where PayPal's share of e- and m-commerce is below 5%.

Following current growth rates without considering the effects of further innovations and market initiatives such as the implementation of request-to-pay or the European Payments Initiative (EPI),[12] payment enablers will expand their revenues by more than 50% until 2028. Together with wallets, they will capture as much as 15% of the value created by 2028. In turn, banks will lose at least 3% of their payments revenues, with payer (issuing) banks standing to lose almost twice as much in revenues from payments as the payee (acquiring) banks.

### 4.1 Value creation in payments – an example

In the example below, we will demonstrate the economics of value creation in payments and argue why changes may be in the offing. Let us look at the example of a tourist called Annika from Amsterdam purchasing a cappuccino and a Sachertorte for EUR 9.80 at a nice but fictitous Viennese café. See figure 6 for a short overview of all steps typically needed to process this retail payment transaction in the retail payments life cycle.

[10] *https://zeb-consulting.com/en-DE*.

[11] *The data for the revenue analysis were taken from the ECB data warehouse for the year 2018 and extrapolated to 2028 with a compound annual growth rate (CAGR) of 6.6%.*

[12] *https://www.epicompany.eu*.

Figure 6

**Example of a cross-border retail payment within the euro area**

| | | |
|---|---|---|
| 1 | Payment method selection | Annika opens her virtual debit card in her smartphone wallet |
| 2 | Provision of payment data | NFC transmission of debit card data from Annika<br>Annika uses Face ID or enters her PIN |
| 3 | Payment delivery | Annika's Dutch bank receives the payment |
| 4 | Processing | Annika's Dutch bank verifies and authenticates payment of EUR 9.80, checks whether Annika has sufficient funds and makes the necessary entries in the bookkeeping system |
| 5 | Clearing/settlement | EUR 9.80 are transferred from Annika's Dutch bank to the Austrian bank of the Viennese café in a collective pooling and settlement procedure |
| 6 | Booking | The Austrian bank of the Viennese café verifies and credits EUR 9.80 to the payee's account |
| 7 | Invoicing/information | The account statement of the Viennese café shows the crediting of Annika's debit card payment |

*Source: Authors' compilation.*

First, Annika needs to choose a payment method other than cash from among the options available to the payee at the point of interaction, such as Bluecode[13] or her debit or credit card. Let us assume that Annika opts for debit card payment using the wallet functionality of her smartphone. Once the waiter brings a mobile payment terminal to the table, Annika, whom we assume to use Apple Pay NFC proprietary technology on her iPhone, provides her debit card payment data without needing to present her card at the terminal. All Annika had to do beforehand was activate the wallet function of her iPhone and link her Apple ID with her debit card payment data. For this to work, Annika's bank also needs to be partner of Apple Pay. In other words, Apple Pay needs to have agreed to provide technical services for payment initiation and authentication, for which the bank pays fees.

As a next step, Annika's payment data need to be verified and authenticated, which is done by Face ID provided by Apple as the payment enabler in our example. Once the payment data have been authenticated, they are delivered to Annika's Dutch retail bank A, which also verifies and authenticates the payment to establish its legal and technical validity, checks the availability of the funds requested and then approves the transaction. After this process, a clearing and settlement process ensures that Annika's payment is transferred from her bank A to the receiving bank B – the bank of the Viennese café. Bank B verifies and credits the café's account, which will eventually find the payment amount on its account statements.

It is also interesting to see which stakeholders benefit from such a retail payment transaction. If Annika pays in cash, no transaction fees apply to the payer or the payee. Yet, Annika must make the effort of withdrawing cash and carry it, while the merchant needs to pay for cash collection, secure transport to the bank and insurance. In addition, no data about Annika's consumer and payment behavior are created.

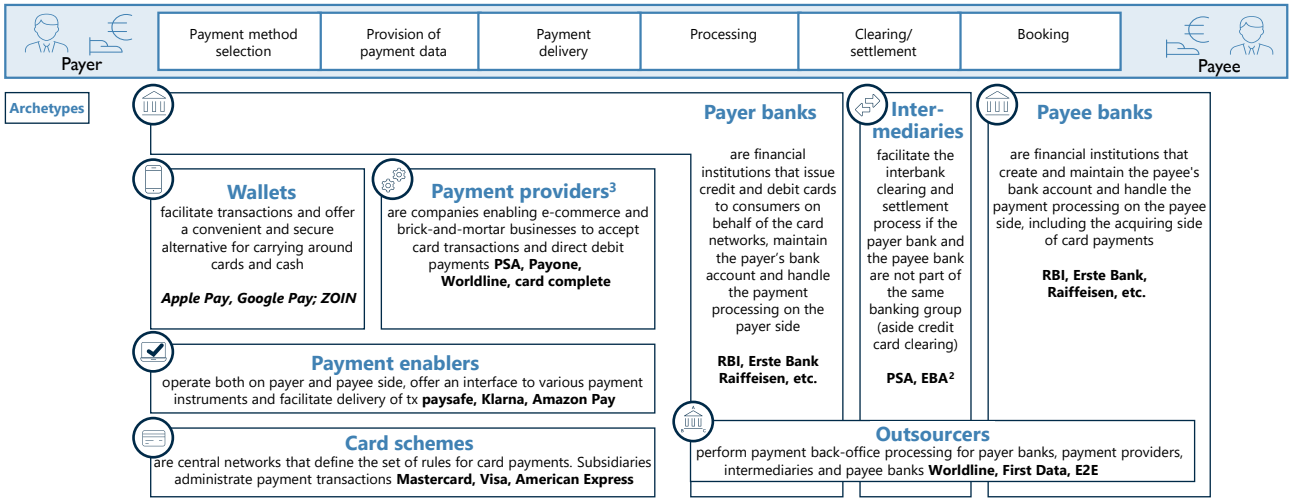
However, if Annika uses her debit card to settle her invoice instead, several more stakeholders will benefit from this transaction. After all, this transaction

[13] *https://bluecode.com/.*

Figure 7

## Current players in electronic retail payments in Europe

**Eight archetypes[1] involved in single and multiple payment value chains**




*Source: OeNB, zeb.*

*[1] Note: Terms reflect a neutral description of the archetypes and are to be understood in a nontechnical and nonlegal way.*
*[2] EBA Clearing and national central banks.*
*[3] May also include majority of independent sales organizations and payment facilitators since they offer their services mainly to merchants.*

will generate not only fee revenues but also payment and consumer behavior data that are of high value for certain stakeholders.

This simple example illustrates the complexity involved in cross-border retail payments. In this respect, retail payments markets can be understood as two-sided network markets that require a large-enough installed user base on both sides of the market to function efficiently and effectively (Weber et al., 2022).

From a European perspective, there are plenty of players involved in each of the steps described above. Nonetheless, international card schemes currently dominate the still largely fragmented national markets. Underlying payment infrastructures and schemes still remain organized along national borders but now face mounting challenges and fierce international competition in an increasingly dynamic environment at the customer interface.

Due to the limited network size in the respective home markets, interoperability and European and international reach are an issue. Therefore, the industry has also witnessed a range of cooperative payment initiatives with a dedicated European focus.

### 4.2 Success factors for retail payments systems

Based on the above insights, certain success factors for retail payments systems have become evident. We would summarize those success factors in the following four categories, three supply-side factors and one demand-side factor:

(1) Network effects – Payment markets are two-sided network markets that require a large-enough installed user base on both sides of the market, i.e. (i) existing infrastructure such as merchant terminals, mobile phones or bank accounts and (ii) existing user accounts such that payers and payees do not need to perform

an additional onboarding process. If an onboarding procedure is deemed necessary, it should be fast and effortless.

(2) Standardization – payments solutions should involve common standards for authorization, messaging, risk mitigation, transaction transfer and the like. Also, a basic common service level must be in place, e.g. for payment guarantees, operational performance or transfer times. This would lower coordination costs, which are an issue given the network nature of the market.

(3) Reach or forced cooperation – payments are a "reach" business; without reach, payments services are perceived dysfunctional by users. Due to the market characteristics, cooperation is often vital, for example cooperation to build a common infrastructure or set necessary common standards. At the same time, such cooperation must not foreclose competitors or suppress competition when it comes to concrete product offerings to users.

(4) Demand-side hygiene factors – characteristics of payment instruments often described in the choice-of-payments literature, such as speed, safety and security (Shin, 2009), ease of use and low costs (van der Heijden, 2002) as well as budgeting usefulness (keeping track of expenses), have become merely hygiene factors in mature markets.

Another two factors may become crucial for creating a stronger European footprint in the retail payments value chain in the future:

(5) Governance – European payments autonomy has been promoted in recent years by the European Commission and the ECB. They argue that independent governance and autonomy ensure low risk and low cost for payments providers in the long run and guarantee customers safe and efficient payments solutions. The impact of payments autonomy on the economy has become most evident since Russia's invasion of Ukraine. It can be assumed that customers will be willing to substitute "ease of use" for transparency, governance and autonomy of payments solutions. The evidence of such customer behavior needs to be evaluated.

(6) Security and privacy – although data protection has a long track record in Europe, security and privacy is still not sufficiently explored, in particular with regard to customer behavior. Recent studies related to the digital euro provide evidence that consumers may differentiate between privacy and "perceived privacy," willing to provide access to data in exchange for "ease of use" if they believe to retain control over the process.

Based on those six factors and their possible development over time, we can create scenarios for the future of retail payments in Europe, considering policy decisions such as increased sanctions in cross-border payments, crypto-asset regulation, and the introduction of the digital euro.

## 5 Scenarios for Europe's future retail payments architecture and conclusion

Electronic payments in Europe have proven to be reliable, secure and innovative within the last 20 years. They have been driven by customer demand and technology. While technological innovations were intended to make payment instruments more convenient at the time of transaction, regulations and central payments infrastructures made electronic payments secure and reliable. The challenge for the next decade is to go beyond low costs and ease of use. Privacy, strategic autonomy, and sovereignty appear to be the major issues Europe will face.

To develop policy implications for the payments market considering those issues, we built a baseline (most likely) scenario and an alternative scenario depicting an almost reverse outcome. The time frame of the scenarios is 15–20 years ahead.

### 5.1 Baseline scenario

The baseline scenario is the future we expect most likely to happen in the absence of any significant policy interventions or market initiatives. Over the next 15–20 years, we expect the trend to an ever higher share of electronic payments of total payments in Europe to continue, as the examples of Sweden or Netherlands show. Considering different demographic mixes and (converging) customer preferences in Europe, we can expect a stable state at a volume of 65% to 70%. This will be propelled by a friction- and seamless payments experience, and a trusted and secure data ecosystem underpinned by new European and potentially global regulations really focusing on consumer wants and needs.

Big tech and fintech will continue to lead the market, harvesting economies of scale and network effects of their solutions, with banks hopefully following the development. The latter will strongly depend on the cooperation abilities of European banks and their capability to raise joint investments, evaluate strategic options and align alongside common governance. Since innovation has proved to be a critical success factor for payments and ultimately for maintaining the customer relationship, outsourcing innovation activities to technology providers and partners may not be a successful strategy in the long run. Innovative and protecting regulation will support more transparent products and services but will not be sufficient to prevent concentrations due to network effects.

Due to automation, mobile authentication for P2P payments but also for highly protected environments like lending processes, artificial-intelligence-enhanced validation processes, machine-to-machine payments and distributed ledgers scaling up for wholesale transactions, overall productivity gains will be huge, and so will be the value to be captured with future payments solutions.

As we assume that the bias to cash in some European societies is strongly connected to generational preferences, pivotal breaks would appear to be likely to occur once the babyboomer generations have entered retirement. This development could be hindered or stopped only by a major backlash, such as a major data security problem or outright theft leading to heavy losses on the personal income statement of individuals and thereby disrupting trust in electronic payment solutions.

We also expect the US dollar and the euro currency areas to converge regarding regulation and standardization in the area of payments due to similar expectations and approaches to key characteristics of privacy, transparency and validity. Though the approaches to innovation are different, we expect the US and the EU to take similar regulatory and supervising avenues in the upcoming consolidation phase of digitalization and its translation into products and services in the payments industry.

In this scenario, the role of central bank money as a payments instrument will decrease significantly, leaving space for market participants to capture part of the value generated by productivity gains and create business models of their own. Downside risks include the exclusion of vulnerable groups from certain payment services (digital divide), stronger exposure to threats (lack of crisis prevention

mechanisms) and loss of choice (alternatively higher costs for consumers). A possible solution to address those risks is the introduction of the digital euro as a retail central bank digital currency.

### 5.2 Alternative scenario

This scenario, from our perspective, depicts a dismal dystopia in which all major common European projects, including the euro, fail to deliver the desired results, with an ensuing loss of trust among European citizens. In such case, European nations will decide to push genuine "local" solutions.

As trust in institutions diminishes, even the nation states themselves show cracks and are being questioned. In payments, consequently, decentralized innovative solutions like privately issued crypto assets gain momentum. Fragmentation increases, trust in crypto assets overall grows while central bank money and bank money lose importance. Stakeholders shift significantly from regulated banking institutions and payment service providers toward unregulated global players – both individual and institutional. Transparency, governance, and security of payments systems decrease, impacting financial stability and the resilience of the economy, as examined in section 2.

### 5.3 Conclusion

To conclude, we assume that electronic payments will continue to capture an increasing share of total payments in our economies. A rising share of electronic payments has the potential to unlock significant productivity gains and thus represents a great share of value, which can be captured by private market participants. The analysis of payment behavior in section 3 underscores this assumption. In addition, we tried to make a case for the major advantages of electronic payment means by looking at the technological development in recent decades, by analyzing studies which concentrate on economic efficiencies, banking resilience, financial inclusion and by elaborating on the value creation of a typical payment process in a Viennese café.

For policymakers, today's fragmented landscape consisting of tech-slow incumbents and highly innovative and highly profitable big techs as well as fast growing fintechs as challengers makes it difficult to come up with a one-design-fits-all policy. With rising geopolitical pressure, strategic payments autonomy and sovereignty move to the top of the agenda of European policymakers. Also, consumers may wish to trade "ease of use" for privacy, security and governance. This shift in customer preferences will have to be explored in detail in the months and years ahead as it can provide a valuable foundation for future policies, offsetting lock-in effects of current big tech and fintech solutions.

In our research, we identified a lack of supporting academic studies regarding the economic value of electronic payment systems in different economies and various market conditions. In addition, there is currently no clear-cut descriptive categorization of major payment markets along a number of characteristics, e.g. the USA, the EU, leading Asian markets and other geographies. Both could be very helpful as a base for further research studies and policy development.

## Annex: Overview of today's payment systems infrastructures and services

Electronic payment systems appear in many different forms and sizes, and new designs continue to emerge (Bech and Hancock, 2020). Figure 8 provides a basic classification for electronic payment systems. In Europe, the major electronic payment systems services are based on underlying bank accounts.

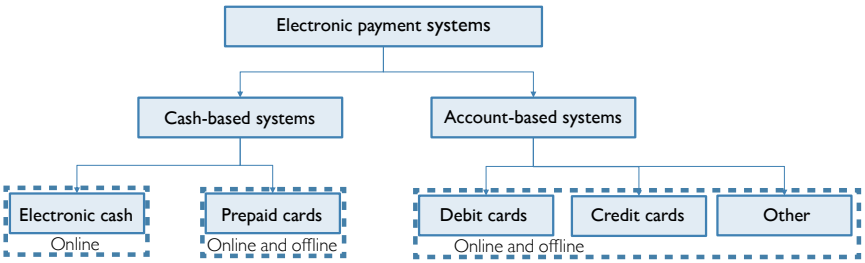
Regarding the value of payments, we typically distinguish between wholesale and retail payments and payments systems:

– Wholesale payments are high-priority and typically large-value transfers made between financial institutions[14] such as banks for their own accounts or on behalf of their customers. Wholesale payments are settled via dedicated interbank settlement systems like TARGET2, the Eurosystem's real-time gross settlement (RTGS) system for euro-denominated payments. To be eligible to conduct wholesale payments, financial institutions need to hold accounts with RTGS providers. Balances on accounts with central banks are central bank liabilities and referred to as central bank money.[15]
– Retail payments are lower-value transactions between individuals, businesses, and governments involving cash, checks, credit transfers, and debit and credit card transactions.

  To be eligible to conduct electronic retail payments, the payer and the payee need to hold bank accounts, and their banks need to participate in the respective electronic retail payments system. The balances on these accounts are commercial bank liabilities toward the payer or the payee and referred to as (commercial) bank money.

Figure 8

**Classification for electronic payment systems**




*Source: Based on Kim et al. (2010).*

[14] *Including payments between sovereigns, since they are usually carried out by the national central banks.*

[15] *There are also a few private wholesale high-value payments systems, such as EURO1 in Europe and The Clearing House in the USA. EURO1 is an RTGS-equivalent net settlement system set up by the Euro Banking Association (EBA). It is overseen by the European Central Bank, and its participants include the Eurosystem national central banks.*

Since payments are transfers of monetary value from payers to payees, usually in exchange for goods and services or to fulfill contractual obligations or other purposes of exchange (Bech et al., 2017, p. 58), retail payments can be further classified according to the type of payer or payee involved as follows:

- Person-to-person (P2P) payments, such as borrowed money returned to a friend or money transferred between family members. Sometimes those payments are also referred as consumer-to-consumer (C2C)
- Person-to-professional (P2Pro) payments like money paid in a barber shop or for the services of a mechanic
- Business-to-consumer (B2C) payments are payments made by businesses in exchange for goods or services purchased from consumers
- Business-to-business (B2B) payments are payments between companies for the delivery of goods along the supply chain or for the purchase of services like shipping services
- Consumer-to-business payments (C2B) are payments from consumers for goods and services purchased from businesses at the point of sale or online, such as grocery store or travel services purchases
- Business-to-agencies (B2A) payments are payments conducted between businesses, government agencies, and public administrations
- Consumers-to-agencies (C2A) payments are payments conducted between individuals and government agencies and public administrations, such as tax payments

Payments made or received within the euro area can be classified into domestic payments, euro-denominated payments to or from other euro area countries (SEPA payments) or cross-border payments.[16] Electronic payment systems such as RTGS systems, automated clearing houses or domestic card schemes are mostly designed for domestic or SEPA transfers. International card schemes like Visa and MasterCard provide procedures and rules for the transfer of funds in multiple currencies between participants. Cross-border payments are mostly transferred bilaterally between banks between accounts they hold with each other, or through intermediaries (correspondent banks). The processing of cross-border payments requires an electronic message transfer infrastructure (SWIFT[17]) and liquidity in foreign currency. This is the reason why cross-border payments are still opaque, slow, and costly.

[16] *In the euro area, cross-border payments are payments between payers and payees from two different countries executed in a currency other than euro. Payments in foreign currency within the same jurisdiction, e. g. Austria, follow the same rules, formats and processing practices as cross-border payments.*

[17] *SWIFT is an international network, established as a cooperative utility under Belgian law, for the exchange of encrypted electronic financial messages. It is the "post office" of the financial system. Every bank has been assigned a unique bank identifier code (BIC) consisting of 8 to 10 digits. The first four digits identify the institute, the second four digits identify the country (digits 5 and 6) and the city (digits 7 and 8) in which the institute is legally registered. To exchange financial messages, banks need to be active users of SWIFT and to "know each other" based on the exchange of encryption keys. SWIFT does not read the financial messages but just ensures the secure transfer between banks. In 2012, SWIFT was exceptionally prohibited under EU Regulation 267/2012 from providing financial messaging services to EU-sanctioned Iranian banks. In 2022, SWIFT was again mandated to restrict its services under EU sanctions on Russian and Belorussian banks.*

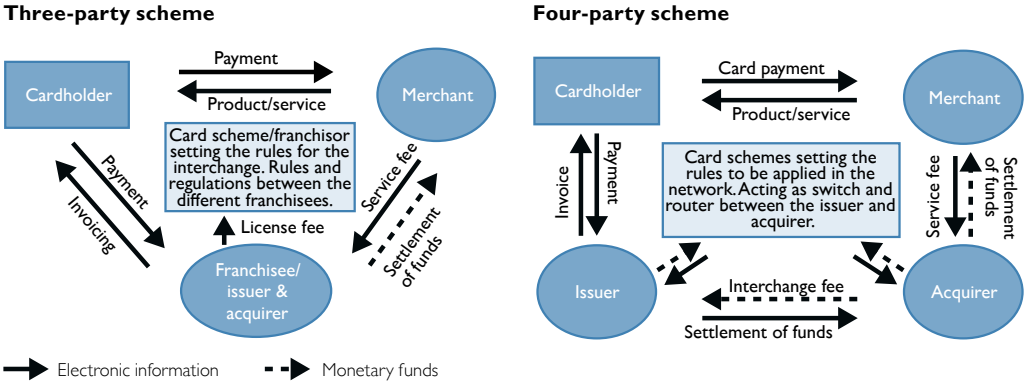
Addressing these challenges has been put as a priority to G20 countries. Further ways to analyze retail payments in particular and to obtain deeper insights into their complexity are the adoption of a process perspective, a stakeholder view or a value-chain perspective.

– From a process perspective, we differentiate between from-account payments and card payments. "From account" payments such as credit transfers or instant payments are instruments which are settled directly on the payers' and payees' accounts. Card transactions are also linked with card holders' accounts but settled using card schemes.
– From a stakeholder perspective, there is a large variety of stakeholders typically involved in electronic retail payment systems (e.g. card schemes). They comprise parties like the payer, payee, issuer/acquirer, liquidity providers and account providers, overlay services, central banks, financial system oversight and regulator. Each of these stakeholders perform different tasks in the process of a transaction.

Particularly interesting for the analysis of the evolution of payments systems and the future policy implications is the differentiation between three-party and four-party retail payments systems. In a three-party model, the payer (or card holder) and the payee (or card acceptor/merchant) use the same intermediary. Although this classification is mostly used for card payments, it applies for all retail payments at the point of sale. For instance, "to account" payments like BlueCode payments in Austria work as a three-party payments system, where the consumer needs to download the BlueCode app and register, and the merchant needs to integrate its payments terminal with the BlueCode platform, which generates a QR code to be scanned by the payer.

Figure 9

**Three-party vs. four-party payment system model**




*Source: Authors' compilation based on Wikipedia.*

Alternatively, the payment process may rely on the services of a (e.g. credit or debit) card issuer and a payment terminal provider, called acquirer (see figure 9). Thus, the issuer and the acquirer are two distinct financial intermediaries, who provide licensed payment means that comply with the respective payment or card rules ("schemes"). In Europe, several national and international card schemes have been implemented. Countries like Germany, France, Spain and Italy maintain their own national card schemes, which are usually co-branded with international card schemes like Visa or MasterCard for use abroad. Other countries like the Netherlands, Belgium, Austria, and most of the Central and Eastern European countries do not have dedicated national card schemes. They use international schemes for their domestic card transactions.

