SPEECH

The digital euro: maintaining the autonomy of the monetary system

Keynote speech by Philip R. Lane, Member of the Executive Board of the ECB, University College Cork Economics Society Conference 2025

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It is a pleasure to participate in the annual conference of the UCC Economics Society. Today, I wish to discuss the digital euro, which is an important project at the ECB.[1] Draft legislation has been proposed by the European Commission and is currently under consideration by the Council of the European Union and the European Parliament.[2]

A few years ago, archaeologists excavated two silver coins at Carrignacurra Castle, not too far from here.[3] The first was a groat (a coin worth four pennies) from the 1200s depicting Henry III; the second was a coin from the 1400s featuring Edward IV. These two coins indicated a society that regarded precious metal as the embodiment of intrinsic value and closely associated money with sovereignty.

Over the centuries, the currency circulating in Ireland has changed multiple times. From 1927 until the launch of the euro, the Irish pound (the punt) was the national currency of Ireland. The punt was not backed by a precious metal, such as gold or silver. Rather, it was a fiat currency that derived its value from government regulation, the assets backing the currency and trust in the issuing authority, the Central Bank of Ireland and its forerunner the Currency Commission. Until 1979, the punt was pegged to the British pound sterling at a 1:1 exchange rate, reflecting the historical linkages with the United Kingdom and the significant bilateral trade volumes. It operated as legal tender until around a quarter century ago, when Ireland along with ten other EU Member States introduced the euro (twenty countries are now members of the euro area). By adopting the euro, Ireland reinforced its commitment to European integration, while also reducing its dependence on the UK monetary and financial system.

The developments in Ireland's currency over time demonstrate how monetary systems are shaped by broader societal and economic transformations. For instance, the history of Irish money includes two episodes of free-banking money, whereby private banks issued banknotes that were used by the public as means of payment.[4] In this aspect, the monetary history of Ireland resembles that of Scotland, England and the United States. This history can shed some light on the current debate about the new forms of private money that are emerging today, such as stablecoins in the context of a digitalising society – a trend that has become more pronounced in recent years.[5]

In an increasingly digitalised society, in which the role of physical banknotes issued by the central bank is receding, the question arises whether the European Central Bank should issue a central bank digital currency (CBDC) for the euro area.[6]

Today, I will explain why it is imperative for the ECB to introduce a digital euro.[7] I will first discuss the roles of central bank money and commercial bank money over time, before describing a range of scenarios that suggest a digital euro is necessary to preserve the monetary autonomy of Europe. Finally, before concluding, I will outline the benefits of the digital euro for Europe's Economic and Monetary Union.

Our current monetary system

The three main properties of money

Let me begin by recalling the three main characteristics of money: (i) it serves as a unit of account, (ii) it provides a medium of exchange, and (iii) it is a store of value.

The unit of account property solves a basic coordination problem in any economy: it is a lot easier to set prices and wages vis-a-vis a single benchmark (a loaf of bread is priced at, say, €2) rather than firms and households resorting to a diversity of benchmarks (a loaf of bread is priced at 10 apples). Through its interest rate and balance sheet policies, the central bank can provide overall price stability by ensuring that average prices do not rise by more than two per cent per year over the medium term.

The medium of exchange function reflects the superiority of monetary exchange to barter-type alternative systems. Suppose someone earns income by working as a university professor but wishes to consume a wide range of goods and services: it is a lot simpler to receive her salary in euro and pay for her desired goods and services in euro rather than searching for suppliers that might be willing to exchange a particular good or service for a customised university lecture. A huge volume of transactions occurs every day, with firms and household buying and selling products in exchange for monetary payments. The central bank anchors the payment systems that process these transactions. In particular, a request by a customer with an account in Bank A to make a €100 payment to a merchant with an account in Bank B is settled through an interbank transaction in which €100 is deducted from the reserve account of Bank A at the central bank and €100 is credited to the reserve account of Bank B at the central bank.