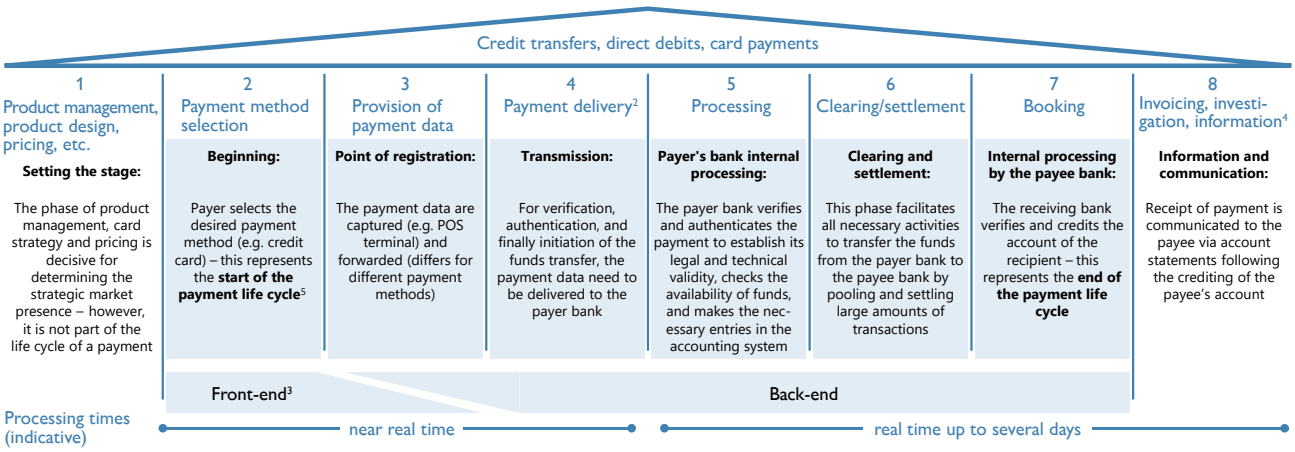
Similar to the rules for card retail payments systems, there are also rules and regulations applicable to from-account payments ("payment schemes"). The major payments schemes rolled out in Europe are SEPA credit transfers (SCT), SEPA direct debits (SDD) and SEPA instant payments (SCT Inst).[18]

– From a value chain perspective, payment systems can also be analyzed based on the different steps in the payment process they fulfill (see figure 10). This helps identify relevant players active at each step of the value chain and cluster players with similar business models to archetypes and assess their concentration.

Figure 10

## Value chain for electronic retail payments

**Overview of process steps in the payment value chain[1]**




*Source: OeNB, zeb.*

*[1] Note: Terms reflect a neutral description of the process elements, they are to be understood in a nontechnical and nonlegal way.*
*[2] Payment delivery is part of the processing step as well and also takes place between step 6 (clearing/settlement) and step 7 (booking) – not repeated for clarity of presentation.*
*[3] Visible to payer, front-to-back handover and specific scope depending on payment method.*
*[4] This step is not part of the payment process itself but is nevertheless part of a payment transaction. Confirmation to the payer takes place at different steps of the value chain, depending on the payment method.*
*[5] Defined as the steps happening between steps 2 and 7.*

*[18] SCT, SDD and SCT Inst are payments schemes managed by the European Payments Council (EPC). The primary task of the EPC is to manage the SEPA payment schemes that facilitate over 43 billion transactions in 36 countries each year.*

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# How much cash is in crypto?

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*In 2008, an anonymous white paper introduced "bitcoin." Its ideas triggered and inspired the emergence of thousands of crypto assets in its wake. Putting key terms used in this paper to a close reading reveals that terms like "electronic cash," "peer-to-peer" and "inflation" are used in a different sense than is customary in economic debate. Despite claims put forth in the white paper, transferring bitcoins is neither "peer-to-peer" in the sense of a non-intermediated transfer between two individuals nor does bitcoin offer technical protection against losses in value and is therefore not "inflation free." Last but not least, bitcoin is not a carrier of stable value that is generally accepted like cash.*

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## From bitcoin to crypto assets: looking for a place in the world of economic value

If all owners of crypto assets of any type had found buyers for their holdings in exchange for cash when the 2021 rally on crypto markets peaked in November, as much as EUR 2.5 trillion would have changed hands. At the time of writing in January 2022, it would have been EUR 1.4 trillion.[2] In contrast to cash stored in safe-deposit boxes at banks and bank deposits that represent claims on banks to provide cash on demand at par value, the relationship between crypto assets and cash is characterized by considerable uncertainty.

More than a decade after the publication of the initial paper "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008), the answer to the question what bitcoin or similar crypto projects are still depends on who you ask and where you look: white papers written by developers, marketing messages of crypto businesses, user surveys, academic research, policymakers or legal texts, etc.[3]

Depending on who you ask, you will find that different terms are used to describe the same crypto phenomena and that terms may mean different things when related to classifying and describing crypto projects.[4]

Therefore, we should take a closer look at the terminology: what do key terms widely used by crypto enthusiasts to describe the properties of bitcoin and similar projects actually mean? What do expressions like "peer-to-peer electronic cash" that is "inflation free" refer to in an economic sense? Are there ambivalences in meaning which might be noteworthy or even misleading?

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[2] *https://coinmarketcap.com/de/charts/.*

[3] *For a discussion of other crypto-related aspects in previous issues of this journal, see Beer and Weber (2014) and Pichler et al. (2018).*

[4] *See Financial Times (2021). Even to use the term "crypto" as a catch-all term for all projects in the wake of bitcoin is a contestable form of borrowing a shorthand for the term "cryptography" to denote what European legislators call "crypto assets."*

The brainchild of an anonymous entity (Nakamoto, 2008), bitcoin came into being in 2008. From the beginning, it has attracted people that attach meaning and devote time and resources to it. Also, bitcoin has triggered various forms of economic activity, and it has inspired the creation of thousands of additional crypto projects. With the regulation on markets in crypto assets (MiCA),[5] the EU is about to establish a comprehensive set of laws applicable to crypto-related activities. Importantly, the regulation is expected to help clarify the relation of crypto phenomena to legal concepts as well as the legal rights and duties attached to them. A major step for both legal systems and crypto-related activities, this legislation is likely to have a decisive influence on the economic activities related to crypto projects. After all, the legal system plays a key role for the operation of the economic system (Pistor, 2019). Note that the MiCa draft refers to "crypto assets" in its title instead of the more popular term "cryptocurrencies." This illustrates that integrating innovation into existing legal and economic systems can also imply confrontation with existing classification systems that exert terminological adjustment pressure.

Bitcoin is the most spectacular attempt in recent history to translate cash into electronic form. In describing this attempt, the pseudonymous author(s) of the initial white paper and subsequent presentations make(s) use of several terms, definitions and descriptions from the English language that give people tools to make sense of this novel concept. Based on this, other people have been devoting attention, interpretations, time and resources to this concept, giving it a social existence.[6]

One starting point for exploring the sources of views, interpretations and labeling efforts with regard to crypto projects is to investigate the context from which bitcoin originated. This context has political aspects: bitcoin emerged from discussions in the "cypherpunk" community. Its members develop privacy-enhancing tools to promote a society characterized by "crypto anarchy." Cypherpunk is a variant of a techno-political view of the internet as a new form of society where freedom means markets and money beyond law, politics and parliamentary democracy (Brunton, 2019; Clark, 2016). The global financial crisis from 2007 to 2009 has significantly influenced the economic context, focusing public attention on issues related to money and finance, government and banking. Another contextual aspect is the field of expertise the developers of bitcoin come from. As a major early survey on the phenomenon notes, "bitcoin's rules were designed by engineers with no apparent influence from lawyers or regulators" (Böhme et al., 2015, p. 213).

Why would identifying crypto designers' field of expertise matter for discussing the nature of bitcoin or crypto assets in general? For one thing, fields of expertise are intertwined with specific world views, among other things. For another, experts usually develop specific terminologies, where terms are given clearly defined meanings fit for their context. We know this from fields like engineering, law or economics, each of which may be further divided into subfields such as game theory and monetary economics as well as different schools of thought, etc. Also, different fields of expertise may use the same terms with different definitions. This

[5] *For a draft, see European Commission (2020).*

[6] *Shiller (2020) highlights the role of sense-making in the form of narratives for economic activity, including bitcoin. Hasufly and Carter (2018) survey key narratives around bitcoin.*

may lead to misunderstandings among members of different fields of expertise, specifically when there is a lack of time, awareness or intention to spell out and discuss the precise meaning and implications of terms.

Böhme et al. (2015) give a further clue on the engineering perspective informing bitcoin by characterizing the project as "an online communication protocol that facilitates the use of a virtual currency." Highlighting the communication aspect is relevant because money, e.g. banknotes, coins, bank deposits or e-money, transferable on payment systems is a means to communicate about economic value, with money serving as a kind of language for the economic system. Any design of money therefore requires consideration of a mechanism that makes money represent economic value and how such money can be used in the economy it is intended for.

In engineering and engineering theory, however, communication is studied in a narrow sense – as the technical process of signal transmission. Hence, engineers treat signals as a physical phenomenon, quantitatively measured in bits. On this conceptual basis, engineering inquiries measure and compare the effort and capacity of various channels for the undistorted technical transmission of signals in various forms. In contrast, the processes associated with coding and decoding social meaning to be transported in communication do not form part of the analysis (Eco, 1976; Shannon, 1948).

While the social – including the economic – dimension and meaning of communication are usually not part of the engineering discipline, the white paper on bitcoin and many references to bitcoin lack such a clarification. As a result, interpretations give rise to ambiguities.

So, how does the white paper on bitcoin use and define key terms that have over time become prevalent in debates about crypto assets and their relation to cash? In a community heralding its dislike of authority, the white paper is perhaps the closest equivalent to something like a foundational text. The fact that the author or authors chose to publish the text under the pseudonym "Satoshi Nakamoto" may have helped avoid personal disputes inventors are often faced with. Most people associated with bitcoin would probably agree on the document's relevance and influence. Although the text and its concept are subject to many disagreements, many terms as used and defined in the bitcoin white paper have been widely adopted among crypto supporters. Among thousands of crypto assets, bitcoin is still the most widely known and by far the biggest one, accounting for a share of around 40% in widely used metrics of crypto market value.[7]

A close reading of the meaning of key terms used in the white paper could therefore be a useful contribution to the wider debate on what bitcoin-like crypto projects are and how they resemble – or differ from – existing economic phenomena like official currency. In the following, I discuss three key terms particularly relevant to comparing crypto assets like bitcoin with banknotes and coins in official currency: (1) cash, (2) peer-to-peer, and (3) inflation. There are many other terms which are widely used to describe or promote bitcoin-like projects, e.g. "cryptocurrency," "token" or "payment system." Here, I concentrate on the term "cash" because this publication centers on this specific form of money. "Peer-to-peer" is the most specific form of what bitcoin supporters perceive as bitcoin's distinctive

[7] *https://www.statista.com/statistics/1269302/crypto-market-share/*.

organizational feature compared to official currency: decentralization. Finally, "inflation" is a key term in any discussion on the economic value of money.

The annex provides a short glossary defining six terms widely used in the context of crypto assets.

## 1 "Cash"

In the title of the 2008 white paper, bitcoin is introduced as an "electronic cash system." From this starting point, the paper (Nakamoto, 2008, p. 2) then proceeds to define the more specific term "coin": "We define an electronic coin as a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner and adding these to the end of the coin. A payee can verify the signatures to verify the chain of ownership. " In the rest of the paper, "coin" is used as a suffix in the project's name, bitcoin, and as a term to describe the units of value its protocol aims to create.

According to this definition, bitcoins are chains of digital signatures. These signatures form part of a database ("blockchain"). And this blockchain is administered by a computer network subject to rules and incentives defined in a protocol. With the exception of node activity expending central processing unit (CPU) time and energy required for creating and ensuring access to them, coins as described in the white paper do not contain any reference or connection to any economic phenomena or entities[8] outside the database: the signatures constituting "coins" refer only to each other. After being created through "mining" activity, access to "coins" can be transferred among unidentified users on a voluntary basis.

How does this compare to characteristics of cash in the traditional sense? In monetary systems based on official currencies, signatures also play a role. One role is to identify, via handwritten signatures or PIN codes, owners willing to access funds held in bank accounts or provided by credit card schemes at physical points of interaction. A similar function is attributed to the mechanism to give access to "coins" in bitcoin where owners electronically sign funds.[9]

But more importantly, signatures also play a key role for transforming physical objects into cash for use in an economic context. The signature of (central) bank representatives on banknotes is a key aspect of what distinguishes cash from a mere assembly of pieces of printed paper (or, in the case of coins, metal) in limited quantity. Signatures on banknotes signify that an issuing bank assumes liability for its notes. In the current monetary systems, central banks are the sole issuers of banknotes in official currency in most jurisdictions. From the perspective of the issuing central bank, this means that issued notes represent liabilities for the central bank. Beyond the mere printing, issuing notes requires a counterparty willing and able to acquire new notes in exchange either for a collateralized claim on the counterparty or for securities issued by third parties (e.g. government or corporate bills and bonds).[10] Assets received in exchange for new notes are subsequently held

[8] *For instance issuers, persons, goods and services, claims or assets.*

[9] *A major contrast to bank accounts is that bitcoin's protocol design makes it technically possible for individual bitcoin owners not to disclose their identity to a third party, but the blockchain contains a complete public register of every bitcoin transaction ever made.*

[10] *See Bindseil (2004), DNB (2015) and ING (2018) on money's operational details.*

on the central bank's balance sheet to back its liabilities until the issuing of money is reversed at contract maturity. At maturity date, debtors have to pay central bank money to the central bank, returning money to the issuer after circulation. By accepting its own liabilities (either electronic reserves or banknotes) at face value to extinguish liabilities of its debtors, the central bank redeems its own liabilities.[11] When counterparties pay debt held by the central bank, both the money returning to the central bank and their own liabilities are extinguished. Because central bank liabilities in the form of banknotes do not offer interest, positive returns accruing on assets held by the central bank as counterparts to circulating banknotes (and electronic reserves) represent income to the central bank ("seigniorage").

From the perspective of central banks' counterparties (i.e. mainly commercial banks in most jurisdictions), holding banknotes means having a claim on the central bank that is received in exchange for an asset (securities held by banks) or incurring a liability to the central bank. By granting credit to bank customers and by accepting cash deposits, commercial banks themselves incur liabilities to their customers. Access to cash for users in the general public is intermediated via the banking system. Cash users are not interested in redeeming banknotes at the central bank to reduce corporate or public debt held by the central bank. Instead, they use money to pay and compare prices of goods and services, or store value.

Bank customers among the general public can use deposits with commercial banks to hold funds denominated in official currency, to make payments by instructing banks to transfer funds to other bank customers, or to withdraw cash at par value on demand. When bank customers make payments by bank transfer across banks, banks settle these payments by transferring central bank reserves among themselves.

Individual banknotes, coins and bank deposits in official currency form both a part of their own class (a numbered series of banknotes, a stock of coins, a stock of deposits, statistically measurable at any point of time as components of the money supply in an economy) and a key part of a chain of contractual commitments across the whole economy.

Because credit is a key input in financing the flow of production of new goods, services and assets, production of money for the economy by providing credit is directly connected and integral to the rest of the economic system. That is why cash or electronic forms of payment in official currency are not just a chain of signatures that give access to a limited stock of monetary objects, but a chain of signatures that represent and form part of a chain of claims across the whole economy that includes the issuer, its counterparties from the financial sector and various entities from the private and public sector engaging in economic activity. Being part of a pervasive chain of claims that are constantly confirmed by money payments when due, money in official currency can come to be treated as if it were a direct claim on any good, service or asset available in markets within the currency area concerned. This is supported by its exclusive acceptance for tax payment purposes and by legal tender laws making it the standard means of payment.

Unlike vague promises, these commitments are quantified and obtain their credibility from the fact that they are costly to break because of incentives and sanctions provided by legal, economic and political systems which they form part of.

[11] *For a practical illustration of key aspects of these mechanisms, see Koning (2021).*

In contrast, the signatures of which bitcoin consists of (i.e. each bitcoin amount consists of a unique pair of a private and a public key) are only a technical tool to provide access to electronic coins, provided the system operates in line with its description, with no references implied to the outside world. There is no reason for users to treat such coins as if they were a direct claim on any good, service or asset available in markets. Over time, bitcoin and similar crypto assets have found a market that initially emerged from, and continues to follow, the logic of markets for collector items: information on limited supply in combination with an intriguing narrative meets unpredictable demand, which results in an unpredictable market price over time.[12] The role of crypto assets for payments has been limited to small niches where payment in official currency is not possible or desired, with prices of goods and services determined in official currency. Their main resemblance to official currencies is the part of activity that is observable in foreign exchange trading markets, whereas the role of official currencies in serving as a stable unit of account, generally accepted means of payment and most liquid store of value within their domestic economy has not been replicated by bitcoin and similar crypto assets (Makarov and Schoar, 2021).

Whereas other projects in the wake of bitcoin have continued to use the term "cash" in a similar sense (e.g. "Dash," "Zcash," or "BitcoinCash"), the most pervasive and most telling use of the term in current crypto-related activity is the phrase "to cash out."[13] In contrast to identifying crypto itself as a form of cash, this phrase describes how crypto assets only result in cash when crypto funds are converted into official currency. The main use of bitcoin and similar crypto assets is in their being held and traded with a view to expected changes in their market price as measured in official currency (Makarov and Schoar, 2021). Therefore, most users are more interested in being able to convert crypto assets into traditional forms of cash than in using crypto assets in lieu of cash to make payments or in using them as a yardstick to measure the value of goods.[14]

Crypto users' need to "cash out" on demand has given rise to "stablecoins" (ECB, 2021). Both the contemporary significance of stablecoins for crypto-related economic activity and their construction are a disappointment to anybody who expected bitcoin and similar crypto assets to rival or replace cash and other forms of official currency.

In contrast to bitcoin's conceptualization of coins as chains of signatures that refer only to their own database, stablecoins are constructed in a way resembling more closely that of actual cash or bank deposits: they have an issuing entity that proclaims to back "coins" by marketable assets held by the issuing entity. Stablecoins are available to users in exchange against official currency. Most stablecoins

[12] *In an e-mail, replying to a suggestion to compare bitcoin to shares, Nakamoto (2010) writes, "bitcoins have no dividend or potential future dividend, therefore not like a stock. More like a collectible or commodity." In line with this classification, the earliest significant trading platform for crypto assets was Mt.Gox (short for "Magic: The Gathering Online eXchange"). The platform started as a venue for trading collector cards from the fantasy game of the same name, before introducing bitcoin trading facilities in 2010 and becoming the world's leading bitcoin exchange until its spectacular crash and bankruptcy in 2014 (McMillan, 2014).*
*In recent years, the hype created by crypto projects dedicated to the deliberate creation of collector items void of other economic ambitions like CryptoKitties and nonfungible tokens (NFTs) has served to underline the continued relevance of collector market mechanisms to understand the crypto sector.*

[13] *See e.g. information provided by two large global crypto trading sites: Binance (2021) and Coinbase (2022).*

[14] *FCA (2021), Makarov and Schoar (2021).*

attempt to relate their value at par to the US dollar or other major official currencies. This mechanism is intended to produce stability in terms of stable market value of these coins against official currency, similar to a bank deposit that is exchangeable on demand with cash at par value. Stablecoins currently serve as a kind of shadow banking system for the crypto sector: they are used for storing and transferring funds in relation to crypto trading in cases where there are legal or economic constraints (e.g. know your customer and anti-money laundering (KYC/AML) requirements, lack of connection of decentralized exchanges to conventional payment systems) to accessing bank deposits for these activities.

Regulatory frameworks for stablecoins are expected to be decisive for whether and how stablecoins can maintain, modify or even expand their role beyond crypto asset trading. So far the role of stablecoins has confirmed the unchanged importance of the world's key currencies as stable anchors of value even in the niches of economic activity related to crypto assets.

## 2 "Peer-to-peer"

A key attribute often held to characterize bitcoin and similar projects is the alleged absence of intermediaries. According to evidence from e-mails and the protocol code, white paper author Nakamoto's dislike of intermediaries results from an affinity to monetary reform ideas inspired by a commodity view of money, where the role of money is thought to be subject to some kind of natural laws (Mehrling, 2017; Weber, 2018). These aspects are not stressed in the white paper, however. Instead, granting that the current system "works well enough for most transactions," Nakamoto (2008, p. 1) cites costs and privacy issues associated with fraud prevention in intermediated electronic payments as a problem which bitcoin seeks to address. It does so by attempting to replace the need for trusted third parties.

In the bitcoin white paper, the term "peer-to-peer" (P2P) is already part of the title ("Bitcoin: A Peer-to-Peer Electronic Cash System"). The paper's abstract specifies that "We propose a solution to the double spending problem using a peer-to-peer distributed time-stamp server to generate computational proof of the chronological order of transactions" (Nakamoto, 2008, p. 1).

In the paper, the "double spending problem" (resulting from the possibility for any user of easily copying electronic coins like other forms of digital content online, thereby increasing one's funds with minimal effort) is described as follows: "[…] the payee can't verify that one of the owners did not double-spend the coin. A common solution is to introduce a trusted central authority, or mint, that checks every transaction for double spending. […] To accomplish this without a trusted party, transactions must be publicly announced, and we need a system for participants to agree on a single history of the order in which they were received" (Nakamoto, 2008, p. 2). After describing key elements of the protocol, the paper concludes: "We have proposed a system for electronic transactions without relying on trust. […] a peer-to-peer network using proof-of-work to record a public history of transactions that quickly becomes computationally impractical for an attacker to change if honest nodes control a majority of CPU power" (Nakamoto, 2008, p. 8).

In an e-mail accompanying the introduction of bitcoin, the author(s) add(s): "The result is a distributed system with no single point of failure. Users hold the crypto keys to their own money and transact directly with each other, with the help of the P2P network to check for double-spending" (Nakamoto, 2009).

What does this mean? In the technical sense used in the white paper, "peers" consist of computers, and the term "peer-to-peer" describes a relation among computers in a network. In contrast to a hierarchical client-server relation, a peer-to-peer computer network consists of several independent machines that are equally eligible to share in contributing to a particular task or function.

In a social and economic sense, however, the term "peer" refers to an individual, and the term "peer-to-peer" describes a direct relation between individuals. As defined in Investopedia (2021), "A peer-to-peer (P2P) economy is a decentralized model whereby two individuals interact to buy/sell goods and services directly with each other or produce goods and service together, without an intermediary third-party or the use of an incorporated entity or business firm."[15]

While the term "peer-to-peer" is mainly used in a technical sense by the author(s) in the bitcoin white paper, and the latter concentrates on outlining its technical consequences in the context of the protocol (control of double spending, no single point of failure), on some occasions it does not take that much care to prevent a reader from giving it a social interpretation: "users [...] transact directly with each other," "a system for electronic transactions without relying on trust," "without a trusted party," "allowing any two willing parties to transact directly with each other without the need for a trusted third party" (see Nakamoto quotes cited above).

Whatever the intention of the white paper's author(s), the use of the term P2P in the bitcoin white paper has nurtured optimism among some of its readers that the intermediaries' role in money and economic activity can be removed with the help of bitcoin and other technological innovations based on blockchain technology (Berg et al., 2019).

But irrespective of the state of technology, intermediaries are key to money and market exchange in modern economies for economic reasons.

Before an exchange can take place, even if we envisage the possibility of a direct bilateral exchange of good against good, some common ground must be established among trading partners. If there is no inequality between the two goods (i.e. if the two are identical), an exchange will make no sense. If there is inequality between the two, some form of equality needs to be established, otherwise there will be no exchange (unless inequality among trading partners gives rise to forced or unequal exchanges). In developed market economies, prices of goods, services and assets are established in money (official currency) as the yardstick to measure value. Market prices are the reference against which exchange rates for goods (and services, and e.g. also assets) are established in a bilateral exchange. Organized markets in a developed economy intermediate bilateral trade by providing indispensable tools for the exchange, above all money, market prices denominated in official currency and a legal system that protects private property and enforces contracts.

In contrast to this, engaging in a non-intermediated bilateral barter exchange implies a lack (of awareness) of market prices, of alternative trading partners potentially offering better bargains and of the other abovementioned tools provided by modern markets. As illustrated in the famous fairy-tale recorded by the Brothers

[15] *See Mueller (2018) for a conceptual analysis of the notion of a peer-to-peer economy.*

Grimm "Hans in Luck" ("Hans im Glück" in the German original),[16] structural lack of intermediation in barter exchanges is likely to lead to unfavorable exchanges and can quickly end in ruin.

Not only do money and markets serve to intermediate economic exchanges, but money itself is also issued by a responsible intermediary. Having said this, a unique feature that distinguishes cash from electronic forms of money like bank deposits is that some – but not all – of its functionalities enable handling on a P2P basis.

Cash can change hands between two individuals without a third party having to be present, or to be aware of, provide input to, take note of or record the transfer. Physical cash is transferable on a peer-to-peer basis. Nevertheless, the existence of an intermediary responsible for issuing, backing and guaranteeing cash is indispensable for its functioning. Cash is much more than just an(y) object in limited quantity. The fact that cash can be exchanged between two individuals against objects traded on markets does not mean that we live in a peer-to-peer economy, where individuals can bilaterally regulate all aspects involved in the trade of objects and intermediaries are superfluous. Trades are typically intermediated by issuers of money guaranteeing its quality, payment service providers, markets providing reference prices for most products and services, a number of legal protections against fraud, theft and mistakes, marketplace providers like supermarkets, to name just some key intermediaries. The invention of crypto assets and technical architectures like blockchains does not replace these functions, and does not open a likely path into a "barter economy of the future" (Berg et al., 2019, pp. 74ff.).

Bitcoin-like crypto assets are not even P2P in the limited social sense the term applies to physical cash, and can hardly be expected to replace intermediaries in key areas of contemporary markets. Bitcoins are not transferable without a third party serving as an intermediary. But for performing some of the functions traditionally performed by intermediaries, bitcoin replaces responsible regulated entities (banks and other financial institutions competing on markets for users) with incentives to attract competing volunteers among users subject to market mechanisms. Among intermediation functions, the bitcoin protocol focuses on solutions for counterfeit control and validation of transactions. Users serving as "miners" by contributing computer power to the bitcoin network compete for new bitcoins by validating bitcoin payments between other users and checking against double spending of coins.

As a result of this design, transferring bitcoins to another user means having your transaction proposal intermediated, i.e. checked and confirmed by a third party in between. The fact that this third party consists of a network of computers belonging to competing firms and individuals operating under the incentives and constraints provided by the protocol surely makes a difference in terms of how this intermediation function is organized, in contrast to e.g. a bank or a traditional payment service provider network. It also makes a difference with respect to the range of services such an intermediary architecture can provide. Most importantly, whereas a regulated bank or card network guarantees the economic value of the

[16] *Starting off with a piece of gold, Hans makes several barter trades, always feeling lucky about them, and ends up with a grindstone and an ordinary stone – and ultimately with nothing, as the two stones finally fall into water.*

funds transferred and the legal finality of the payment, the only provision made in the bitcoin protocol to support the value of coins is the supply limit, which leaves it up to users to negotiate its value on markets not regulated by the protocol. But paying with bitcoins does not mean engaging in a non-intermediated transfer.

The competitive design of intermediation functions in bitcoin-like crypto assets has nurtured a further social interpretation of the notion P2P that has become popular in debates about crypto. This involves translating technical decentralization as political democratization. In this view, participation in the crypto ecosystem involves fairness and equality in the sense of open access and competition among individuals of equal power, in contrast to large traditional intermediaries enjoying considerable market power in the established economy. Therefore, some observers consider the technical decentralization in bitcoin-like architectures to be decentralization in the sense of dissolving social power, even a form of "democracy."[17]

Researchers have pointed out that it is questionable to apply the term "peer-to-peer" in this wider, more social sense for describing bitcoin's technical architecture given considerable market concentration in a number of key activities, i.e. mining, coding, ledger storing, coin ownership and the widespread use and market power of various intermediary services for trading, storing and transferring crypto assets (Makarov and Schoar, 2021; Walch, 2021). Although not directly subject to the bitcoin protocol outlined by Nakamoto, an ecosystem of crypto intermediary services has developed that is indispensable for the actual operation of crypto on its current scale. Sizable firms dominate the market of crypto exchanges, where users trade cryptos against official currency, publishing exchange rates serving as a reference for bitcoin's market value. Wallet providers offer services to safely store private keys giving access to bitcoins. Payment service providers offer to ease usability and absorb some risks associated with crypto payments. Many of these providers closely resemble traditional financial intermediaries.

The fact that bitcoin transfers are intermediated is also visible in the variable fees that providers of intermediary functions (i.e. successful miners) receive from users for confirming transactions. A peculiar aspect of bitcoin's design is that user fees do not absorb the full cost resulting from miners' transaction confirmation activity. Miners have to cover the rest of their substantial energy and computer costs by "cashing out," i.e. by selling new bitcoins created and received as a reward as intended by the protocol. In this way, people that buy new bitcoins on trading platforms subsidize existing users' transactions.

"Peer-to-peer" in bitcoin does not even mean the ability to transfer bitcoins between two individuals without support of a third party, which is possible with physical cash in official currency. In many areas of crypto markets, concentration and asymmetries of power are prevalent, which makes it hard to characterize the ecosystem as peer-to-peer based in a social sense.

## 3 "Inflation"

As mentioned above, the white paper on bitcoin does not discuss mechanisms how cash becomes a carrier of value. A key term used in discussing the economic value of money is "inflation." In a contemporary economic context, "inflation" means changes in the purchasing power of money as measured by changes in prices of a

[17] *See e.g. Mueller (2018) and Parkin (2019) for a discussion.*

basket of goods and services over a predefined period. Legal mandates for most central banks provide "inflation targets" in this sense of the term. Statistical agencies collect and publish statistical information about price changes in the economy, and policymakers use these and other sources of information to monitor the evolution of prices and instruments at their disposal to stabilize inflation.

In the white paper, the term "inflation" is mentioned only once: "By convention, the first transaction in a block is a special transaction that starts a new coin owned by the creator of the block. This adds an incentive for nodes to support the network and provides a way to initially distribute coins into circulation, since there is no central authority to issue them. [...] Once a predetermined number of coins have entered circulation, the incentive can transition entirely to transaction fees and be completely inflation free." (Nakamoto, 2008, p. 4).

Inflation in an economic sense is measured in the amount of goods and services a monetary unit is able to buy. In the bitcoin context, it is used in a different (more colloquial, metaphorical, or general) sense of "quantitative growth of a stock of items": inflation is defined self-referentially as growth of a stock of units as measured in its own unit, and does not refer to changes in its economic value in terms of its exchange rate against goods and services.

Crypto enthusiasts have increasingly adopted the term "inflation" to describe growth in the supply of a certain type of coin. A prominent example is the white paper of Ethereum, the second largest project in the crypto market of recent years (Ethereum, 2022).

Using the term inflation in the sense of "growth of the money supply" echoes a period in the 18$^{th}$ and 19$^{th}$ centuries when that was common among early scholars of the modern discipline of economics. While there is no consensus in contemporary research on causal relations between changes in the supply of money and the price level, analytical efforts to identify changes in the money supply as the key driver for changes in the price level persist, known as the "quantity theory of money" (Blaug, 1995). This theory presupposes several quantifiable and observable regularities in the role and usage of a clearly defined money supply in a clearly defined economy that demands and uses this supply.

But in the absence of any information on an economy that routinely uses a stock of units for a specific purpose, there is no way to derive the economic value, or changes of value over time, of such units from changes in their quantity. If you are asked to accept a payment of 1 bitcoin, technically verifiable knowledge that this represents 1 out of 21 million units is next to irrelevant for your decision. What counts is its economic value: what and how much you could obtain in exchange for 1 bitcoin (e.g. bread) and if such payment would be accepted. Unfortunately, if there existed a maximum output of e.g. 21 million loaves of bread on a given morning, this would not mean that 1 bitcoin would buy 1 loaf, even if you could be sure that bitcoins were accepted everywhere as a means of payment. Instead, markets coordinating supply and demand for each relevant unit or good (i.e. bitcoin and bread) determine the price of each and measure it in an external yardstick (in general an official currency). Comparing two items from different object classes based on the overall number of units available or any physical measure (like weight, size or temperature) does not offer any clue about the comparative market value of the two items.

The emergence of thousands of other crypto assets after bitcoin, some of them very similar to the original, provides a useful illustration. Like bitcoin, many of these assets are expected by their supporters to have functionalities close to money. Together, they provide millions of units, each potentially serving as money in markets for existing goods and services. If the mere coming into being of additional units of potential money led to inflation in the economic sense, the proliferation of thousands of crypto assets without their own economy would undermine any initial intention of limiting the supply of bitcoins to prevent monetary inflation. Even if bitcoin were the only crypto asset and were to be adopted as the single currency of an economy, the following would hold: in a capitalist economy, where permanent change (e.g. production, competition, innovation) is a key characteristic, a currency based on an immutable stock of money would prove unsuitable to fulfill monetary functions.

Therefore, vendors that promote bitcoin and similar crypto projects by referring to their alleged quality of offering "inflation protection"[18] use these terms in a non-economic sense. They do not refer to any technical defense against losses in market value over time, but to an upper limit for the supply inscribed in bitcoin's protocol and to the presence of incentive mechanisms to deter changes to this limit.

The bottom line is that important information is lacking even if we were to employ the most basic theory of market value, according to which market value is a result of the interaction of supply and demand. There is no ex ante knowledge of the fraction of bitcoin's total supply that is put on sale at a given time by existing owners or of the quantity of demand on markets where crypto assets are traded. The future evolution of both quantities is by and large unpredictable. This will not – nor should it – deter any interested parties to make their own assumptions and predictions about the future of the crypto market. But it would be highly misleading to create the impression that bitcoin and similar crypto coins rely on a technological mechanism that prevents the occurrence of losses in their economic value over time.

## 4 Conclusions

In this paper, I have subjected key terms associated with bitcoin, most importantly "cash" as in "electronic cash," "peer-to-peer" and "inflation," to a close reading by examining their definitions in the original white paper on bitcoins entitled "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008). In addition, I have contrasted the way these concepts are used in the crypto world with their meaning in debates about economic phenomena. The analysis revealed that the differences in usage and meaning of key terms are likely to be attributable to the engineering perspective taken by the pseudonymous author(s) of the white paper and bitcoin's initial supporters. Pointing out these differences may help avoid misunderstandings among potential users or students of bitcoins and similar crypto assets.[19]

[18] *See e.g. Kraken (n.d.).*

[19] *Note that there is a large literature where other key crypto-related terms have been subjected to critical investigation. Such terms include, for instance, "trustlessness" (e.g. Bratspies, 2018; Vidan and Lehdonvirta, 2018) or "smart contracts" (e.g. Schuster, 2021).*

Transferring bitcoins is neither "peer-to-peer" in the sense of a non-intermediated transfer between two individuals, nor does it offer technical protection against losses in value, i.e. it is not inflation free. And bitcoin is not like cash in important respects. In bitcoin and other crypto asset schemes, an assembly of machines is instructed to transport computer bits irrespective of their meaning. With actual cash in official currency, people and machines "transport" banknotes and coins because cash serves as a carrier of stable value that is generally accepted. A focus on tangible objects and their physical qualities is insufficient to comprehend the key role of intermediaries in this process.

As a result, the relation between cash and bitcoin-like projects is likely to remain unstable and uncertain in many respects.

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## Annex: Glossary of key crypto-related terms[20]

**Blockchain:** a form of distributed ledger in which details of transactions are held in the ledger in the form of blocks of information. A block of new information is attached into the chain of preexisting blocks via a computerized process by which transactions are validated.

**Crypto asset:** a type of private sector digital asset that depends primarily on cryptography and distributed ledger or similar technology.

**Cryptography:** the conversion of data into private code by using encryption algorithms, typically for transmission over a public network.

**Distributed ledger technology (DLT):** a means of saving information through a distributed ledger, i.e., a repeated digital copy of data available at multiple locations.

**Mining:** one means to create new crypto assets, often through a mathematical process by which transactions are verified and added to the distributed ledger.

**Stablecoin:** A crypto asset that aims to maintain a stable value relative to a specified asset, or a pool or basket of assets, e.g. an official currency.

[20] *Selected from the glossary in FSB (2022).*

# A digital euro and the future of cash

*Martin Summer, Hannes Hermanky*[1]
*Refereed by: Thomas Moser, Swiss National Bank*

*What is the discussion about a digital euro – and, more generally, digital central bank currencies – all about? We are focusing here on the future of cash. For strategic reasons, central banks are seeking to provide a credible and viable public anchor for digital money given that the future might be shaped more strongly by new private issuers of money. The technological structures and business model-driven incentives of the new players, which are associated with the internet economy and thrive on network effects, might lead to a concentration of significant market power in payments. Ultimately, this might even result in a fragmented monetary system and jeopardize universal access to public money. From a central bank's perspective, the crucial question is therefore not so much about replacing cash with new payment technologies but about finding ways to ensure that the monetary system will continue to work in the public interest in a digital future. Cash will, and should, play a role also in a future monetary system. By creating a digital euro, central banks in the euro area aim to adapt cash in such a way that it meets the needs of the digital age.*

*JEL classification: E42, E52, E58, G21*
*Keywords: central bank digital currency, digital transformation of money and finance, payment economics*

Both the work and discussion on a digital euro are often perceived in the public as driven by a desire to ultimately replace cash. Yet, the European Central Bank (ECB) has stressed on many occasions that this is incorrect. Plus, the ECB has emphasized that any potential future model of a digital euro will only complement, and not substitute, existing means of payment, in particular cash. Yet, since banknotes and coins cannot be used for digital payments, there is a lingering perception that they are an outdated technology that will sooner or later have to be replaced. The root cause seems to be a superficial understanding of the modern monetary system and of the factors driving the debate on central bank digital currencies (CBDCs).

We argue that the discussion about a digital euro is not about replacing cash but a strategic discussion of how money can function in the public interest in a digital age. It is a debate about how to ensure universal access to central bank money for all citizens and how central banks should react to new, technology-driven issuers of private money in the platform-centered internet economy. Rather than a project to replace cash, a digital euro would therefore be the Eurosystem's response to challenges arising from new entrants into the market for digital payments.

The monetary and payment systems have been working so well that in our daily activities we rarely give much thought to the details of the architecture these systems are based on. In our daily lives, EUR 1 is EUR 1, no matter whether we pay by cash, debit card, credit card or other digital tools. We therefore begin our discussion in section 1 with a comprehensive overview of the architecture of the

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modern monetary system and the precise role that cash has in it. In section 2, we explore how the entry of new private issuers of money or money-like instruments has created the need for central banks to engage in the discussion on new forms of digital central bank money in the first place. In section 3, we explain why central banks consider it necessary to ponder whether they should develop a new digital form of central bank money for the public. In this context, papers and reports spell out various arguments for such a move, but replacing cash is not among them.

Arguments why it might be a good idea to develop a public alternative to privately issued money are bound to be very abstract. In section 4, we therefore try to discuss implementation options and their various issues and trade-offs in a broad, yet sufficiently detailed way. We aim to give readers an idea of what it would mean for them if such a public payment instrument became available. In section 5, we summarize some positive and normative arguments why we believe that cash will and should play a role also in a future monetary system that is likely to provide new forms of public and private digital money. Section 6 concludes.

## 1 The role of cash in the current monetary system

Both as consumers and producers of goods and services, citizens in Austria are used to having permanent access to a smoothly functioning payment system to pay their bills and transfer money. This is also true for people living in the euro area, the European Union (EU) or in developed countries around the world. People predominantly make larger-value payments digitally by using cards, bank transactions, smartphones or other digital devices, while they tend to use cash for smaller-value transactions. There seems to be a long-term trend away from cash toward digital payments, but in the EU at large cash still plays a significant role as a preferred means of payment.[2] From the perspective of payment system users, EUR 1 is EUR 1 no matter whether this amount is paid in cash or digitally. From this point of view, it is perhaps difficult to make sense of the discussion on a future digital euro. Without additional information or context, many people might think this discussion is a first step in a general attempt to replace cash. But this is not the case. To the contrary, the debate is zeroing in on the problem how to guarantee universal access to central bank money in a world that has an increasing need for digital payments. As a consequence of digital transformation, online communication, collaboration, banking and shopping have become ubiquitous in our everyday lives.[3] To better understand and assess this claim, let us take a brief look at how the modern monetary system works and which role it assigns to cash.

In a modern economy, citizens, businesses and public institutions use two forms of money, broadly speaking: state or public money and private money.[4] State money is issued by a central bank acting as an agent of the state. It is therefore usually referred to as central bank money. This form of money exists both in digital form – as entries in central bank accounts – and as banknotes and coins. Private

[2] *See the contribution by Schautzer and Stix in this issue.*

[3] *See Cochoy et al. (2017) for a detailed discussion of the effects of digital transformation on consumers.*

[4] *For an excellent overview of how the modern monetary system works, see Weber (2018) or the classic by Holme-Robertson (1924).*

money has been traditionally issued by commercial banks and exists as digital entries in bank accounts, i.e. in a database.[5]

Central bank money is issued digitally as deposits to selected commercial banks, which are supervised, regulated and subject to some form of deposit insurance. So, this form of money, technically referred to as central bank reserve accounts, has been digital since computer technology allowed for industrial-strength use of digital databases. Central bank money is also issued physically in the form of banknotes and coins. Only in this form is central bank money currently available to the public at large. Given its physical nature, it cannot be used for digital payments.

Legally, central bank money is a liability of the central bank. It is, however, not redeemable against assets held by the central bank. When we pay with cash, we ultimately pay with central bank money as it happens to be the final domestic means of payment. Central bank money also serves as a settlement asset among banks for payments made by their customers through transfers between bank accounts. The value of central bank money is managed through the central bank's monetary policy, which consists in the legally enshrined promise and mandate to keep the purchasing power of central bank money stable relative to a broad basket of goods and services. The main responsibility and policy goal of a central bank is therefore to fulfill this mandate and keep the promise of price stability by means of its monetary policy.[6]

Bank deposits, which are private money, are issued by commercial banks to all citizens with a bank account. Most payments in a modern economy – about 95% – are made by digital transfers between bank accounts. Bank deposits can be accessed via debit cards, credit cards and other, mostly digital, payment instruments. Account owners may use such instruments to instruct their bank to carry out transactions on their behalf.

In contrast to state money, private money is a liability of a commercial bank. It is a promise obliging the commercial bank which has issued the deposit to convert the private money at par – this means 1 to 1 – into central bank money anytime on demand unless the account has certain covenants attached which restrict immediate conversion. Unlike central bank money, commercial bank money has some credit and liquidity risks, although these risks are contained by various policy instruments such as bank licensing, supervision, regulation, deposit insurance and access for banks to refinancing facilities at the central bank.

Under normal circumstances central bank money and deposits are interchangeable, i.e. EUR 1 in a bank account can be exchanged for EUR 1 in cash. Ultimately, the quality of central bank money is superior to that of a bank deposit, however, because central bank money does not depend on the solvency of a private issuer. Central bank money rests on a unique legal framework, the power of the state to

[5] *The traditional unique role of commercial banks as issuers of private money has recently been enlarged by new institutions outside the traditional banking system, such as internet firms and crypto asset issuers. We will discuss these new players and their role in the modern monetary system in section 2. Historically, there have also been periods, mainly in the 19th century, when commercial banks also issued their own banknotes. This practice ended with the regulation that invested central banks with the monopoly to issue banknotes.*

[6] *See Article 127 of the consolidated version of the Treaty on the Functioning of the European Union (TFEU) at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12016E127.*

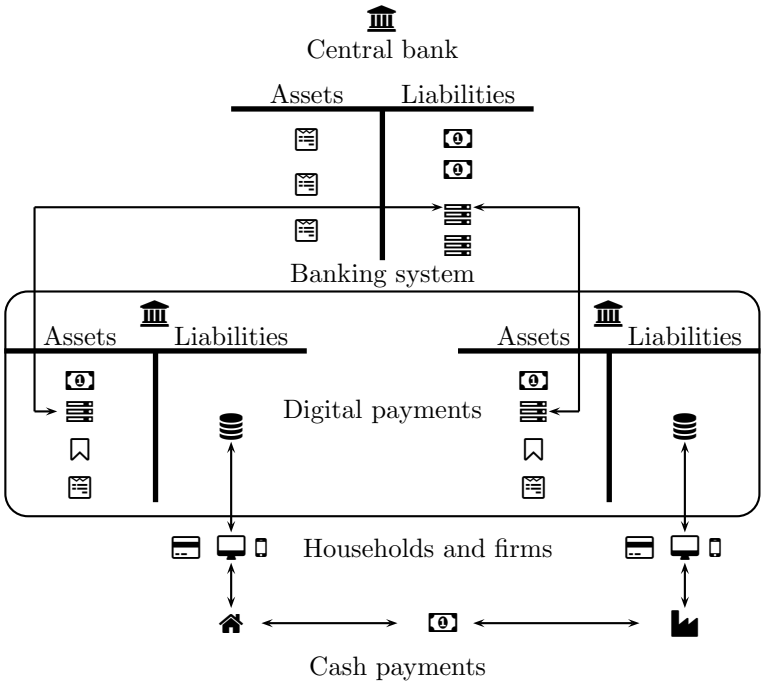
collect taxes and its status as legal tender[7]. The ultimate asset for settling payments between banks, it defines the unit of account.

Experts and many nonexperts know that deposits carry some credit risk. Yet, the prudential measures aimed at minimizing this risk are generally considered to be very credible. For this reason, we expect that EUR 1 is EUR 1 no matter whether we pay in cash or by bank transfer, debit card or another means involving a bank account. The private banking system is highly integrated with the central bank and the monetary system at large in operational, legal and regulatory terms. As a result, the vast majority of people accepts private money issued by banks, considers it legitimate and does not see a need for a digital payment system directly in central bank money.[8]

Figure 1 summarizes this section in a schematic illustration showing the different layers of the modern monetary system: the central bank at the top, the banking system (here represented by two banks) and households and firms as well as the different forms of money (digital, cash). Due to the hierarchical structure, this system is often referred to as a two-tier system. The central bank issues money in electronic form to selected commercial banks as reserve accounts (stack symbols) and as banknotes and coins (banknote symbols). In exchange for this money, the central bank receives high-quality securities (contract file symbols on the asset side

Figure 1

**The modern monetary system**




*Source: Authors' compilation.*

[7] *Legal tender is a notion of EU law enshrined in Article 128(1) TFEU. Means of payment cannot generally be refused in the settlement of a debt in the same currency unit. They must be accepted at full face value, with the effect of repaying the debt.*

[8] *While legitimacy has always been a bone of contention and led to various reform ideas and initiatives, only few people engaged in this discussion in the past (Weber, 2018).*

of its balance sheet) from the commercial banks. Commercial banks create deposits (database symbols) through extending credit to households and firms (flag symbols) and can make digital transfers among each other via the central bank. At the bottom of the monetary hierarchy, households (house symbol) and firms (industry symbol) may pay physically with central bank cash or by instructing their commercial bank to transfer deposits between accounts while using different devices (card, computer and smartphone symbols). Cash and reserves are the ultimate settlement assets on which all other financial promises are based.

Cash is likely to play a role even in the modern payment environment that will increasingly depend on digital payments. This will be due both to some of its unique features and benefits for users and to its key legal role in financial contracts.

Several features of cash that are unique from the user perspective are not easy or perhaps not feasible to implement digitally (Bundesministerium für Wirtschaft und Energie, 2017). Cash allows for simplicity and immediate finality in payments. Payments are made by a simple physical transfer of banknotes or coins. No signatures, no further bookkeeping of the payment in a register or no internet availability are necessary. Persons not knowing each other may simultaneously exchange a good or service for physical cash. Such exchanges require little personal trust, and they would not take place were it not for this form of payment. Digital payments depend on digital transaction registers as well as some form of intermediation or transfer infrastructure. In fact, electronic payments involve many different parties to ensure the alignment of payment messages and funds. Cash is uniquely robust and resilient due to its independence from electronic devices. Many consumers use cash because it provides them with a simple and effective way to keep track of their expenses (Bagnal et al., 2016). Cash payments protect consumers from abuse of their payment information. They leave no trace about what consumers paid for. For instance, if persons wanted to be tested for an HIV infection and to keep this information private, they could pay for such tests with cash. Besides, payment information collected on individuals could be abused to manipulate their behavior. If such data were sold for advertising without consumers' consent, they could also be abused for commercial purposes. On the other hand, another unique feature of cash worth mentioning is that physical proximity is necessary for making or receiving payments, which could be regarded as a disadvantage from a user perspective.

Overall, demand for cash is unlikely to disappear completely. The user advantages of cash combined, including device and internet independence in exchanges, cannot be fully replicated digitally. Even if demand for cash as a means of payment will decrease in the long run, its unique advantages will remain attractive for users.