Money also acts a store of value. Alongside other financial and non-financial assets, households also hold bank deposits and banknotes in order to transfer purchasing power from one period to the next. Since overnight bank deposits (current accounts) pay nil or very little interest and banknotes do not pay interest, money is typically dominated by other assets in relation to long-term saving and investment plans.[8] At the same time, money provides a highly-liquid store of value and its roles as a unit of account and medium of exchange are closely connected to its role in preserving liquidity from one period to the next.

Two sides of the same coin

In essence, our monetary system consists of two layers: "*central bank money*" and "*commercial bank money*". The use of the term "money" here does not mean that we are speaking about two independent

types of money. In practice, central bank money and commercial bank money are intertwined: indeed, it is essential that households and firms view these as equivalent. The label simply refers to the type of entity that issues the respective components of the aggregate money supply. More general terms for these two layers underline how money is created and distributed in the economy: since central bank money (banknotes and the central bank reserves held by commercial banks) is issued by the central bank, it originates outside the private sector and is referred to as *"outside" money*. By contrast, commercial bank money (bank deposits) originates from, and circulates within, the private sector and is called "*inside" money* (seen from the perspective of the private sector).

As central bank money is issued directly by the central bank, from an accounting perspective, it is backed by the assets of the central bank. That is, the Eurosystem can increase the supply of euro "outside" money by crediting the reserve accounts held by commercial banks at the central bank in exchange for assets. This can be done by providing a loan to a bank (strictly, a temporary collateralised loan under its refinancing operations) or by acquiring bonds.[9] As noted above, the reserve accounts held by commercial banks at the central bank are an essential component of the overall monetary system, since most monetary transactions involve an interbank transfer from the customer's bank to the merchant's bank whereby funds are deducted from the reserve account of the customer's bank and credited to the reserve account of the merchant's bank. In turn, this implies that a commercial bank can only efficiently provide banking services to its customers (and maintain the trust of its counterparts) if it has sufficient central bank reserves to meet payment and withdrawal requests. Currently, commercial banks hold about €3 trillion in reserve accounts in the Eurosystem (corresponding to about 20 per cent of euro area GDP). As euro liabilities of the central bank, these reserves are the ultimate safe asset: there is zero credit risk. Moreover, reserves are the highest form of liquidity (one euro is always one euro), which is the foundation for reserves as the settlement asset for inter-bank transactions.

The supply of euro "outside" money also includes about €1.6 trillion in banknotes (about 10 per cent of euro area GDP). Mechanically, banknotes are supplied via the banking system: an individual bank might request €10 million in banknotes to feed its ATMs or in response to the currency demands of its corporate customers and its reserve account with the Eurosystem is duly debited for this amount. If the bank does not have enough reserves for that operation, it must borrow them either from another bank or from the central bank itself. In the aggregate, this means the central bank also funds its acquisition of assets by issuing banknotes.

Unlike standard liabilities of other institutions, central bank money is not redeemable for commodities (such as gold) or alternative means of payment or stores of value. Instead, its intrinsic value comes from its acceptance as currency, which is deeply connected to the credibility of the monetary policy of the central bank in maintaining its value in terms of purchasing power (that is, maintaining price stability). This credibility is crucial because it shapes public trust in the currency and its stability.

In turn, the authority and credibility of the central bank are intrinsically linked to its sovereign foundations. In national currency systems, the central bank is established by the nation state as the monopoly provider of "outside" money.[10] In the euro area, the ECB was established by the Treaty on European Union and

controls the issue of euro as a currency, with the mandate to maintain price stability. The Eurosystem (comprising the ECB and the national central banks of those EU Member States whose currency is the euro) decides and implements monetary policy decisions.