While playing a minor role in terms of transaction volumes, cash nevertheless is key to the current monetary system (Bundesministerium für Wirtschaft und Energie, 2017). This key role comes from the function cash has in financial contracts, in particular debt contracts. Debt contracts legally oblige the debtor to provide certain amounts of money, which is usually specified as cash. For instance, deposits held at a commercial bank are debt contracts which oblige banks to pay back (parts of) the deposits as cash on demand. This special role of cash, or central bank money more generally, is attributable to the fact that, in our monetary system, central bank money is the final settlement asset in the current hierarchy of payment instruments. A legal obligation to provide cash to settle a debt only makes sense in a world where the asset on which the obligation is based is available to both contracting parties.

Of course, it would be possible in theory to reinterpret the notion of an obligation to deliver cash and consider other titles, such as deposits at the central bank, that must be delivered. One could even define the legal tender notion, which in many jurisdictions refers to cash, as referring to this other form of money, contrary to widespread current practice.[9] In this case, many new and tricky issues arise, which are not straightforward to address and are difficult to solve. If – contrary to current practice – in a new monetary arrangement all natural and legal persons had direct access to the central bank's balance sheet, this would probably concentrate the payment system at the central bank. This would create problems of transaction data protection and governance as well as new infrastructure requirements which would prove very challenging in practice or might even indirectly threaten central bank independence (Chaum et al., 2021).

## 2 New players in the market for privately issued money

More recently, banks have experienced new competition from other private issuers of money. Among these private issuers, crypto assets like bitcoin and ethereum have received the most public attention and have also fueled debates on the future of money and the monetary system. However, such debates, often led with exuberant enthusiasm, idealism and quasi-religious fervor, quickly revealed that crypto assets are unlikely to succeed as privately issued money. They are not expected to supersede conventional money in its current form for various reasons. They are not generally accepted as payment for goods and services, are highly volatile, have technical scaling problems, waste enormous amounts of energy and – perhaps most importantly – lack a responsible and accountable issuer. For central banks and governments, crypto markets have so far been more of a potential challenge to financial stability given their enormous growth and progressive interlinkages with the traditional financial system. Crypto assets also pose challenges for fighting money laundering, financing of terrorism and online crime (see e.g. FSB, 2022).

Another form of privately issued digital money that is relatively new are so-called stablecoins. Stablecoins are crypto assets whose issuers attempt to stabilize the value either by algorithmically controlling the supply or by backing the stablecoins by other assets or currencies. This is only a very rough classification; for a more detailed description, see Clark et al. (2021). While algorithmic stablecoins have been a failure in practice so far, asset- or currency-backed stablecoins have been more successful. Backing their financial promises with certain asset classes, stablecoin issuers closely resemble banks in economic terms but have yet to be integrated in the same legal and regulatory framework as banks. As pointed out by Chaum et al. (2021), unlike crypto assets, stablecoins, especially if properly regulated, have a better chance to succeed as a new form of private money.

These new entrants into the market raise a question of strategic importance: how can we ensure that in a future where more and more payments become digital, citizens will still have universal access to central bank money and will not entirely depend on private money issuers to make digital payments?

[9] *Note that the notion of legal tender is not uniformly defined across jurisdictions. Legal tender often refers to cash, but sometimes central bank deposits are included, as for example in Switzerland. Including deposits of commercial banks at the central bank, however, differs substantially from granting general access to the central bank balance sheet to the general public.*

Why should we raise this strategic question in the face of new suppliers of privately issued forms of money? Here, it is important to see the nexus between stablecoin issuers and so-called big techs, the giant global internet firms of the digital age. The core of their business models consists in collecting, repackaging and reselling user data acquired in their platform-based business lines of messaging, social media, internet search technology, e-commerce and computing. These firms have a huge incentive to enter the payment market and the market for privately issued money, because adding payment information to their existing user data would make these data much more informative and therefore valuable. After all, they would generate data on consumers' willingness to pay for goods and services at the individual level. Stablecoin models are a technology that can be easily combined with a platform business.

Economists refer to the core feature of such business models as "network effect." A network effect implies that a good or service becomes more useful to everybody if more people use it. Payment technologies typically show such effects, which is natural. After all, a payment instrument is useful if it is widely accepted in exchange for goods and services, and it helps of course if many people use this payment instrument. Network effects run the risk of concentrating market power, pushing up transactions costs as well as impeding competition and innovation, which could even result in a breakdown of universal access to digital payments (BIS, 2021).

Such a concentration of market power also indirectly entails the risk of mass surveillance and privacy intrusions. It also poses a serious threat to the right to informational self-determination and puts citizens at risk from data exploitation by payment service providers.

In such a situation, properly designed digital central bank money that is accessible to all citizens may offer individuals a choice of a digital payment instrument that protects their data and their privacy. It could provide a neutral payment infrastructure that supports competition, efficiency and innovation. And it could sustain universal access to central bank money even in a future where people depend more and more on digital payments and physical cash becomes a fallback payment solution.

In this context, it may be easier to understand that the discussion about developing a new form of digital central bank money is not about replacing cash but about ensuring universal access to central bank money in a future dominated by digital payments.

## 3 Arguments for a central bank-issued digital means of payment

According to Auer et al. (2020) and Auer and Böhme (2021) as well as other international sources[10], central banks around the world have stepped up their research and development of a general central bank digital currency, or CBDC. After some preparatory work in 2020, the ECB (2020, 2021a, 2021b) launched a project-investigating phase to analyze and solve issues with respect to a digital euro to be able to decide soon whether an actual development phase should be started. Global trends in technology as well as country- or currency-specific circumstances are often reported as the main motivations to look deeper into the CBDC question.

[10] *See, for example, the website https://cbdctracker.org/.*

These motivations by themselves would, however, be rather general and inconclusive for launching projects of this scale that are likely to have huge structural repercussions for the financial system. So, let us look more closely at the arguments given by central banks and in the public policy discussion.

The strategic argument of preserving universal access to central bank money for citizens even in a world increasingly shaped by digital payments and private issuers of money was elaborated in detail by the BIS in its annual economic report 2021. This argument was also featured in the report of the ECB's High-Level Task Force on a digital euro (ECB, 2020). It has been restated in various forms in the public debate and in recent policy reports, e.g. in Brunnermeier and Landau (2022).

The BIS (2021) starts from the role of the public sector to enable and sustain a monetary system that can function in the public interest. According to the BIS, this encompasses the ability to maintain a competitive structure in payment services, high-quality governance structures as well as the guarantee of basic rights such as data protection, informational self-determination and universal access to central bank money.

In the view of the BIS, these tasks are potentially challenged by the entry of big techs into the market for payments. These companies are the backbone of the platform economy that thrives on network effects: the more people use a particular platform, the more attractive this platform is to others to join irrespective of whether the platform specializes in search technology, messaging, social media, computing or e-commerce. Not only do these network effects create a very valuable, but rarely directly visible, complementary business of commercializing the user data gained in the platform activities, but they also lead to a concentration of market power and political power, which inhibits competition, efficiency and innovation (see e.g. Zhuboff, 2019). Entrenched market power can exacerbate and sustain already high costs in payment services even though the cost of communication devices and bandwidth has been declining.

This argument is also made by Brunnermeier and Payne (2022) and Brunnermeier and Landau (2022). They stress that the structural logic of the platform economy tends to create and develop complementarities between different activities and fosters economic incentives to create a closed system and erect technical barriers. As a shared form of currency on the platform would strengthen these complementarities and links, platforms have a strong incentive to develop new digital forms of money. This can lead to an excessive fragmentation of the monetary system and entails the danger that the monetary system is weakened for lack of a stable, universally accessible anchor of value that is currently provided by central bank money.

The BIS (2021) also takes issue with lacking universal access and data governance in a digital payment market where big techs hold entrenched market power. The BIS sees CBDC initiatives as a strategic policy tool to meet this new challenge. Creating an open payment platform promotes competition and innovation, which channels network effects into a virtuous circle of competition and innovation in payments instead of getting trapped in a vicious circle of market power, inefficiency, mass surveillance and lack of innovation.

Universal access and a uniform currency are of vital importance for central banks also for the effective conduct of monetary policy. The fact that the euro is

the only standard of value for all people in the euro area is the basis for an effective and functional monetary system and monetary policy. As pointed out by Brunnermeier and Landau (2022), "a uniform currency and the control of the unit of account are jointly necessary to ensure the implementation of monetary policy and preserve monetary sovereignty."

This strategic view on CBDC developments as articulated by the BIS and echoed in many reports and policy papers of central banks is one of the arguments supporting central banks' increased efforts to come up with their own versions of digital central bank money. Ultimately, the debate is about which institution in the economy should have the power and the means to conduct monetary policy.

Besides these strategic arguments, business or efficiency arguments advocate the development of CBDCs. A case in point is fostering innovation and competition in payments. For instance, focusing on the US payment system, Duffie (2021) claims that US banks can provide a low-cost payment system but have not done so. His focus therefore is on the private banking system as an issue of inefficiencies and not on big techs' market power or on cash. In Duffie's perspective, this inefficiency in the US system drives the power and energy of new entrants like big techs and other private issuers of money. The argument that the central bank should develop a CBDC to increase pressure on private banks to offer better payment services is less frequently voiced in the public discussion. It also has some country-specific features. The situation in the USA does not seem to be directly comparable to the payment system in the euro area although inefficiencies could perhaps also be identified there. One example is the rollout of the Single Euro Payments Area (SEPA), an EU initiative to unify standards for digital payments in the euro area and to tackle the fragmentation of the European payment system that had previously relied on different national standards. The adoption of SEPA schemes proceeded slowly because voluntary migration was perceived as expensive and risky for first movers, as they had to keep the old and the new system running in parallel. Therefore, EU legislation was necessary to set end dates for completing the migration of credit transfers and direct debits to the harmonized SEPA standards. Today, some parallels can be drawn between SEPA and the sluggish implementation of instant payments in the EU, which might again necessitate a legislative intervention. Again, early adopters face higher costs for running an additional payment infrastructure. Also, the shift from deferred net settlement to prefunded settlement in central bank money is less favorable for banks from a liquidity management perspective unless all banks move from SEPA credit transfers to SEPA instant payments.

When existing digital payments are compared to cash from a cost perspective, there seems to be no clear-cut answer. A report for the German ministry of economic affairs[11] claims that in Germany cash payments have been cheaper for users than card payments. Credit card payments seem to be the most expensive form of digital payments across Europe.

Various reports have pointed to the high costs and apparent inefficiency in international payments. Hopes are expressed that CBDCs might make these payments cheaper and faster. However, no clear evidence is available on the precise mechanism how this could be achieved. It seems that a deeper understanding of the

[11] *Bundesministerium für Wirtschaft und Energie (2017).*

root causes of existing inefficiencies has yet to be developed. Furthermore, Auer et al. (2021) point to various coordination challenges that might arise in establishing interoperability of CBDC systems around the globe.

Finally, CBDCs are sometimes also regarded as an instrument that might improve financial inclusion. Such hopes – justified or not – certainly do not apply universally. Especially in the highly developed countries, it is rare that somebody is excluded from participating in the financial system or from receiving or making payments because a CBDC is not yet available. On the contrary, now it seems difficult to beat cash in terms of inclusiveness. Cash is particularly easy to use and is available to everybody in society, including people without access to electronic devices, such as children, poor or older people. However, this situation might change in the future if the use of cash in a more digitally dominated world is further declining. In the future, the economic opportunities of a person who participates in the payment system while having only access to cash might be severely restricted.

Overall, it seems that the arguments voiced in favor of developing CBDCs are mainly based on strategic considerations, either as a counterbalance of the public sector against big techs' current and potential future market power, or as an instrument to increase competitive pressure on banks and credit card firms to offer cheaper payment services, or as an instrument to improve financial inclusion.

None of these arguments for developing a CBDC makes a case for replacing cash. In fact, competition for a potential new digital currency comes from big techs and other private issuers of money like players in the global platform industry. In contrast to public perception, in which the debate about a digital euro is often framed as an initiative or even a "war" against cash, replacing cash does not figure across the public sector and in any official reports on the various projects around the globe. Instead, in their pursuit of CBDCs, central banks are motivated by declining user demand for cash that is driven by digital transformation. This general trend raises concerns that the private sector might come to hold entrenched power in digital payments in the future.

## 4 Three ways in which a digital euro could be implemented

Implementation of CBDCs is still in its infancy. What is more, unclear and ambiguous terminology often obscures, rather than clarifies, the issues yet to be resolved. Reports often take recourse to the institutional features of the modern monetary system by referring to forms of money existing as physical objects – like cash – or money as an entry in ledgers – like deposits at commercial banks or reserve accounts at the central bank.[12] The often invoked terminology of "token-based systems" and "account-based systems" rarely helps clarify implementation issues, as has been pointed out by Lee et al. (2021).

We thus organize our discussion around concrete technologies rather than abstract and potentially confusing concepts. Let us start with the most familiar concept from the current system, the concept of a deposit account.

[12] *By the way, these two forms of money predate the modern monetary system by a few centuries and have been in use since the late Middle Ages and the Renaissance period in Europe.*

### 4.1 Deposit accounts held directly or indirectly at the central bank

From an implementation perspective, the straightforward option would be that the central bank opens its balance sheet not only to selected commercial banks with whom it does business and jointly runs the payment system, but also to all citizens by allowing them to open accounts directly with the central bank – in the same way as is now possible with commercial bank accounts. This pure and perhaps excessively centralized form would significantly change the central bank's operations. For one thing, the ECB would face the challenge to run about 500 million new customer accounts on its systems in addition to the current payment infrastructure. For another, this option would also entail many new functions for the ECB currently performed by commercial banks, most importantly customer identification (the implementation of so-called KYC or "know your customer" rules) as well as compliance with anti-money laundering legislation (so-called AML rules). It would mean operating customer front ends and services and most likely investing in the energy and communication technology infrastructures to ensure the availability and robustness of the payment infrastructure. The payment system would be excessively concentrated with the central bank, and massive information concentration would ensue as well. Such changes would significantly transform the political economy role of the central bank by giving it a much larger public footprint. While citizens view central banks now mainly as bureaucratic institutions responsible for price stability and financial stability, this would bring central banks in the focus as institutions that could directly intervene in the distribution of money, in transfers and other operations that are now usually seen as being in the realm of fiscal authorities.

This extreme approach does not figure in the discussion, however. Most central banks considering digital central bank money are discussing an implementation option which would assign the servicing and maintenance of customer accounts as well as the implementation of KYC and AML compliance rules to third parties or to commercial banks.

Auer and Böhme (2021) provide an overview of how such systems of accounts could be organized in principle and discuss models where central bank accounts would be held by citizens only indirectly via intermediaries. Specifically, they discuss (1) a model where commercial banks handle customer onboarding and compliance as well as the retail payment infrastructure, with the central bank periodically recording retail balances (hybrid CBDC), or (2) an architecture, in which intermediaries onboard clients, handle KYC and AML policies and run the retail payment infrastructure, with the central bank handling wholesale payments in the background (fully intermediated CBDC). Similar architectures can be found in the report of the ECB (2020) on a digital euro.

While maintaining customer accounts and the underlying IT infrastructure is a time-tested activity, account models have two problems, which limit their attractiveness as a model for implementing a CBDC.

The first concern is data concentration at the central bank. A CBDC model that involves a system of directly or indirectly held customer accounts and allows citizens to directly access the central bank's balance sheet concentrates a huge amount of data at the central bank or makes these data indirectly accessible to the central bank, as pointed out by Chaum et al. (2021). A payment system based on an infrastructure of accounts must associate ledger entries with some form of

identity, transaction histories of individual accounts and a list of credits and debits per account. Otherwise, it is not possible to ensure transaction legitimacy, i.e. the legitimate change of entries in the ledger of accounts.

Technological tools may protect the privacy of transaction data against abuse and vis-à-vis other parties, but they do not guarantee transaction data privacy to the users of the digital currency. While the technology allows to protect user data, in such a system the users cannot themselves control and guarantee transaction privacy as informational self-determination would require (see e.g. D'Aligny et al., 2022). An account infrastructure, even if established with the best of intentions and measures of prudence, practically makes mass surveillance and the imposition of sanctions against individual account holders relatively cheap. Because the transaction data of an account system are centrally held, it is technically easy to enforce sanctions or surveillance measures. The very nature of data centralization, as pointed out by Chaum et al. (2021), would open a new avenue to exert pressure on central banks. This might undermine central bank independence and central banks' effectiveness in fulfilling their mandate to guarantee price stability through conducting monetary policy.

Note that hybrid systems as discussed in Auer and Böhme (2021) could provide a counterweight to such data centralization. But such systems come with other problems. For instance, in a hybrid system the central bank would be forced to honor claims it has no records of. This makes the central bank completely dependent on trusting in the integrity and reliability of the records held by third parties.

The second concern is competition with commercial banks. CBDCs implemented as a system of accounts would give customers the opportunity to hold their account at a commercial bank or at the central bank. This would have implications for financial stability (see e.g. Bindseil et al., 2021). The easy and practically frictionless alternative of a credit risk-free opportunity to deposit and store money could trigger a run and lead to outflows from commercial banks to the central bank at the slightest hint of financial uncertainty. Since banks play a major role in the euro area for financing households and firms, concerns that a CBDC for all might undermine banks' business model have been gaining relative weight.

A digital euro implemented in this way might also lead to a structural shift away from bank deposits into the CBDC. This would reduce funding and intensify competition for deposits. Higher interest rates might, in turn, reduce bank profitability and thus banks' credit intermediation capacity.

The discussion among experts about the significance of these concerns is not yet conclusive. Some take a more pessimistic view, and others a more benign one.[13] The financial stability arguments are, however, taken seriously so that policy measures have already been proposed which should help the central bank stabilize flows between the central bank and commercial bank deposits. The proposals contain either quantity measures limiting possible CBDC holdings or price measures which would allow to penalize holdings that are considered excessive through negative interest rates on CBDC stocks above a certain threshold (Bindseil et al., 2021). Given the huge heterogeneity among the potential users of a future digital currency and the differences between private and corporate users, it will be difficult to enforce flow controls via transparent rules.

[13] *See Brunnermeier and Niepelt (2019) for an optimistic view and Pichler et al. (2018) for a more skeptical view.*

### 4.2 Blockchain technology

Many reports on CBDCs have suggested that ideas from the world of crypto assets might provide interesting design elements. What could provide a "cash-like" digital alternative to a more traditional system of directly or indirectly held customer accounts is a combination of the decentralized control features of blockchains and a transaction register based on pseudonymous identities.

The design of the bitcoin system and the blockchain featuring decentralized control of the transaction ledger is an interesting concept. It lends itself for a situation where no central party exists that would keep and update transaction records or where the transaction parties cannot agree on such a central party because all potential players are assumed to be malicious or untrustworthy. Such a situation does, however, not reflect the state central banks and the current monetary system are in.

If a CBDC works in collaboration with intermediaries, they would be a supervised, vetted and licensed circle of institutions. In such a system, it is sufficient that malicious behavior can be detected, and illegitimate transactions can be recovered. The uncontested role of the central bank as an institution in the modern monetary system would also make it unnecessary to distribute the central bank's ledger with a blockchain. It would be of no benefit but increase transaction costs instead.

Auer and Böhme (2021) point out a second important reason why the crypto asset model will not be the answer to a CBDC implementation. The way in which access to crypto asset systems is implemented would be not practical for a CBDC. In bitcoin, transactions are authorized by digital signatures alone. The security of assets in such a system hinges therefore entirely on the security of the secrecy of private keys. According to Auer and Böhme (2021), "[...] if 20 years of research in usable security teaches us a single lesson, then it is that 'Johnny can't encrypt' (Whitten and Tygar, 1999); precisely because end users cannot manage private keys! Given that proficient cryptocurrency users keep losing fortunes due to lost and stolen keys (e.g. Abramova et al., 2021), there is simply no case for making people's direct claims on the central bank – their money under the mattress – contingent on the use of cryptography without any safety net."

Such arguments might sound confusing to readers who have read about various industrial-strength enterprise projects built on blockchain technology enabled by systems like Corda, Hyperledger or Quora. But, as Auer and Böhme (2021) point out, a closer look often reveals that these systems are run in configurations that resemble redundant but centrally controlled database systems rather than bitcoin.

Since crypto asset technology addresses issues that do not arise for a central bank in a modern monetary system and since there are critical security issues in the way transactions are authorized, blockchain is unlikely to be the answer for implementing a CBDC.

### 4.3 Digital bearer instruments: digital cash and its modern implementation

An early concept of digital money proposed by the computer scientist and cryptographer David Chaum (1983) is the model of digital cash. For reasons we cannot trace with confidence, this model fell somewhat into oblivion but was taken up and further developed by the so-called GNU Taler project, a software project led by

the computer scientists Christian Grothoff and Florian Dold (2019) and run by a team of developers and researchers.[14]

Building on digital cash and its principles, this model pulls this old technology toward the current technology frontier. It strongly focuses on transaction data privacy. The technology was presented in a working paper of the Swiss National Bank (Chaum et al., 2021) as a potential model of how a CBDC could be implemented. It provides an interesting model for a digital form of central bank money that would functionally be closer to cash than to directly or indirectly held customer accounts.

The GNU Taler system provides a model of a digital bearer instrument that exists locally in a wallet very much like physical banknotes. The local storage property is, however, achieved in a full online mode, with no offline functionality. The competitive niche of such an instrument would therefore not be physical cash but other digital payment solutions, be it traditional ones like credit cards or new ones like stablecoins. So let us briefly describe its main features.

Implemented as a CBDC,[15] GNU Taler would be issued by the central bank and distributed to commercial banks, just like banknotes. Issuance is central and no distributed ledger is involved in issuing, distributing and paying. The central bank does not directly interact with customers in this model, and the only information that remains with the central bank is a list of spent coins.

Customers withdraw the digital coins at their commercial bank that oversees KYC and AML compliance. The coins are kept in electronic wallets, which could be on a smartphone or on other electronic devices, from where they can be spent at a merchant. Transaction data privacy vis-à-vis the bank as well as the merchant is guaranteed via time- and industry-tested cryptographic techniques.[16] The coin income on the merchant side is, however, transparent, and therefore taxable. The coins earned by the merchant are deposited at the merchant's bank, which is again responsible for the KYC and AML procedures. Double spending is controlled by checking the coins against the spent coins list database at the central bank. This is the big picture of the GNU Taler circulation.

Transaction privacy is achieved using so-called blind signatures. The blind signature protocol prevents both the central bank and the commercial bank from tracing purchases made with the digital coins back to the customer. The customers blind their coins with a local cryptographic procedure on their own devices before having them digitally signed by the central bank. The hidden numeric value representing the coin then functions as a public key with an associated private key known to the owner of the coin. The central bank's signature on the coin's public key gives value to the coin. The central bank signs the coin with its own private key. A merchant or another payee can use the central bank's corresponding public key to verify the central bank's signature and thus the coin's authenticity.

The information accessible to central banks is the total amount of coins withdrawn and the total amount of coins spent. Commercial banks learn how many

[14] *https://taler.net/en/index.html*.

[15] *We use the qualification "as a CBDC" because the system could certainly also be used by private issuers. Issuing a CBDC would be one possible use case of GNU Taler.*

[16] *These are technically modern versions of cryptographic hash functions (invented in 1989), blind signatures (invented in 1983), Schnorr signatures (invented in 1989), Diffie-Hellman key exchange (invented in 1976), cut-and-choose zero-knowledge proofs (invented in 1985). See Dold (2019) for details and the respective references.*

coins a customer has withdrawn but not how many – and where – coins have been spent.

As with crypto assets, transactions are authorized by cryptographic keys alone, which are under the user's self-custody and can thus be lost or stolen. Like a lost wallet filled with cash, digital cash that has been lost or stolen because the cryptographic private keys have come into unauthorized hands cannot be recovered or regained.

A technological challenge posed by digital bearer instruments is how to prevent double spending. After all, digital objects are usually easy to copy. The GNU Taler system takes an approach to this problem which does not deal with copy prevention but assures within the system that each coin can be spent only once. Once a coin has been spent, the number of the coin – but no transaction history – goes to the central bank, which keeps a list of spent coins. When payees receive coins, the system helps them consult the list to verify that the coins have not already been spent before. If the coin was spent before, the payment would be invalid.

In such a system, the transaction data privacy problem is solved by giving users full control of transaction data privacy by locally using the blind signature scheme on their own devices. Unlike in a system of directly or indirectly held customer accounts, users do not have to entrust any third party with transaction data privacy.

In this system, excessive flows between commercial bank accounts and this form of a CBDC are less of a concern compared with a system of customer accounts. Given the self-custody of the CBDC in the Taler system, transferring money into the Taler wallet is not risk free since users must safeguard their wallets against both physical and digital threats. So, the system has a built-in self-regulation against excessive flows of funds. While transaction limits could be legally imposed in principle, it is not possible to impose holding limits, since there are no (customer) accounts. But as such limits have many problems on their own, as discussed in the subsection on accounts, this could be considered an advantage rather than a disadvantage. Of course, as with real bank runs, where customers scramble to convert their deposits into cash, such a run could occur here as well amid big uncertainty and solvency concerns via a commercial bank, perhaps facilitated by the digital and thus less friction-prone process of conversion.

Overall, a system envisaged in GNU Taler could be a useful blueprint for a CBDC implementation that would reap the benefits of a digital economy without disrupting the architecture of the monetary system and without necessitating massive new infrastructure investment and operations. Its efficiency and cost effectiveness combined with its usability would make it a viable competitor for privately issued digital assets in the platform economy. Since it is envisioned as an online-only system (Grothoff and Dold, 2021), it would by design not compete with cash, which would then remain the only form of central bank money that can be used without digital devices.

## 5 Cash is set to play a role also in the payment landscape of the future

We have stressed throughout this paper that the discussion about the digital euro centers on how to assure (1) universal access to central bank money, (2) a coherent and unfragmented monetary system and (3) an innovative and competitive environment for payment services in an increasingly digital economy dominated by huge platform businesses. It is not about abolishing cash. The recent pressure on cash

seems to come from the user side as digital forms of payment are becoming more popular. As we have argued in section 2, the demand for cash is unlikely to decline to zero, even in the longer term, because cash offers unique features to users. And cash is also unlikely to be abolished soon due to its unique legal function in contract law; in the current legal system most financial promises are based on cash.

Documents published by central banks, in particular the report on a digital euro issued by the ECB (2020), argue that a digital euro would complement existing payment solutions and would not substitute either bank deposits or cash. Even in a monetary and financial system where payments are increasingly digital and even when a digital central bank currency would be available, cash would still be an indispensable element in the universe of payment instruments. This will guarantee robustness by providing a physical device-independent opportunity to make payments. Overall, these arguments support both a positive and normative conclusion about the future of cash in a world where the payment landscape could be augmented by new private as well as public digital payment solutions. In a nutshell, cash will and should play a role in this future landscape.

## 6 Conclusions

Throughout history, technological change has also fostered change in payment technologies and instruments and the monetary system in general. In this day and age, digital transformation and the internet economy have created huge incentives for new private issuers of money to enter the market for payments. In other words, the incumbent issuers of private money, i.e. commercial banks, as well as central banks might face stiff competition. Since the dominant new players are mainly associated with the internet economy, which thrives on network effects, the danger of future market concentration and fragmentation in the market for digital payments is looming. This poses a strategic challenge to central banks. The all-important question is therefore: can central banks develop a new form of public digital money that (1) safeguards universal access to payments and the monetary system, (2) fosters competition and innovation, (3) protects the privacy of personal data and (4) supports effective monetary policy? This is the challenge that central banks around the world have risen to by launching new projects on central bank digital currencies, including the ECB's digital euro project. Introducing a digital euro does not aim to replace euro cash as a technologically outdated means of payment. Cash will and should have a role to play even in a future monetary system with a changed payment landscape, in which digital forms of money will have a more prominent role than they have today.

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# Should the use of cash be limited?

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*Payment habits have changed over the last twenty years. In Austria, cash is still the most popular means of payment at the point of sale (POS). But card payments have become more important, which is largely due to technological progress. The COVID-19 pandemic has likewise amplified the trend toward cashless payments. Additional pressure on cash also results from an initiative of the European Union (EU): The EU plans to introduce an EU-wide upper limit for cash transactions, namely EUR 10,000. The respective regulation is currently being discussed as part of a package of measures to combat money laundering and terrorist financing. Cash ensures anonymity and protects privacy. Cash works even when technology fails. In terms of inclusion, cash is important for people whose self-reported income is in the lower income brackets as well as less technically versed people. During the pandemic, cash enabled them to satisfy their basic needs. Given its tangible nature, cash moreover allows people to keep track of their financial resources. The flip side of anonymous cash are illegal activities. This is why the EU proposed to put a uniform ceiling on cash transactions. To this effect, the European Central Bank (ECB) had already in 2016 decided to stop producing the 500 euro banknote and to exclude it from the second euro banknote series. Austria has not imposed any legally standardized ceilings for cash payments – in contrast to 10 of the 19 euro area countries. The restrictions range from EUR 500 in Greece to EUR 15,000 in Slovakia. Worldwide, upper limits for cash payments are rare, existing only in 9 non-European countries to our knowledge. Such ceilings are just one way of combating crime and money laundering. As a matter of fact, national cash ceilings have had little effect so far. What speaks against restricting cash payments? An EU-wide limit on cash payments might distort competition and redistribute illegal activities within the euro area. Stricter national limits would be likely to continue to apply. Illicit activities have already started to shift to alternative, i.e. digital, means of payment, so-called crypto assets. Limiting cash payments without introducing accompanying measures could thus prove ineffective – as could restricting a single means of payment. Last but not least, an absolute, uniform measure does not do justice to the EU's subsidiarity principle, given that wage and price levels differ substantially across EU countries.*

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*Keywords: limits on cash payments, cash payments, COVID-19*

For Austrians "cash is king," and their love of cash is well known. Not surprisingly, cash payments are still very common in Austria, accounting for 66% of all physical point-of-sale (POS) transactions (Höpperger and Rusu, 2022).

However, as technological progress has over the past two decades pervaded many areas of our daily lives, we have seen notable changes in payments as well: means of payment have evolved, and people's payment habits have changed accordingly. In other words, people increasingly use cards for everyday payments: by end-2020, already 83% (2019: 73%) of debit card payments were contactless (PSA, 2020, 2021). In addition to this trend, recent measures to combat the COVID-19 pandemic have

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led to a decline in cash use. At the beginning of the pandemic, this development was especially due to partly false information about the risks of virus transmission through banknotes (ECB, 2021; Höpperger and Rusu, 2022). In addition, the European Commission (2021a) published a proposal for a regulation in July 2021 that provides for the introduction of a uniform upper limit for cash payments of EUR 10,000. In light of this, the pressure on cash is mounting.

According to the European Commission (2021b), limiting cash payments is meant to make a significant contribution to the fight against money laundering and terrorist financing. Large-value cash payments leave hardly any trace, which is why, according to EU political leaders, criminals prefer using such payments for money laundering (Engel, 2021). In this article, we aim to critically analyze and assess the arguments put forward for introducing a uniform EU-wide ceiling on cash payments. For this purpose, we first explain the functions of cash before we take a look at the current legal situation and national cash payment ceilings that exist already. Next, we present the arguments the European Commission has given for introducing a cash payment ceiling and examine them from a critical perspective. We conclude by summarizing our key findings and provide reasons why a cash ceiling does not lend itself to combating money laundering and terrorist financing.

## 1 The importance of cash

Almost three decades ago, the signing of the Maastricht Treaty laid the legal basis for the euro. In 1999, the euro was introduced as a common currency in the form of book money and in 2002 in the form of cash. 20 years later, euro cash continues to be a central, indispensable component of payment transactions, thus representing one of the most "tangible" symbols of European integration. After all, cash fulfills critical functions not only for the economic cycle, but also for private individuals. It is the only *means of payment* that allows citizens to make a transaction in central bank money that is settled immediately and thus definitively (Krueger and Seitz, 2018). With cash payments, neither the seller nor the buyer of a good has to pay in advance. Both are thus protected against the other party's insolvency.

Especially in a time in which digital networks and data collection for commercial purposes are becoming ever more important, cash guarantees a high level of data protection (Krueger and Seitz, 2018). In contrast to noncash means of payment, cash leaves no (digital) traces in transactions and thus supports a person's economic freedom of disposition. At the same time, cash plays an important role in providing payment options for people whose self-reported income is in the lower income brackets. People who pay a larger share of their expenses in cash include older or unemployed people, immigrants, minors, people with lower levels of education as well as people with limited or no access to digital payment services (Krueger and Seitz, 2018). Cash is thus an important means of promoting financial inclusion. Especially in a crisis situation such as the COVID-19 pandemic, nonacceptance of cash at the POS would probably make it very difficult for the abovementioned people to meet their basic needs. Moreover, paying with cash helps people keep better track of their spending, something many households take advantage of, especially those who have less money at their disposal. If people have a certain budget, e.g. for household expenses, in cash, looking into their wallets lets them know how much money they have left.

Cash can also be kept, lent, stored and saved for larger purchases. Cash thus also has a *store-of-value function*. Recent studies show that the demand for euro banknotes continues to rise, even though the share of cash transactions has declined in the euro area. As has been shown by the ECB (Zamora-Pérez, 2021), this seemingly counterintuitive paradox is due to the demand for banknotes as a store of value both in and beyond the euro area (euro area countries: 28% to 50% of total circulation value in 2019; foreign demand for euro banknotes: 30% to 50% in 2019). This is also confirmed by extensive research on foreign demand for banknotes (Lalouette et al., 2021).

Furthermore, cash lends itself to comparing the value of different goods and services, serving as a unit of account. It is also crisis-proof given that it functions independently of electricity and also in the event of payment system failures. At the beginning of the COVID-19 pandemic, the sharp increase in cash withdrawals in Austria has driven home that, in times of crisis, the Austrian population relies on cash.

Finally, it is worth mentioning that the euro banknotes have for years been among the most counterfeit-proof banknotes in the world, as confirmed by the counterfeit money statistics of the ECB (2022) published at the beginning of 2022.[2]

## 2 Status quo of cash payment restrictions

Despite its many positive features and functions, cash is often associated with illegal activities. Who does not know at least one movie scene in which someone hands over "dirty" money from criminal activities in a suitcase? In everyday life, people usually use a mix of means of payment ranging from cash to cards to alternative means of payment such as crypto assets. The ability to switch between different means of payment has also proven beneficial in criminal activities such as tax evasion, terrorist financing and money laundering. Government authorities, law enforcement agencies and other institutions have in recent years started to target cash as the (main) cause of such activities.

As a result, measures have been taken to restrict the use of cash, or at least make it increasingly unattractive. The ECB, for example, has stopped issuing the 500 euro banknote.

### 2.1 Applicable legal regulations

The 4th Anti-Money Laundering Directive (Directive (EU) 2015/849),[3] which was published in the Official Journal of the European Union on June 5, 2015, obliges companies that receive cash payments of more than EUR 10,000 when trading goods to apply this EU directive. The aim is to prevent the infiltration of illegal sums of money into the financial and economic cycle. The directive is a minimum harmonization directive, which means that EU member states have been able to adopt stricter measures.[4]

[2] *In the course of 2021, the number of counterfeits seized from circulation in Austria fell by almost one-third to 4,456 (2020: 6,321 counterfeits). Note, however, that the pandemic did not yet play a major role in the first quarter of 2020. Even if we narrow down the comparison period to Q2 to Q4 2020, counterfeits also fell by 27%.*

[3] *Implemented in Austria by the Financial Market Money Laundering Act.*

[4] *See in particular recital 6 und Article 2 paragraph 1 lit e.*

The provisions place great emphasis on the "know your customer" principle, which is intended to deprive money launderers of the advantage of anonymity. Another piece of legislation worth mentioning in this context is the Cash Regulation[5], which stipulates that travelers entering or leaving the EU and carrying a cash amount of EUR 10,000 or more must declare the amount to the customs authorities.

Judicial case law also points in a certain direction. In a recent decision[6], the Court of Justice of the European Union (CJEU) considered a limit on cash payments to be permissible in principle in light of the free movement of capital (Article 63 of the Treaty on the Functioning of the European Union –TFEU), provided that such a limit is appropriate and necessary to achieve the objective pursued (combating tax evasion and tax avoidance). Furthermore, the CJEU has confirmed in another decision that certain reasons may justify a restriction on cash payments.[7] Accordingly, although legal or other generally applicable regulations do not allow member states to impose cash restrictions of any, i.e. unlimited, size, they are not completely ruled out either.

In Austria, no legally standardized upper limits apply to cash payments. However, Austria provides for an identification obligation for transactions with a value of EUR 10,000 or higher, unless the transactions fall within the scope of a permanent business relationship. An identification obligation also applies to deposits or withdrawals of savings deposits if the amount to be deposited or withdrawn amounts to EUR 10,000 or more. In addition, it is prohibited to pay or receive wages for the provision of construction services in cash. Beyond that, restrictions on cash payments are subject to private autonomous disposition under Austrian law.[8] Theoretically, private individuals can therefore exclude the acceptance of cash in general and for all monetary debts denominated in euro without violating legal provisions.

### 2.2 Cash limits in euro area countries

As mentioned above, the European Commission is planning to implement an EU-wide cash limit. In recent years, more and more EU member states have introduced national restrictions on cash payments with the aim of combating illegal activities (especially terrorist financing and money laundering) as well as tax evasion and the shadow economy in general (see table 1 in the annex).

Currently, ten euro area countries (Belgium, Greece, Spain, France, Italy, Latvia, Malta, Portugal, Slovenia, Slovakia) have national limits on cash transactions. They range from EUR 500 in Greece to just over EUR 15,000 in Slovakia. In addition, special restrictions may apply to specific payments, such as tax payments (see table 1 in the annex). The national cash payment ceilings differ not only with regard to the threshold values, but also with regard to the group of persons and sectors covered.

Nine euro area countries (accounting for 31% of the total euro area population) currently do not apply, or intend to apply, cash ceilings at the national level. These

[5] *Regulation (EC) No 1889/2005 of the European Parliament and of the Council of 26 October 2005 on controls of cash entering or leaving the Community.*

[6] *See the judgment of the CJEU of October 6, 2021, Ecotex Bulgaria, C-544/19.*

[7] *See the judgment of the CJEU of January 26, 2021, Hessischer Rundfunk, joint cases C-422/19 and C-423/19, ECLI:EU:C:2021:63, paragraphs 69–70.*

[8] *On the fundamental obligation to accept euro banknotes and coins, see Article 61 paragraph 2 of the Federal Act on the Oesterreichische Nationalbank and Article 8 paragraph 3 of the Austrian Coinage Act.*

countries are Germany, Estonia, Ireland, Cyprus, Lithuania, Luxembourg, Austria, the Netherlands[9] and Finland.

As far as we know, outside Europe, few countries have introduced limits on cash payments. Three countries, namely Mexico, Uruguay and Indonesia, have a cash ceiling above EUR 10,000. Another three countries (Chile, Argentina, India) have limits for cash transactions of up to EUR 10,000. Israel, Russia and Vietnam are considering introducing limits on cash payments.

## 3 The EU's anti-money laundering package

The cash payment ceilings introduced so far in EU member states are only one of many measures to combat money laundering, terrorist financing and tax evasion. The countries that have not implemented such a cash ceiling to date may likewise choose from various legal measures to combat illegal activities.

At the EU level, however, there is agreement that most EU member states have a massive backlog in their fight against crime and money laundering. The European Commission now intends to make this fight more effective with the help of the anti-money laundering and countering of the financing of terrorism (AML/CFT) package that consists of four legislative proposals. The goal is to close gaps in the law, standardize rules and monitor them better. According to the European Commission, national measures have so far had little effect in the fight against money laundering and terrorist financing for lack of understanding and applying the AML/CFT requirements, lack of supervision and the limited number of suspicious transactions reported to the central reporting agencies.

In addition to introducing a European anti-money laundering authority, the proposed regulation (COM(2021) 420 final) therefore now provides in Article 59 for a cash ceiling of EUR 10,000 (or the equivalent amount in other currencies) for commercial transactions (i.e. for persons trading in goods and providing services). The only exceptions to this cash ceiling are (1) payments between natural persons not acting in their professional capacity and (2) payments or deposits at the premises of credit institutions.

The proposed regulation also allows member states to retain lower limits. Thus, existing national cash ceilings retain their validity. In addition, the member states are authorized to adopt lower cash ceilings than those provided for in the regulation after having consulted the ECB. Finally, the proposed regulation (Article 63) requires the European Commission to submit a new assessment of the necessity and proportionality of a lower cash ceiling after three years from the date of application of the regulation.

## 4 Advantages and disadvantages of cash limits

Discussions about the introduction of an EU-wide cash ceiling are not a new phenomenon. Already in 2015, efforts were taken at the European level to enact corresponding regulations. For lack of an empirically verifiable connection between a cash ceiling and a restriction of money laundering, these efforts stalled. The new

[9] *Currently no upper limit for cash payments is in place for private individuals. However, a legislative proposal provides for the prohibition of cash payments above an amount of EUR 3,000. In addition, a reporting obligation applies to suspicious payments over EUR 2,000. This obligation applies, for example, to professionals in the banking sector, freelancers, insurance companies and casinos.*

proposed regulation (COM(2021) 420 final) again refers to the fight against money laundering and terrorist financing as a priority goal.

In his book *The Curse of Cash*, the former chief economist of the International Monetary Fund (IMF), Kenneth Rogoff (2016), also assumes that a large part of the world's cash circulates in the shadow economy. He believes that abolishing larger banknotes would help significantly curb criminal activities such as tax evasion, drug trafficking, illegal immigration, money laundering, human trafficking, bribery of government officials and possibly even terrorist activities. Moreover, curbing such activities would have the added benefit of increasing government tax revenues (Rogoff, 2016).

In the proposed AML/CFT regulation, the European Commission (2021a) also cites the existence of different national restrictions as an argument for introducing a uniform cash payment ceiling. Differing approaches weaken the effectiveness of national measures, as they can be exploited to shift illegal activities from one member state with cash payment restrictions to another where restrictions on cash payments are less strict or absent altogether (recital 94). A harmonized limit on cash payments would thus eliminate distortions of competition in the internal market (recital 95) that have arisen from the different national rules for cash payments. The different rules can have a negative impact on certain economic sectors in countries with cash payment restrictions, while benefiting competitors in neighboring countries without such restrictions. Furthermore, the cash limit is also justified by citing the claim that criminals then find it more difficult to carry out illegal transactions because it is easier to trace electronic transactions than cash payments.

At the same time, several arguments imply that cash limits will not have the desired AML/CFT effect. First, it would be shortsighted to look at cash in an isolated manner as the root cause of all illegal activities. In fact, new payment methods are becoming increasingly popular in criminal activities (FATF, 2010). Foremost among them are crypto assets, such as bitcoin, where complex transaction chains enable anonymous payments abroad (Krueger and Seitz, 2018). According to a recent report by CipherTrace[10] (2020), a total of USD 3.5 billion worth of transactions was sent from criminal bitcoin addresses in 2020 on the bitcoin platform alone. These payments from bitcoin addresses were controlled by shadow market participants, hackers or other criminals.

Moreover, credit cards and what is called transaction laundering – a new form of money laundering via online transactions and payment services – are also gaining in importance (Dalinghaus, 2017). In addition, opaque company constructions and offshore destinations allow to move funds on a large scale and across several jurisdictions, thus disguising the funds' dubious origin (Schäfer, 2018). Finally, domestic law enforcement agencies find it hard or impossible to investigate money laundering given the lack of or sluggish administrative assistance from offshore destinations.[11] In view of such possibilities, the use of cash for the purpose of money laundering ("money suitcases") appears to be a relic of the past, when the cashless transfer of money and assets was not or not fully possible. The introduction of a cash payment restriction would not be a major hurdle for criminals using cash as

[10] *CipherTrace (US crypto currency intelligence organization); https://ciphertrace.com/.*

[11] *The Panama Papers, for example, have clearly shown how money laundering or tax evasion can be carried out with letterbox companies.*

they may switch to alternative (digital) means of payment. Restricting only one means of payment has the effect of shifting illegal activities to other means of payment, but would not prevent them (Dalinghaus, 2017).

Furthermore, for money launderers, the cost factor plays a significant role in which methods to choose for money laundering. Dealing with very high volumes of cash increases costs compared with digital means of payment and also involves the risk of personal contact. This is another reason why many new payment methods and electronic forms of money laundering are becoming more attractive.

Finally, the EU's AML/CFT package does not distinguish between terrorist financing and money laundering but caps cash payments to combat both. Hamed Tofangsaz, a specialist in criminal law and terrorist financing, criticizes such an approach for assuming that terrorist groups by default commit criminal acts before committing a terrorist act, which is not the case in reality (Tofangsaz, 2015). More often than not, terrorists procure and distribute funds in a legal manner, so that they commit no incriminating acts until the time of the attack, which is in contrast to money laundering. Therefore, the question arises whether two offenses that differ not only in their methods but also in their intentions (De Goede, 2012) can be effectively combated with one and the same measure.[12]

Moreover, as long as stricter national rules are permitted, a uniform cash ceiling would probably not prevent the problem of distorting competition. For their activities, criminals could continue to opt for member states where at least no stricter provision than the EUR 10,000 limit is in place. Furthermore, in the face of a cap for cash payments in euro, criminals may switch to other currencies in transactions outside the EU where no cap exists. In other words, only setting an upper limit for cash payments in the euro area is not expedient. For cash limits to be effective, a global solution would be called for (Krueger and Seitz, 2018). However, this is currently not feasible for the simple reason that many people still do not have access to noncash means of payment. Furthermore, from today's perspective, it seems very unlikely that the world's dominant countries in the monetary field would agree on a joint initiative to restrict or abolish cash simultaneously (Schäfer, 2018).

In light of the above arguments, it is more than doubtful whether the planned cash limit measure is suitable for combating money laundering and terrorist financing. This is, however, a mandatory prerequisite for an encroachment on fundamental rights and freedoms protected under European law, such as the right to property and privacy. First of all, it is difficult to establish a clear connection between the amount of cash held in a country and the shadow economy or criminal activities, because no clear pattern can be drawn from the available data (Schäfer, 2018). Austria and Switzerland, for example, are highly cash-reliant countries with a relatively small shadow economy sector, which contradicts the hypothesis that substantial cash holdings are associated with a sizable shadow economy. Sweden, on the other hand, with the lowest cash ratio, has a significantly larger shadow economy. The same applies to Canada and Australia, which are among the pioneers in cashless payments and nevertheless have a larger shadow economy than the more cash-friendly countries (Schäfer, 2018). Based on econometric studies, Schneider (2017)

[12] *From a legal standpoint, Tofangsaz (2015) notes that the "nature and definition of terrorism" remain fraught. In contrast to organized crime, about which there is more agreement on certain characteristics, a similar consensus does not hold for terrorism or terrorist groups. For differences between terrorist financing and money laundering in relation to accounting methods and techniques, see Frédéric Compin (2008).*

also concludes that cash can at best only empirically explain a small part of a shadow economy or other illegal activity. Questions of causality or the actual effects of abolishing cash, however, remain largely unanswered (Schneider, 2017). In a study commissioned by the European Commission, De Groen et al. (2017) concluded that cash restrictions do not have the desired result on terrorist financing and money laundering. As a result, a cash ceiling appears neither necessary nor proportionate.