By contrast, commercial bank money is created through the lending and intermediation activities of commercial banks. Mechanically, when a bank makes a loan to a firm or household, it creates a deposit in the account of the borrower, thereby increasing the overall money supply (the sum of outside and inside money). The value of commercial bank money – mainly bank deposits – is pegged to central bank money: a €50 deposit has the same value as a €50 banknote. In turn, this means that retail transactions can be settled either by transferring funds from the bank account of the customer to the bank account of the merchant or by paying in banknotes.[11] The equivalence of bank deposits and banknotes is maintained through the promise of convertibility of bank deposits into banknotes (and vice versa): in particular, customers always have the outside option to withdraw their deposits in favour of banknotes that are backed by the central bank.

While banknotes (and coins) are still widely used to purchase goods and services, the central role played by commercial banks in an efficient payment system reflects the transactions services provided by banks to their depositors: inside money is particularly attractive as a means of payment, especially for large-scale transactions.[12] [13] For all these reasons, commercial bank money today accounts for the bulk of the money in circulation. For instance, in the euro area, the size of our broad monetary aggregate M3 is ten times that of the banknotes in circulation.[14]

Inside money is ultimately backed by the assets of the commercial bank, primarily loans and, to a lesser extent, bonds. Put differently, commercial bank money is not completely “information insensitive” in the following sense: its value is conditional on the creditworthiness of borrowers and the financial health of banks. For this precise reason, commercial banks are heavily regulated and closely supervised. In addition, deposit insurance limits the risk that a liquidity shortage may hamper the capacity of the bank to convert deposits into cash in full and on demand, while central banks typically respond to systemic stress events by elastically providing liquidity to the banking system. While these safeguards are extensive, the traditional ability of customers to convert bank deposits into banknotes has played a foundational role in ensuring that the value of inside money is anchored by the value of outside money. In particular, outside money is entirely “information insensitive” since it is the central bank that statutorily issues currency, which is the ultimate means for discharging liabilities in the economy. Furthermore, the direct access of the general public to outside money in the form of banknotes has underpinned the stability of the unit of account: in this way, everyone in society has had a personal (and, indeed, emotional) connection to central bank money.

An evolutionary process towards a flexible but stable monetary system

This two-tier monetary system emerged gradually over the centuries.

The coins that were discovered in the nearby excavations in Cork are clear examples of state money – complete with depictions of a sovereign that reinforced the authority of the state backing the coins. Of course, the emergence of state money goes further back. In ancient civilisations such as the Roman Empire or imperial China, state money provided a degree of standardisation in terms of weight, metal content and design that ensured trust in the value of the coins.[15] This way, state-issued coins were recognised and accepted across the vast territories of the empire; these were "information insensitive" – facilitating trade and taxation and, in general, monetary exchanges. The standardisation was a public good which generated widespread benefits that individual agents could have not easily produced on their own, thus improving social welfare. A broadly accepted means of payment facilitated the local exchange of goods and fostered trade over longer distances. As indicated earlier, this contrasts with the disadvantages of the direct exchange of goods (or barter), which requires the "double coincidence of wants".[16]

The need for more efficient financial instruments to support the expanding trade networks and economic activities in those economically dynamic empires also gave rise to the origins of inside money. In the China of the Tang Dynasty (the High Middle Ages in western chronology), the "feiqian" or "flying cash" was developed to solve the challenges of long-distance trade. The "feiqian" functioned as a promissory note, allowing the holder to redeem it for cash at a designated location. That experience paved the way for the issuance of "jiaozi", the first exchange notes, which appeared before the end of the first millennium. These circulated freely in the market, becoming the first paper money, which helped China overcome challenges such as coin shortages in the context of a rapidly growing economy.[17] Moreover, it is worth noting that Song China's paper money was initially freely issued by private merchants and later taken over by the government to ensure stability and trust. The lessons from China's monetary history do not end there: over-issuance brought paper money to an end during the 15th century (Ming dynasty).[18]