Furthermore, we should also consider the proposed introduction of a cash payment ceiling from the perspective of the subsidiarity principle under EU law. The EU has 27 member states, and not all of them have adopted the euro. There are differences in wage and price levels both within and outside the euro area. Additionally, customs in business and economic life, including the use of cash, differ and so does the availability of cashless payment methods. An undifferentiated approach with a rigid cash payment ceiling of EUR 10,000 does not do justice to this reality. It does not account for national characteristics – especially the purchasing power in the individual economies. In view of this heterogeneity, setting an upper limit at the member state level appears more appropriate.

In this context, we want to refer to the recent ruling of the CJEU (C 544/19 of October 6, 2021) on a cash payment limit applicable in the Republic of Bulgaria. The CJEU considers such a limit permissible with regard to Article 63 TFEU (freedom of capital movements and payments), provided that such a limit is appropriate and necessary to achieve the objective pursued (combating tax evasion and avoidance). The decision is based on the Bulgarian law on the restriction of cash payments, which provides for a widely applicable upper limit for cash payments of BGN 10,000 (approx. EUR 5,110). As to the level of that ceiling, the CJEU stated in its reasoning that "the threshold of BGN 10,000, above which the obligation to transfer or deposit money into a payment account applies, does not appear excessively low, since it does not result in private individuals being denied a cash payment in their daily purchases or transactions." This statement does, however, not apply to the cash payment limit proposed by the European Commission: according to Eurostat, the average annual income (average equivalent total net income) in Bulgaria in 2020 was EUR 5,927, while in Austria it was almost five times as high in the same year (EUR 29,503). On the other hand, the upper limit for cash payments proposed by the Commission is only twice (!) as high as in Bulgaria. In our opinion, this illustrates that a uniform ceiling on cash payments of EUR 10,000 violates the subsidiarity principle, as it reflects a lack of proportionality. Finally, from a fundamental rights perspective, there seems to be a problem with the CJEU's reasoning that daily purchases are still possible when a cash payment restriction is in place.

What might also be problematic is that the cash limit will not be adjusted for inflation, which could lead to an ever-lower limit over time and might thus be interpreted as a step toward abolishing cash in transactions. A possible indexation over a certain period of time, for instance every five years, would be recommendable.

Finally, it should not go unmentioned that the timing increases pressure on cash, especially after the pandemic. This may raise people's concerns about a creeping abolition of cash.

## 5 Summary and conclusions

In this paper, we have analyzed arguments that speak for and against introducing an EU-wide uniform ceiling for cash payments, examined the current legal situation as well as existing cash ceilings and highlighted the importance of cash.

According to our analysis, a uniform EU cash ceiling will not be effective in combating money laundering and illegal activities, including terrorist financing. Instead, it is set to merely cause criminals to shift illegal activities to other means of payment. Current national restrictions confirm that cash ceilings have had little effect so far. Moreover, according to the regulation recently proposed by the European Commission, different national cash ceilings are likely to remain in place. As a consequence, the internal market will continue to suffer from distortions of competition. Finally, a uniform cash ceiling does not do justice to the EU's principle of subsidiarity: in particular, it does not account for the differences in the purchasing power of the individual economies, and would disproportionately encroach on legal positions protected by fundamental rights.

As the only legal physical means of payment, cash fulfills indispensable, critical economic functions in both payments and investments, and it also stands for financial inclusion. The COVID-19 pandemic has driven home that, in times of crisis, people trust cash. Any loss of these important functions that are guaranteed by cash would not be justifiable by cash payment restrictions whose effects remain questionable. Economic policymakers should therefore give equal weight to developing the cash sector and to advancing digital payment transactions. Despite some competition, cash and digital means of payment complement each other and both are of great importance to the national economy. Last but not least, consumers should always be free to choose the means of payment.

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# Annex

Table A1

## Cash ceilings in euro area countries

| | Peer-to-business (P2B) / business-to-business (B2B) | Peer-to-peer (P2P) |
|---|---|---|
| Belgium | EUR 3,000 | No limits |
| Germany | No limits | No limits |
| Estonia | No limits | No limits |
| Ireland | No limits | No limits |
| Greece | Law 4446/December 22, 2016:<br>EUR 500 for P2B | No limits |
| Spain | Art. 18 Law 11/2021:<br>EUR 1,000 for residents<br>EUR 10,000 for nonresidents | No limits |
| France | EUR 1,000 for residents<br>EUR 15,000 for nonresident private individuals | No limits |
| Italy | EUR 2,000 from July 1, 2020 to December 31, 2021;<br>EUR 1,000 as of January 1, 2022<br>EUR 15,000 for nonresident (only for tourists) | Same limits as for P2B/B2B |
| Cyprus | No limits | No limits |
| Latvia | EUR 7,200 | No limits |
| Lithuania | No limits | No limits |
| Luxembourg | No limits | No limits |
| Malta | EUR 10,000 for (a) antiques (b) immovable property (c) jewelry, precious metals, precious stones and pearls, (d) motor vehicles (e) seacraft and (f) works of art | Same limits as for P2B/B2B |
| Netherlands | Planned: EUR 3,000 | No limits |
| Austria | No limits | No limits |
| Portugal | Law No 92/2017 of August 22, 2017:<br>EUR 3,000 for residents<br>EUR 10,000 for nonresident natural persons (P2B)<br>EUR 1,000 for B2B | EUR 3,000 |
| Slovenia | EUR 5,000 for P2B<br>EUR 420 for B2B | No limits |
| Slovakia | EUR 15,000 for P2B (since 2013)<br>EUR 5,000 for B2B | EUR 15,000 |
| Finland | No limits | No limits |

*Source: Authors' compilation.*

# The use of euro cash as a store of value in CESEE

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*People in Central, Eastern and Southeastern Europe (CESEE) have been using euro cash as a store of value ever since euro banknotes and coins were introduced in 2002. At that time, the euro replaced Austrian schilling, Deutsche mark and US dollar banknotes as a safe asset. To arrive at descriptive results for the use of euro cash in CESEE over the past 20 years, we drew on time series from the OeNB Foreign Currency Survey (1997–2007) and the OeNB Euro Survey (2007–2021). For one thing, we sum up the literature on euroization in CESEE. For another, we update and discuss key indicators of euro cash holdings in the region published in former studies that used OeNB survey data.*

*Holding euro cash as a store of value is still widespread in Albania, Croatia, North Macedonia and Serbia. Survey respondents in Croatia, Romania and Serbia reported the highest median amounts of euro cash. Overall, the relative share of euro cash in total currency in circulation has been on a downtrend in all CESEE countries since 2007–08. However, on the level of individual portfolios, euro cash still plays an important role, in particular for the relatively large group of individuals with small savings in Southeastern Europe. Even among the relatively small group of banked savers in Croatia, Hungary, Albania, Bosnia and Herzegovina and Serbia, around 40% reported holding more than half of their total savings as cash in 2020–21.*

*Many people in CESEE still prefer to save in cash and in euro. This suggests that the determinants of the demand for euro cash as identified by Stix (2013) and Brown and Stix (2015) are still relevant: a lack of credibility in the long-term stability of the local currency, network effects and a lack of trust in the stability of the banking system. We therefore assume that, also in the foreseeable future, euro cash will continue to play a role as a safe haven asset in CESEE.*

*JEL classification: E41, D14, O16*
*Keywords: euroization, asset and currency substitution, survey data, CESEE*

Ever since euro banknotes and coins were introduced in twelve EU member countries in 2002, a growing number of euro banknotes has been circulating outside the euro area. This also holds true for the countries in Central, Eastern and Southeastern Europe (CESEE) that have not adopted the euro as legal tender.[2] The authors of a recent study released by the ECB (Lalouette et al., 2021) aimed at identifying the drivers of foreign demand for the euro and also estimated the share of euro banknotes circulating outside the euro area. According to their results, euro cash flows are mainly driven by factors that affect a given country's demand for the euro (local inflation, economic activity and foreign tourism) rather than external factors (global uncertainty or short-term interest rates in the euro area). At end-2019, the share of euro banknotes in circulation outside the euro area was estimated to

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[2] *For details on the international use of the euro and in particular on the export and import of euro banknotes, see ECB (2021, 2022).*

amount to between 30% and 50% of the total value of euro banknotes in circulation (Lalouette et al., 2021).

Most CESEE countries have a long history of currency and asset substitution, i.e. using foreign currency as a secondary currency and safe haven asset. This not only constrains the conduct of monetary and fiscal policy, but also poses a risk to financial stability. Before the euro, the Deutsche mark (DEM), Austrian schilling (ATS) and US dollar (USD) served as secondary currencies. Unofficial euroization[3] emerged in times of high inflation, currency or banking crises, when foreign currencies were used as a store of value. If a crisis deepened (e.g. through hyperinflation or the confiscation of savings deposits) and lasted longer, the foreign currency was then also used as a medium of exchange. It is well established in the literature on dollarization that de-dollarization does not necessarily occur, at least not fully, once macroeconomic stabilization has been achieved (e.g. Feige and Dean, 2004, for CESEE and the Commonwealth of Independent States). Economic agents continue using the foreign currency for both savings and transactions for a protracted period of time after successful macro stabilization.

Calvo and Vegh (1992) first examined this so-called ratchet effect, i.e. an economic process that is difficult to reverse once it is underway or has already occurred. They identified two potential explanations for the phenomenon. First, currency substitution persists because economic agents continue to have doubts about the future stability of the domestic currency even if the exchange rate is stable or inflation is low for the time being. The second explanation relates to network externalities. They reduce the transaction costs associated with using the foreign currency, i.e. economic agents in a multi-currency environment prefer the currency which is already used widely (Craig and Waller, 2004). Hence, if currency substitution reaches sufficiently high levels during a macroeconomic crisis, it will persist even after the crisis because the foreign currency has become a well-established medium of exchange. Both explanations are essentially rooted in a loss of trust. Once trust in a currency is lost, it returns only very gradually (Hosking, 2014).

The main aim of our descriptive study is to take stock of the use of euro cash by residents in ten selected CESEE countries. Fortunately, the OeNB has unique regional data at its disposal; normally hardly any data are available on currency in circulation abroad. Based on microdata from the OeNB Foreign Currency Survey (1997–2007) and the OeNB Euro Survey (2007–2021), we present indicators on (1) the extensive and intensive margin of euro cash holdings, (2) the degree of asset and currency substitution as well as (3) cash and currency preferences. Most of these indicators have been presented in former studies using OeNB survey data. We contribute to the literature on euroization by updating and discussing these indicators. We zero in on the use of euro cash as a store of value: former studies and reported motives indicate that asset substitution is still significant in the region, while the use of euro cash for payments has declined remarkably since 2007–08.

[3] *Manjani (2015) lists three main types of unofficial dollarization or euroization: (1) monetary dollarization or currency substitution, i.e. the substitution of domestic currency with foreign currency for transaction purposes; (2) financial dollarization, i.e. economic agents' holding of foreign currency assets and liabilities; and (3) real dollarization, i.e. the indexation of wages, real estate and/or durable goods prices in foreign currency. We use the terms "asset substitution" and "currency substitution" as discussed by Feige and Dean (2004). Asset substitution refers to holding foreign currency assets (cash and/or deposits) as a store of value, while currency substitution refers to the use of a foreign currency as a means of payment.*

We find that euro cash holdings are especially widespread in Czechia (mainly for traveling purposes) as well as in Albania, Croatia, North Macedonia and Serbia, where euro cash predominantly serves as a store of value. The share of euro cash holders dropped in the aftermath of the global financial crisis (GFC) and the euro area sovereign debt crisis, but has picked up again in recent years. The median amounts of euro cash holdings likewise increased again. In 2020–21, they were highest in Croatia (nearly EUR 600) as well as in Romania and Serbia (about EUR 450 each). The lowest amounts were reported in Czechia, Bulgaria and Poland (around EUR 200 each). Furthermore, the time series of the currency substitution index (i.e. the ratio of euro cash to euro cash plus local currency in circulation) has trended downward in all Southeastern European (SEE) countries since 2007–08. Croatia, North Macedonia and Serbia still have noteworthy levels of euro cash hoardings on the aggregate level. However, on the level of individual portfolios, euro cash still plays an important role, in particular for the relatively large group of individuals with small savings in SEE. Even among the relatively small group of banked savers in Croatia, Hungary, Albania, Bosnia and Herzegovina and Serbia, around 40% reported holding more than half of their total savings as cash in 2020–21. Finally, many people in CESEE still prefer to save in cash as well as in foreign currency, predominantly the euro. This holds true especially in Serbia, North Macedonia and Croatia. The underlying determinants, as identified by Stix (2013) and Brown and Stix (2015), are apparently still relevant and effective: a lack of credibility in the long-term stability of the local currency, network effects and a lack of trust in the stability of the banking system. Consequently, euro cash has remained a safe haven asset in SEE and is likely to also play a role in the foreseeable future.

This study is structured as follows: section 1 discusses the historic background of euroization in CESEE. In section 2, we describe the data sources. In section 3, we offer descriptive analyses of OeNB survey data regarding the use of euro cash as a store of value from 1997 to 2021. Furthermore, we assess how important euro cash holdings are for individuals' portfolios. To this end, we relate euro cash holdings to two close substitutes, namely local currency in circulation and bank deposits. In section 4, we briefly discuss determinants and preferences with respect to saving in cash and foreign currency. Here, we mainly draw on studies using OeNB Euro Survey data. In a box, we present descriptive evidence on the prevalence of domestic payments in euro in CESEE and discuss the underlying preferences. Section 5 concludes with policy implications.

## 1 Brief overview of euroization in CESEE

European currencies have been formally or informally part of the economic systems of CESEE countries for a long time. In socialist Yugoslavia for example, it was common to informally trade foreign currencies, which allowed people to buy foreign goods (Lofranco, 2020). Also, euroization has been a widespread phenomenon in transitioning economies. The Western Balkan countries rank among the most euroized countries in Europe. What they have in common is a history of political uncertainty, macroeconomic instability and conflicts.[4] Hyperinflation, banking and currency

[4] *The policy challenges of the transition process were aggravated by a series of wars in the 1990s and early 2000s. After the breakup of Yugoslavia, the newly created democracies faced a double challenge: rebuilding their economies in both a post-war and an economic transition context (Országhová, 2015).*

crises – leading to a loss of confidence in the local currency – as well as debt crises went hand in hand with the transition process in CESEE countries (Ganic et al., 2017). Additionally, their possible EU accession and subsequent obligation to introduce the euro has played an important role in that context (Ritzberger-Gründwald and Scheiber, 2012; Dumičić et al., 2018). Ritzberger-Grünwald and Stix (2007) showed that the increase in euro demand due to anticipation (i.e. expectations about euro introduction, inflation or exchange rate movements) is stronger than the decrease in demand due to economic stabilization. For a small and open economy with strong economic ties to the euro area, the optimal level of euroization is higher than zero but lower than the levels observed in many Western Balkan countries that are (potential) candidates for EU accession (Della Valle et al., 2018).

All in all, people in CESEE have been choosing to hold euro cash for various motives. The most common reasons are (1) geographic proximity, coupled with increasing economic interlinkages, (2) the desire to minimize risk, and (3) tradition. In addition, when households make more active financial decisions, national economic determinants such as inflation and exchange rate expectations may also play a greater role.

The extent of asset and currency substitution varies considerably between countries (Backé et al., 2007). Before the launch of euro cash in 2002, the most important foreign currencies in CESEE were the US dollar, the Deutsche mark and the Austrian schilling. Foreign currencies started to circulate in the region in the late 1960s to early 1970s. Their use related to salaries and remittances[5] of labor migrants or short-term workers ("Gastarbeiter") from CESEE countries e.g. in Germany and Austria. Vice versa, some of the former Yugoslav republics increasingly attracted tourists from abroad.

Other CESEE countries were affected by similar developments more recently. During and right after their initial transition process, hyperinflation, currency devaluations or bank failures gave rise to distrust of the national currency (Ritzberger-Grünwald and Stix, 2007).

Stix (2004) pointed out that, during the cash changeover period following the euro's launch, a substantial fraction of the stock of DEM, ATS and other euro area currencies that circulated in the five CESEE countries he examined (Croatia, Czechia, Hungary, Slovakia, Slovenia) were exchanged into euro.

## 2 Data sources

Even though foreign currencies played a significant role in the CESEE region, which also impacted on monetary and fiscal policy, little was known in the 1990s about the various dimensions of foreign currency use. Data on the use of foreign currency cash were scarce. For this study, we draw on unique data from two surveys commissioned by the OeNB that cover a period of 25 years from 1997 to 2021.[6]

[5] *The share of households with euro cash holdings is higher for people that have relatives in euro area countries. Euro cash holdings may – at least partially – stem from remittances of family members abroad (Backé et al., 2007).*

[6] *For details on the two surveys, see Bittner (2020) and the OeNB website: OeNB Euro Survey - Oesterreichische Nationalbank (OeNB) and Previous surveys of the OeNB in CESEE - Oesterreichische Nationalbank (OeNB).*

### 2.1 1997–2007: OeNB Foreign Currency Survey

In preparation of the euro banknote launch, the OeNB commissioned the semiannual Foreign Currency Survey. This survey covered five countries close to Austria, i.e. Croatia, Czechia, Hungary, Slovakia and Slovenia, and was conducted between 1997 and 2007. Each representative survey covered about 1,000 persons aged 15 years or older per country; respondents were interviewed in April/May and in October/November.

The goal of the survey was twofold: (1) to assess how much DEM, ATS and USD cash was circulating in these countries, and (2) to establish a realistic forecast of the demand for euro banknotes in these countries. Given that some of the countries were highly dollarized, one particularly interesting question was whether households and businesses would exchange their DEM and ATS cash holdings for euro, US dollars or local currencies, or place them in bank accounts (Stix, 2001; Bittner, 2020).

### 2.2 2007–2021: OeNB Euro Survey

In fall 2007, the OeNB expanded the range of surveyed countries from five to eleven.[7] The scope of the questionnaire was broadened to include asset and liability euroization, and the survey was renamed OeNB Euro Survey.[8] From 2007 to 2014, surveys were conducted twice a year, in spring and in fall. Since 2015, the survey frequency has been reduced to once a year (October/November). In each wave, a representative sample of approximately 1,000 individuals is polled in each country in a multistage stratified random sampling procedure. The target population comprises residents aged 15 years or older. The sample is representative of the country's population with regard to age, gender and region.

Data weighting ensures a nationally representative sample for each country. Sampling weights use population statistics on gender, age and region and, where available, education and ethnicity. Interviews are carried out face-to-face at the respective respondent's home.[9]

### 2.3 Characteristics and limitations of the data

Both survey datasets are unique sources for foreign currency cash holdings but should be interpreted with caution (Stix, 2001; Scheiber and Stix, 2009). First, underreporting is likely for the sensitive question on the amount of euro or other foreign currency cash holdings, although the question does not explicitly refer to

[7] *The then six EU member states Bulgaria, Czechia, Hungary, Poland, Romania and Slovakia as well as the EU candidates Albania, Bosnia and Herzegovina, Croatia, North Macedonia and Serbia. Slovenia dropped out of the survey as it formally adopted the euro in 2007. For the same reason, Slovakia was excluded from the survey in 2009. Croatia became a member of the EU in July 2013. Montenegro and Kosovo are not sampled because they unilaterally introduced the euro as legal tender.*

[8] *The core questions relate to cash holdings in foreign currencies, savings and other assets as well as bank and nonbank loans. Moreover, the survey collects respondents' economic sentiments, experiences and expectations as well as trust in institutions and currencies. A wide range of sociodemographic and socioeconomic variables as well as paradata complement the questionnaire. Sampling methodology has been improved in 2012 and 2016. For more details, see Bittner (2020).*

[9] *In 2020 and 2021, data collection was mostly finished before severe coronavirus infection waves hit the survey countries. Interviews were exclusively conducted face-to-face and appropriate precautionary measures were applied by the survey institutes in all countries. Unit nonresponse rates increased in Albania, Croatia, Czechia, Hungary, Poland, Romania and Serbia but did not differ too much from those of previous years. Only Bosnia and Herzegovina recorded an unprecedented increase in nonresponse.*

grey economy activities. Any results related to amounts should therefore be regarded as constituting a lower bound of actual figures.[10]

Second, figures may be biased if item nonresponse is not random. Across all countries, an average 16% of all respondents who reported euro cash holdings refused to state the respective amount. Item nonresponse varies substantially across survey waves and ranges from 5% in Czechia to 30% in Bosnia and Herzegovina and Serbia.[11] The indicators we present in this study are based on the methodology of Scheiber and Stix (2009), who assumed that nonresponse is random.

Third, both surveys focus on individuals as opposed to households. Consequently, the questionnaires address personal holdings but account for joint holdings of couples explicitly.

## 3 Euro cash as a store of value in CESEE

In this section, we present survey evidence about the role foreign currency cash plays in CESEE as a store of value. Subsections 3.1 and 3.2 shed some light on the dissemination of foreign currency cash holdings since 1997 and on fluctuations of median amounts. To gauge how important euro cash holdings are for individuals' portfolios, we relate the amount of euro cash holdings to two close substitutes, namely local currency in circulation and bank deposits both denominated in local currency and foreign currency (mainly euro).

### 3.1 Results from studies using data of the Foreign Currency Survey

#### The period 1997–2002

In the years after the transition crisis and the 1990s Yugoslav Wars, people in CESEE would mainly use foreign currency cash as a general reserve and for payments abroad.[12] According to the OeNB Foreign Currency Survey, in 1997, around 40% of the respondents in Slovenia, Czechia and Croatia held Deutsche mark (chart 1, left panel). Lower shares were reported for Slovakia (around 20%) and Hungary (around 10%). US dollar holdings were quite common in Czechia and Slovakia (around 15% each), while Austrian schilling banknotes were mainly circulating in Czechia (25%), Slovenia and Slovakia (15% each). In Croatia and Hungary, both the shares of US dollars and Austrian schillings were below 5%.[13]

Until 2000, foreign demand for Deutsche marks had declined and demand for Austrian schillings and US dollars had increased. Stix (2001) found some evidence pointing to a substitution of US dollars for Deutsche marks until end-2000, but overall the demand for both Deutsche marks and US dollars had declined as a result of successful macroeconomic stabilization. In line with Stix's (2001) interpretation, the substitution that was relevant did not concern DEM and USD cash but

[10] *Scheiber and Stix (2009, footnote 9) gauge an underreporting factor of 2.2 for Croatia in 2007/2008.*

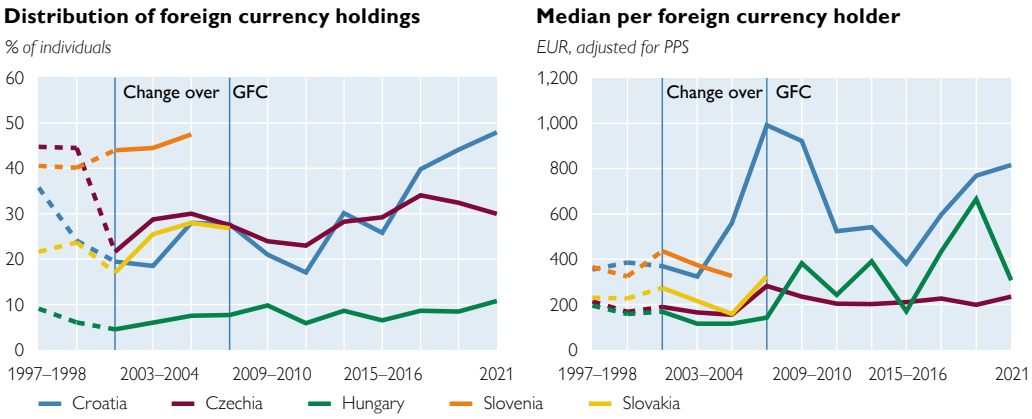
[11] *For comparison, item nonresponse for the sensitive information on monthly net household income averages 21.4% and ranges from 4% in Czechia to 34% in Bosnia and Herzegovina and 30% in Serbia. In contrast, item nonresponse for the question whether the respondent owns euro cash is rather low at an average 2.3%, ranging from 0.4% for Czechia to 5.2% for Serbia.*

[12] *See chart A1 in the annex. Note that respondents were asked about their motives for holding foreign currency cash for each currency separately and as a general question for all foreign currencies. Chart A1 captures the responses to the general question.*

[13] *Chart 1 shows only DEM figures since the DEM accounted for the highest share in all countries surveyed in 1997. To learn more about the other currencies prior to the euro cash changeover, see Stix (2002).*

Chart 1

**Holdings of Deutsche mark prior to 2002 and of euro cash 2002 onward**




*Source: OeNB Foreign Currency Survey 1997–2007, OeNB Euro Survey since fall 2007.*

*Note: The figures show weighted averages and medians across all survey waves for the respective time period using weights that are calibrated on census population statistics (separately for each country). Respondents who answered "Don't know" or who refused to answer have been excluded. Slovenia adopted the euro as legal tender in 2007, Slovakia in 2009. Median values were calculated using linear interpolation between class limits. Purchasing power adjustments are based on the PPS exchange rates provided by the Vienna Institute for International Economic Studies (wiiw) database. GFC = global financial crisis (2008) and launch of the OeNB Euro Survey in fall 2007. Dotted lines refer to DEM amounts converted into EUR at central parity.*

related to that between domestic and foreign currency cash or foreign currency bank savings. The latter signaled a gradual return of trust in the stability of the banking system.

### From the euro cash changeover in 2002 onward

Following the euro cash changeover in early 2002, the May 2002 Foreign Currency Survey revealed that the majority of respondents had exchanged their DEM cash holdings for euro. Furthermore, a substantial share of respondents opted for local currencies, while the share that opted for the US dollar was sizable only in Croatia and Slovakia (Stix, 2002). The share of respondents who held euro in May 2002 was significantly lower than the share who held either Austrian schillings or Deutsche marks in November 2001; the share of respondents holding US dollars remained roughly constant (chart 1, left panel). A general decline was evident in the proportion of residents that held any foreign currency – both in the short term (fall 2001 to spring 2002) and in the longer term (1997 to 2007), with the exception of Slovenia. In addition, the estimated nominal euro amounts held in Croatia, Czechia, Slovakia and Slovenia had contracted substantially from 1999/2000 to May 2002 (Stix, 2002).

Already 20 years ago, an overwhelming share of people in the covered CESEE countries regarded the euro as a stable currency (Stix, 2004). Significant amounts of euro cash were held in only two countries, namely Slovenia and Croatia (chart 1, right panel). Both are former Yugoslav republics, in which currency substitution (mostly DEM) had been a widespread phenomenon in the wake of economic crises and war. In 2002, about two-thirds of the Croatian and Slovenian respondents agreed with the statement that they hold euro cash mainly as a general reserve and store of value. In the other three countries – Hungary, Czechia and Slovakia – foreign currency cash holdings were relatively small in terms of value already prior to

the cash changeover. Such holdings were mainly kept for regular shopping tours to, or vacations in, the euro area (Ritzberger-Grünwald and Stix, 2007).[14]

The prevalence as well as the median amount of euro cash holdings soared during the economic boom phase around the EU's enlargement in 2004. Dynamics in Slovenia and Slovakia were likely to have been also influenced by the two countries' euro adoption prospects. The demand for euro cash increased particularly strongly in Croatia after the outbreak of the GFC, not least because of the heightened uncertainty and a swift deterioration of trust in the stability of the local currency.

### 3.2 Results from the OeNB Euro Survey: euro cash holdings in CESEE

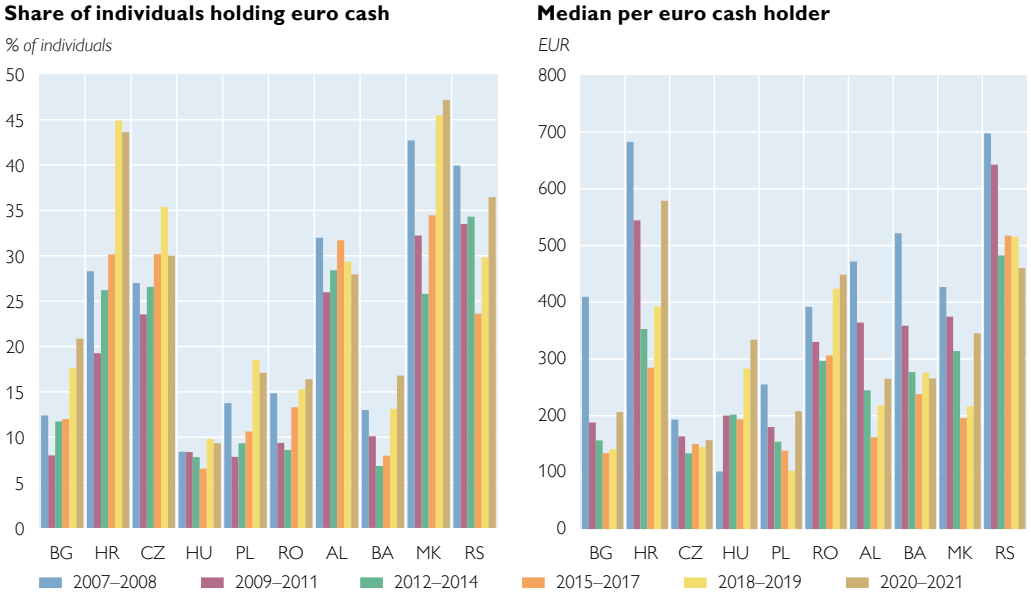
#### Extensive margin: how are euro cash holdings distributed?

Since 2007, the OeNB Euro Survey results have been shedding light on euroization beyond Austria's neighboring countries. Apart from Croatia and Czechia, euro cash holdings are especially widespread in Albania, North Macedonia and Serbia.

The left panel of chart 2 shows the percentage of individuals who hold euro cash in the ten CESEE countries covered by the OeNB Euro Survey – averaged across survey waves of two to three years as indicated in the legend. After a drop in the last decade in the aftermath of the GFC and the sovereign debt crisis in the euro area, the share of respondents who reported holding euro cash has picked up again in recent years, surpassing 2007 levels, with the exception of Albania and Serbia.

Chart 2

**Euro cash holdings in CESEE since 2007**




*Source: OeNB Euro Survey.*

*Note: Weighted percentages are based on pooled data from survey waves of the time period as indicated in the legend. The weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). Respondents who answered "Don't know" or who refused to answer have been excluded. Median values were calculated using linear interpolation between class limits.*

[14] *See chart A1 in the annex for country results on the motives for holding foreign currency or euro cash.*

First, the recent rebound in euro cash holdings might be driven by rising incomes after the recovery from the GFC and given a higher prevalence of remittances due to the opening-up of the EU labor market in 2013 (Scheiber, 2019). Some respondents also report incomes in euro, in particular in capital cities, regions bordering the euro area (probably due to commuters) and regions with a strong tourism industry (see figure A1 in the annex). Second, heightened uncertainty around the COVID-19 pandemic might have increased the demand for euro cash in particular in Bosnia and Herzegovina, Croatia, North Macedonia and Serbia. This points to the still important role of monetary expectations. The fear that the local currency might depreciate largely drives SEE residents' demand for a safe asset (Beckmann and Fernandes, 2021).

In 2021, as much as 60% of euro cash holders in SEE report that they hold euro cash mainly as a general reserve (see chart A1 in the annex), with the exception of Bulgaria. The differences in motives between residents of Central and Eastern Europe (CEE) and of SEE are also reflected in the median amounts.

#### Intensive margin: how much euro cash do individuals hold?

Analogous to the distribution (extensive margin) of euro cash holdings, the median amounts (intensive margin) dropped after the GFC, followed by mixed dynamics since then (chart 2, right panel). Medians decreased substantially in all SEE countries that had stated relatively high median amounts in 2007–08. In recent years, the median increased strongly in Albania, Croatia, Hungary, North Macedonia and Romania.

At a median amount of almost EUR 600, Croatia reports the highest amount in 2021, followed by Romania and Serbia (around EUR 450 each).[15]

### 3.3 Croatia, North Macedonia and Serbia: euro cash still accounts for a significant part of total currency in circulation

To gauge the macroeconomic significance of euro cash in CESEE, we relate survey figures to aggregate statistics on currency in circulation. Moreover, a direct survey question reveals that euro cash holdings account for a significant share in total cash holdings at the individual level in 2021, which indicates that saving in euro cash is quite common among SEE residents, except for Bulgaria.

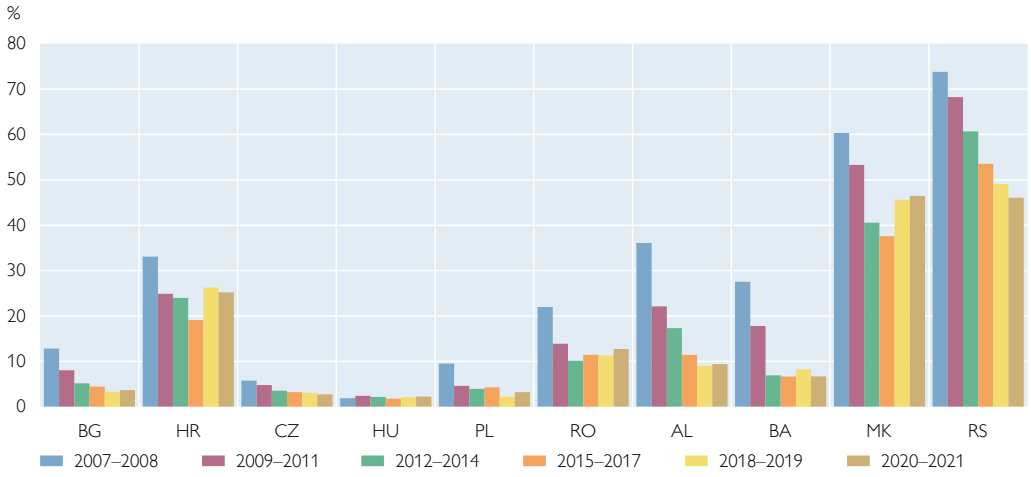
Chart 3 shows the currency substitution index (CSI) for CESEE countries, i.e. the ratio of projected euro cash per capita over euro cash plus local currency in circulation per capita.[16] In 2007–08, Albania, Bosnia and Herzegovina, Croatia and Romania exhibited medium levels of currency substitution of between 20% and 40%. In North Macedonia and Serbia, the CSI was at 60% and 75%, which implies that on the aggregate level more euro cash was circulating than local currency. Since 2007–08, the relative share of euro cash in circulation has trended downward in all SEE countries. However, Croatia and in particular North Macedonia and Serbia still register medium to high levels of euro cash in circulation. In the EU members Bulgaria, Czechia, Hungary and Poland, in contrast, euro cash circulation

[15] *Similar to Slovenia's and Slovakia's experience before their adopting the euro, the dynamic in Croatia might be influenced by the country's euro adoption prospects that have recently risen. See Scheiber (2019) to learn more about the impact euro adoption expectations may have on euro cash holdings.*

[16] *For details on the CSI methodology, see Scheiber and Stix (2009).*

Chart 3

**Currency substitution index**




*Source: OeNB Euro Survey, national central banks.*

*Note: The currency substitution index is calculated as the ratio of euro cash to euro cash plus national currency in circulation. For details, see Scheiber and Stix (2009).*

had been macroeconomically insignificant already in 2007–08, and it has since declined further.

It is advisable to take the survey results on euro amounts with a grain of salt and to use several indicators. Given the sensitive nature of the direct questions about euro cash holdings, we are faced with data limitations – in particular underreporting and non-randomness of item nonresponse.[17] Chart 4 provides information on the self-reported share of foreign currency cash holdings in total cash holdings for the medium to highly euroized SEE countries.[18]

The share of respondents holding more than 50% of their cash in foreign currency (chart 4, blue and red columns) decreased remarkably since 2008 in Bulgaria, Bosnia and Herzegovina, Croatia, North Macedonia and Serbia, which mirrored the CSI dynamics. The figures for Albania and Romania have been hovering around 15% and 30%, with no clear trend, while the CSI indicates that euro cash circulation declined substantially from 2007 to 2021.

### 3.4 SEE: euro cash holdings remain an important safe asset at the individual level

In 2021, euro cash holdings still served as a safe asset in the following five countries: Bosnia and Herzegovina, Croatia, North Macedonia, Romania and Serbia. There, they continued to make up the bulk of individuals' cash reserves. So, how do these euro cash hoardings compare with formal savings at banks?

Back in 2007–08, saving in cash was common in CESEE. Half of the CESEE population did not have a bank account or savings deposits back then. In Albania, Bulgaria and Romania, the share of banked individuals was below 30%.[19] In 2020–21,

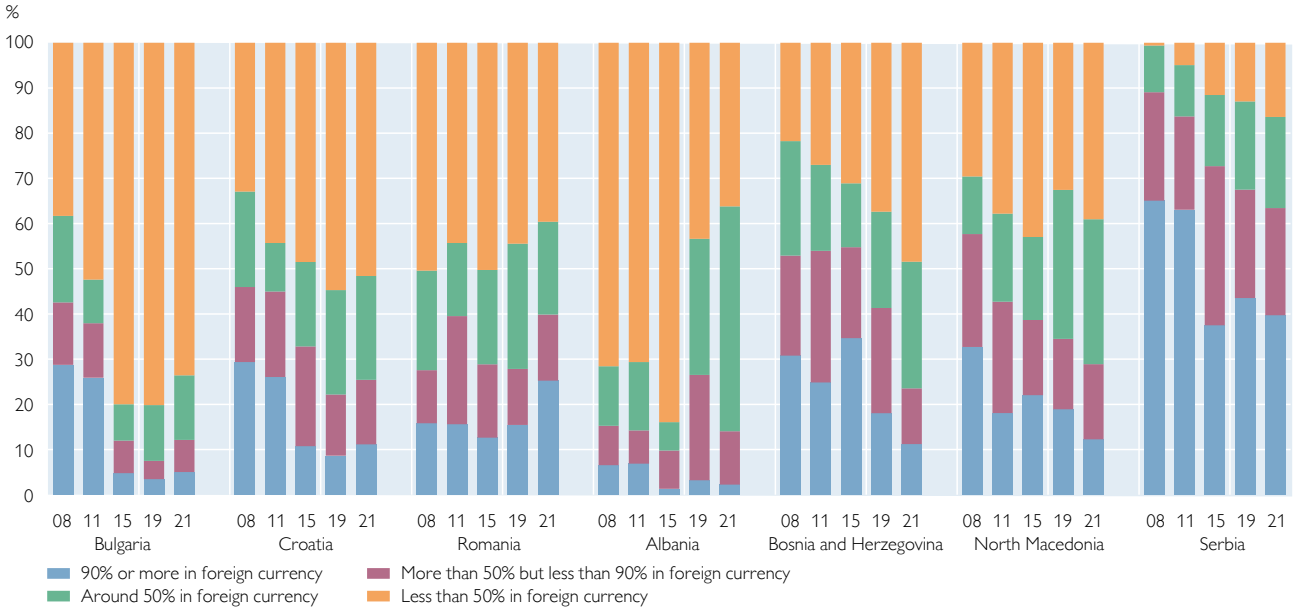
[17] *Note another caveat: local currency circulating outside the banking sector is not only in the hands of individuals but also in the vaults of corporates.*

[18] *We do not include CEE countries in this chart because their CSI was already low in 2007–08.*

[19] *Beckmann et al. (2013) looked at the structure of CESEE household portfolios and found that in 2010–11, cash holdings were, on average, the most important savings instrument even for banked households.*

Chart 4

**Share of total cash holdings that is denominated in foreign currency (self-reported)**




*Source: OeNB Euro Survey.*

*Note: Weighted percentages; the weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). Respondents who answered "Don't know" or who refused to answer have been excluded. This question was not asked in each survey.*

80% of individuals across the CESEE region were banked on average, with Albania and Romania at the lower end with about 60% (see column 2 of table 1).

While financial inclusion has increased since 2007–08, owning a current account or a savings deposit does not necessarily imply that a person holds any savings. In

Table 1

**Savings in cash and at banks**

| | Respondents report savings (cash, deposits, financial assets) | Banked (respondents have current account or savings deposits) | Respondents hold savings deposits | Respondents hold savings deposits in EUR | Share of savings-deposits denominated in EUR[1] | If banked and reported savings: more than 50% of savings held as cash |
|---|---|---|---|---|---|---|
| | *% of individuals* | | | | | |
| Bulgaria | 42.2 | 79.3 | 27.2 | 7.5 | 27.6 | 27.0 |
| Croatia | 57.4 | 97.5 | 32.8 | 18.7 | 57.0 | 43.8 |
| Czechia | 75.5 | 93.4 | 34.0 | 1.5 | 4.3 | 7.7 |
| Hungary | 45.2 | 89.7 | 18.7 | 2.0 | 10.6 | 44.2 |
| Poland | 48.1 | 90.8 | 23.2 | 2.5 | 10.8 | 21.4 |
| Romania | 29.5 | 67.0 | 12.1 | 2.8 | 23.3 | 33.0 |
| Albania | 25.2 | 55.9 | 26.0 | 7.5 | 28.8 | 42.7 |
| Bosnia and Herzegovina | 26.0 | 77.9 | 8.2 | 2.1 | 25.1 | 48.3 |
| North Macedonia | 46.4 | 89.8 | 25.5 | 14.2 | 55.9 | 33.4 |
| Serbia | 26.0 | 89.0 | 10.4 | 8.9 | 85.9 | 39.9 |

*Source: OeNB Euro Survey 2020–2021.*

*Note: Weighted percentages are based on pooled data from the survey waves 2020 and 2021. The weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). Respondents who answered "Don't know" or who refused to answer have been excluded.*

*[1] The figures in this column refer to shares of savings deposits denominated in EUR and not to % of individuals.*

2020–21, less than half of the respondents on balance reported any savings (i.e. cash, deposits or other financial assets). The percentages of people reporting savings ranged from around 25% in Albania, Bosnia and Herzegovina and Serbia to 76% in Czechia (column 1 of table 1). Among banked respondents, less than one-third reported having a savings deposit. In Croatia, North Macedonia and Serbia, more than 50% of these saving accounts are denominated in euro (columns 3 to 5 of table 1).

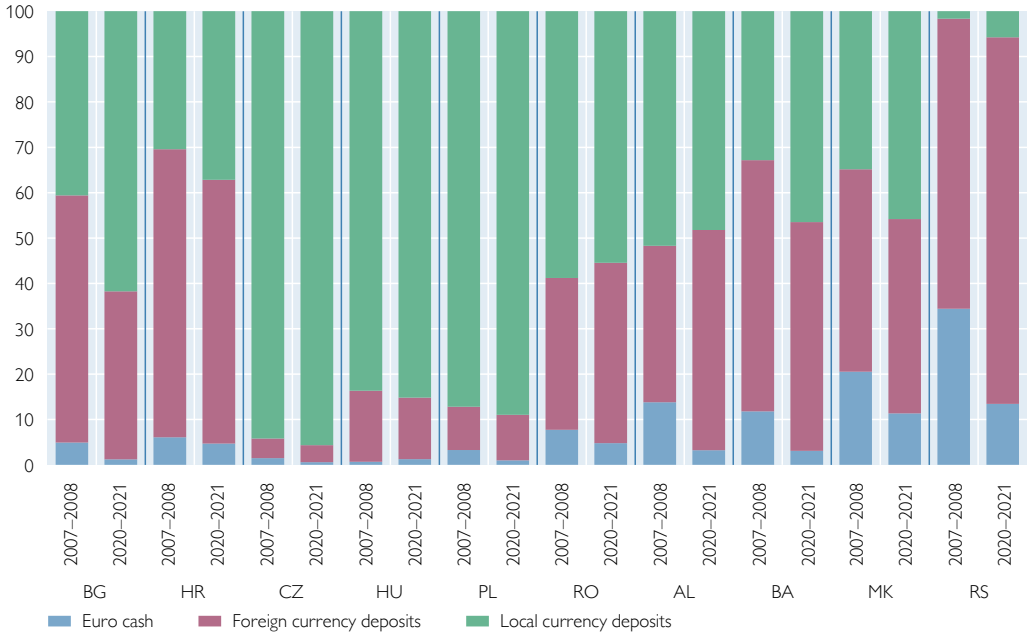
As a result, (euro) cash holdings are an important part of savings even among individuals who report savings at banks. Self-reported figures in column 6 of table 1 are based on individuals who are banked and who reported savings. Among this group, around 40% in Croatia, Hungary, Albania, Bosnia and Herzegovina and Serbia (and about one-third of banked savers in North Macedonia and Romania) reported in 2020–21 that they hold more than half of their total savings as cash.

Finally, let us take a brief look at the importance of euro cash savings at a macroeconomic level. Chart 5 assumes a representative agent that holds three financial assets in his or her portfolio. The euro cash share is derived from projected per capita euro cash holdings following the methodology of Scheiber and Stix (2009). The shares of the foreign currency deposits and the local currency deposits are calculated from national monetary statistics of the household sector excluding nonprofit institutions serving households.

Chart 5

**Savings portfolio composition for a representative agent**

*% of total nominal euro cash and deposit holdings (per capita; projected for the population aged 15 years or older)*




*Source: OeNB Euro Survey, national central banks.*

*Note: Euro cash savings are projected per capita amounts for the population aged 15 years or older, based on OeNB Euro Survey data (see Scheiber and Stix, 2009). Shares of foreign currency and local currency deposits are derived from national monetary statistics of the household sector excluding nonprofit institutions serving households; nominal values.*

Already in 2007–08, euro cash made up only a small share of total savings of the household sector in all CESEE countries. Exceptions were Albania, Bosnia and Herzegovina, North Macedonia and Serbia. Since then, the relative importance of euro cash savings has declined further in all countries. Between 2007–08 and 2020–21, the share decreased as follows: in Albania and Bosnia and Herzegovina from around 10% to 3%, in North Macedonia from 21% to 11%, and in Serbia from 34% to 13%. Given that savings at banks are not that common, as discussed above, these results point to a rather unequal distribution of bank savings among CESEE residents.

## 4 Saving in cash and in foreign currency in CESEE

As discussed in section 1, economic crises triggered by the transition process or by wars have led to asset and currency substitution in CESEE economies. Some SEE countries still feature a high degree of asset substitution – despite macroeconomic stabilization and partly strong economic growth in particular after EU accession. What are the continued benefits of saving in cash and saving in foreign currency? The initial reasons for euroization have vanished, but individuals are still willing to forgo higher interest rates in local currency as an insurance premium for holding a safe haven asset.

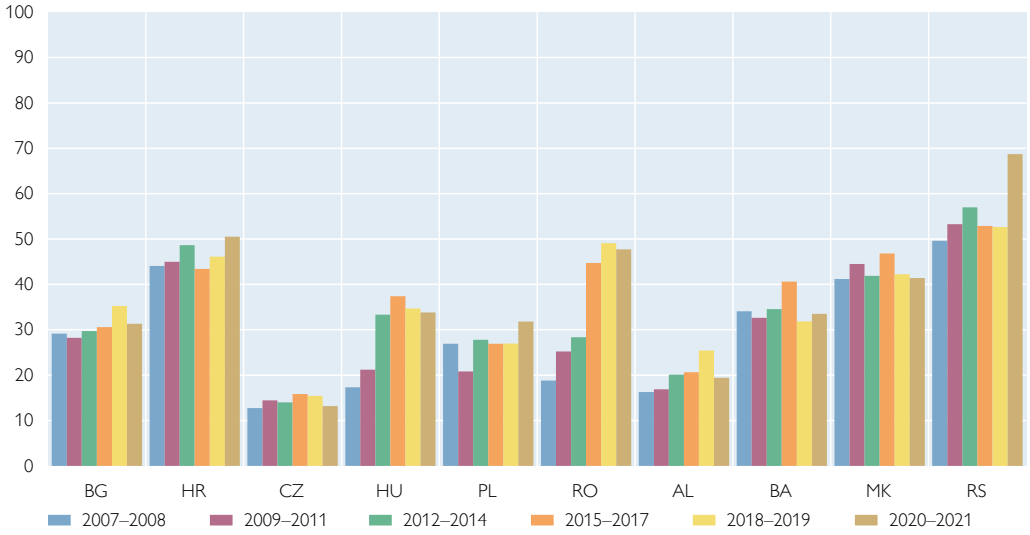
Individual portfolio choice rests on the interplay of two elements: (1) the cash versus deposit decision and (2) the foreign currency versus local currency decision. Preferences are determined by various supply and demand factors that influence a person's subjective assessment of return and risk. The dollarization literature of the last two decades stresses the central role that trust and confidence play in households' financial decisions (Kraft, 2003; Feige and Dean, 2004; Guiso et al., 2004; Coupé, 2011; Brown and Stix, 2015). Furthermore, there is strong evidence that crisis experiences have long-lasting effects on household preferences and hence financial choices (Osili and Paulson, 2008; Mudd et al., 2010; Brown and Stix, 2015; Malmedier and Nagel, 2016; Rajkovic and Urosevic, 2017). Two studies (Stix, 2013; Brown and Stix, 2015) drawing on data from the OeNB Euro Survey concluded that the degree of persistence in the use of euro cash in SEE can primarily be explained by people's having experienced economic crisis. In other words, currency and asset substitution in SEE are mainly demand-driven.