The complex societies of Rome and imperial China also generated early forms of banking.[19] However, the economic revival of late medieval and Renaissance Europe recreated banking in a way that expanded its activities to accepting deposits, making loans and engaging in trade remittance, with a proliferation of letters of exchange. All that came with a simple, but crucial, technological innovation affecting ledgers: double-entry bookkeeping improved the accuracy, transparency and reliability of financial records.[20]

Nevertheless, Renaissance Europe experienced challenges related to the complexity and fragmentation of the system, with numerous kingdoms, principalities and city states each issuing their own currency. In certain cases, this gave rise to a sort of "currency substitution", with a widespread acceptance and use of certain currencies well beyond their issuing region due to their perceived stability, the economic and political power of their issuers and the trust these commanded in international trade.[21]

Still, the public deposit banks of that period, which were precursors of central banks as we know them today, contributed to the stability to the monetary system and reduced its complexity. These public deposit banks offered settlement of payments in their accounts and some of them were pioneers in creating certificates of deposits that could be used as proto-banknotes.[22] Indeed, it was that government backing

that helped the banknotes issued by the Swedish Riksbank (founded in 1668) and by the Bank of England (founded in 1694), the oldest central banks that still operate today, to achieve widespread acceptance in the course of the 18th century.[23]

The popularity of banknotes reflected a tacit acknowledgement that a monetary system solely consisting of precious metals was not only inconvenient but could not keep pace with the rapidly growing needs of commerce.[24] Without a government monopoly in the issuance of banknotes, private institutions not linked to the government also started issuing banknotes, as had already occurred in China almost a millennium earlier. The apex of that development occurred during the free-banking experiences in the 19th century, a system characterised by competitive note issuance with low legal barriers to entry, and little or no central control of the assets backing these banknotes.[25] At that time, these assets mainly consisted of scarce commodities such as gold or of certain securities deemed to have low enough risk.

However, repeated panics and banking crises during the century led early central banks such as the Bank of England and the Riksbank to de facto assume the role of lender of last resort – one of the classical tasks of a modern central bank, as articulated in Walter Bagehot's *Lombard Street: a description of the money market* in 1873.[26][27] By ensuring that banks had sufficient liquidity to meet requests to exchange bank deposits for cash, the frequency and severity of banking crises were reduced and the resulting system helped bridge the gap between outside and inside money. The gap was further closed by the growing moves towards the central bank's monopoly as sole issuer of banknotes and the legal establishment of state-backed paper money as legal tender.[28]

However, at the time, central banks and governments had not yet developed the institutional frameworks and policy tools necessary to manage such fiat currencies effectively.[29] Rather, credibility relied on backing currency with metallic standards. The straitjacket of a metallic standard constrained their ability to flexibly respond to macroeconomic fluctuations and financial crises – as evident, for instance, during the gold standard period.[30]

As the twentieth century progressed, the monetary system evolved beyond the constraints of metallic standards. The comprehensive regulation of banks, the establishment of deposit guarantee schemes and the abandonment of the gold standard, particularly after the Bretton Woods system collapsed in the early 1970s, permitted the transition to our layered fiat currency system. In that system, privately-issued means of payment in the form of scriptural inside money is valued to the extent that there is sufficient confidence that it can always be converted in full and upon demand into what has become the foundation of the whole monetary architecture: unbacked outside money issued, in the form of paper banknotes or electronic reserves held by commercial banks, by a sovereign or a central bank acting in the public interest.[31][32]

Modern central banks now operate within institutional frameworks that prioritise transparency, independence, and accountability. By relying on these flexible and credible setups, and within the guardrails of their statutes that mandate them to the pursuit of clear objectives, central banks have

acquired and retained the tools for managing the currency in a way that fosters price stability and balanced growth.