First, Stix (2013) analyzed why individuals in CESEE hold sizable shares of their assets in cash at home rather than at banks. Important factors are a lack of trust in banks, memories of past banking crises and weak tax enforcement. Moreover, people in euroized SEE economies have a stronger preference for a "safe" foreign currency as a store of value. Network effects of asset substitution and doubts about the stability of the local currency increase the preference for saving in cash (Stix, 2013).

Chart 6

**Preference for saving in cash, 2007–2021**

*% of individuals who have a current account and/or a savings account*




*Source: OeNB Euro Survey.*

*Note: Data show weighted percentages of respondents who have a strong cash preference on a 6-point Likert scale derived from the statement "I prefer to hold cash rather than a savings account." The weights used are calibrated on census population for age, gender, region and, where available, education and ethnicity statistics (separately for each country). Respondents who are under 18 years of age unemployed or economically inactive or who answered "Don't know" or who refused to answer have been excluded.*

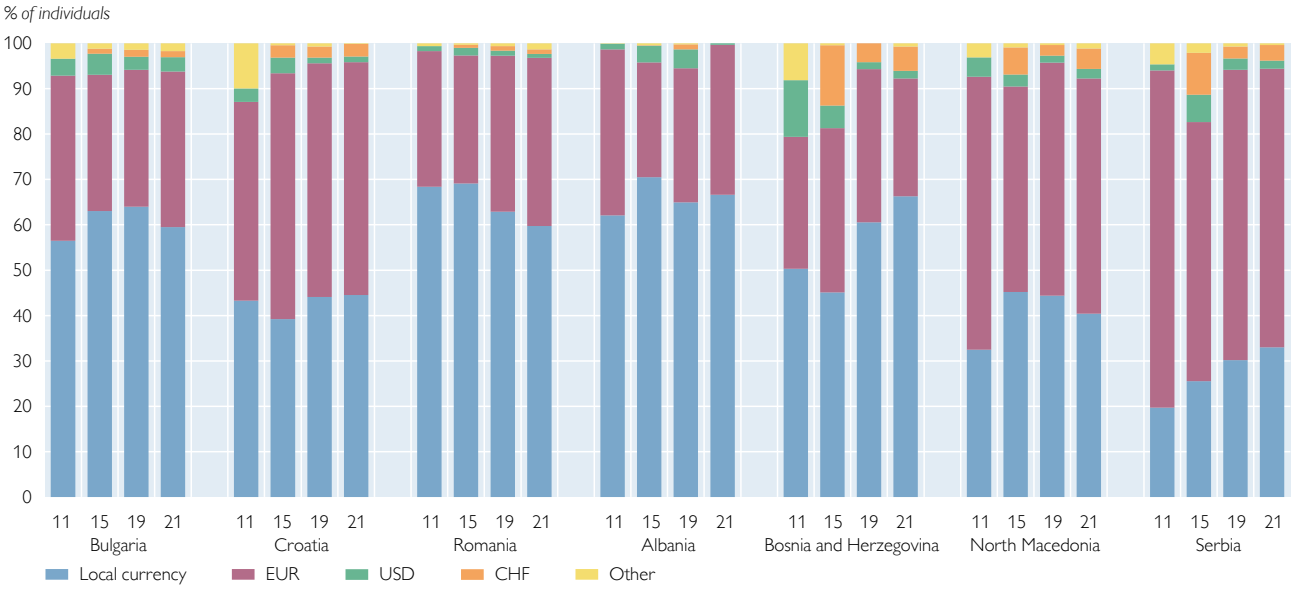
Chart 6 presents the time series on CESEE residents' preferences for saving in cash since 2007 (i.e. one of the dependent variables used by Stix, 2013).[20] The share of banked respondents who state that they prefer to save in cash varies across the observed countries but remained remarkably stable across time, with the exception of Croatia, Hungary, Poland, Romania and Serbia. In these five countries, the share of respondents who prefer to save in cash increased significantly (at the 1% level) between 2009–11 and 2020–21.

Second, Brown and Stix (2015) analyzed the determinants of people's preference for foreign currency deposits in CESEE, using OeNB Euro Survey data from 2011–12. Chart 7 presents updated evidence on CESEE individuals' preference for saving in foreign currency – mainly euro (i.e. one of the dependent variables used by Brown and Stix, 2015). In 2011, a majority of individuals in Croatia, Bosnia and Herzegovina, North Macedonia and Serbia preferred the euro over the local currency. As is also evident from the euroization index (chart A2 in the annex), the foreign currency preference gradually declined in CESEE over the last decade. In Bulgaria, Croatia and Albania it remained mostly unchanged, while in Romania saving in euro increased to almost 40% – which presumably reflects diminishing trust in public institutions. According to this direct measure of currency preferences and the euroization index, deposit substitution seems to persist in SEE.

[20] *Note that Stix (2013) pooled the data from 2010 and 2011 and restricted the sample to those respondents who are 18 years and older, economically active or retired and who are banked. This restriction was chosen to make sure that the sample only includes respondents who face true economic choices when it comes to saving. We use the same restrictions to make the data comparable across time.*

Chart 7

**Preference for saving in foreign currency**




*Source: OeNB Euro Survey.*

*Note: Weighted percentages excluding respondents who answered "Don't know" or who refused to answer. The weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). The answers refer to the question "Suppose you had two average monthly salaries to deposit in a savings account. Would you choose to deposit this amount in local currency, EUR, USD, CHF or other currency?" This question was not asked in each survey.*

As explained by Brown and Stix (2015), people's currency preferences in CESEE are partly driven by their distrust of the long-term stability of the domestic currency. This distrust is related to people's assessment of current policies and of the quality of institutions.[21] The authors find that network effects strongly affect household preferences for foreign currency deposits: depending on their monetary expectations, households reporting that foreign currency saving is common in their country are more likely to prefer foreign currency deposits.

Furthermore, Brown and Stix (2015) confirm that the observed persistence of deposit euroization across the region is strongly influenced by individuals' experiences of banking and currency crises during the 1990s.

To sum up, first, indicators show that individuals' preference for saving in cash in CESEE increased significantly between 2009–11 and 2020–21 in Croatia, Hungary, Poland, Romania and Serbia. Second, the preference for saving in euro is still elevated in SEE, in particular in Croatia, North Macedonia and Serbia. These results suggest that the determinants identified by Stix (2013) and Brown and Stix (2015) are still relevant and effective. Heightened uncertainty, economic turbulence or other crisis events may therefore trigger swift withdrawals of savings deposits in countries where relatively high shares of individuals prefer to save in cash and foreign currency. This raises the demand for both euro deposits and euro cash (Prean and Stix, 2011; Beckmann and Fernandes, 2021; Koch and Scheiber, 2022).

[21] *For time series on individuals' trust in government, trust in banks, trust in the stability of the local currency or of the euro, as well as individuals' economic sentiments and monetary expectations (i.e. inflation expectations and exchange rate expectation), see: Individual trust and expectation indicators - Oesterreichische Nationalbank (OeNB).*

Box 1

## The euro's role as a means of payment in Southeastern Europe (SEE)

*What do we know about today's use of the euro as a means of payment in SEE? In our analysis based on the fall 2021 Euro Survey wave, we exclude Czechia, Hungary and Poland given that the share of the euro in total currency in circulation is very low in these countries. Moreover, individuals reported that they mainly use euro cash for payments abroad when traveling to the euro area (chart A1). By contrast, about one-fifth of respondents in Albania, Bosnia and Herzegovina, North Macedonia, Romania and Serbia confirmed that they also hold euro cash to make domestic payments.*

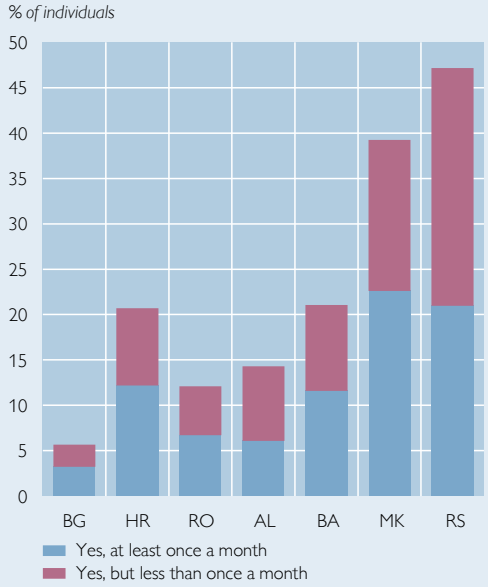
*To our knowledge, Bosnia and Herzegovina, Croatia, North Macedonia, Romania and Serbia legally restrict transactions in foreign currency. But explicit exemptions apply in most countries, e.g. regarding occasional transactions among residents. In a scenario involving a hypothetical car sale, about half of the respondents in Albania, Croatia and Romania would prefer to receive the payment in euro. In North Macedonia, this figure amounts to around 70% and, in Serbia, to over 80% (left-hand panel, blue columns). When respondents are asked in which currency car sales have usually been settled, the figures are substantially lower. The share of individuals who reported car purchases invoiced in euro ranged from about 20% in Croatia and Romania to almost 30% in North Macedonia and roughly 40% in Albania and Serbia (left-hand panel, green columns). Compared to the 2014 results (Scheiber and Stern, 2016), the preference for payments in euro and actual payments in euro remained at similar levels in 2020–21, except for Albania, where both indicators declined.*

Chart Box 1

### Paying in euro in SEE – preferences and reported behavior

**Preference for receiving euro for a car sale and actual invoice currency for car purchases**


**Reported payments in euro over the last 6 months**




*Source: OeNB Euro Survey fall 2021.*

*Note: Weighted percentages excluding respondents answering "Don't know" or who refused to answer. Left-hand panel: preferences for receiving payments in euro are based on the question "Suppose you could choose the currency in which you receive the payment from a car sale. Would you prefer to receive local currency, euro, US dollar or another foreign currency?" Moreover, respondents were asked "In which currency do you usually make car purchases?" The second (third) column excludes (includes) respondents who did not purchase a car. The right-hand panel refers to the question "Did you make any payments in euro during the last 6 months in your country?"*

*In general, the use of the euro for payments has declined over the last decade. In 2021, about 20% of individuals in Croatia and Bosnia and Herzegovina used the euro for domestic payments during the last six months, while in North Macedonia and Serbia the figure was as high as 40% and more. But these numbers must be interpreted with caution, since the wording of the questions is rather vague and answers might include euro cash payments as well as noncash payments in euro or even payments indexed to the euro.*

## 5 Summary and conclusions

For a long time already, European currencies have figured formally or informally in the economic systems of many Central, Eastern and Southeastern European countries. Ever since euro cash was launched in 2002, large amounts of euro banknotes have been circulating outside the euro area. This holds true for many CESEE countries. While they have not adopted the euro as legal tender, asset substitution – the use of euro cash as a store of value – has been an important and persistent phenomenon.

Using data from the OeNB Foreign Currency Survey (1997–2007) and the OeNB Euro Survey (2007–2021), we examined the use of euro cash in the CESEE region over time. Irrespective of a certain heterogeneity between the observed countries, euro cash holdings still play an important role as store of value in the countries of Southeastern Europe. Preferences for saving in cash and depositing money in euro have remained widespread in SEE. In light of stable or only gradually changing preferences, the main determinants of demand for euro cash, as identified in previous studies (Stix, 2013; Brown and Stix, 2015) are still relevant and effective. Using data from the OeNB Euro Survey 2010–11 and 2011–12, the authors of the previous studies found that the demand for euro cash is mainly driven by a lack of credibility in the long-term stability of the local currency, network effects and a lack of trust in the stability of the banking system. Furthermore, personal experience of macroeconomic crisis and individuals' weak assessment of current policies and institutions put a persistent drag on individual monetary expectations.

The results of Brown and Stix (2015) suggest that today's policymakers may tackle asset and currency substitution in CESEE, among other things, by ensuring a stable monetary regime and sound economic policies: rebuilding trust through a track record of stabilizing the exchange rate via sound macroeconomic and fiscal policies. The recent de-euroization policies of Serbia and Albania also aim at fostering local currency financial markets and raising trust in public institutions. Another means are credible exchange rate regimes, such as the currency pegs of Bulgaria and Bosnia and Herzegovina (Begovic et al., 2016) or the managed floats of Croatia and North Macedonia. They have likewise contributed to the effort of building a track record of macroeconomic stability and growth. De-euroization would also benefit from building better institutions. What jeopardizes progress already achieved are stalling EU accession processes in EU candidates and potential candidates, rising corruption and irresponsible populist politics (EBRD, 2019 and 2020; Della Valle et al., 2018).

However, stable monetary policy is unlikely to be sufficient to deal with the hysteresis of deposit euroization across the region since holding foreign currency deposits has become a 'habit' and is still strongly influenced by the experience of financial crises in the 1990s (Brown and Stix, 2015). Czechia, Hungary, Poland,

Slovakia and Slovenia have patently demonstrated that it is possible to overcome both asset and currency substitution. Network effects and backward-looking monetary expectations have virtually stopped impacting on people's preferences. EU integration, including the rule of law, economic policy coordination and surveillance, may have helped speed up the process of re-establishing trust in the domestic currencies (Scheiber and Stern, 2016).

On the one hand, the question arises whether the current episode of elevated inflation will make euro cash less attractive as a safe haven asset for residents in SEE. This might accelerate the current downtrend of the use of euro cash as a store of value and a medium of exchange in CESEE. On the other hand, crisis episodes like the global financial crisis or the COVID-19 pandemic have at least temporarily increased the demand for euro cash in the region.

It would be important to supplement this descriptive study with empirical, quantitative analyses using recent OeNB Euro Survey data. Such analyses could be aimed at testing whether the relative importance of monetary expectations, network effects and trust in institutions in explaining the preference to save in euro has changed over the last decade. The results may help modify and update policy conclusions for the future.

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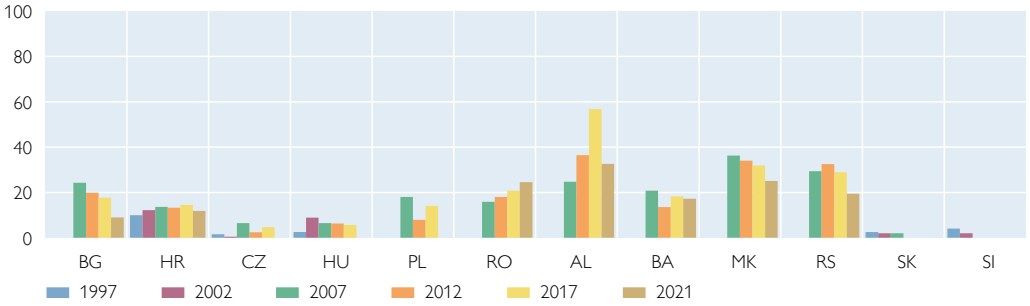
# Annex

Chart A1

## Motives for holding foreign currency cash or euro cash (from 2007 onward)

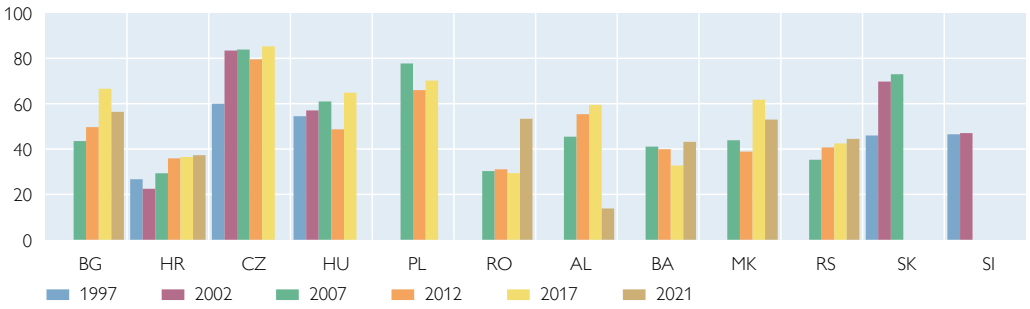
**Agreement with the statement "...to make domestic payments"**

*% of individuals*



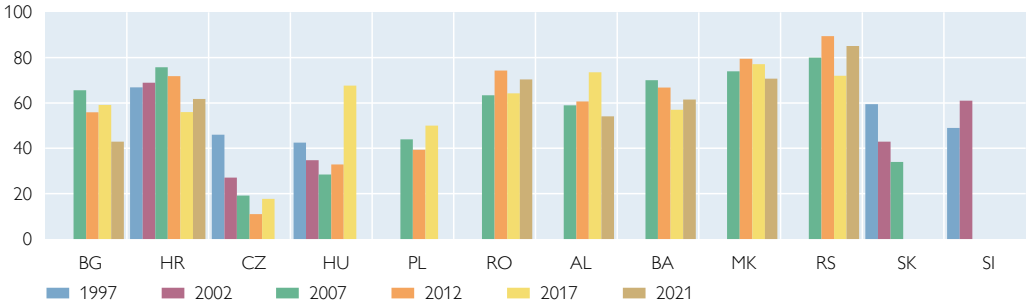

**Agreement with the statement "...to make payments abroad"**

*% of individuals*




**Agreement with the statement "...as a general reserve or as a means of precaution"**

*% of individuals*

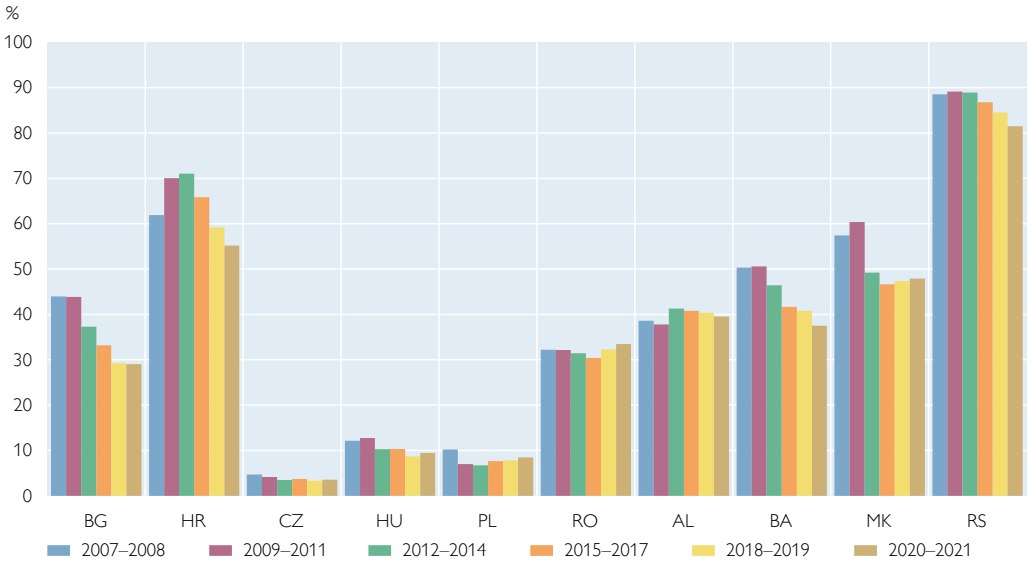



*Source: OeNB Foreign Currency Survey 1997–2007, OeNB Euro Survey 2007–2021.*

*Note: Weighted percentage shares of respondents who (strongly) agreed with the statements ("I hold euro cash ...") on a 6-point Likert scale. The weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). Respondents answering "Don't know" or "no answer" have been excluded. Slovenia adopted the euro as legal tender in 2007, Slovakia in 2009.*

Chart A2

## Euroization Index



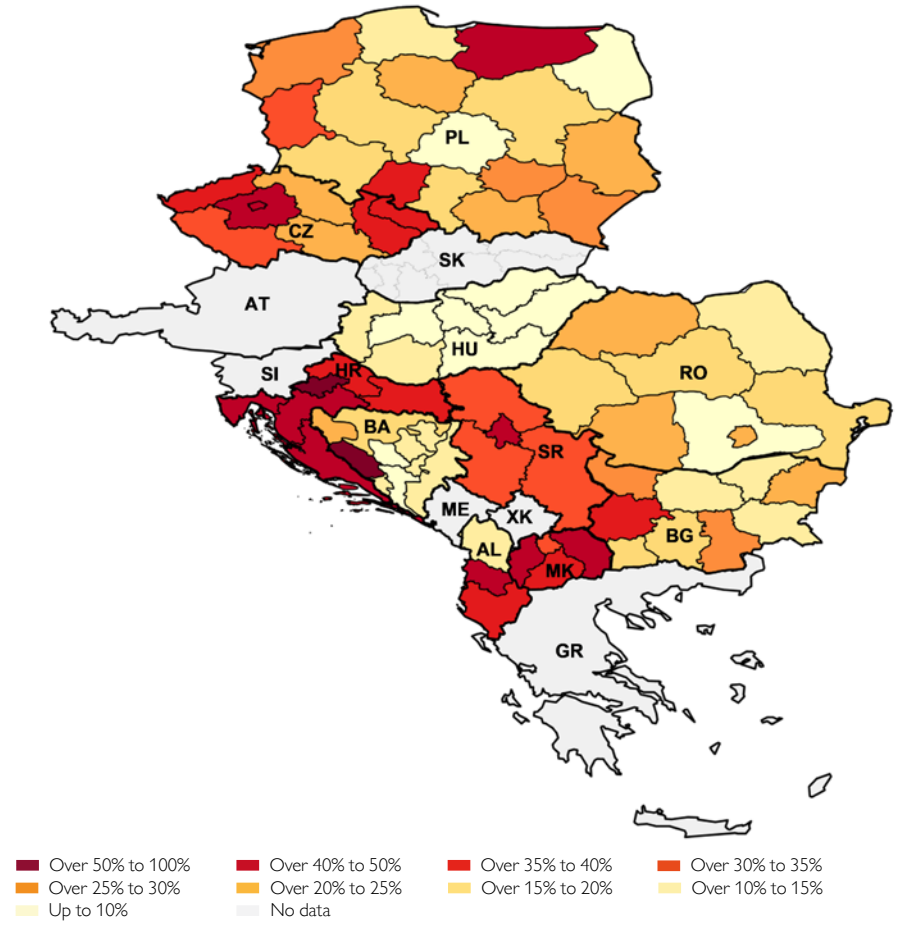

*Source: OeNB Euro Survey, national central banks.*

*Note: The euroization index is calculated as euro cash plus household foreign currency deposits divided by the sum of total cash in circulation and total deposits of the household sector. For details see Scheiber and Stix (2009).*

Figure A1

## Regional prevalence of euro cash holdings

*% of individuals per region*




*Source: OeNB Euro Survey 2019 and 2020.*

*Note: Weighted percentages; the weights used are calibrated on census population statistics for age, gender, region and, where available, education and ethnicity (separately for each country). Respondents who answered "Don't know" or who refused to answer have been excluded.*