The historical evolution of our monetary system highlights several key lessons. Central banks, by ensuring standardisation of outside money, trust in its value, and fungibility, provide an important public good: price stability as the prerequisite for macroeconomic stability. At the same time, inside money enhances the efficiency of the monetary system by addressing practical challenges, leveraging technological innovations, and meeting the liquidity and transaction needs of complex economies. The lesson of history is that inside money is best safeguarded through regulation and supervision of banks, the provision of deposit insurance and the willingness of the central bank to act as the lender of last resort in the event of a systemic liquidity crisis. In summary, an optimal combination of both inside money and outside money creates an efficient and resilient monetary system that can adapt to changing technological and economic conditions while maintaining stability and public trust in the currency.

CBDC as a robust response to digitalisation

This evolution has brought us to the stable two-tier monetary system that I highlighted earlier. Central bank money serves as the monetary anchor: the central bank has full sovereignty over monetary policy; all forms of commercial bank money are convertible at par with central bank money; and payments can be made with both inside and outside money.

We are now witnessing a profound technological revolution that is reshaping economies worldwide. Naturally, as has always been the case, money will adapt to these shifts. I am referring to three trends in particular.

First, the increasing digitalisation of our economy is changing payment methods and behaviours. For instance, e-commerce now accounts for around one third of non-recurring payments in the euro area. Similarly, e-payment solutions (e-payment wallets and mobile apps) are gaining traction, growing at double-digit rates.[33] These developments highlight the diminishing role of physical banknotes as a means of payment in an increasingly digital world.[34]

Second, entirely new forms of financial assets are emerging in in the wake of this digital transformation. Decentralised finance applications and crypto-assets such as bitcoin aim to bypass traditional financial intermediation. Of particular relevance as a medium of exchange are stablecoins. The proponents of stablecoins seek to combine the advantages of distributed ledger technologies with a stable conversion rate into traditional currencies. By contrast, crypto-assets such as bitcoin are not well suited to performing the medium of exchange function due to high price volatility and an incapacity to process high volumes of transactions at speed.

Third, digital ecosystems – platforms such as Alibaba and Alipay that integrate proprietary forms of money with other services – are creating closed environments that encourage consumers to remain within specific systems.[35]

These technological advances offer opportunities, such as a more efficient and innovative financial system, but also pose challenges. These have the potential to disrupt the delicate balance of the two-tier monetary system and could threaten the sovereignty of central banks over monetary policy. Taking a forward-looking perspective is crucial because network effects heavily influence how money and payment systems evolve. The more widely a form of money or payment application is used, the more attractive it becomes to others – a dynamic that can entrench suboptimal developments if these take hold. For instance, once the adoption of a payment system or a communication app reaches a certain threshold, people tend to continue using it because others are also using it, which makes it more convenient but also "locks in" users. At that point, reversing the adoption trend becomes exceedingly difficult.

It follows that we need to anticipate this type of development and be prepared if it materialises, because our responsibility is to ensure that the foundations of a monetary system that has proved its value are preserved for the future. I would like to explore the three trends that I have just identified in more detail and understand their implications. Those trends are likely to occur simultaneously and to various degrees, and are likely to interact with each other. Nevertheless, to simplify the analysis, let me analyse these trends one by one.

A decreasing use of banknotes by the public

Within an ever-expanding digital economy, there is an increasing share of online transactions. The ECB remains committed to continue providing physical cash in the future and ensuring cash acceptance throughout the euro area. At the same time, the more transactions are made online, the lower the possibility for consumers to pay with physical banknotes, which are the legal tender and – together with their electronic counterparts, the central-bank-issued euro reserves held by banks – constitute the current form of central bank money.[36] This is obviously a natural technological progression, but it raises profound questions about the role of central bank money and the stability of the monetary system.

Will monetary policy remain effective and the monetary system cohesive if that trend continues? Traditionally, cash has played a critical role in maintaining trust in the convertibility of commercial bank money into central bank money and supporting effective monetary policy. Cash issued by the central bank acts as a "glue" and vivid reminder that all forms of money – whether commercial bank deposits or other forms of inside money – owe their wide acceptance in commerce to their convertibility into central bank money at par. This possibility of convertibility fosters trust in the value of deposits and helps to contain the "information sensitivity" of commercial bank money to a minimum, such that transactions of goods and services are fluid and unhampered by a constant need to verify the standing of the means of payment offered in exchange.

Conversely, the absence of such a monetary anchor could slow down and fragment the web of daily transactions that form the modern-day multi-trillion payment system. In addition to fostering trust, having public access to central bank money serves as a disciplining mechanism, providing a reliable fallback option to using commercial bank money.[37] In turn, the option of using central bank money for payments limits the scope for commercial payment systems to exploit monopoly power to charge excessive payment

fees.[38] As the share of online transactions increases, the extent to which the option to make payments in cash can act as a disciplinary tool against market power decreases.

The convertibility stipulation that lies at the foundation of our layered monetary system necessitates that commercial banks are granted access to central bank money in sufficient amounts to always be able to convert deposits into banknotes upon demand. As noted earlier, the central bank creates reserves – an electronic form of cash that can only be held by commercial banks – by making loans to the banks or by purchasing assets. Together with the interest rates charged on loans to banks, the interest rate paid on the reserves held by banks is the lever through which a modern central bank influences interest rates across the financial system, thereby affecting monetary conditions across the economy.[39]

Without positive demand for central bank money, this link would weaken or disappear, undermining the ability of the central bank to guide monetary conditions. As inflation is determined over the medium term by monetary policy, dwindling demand for central bank money could threaten the control of the monetary authority over inflation and risk price indeterminacy.[40]

Even if there was zero demand for banknotes and the general public did not directly hold money issued by the central bank, there would still be demand from commercial banks for the electronic cash (reserves) issued by the central bank in order to have sufficient liquidity to cope with high and volatile volumes of interbank payments and to be in a position to meet deposit withdrawal requests.[41] In principle, under normal conditions, the central bank could continue to deliver price stability by raising or lowering the interest rates paid on the reserve deposits held by commercial banks and the interest rates charged to supply extra reserves through making loans to commercial banks.

However, if the general public did not directly hold central bank money, an important and historic safeguard would no longer be available, namely the ability of firms and households to make direct payments in central bank money – banknotes. Moreover, the absence of a default central bank payments option that sits outside the commercial banking system could also endanger the capacity of the central bank to deliver price stability, especially under stressed conditions. In particular, if the payments system were to be totally dependent on the soundness of commercial banks, this would further raise the stakes in scenarios in which liquidity provision to commercial banks might run against the appropriate monetary policy stance. In summary, while the private incentives of individual commercial banks and the array of safeguards discussed above go a long way in underpinning monetary stability, the weakening of the effective capacity of the general public to transact in central bank money directionally increases risk in the monetary system.

Stablecoins as a medium of exchange

What are the challenges facing our monetary system in an era of rapid technological change? Intuitively, distributed ledger technologies can provide the technological platform for a decentralised system in which private issuers could offer to settle transactions in secure and apparently “information insensitive” forms of money outside traditional central bank systems. For example, bearer-based stablecoins – digital

representations of private electronic banknotes that are designed to be backed by safe assets such as government bonds or bank deposits – could bypass settlement via central bank reserves altogether, thereby creating a monetary ecosystem that flies under the radar of central bank oversight.[42]

In particular, central bank money would play a much-diminished role in the payments system, if households and firms were to maintain their primary transaction accounts in stablecoins and only use commercial bank accounts to upload and download funds from these transaction accounts.[43] In a sense, a stablecoin provider would resemble a so-called narrow bank that only holds high quality liquid assets and promises to maintain a stable value of its liabilities (the funds held by customers in their stablecoin accounts). While the pros and cons of narrow banking have been much debated over the decades, a material decline in the volume of deposits held in commercial banks would disrupt the role of commercial banks in credit provision, which is especially prominent in the bank-based European financial system. Moreover, even if stablecoins were fully backed by deposits in the commercial banking system (that is the stablecoin provider would match stablecoin liabilities with deposit assets), these deposits would effectively constitute “wholesale” deposits rather than “retail” deposits, resulting in a lower liquidity coverage ratio (LCR).[44]

Indeed, stablecoins, which are designed to maintain a stable value relative to a specified asset or pool of assets, have already gained a significant foothold in the crypto-asset universe.[45][46] Their appeal lies in their ease of use and innovative features and in the possibility for fast, low-cost transactions.[47] While stablecoins play a central role in settling transactions in other crypto assets, it is clear that stablecoins are also attracting interest in the facilitating low-cost cross-border transactions in the “traditional” economy and financial system.

In particular, despite significant technological progress, cross-border trade between countries remains to this day costly and inefficient, with large-value payments going through the correspondent banking network, which can take days to settle. There are unrealised positive network externalities, which are particularly evident to companies that maintain global supply chains.[48] Subject to being credibly backed by high-quality liquid assets, stablecoins can acquire a degree of global acceptability in wholesale transactions that can, in principle, address the inefficiencies that merchants face when making large cross-border payments through banks.

At the same time, as these digital assets continue to evolve and gather pace, one has to carefully assess their potential spillovers for domestic retail payments and consider the implications for the monetary system more broadly. In particular, as noted earlier, an equilibrium could emerge in which households and firms maintain transaction accounts with stablecoin providers, causing bank deposits and banknotes to lose relevance as a medium of exchange. Indeed, it is possible to imagine workers receiving salary payments in stablecoins (or immediately transferring salary payments from bank deposits to stablecoin accounts).

Let’s consider two potential situations.

To start, imagine a situation in which euro-based stablecoins assert themselves as new dominant players. Imagine the pool of safe assets backing the stablecoins being directly or indirectly backed by the reserve accounts of commercial banks with the Eurosystem. These new instruments would essentially represent a novel form of inside money within our euro-based monetary system. Their strength would lie in their accessibility and transferability, potentially increasing the efficiency of the monetary system, especially in cross-border transactions or in facilitating so-called smart contracts.[49] Unlike traditional money market funds, such stablecoins could seamlessly serve as both savings and payment instruments.[50] Critically, the ultimate nature of the two-layered system I was describing before would be preserved, with euro reserves issued by the Eurosystem providing the foundation of the new monetary order: the commercial banks that stablecoin providers deposit their funds with would need to hold larger reserve accounts to accommodate withdrawal requests from the stablecoin provider.

Still, a two-layer monetary architecture in which “inside money” transactions are dominated by stablecoins rather than by commercial banks would pose new challenges. First, the new form of money would be less “information insensitive” than the inside money created in the current institutional environment. The reason for this is essentially inadequate regulation and supervision. Recent experience has shown that, given the regulatory and supervisory vacuum in which these operate, some stablecoins can fail to maintain their intended stability, deviating (sometimes in dramatic fashion) from par value with their underlying reference asset.[51] While this risk would be minimal if the assets backing stablecoins were exclusively composed of deposits in the commercial banking system, stablecoin providers would naturally be tempted to hold higher-yielding but riskier securities in their asset portfolio. If the conversion rate between inside money – the stablecoins – and the anchoring asset can change, it is up to the holder and the payee in a transaction to verify whether parity holds. This process is costly and prone to changes in sentiment. A change in sentiment about the capacity of the issuer to redeem the stablecoins at par could lead to systemic shocks and runs of the sort seen in the era of free banking, when private banks were given the authority to issue their own currency backed by Treasury bonds.[52] In summary, while the “moneyness” of stablecoins relies on one-to-one convertibility into currency, this promise carries less credibility for stablecoin providers, which do not perform bank-like tasks such as credit provision to the economy and are not supervised or back-stopped by the central bank.

Second, as funds shift towards these new instruments, the stability of the financial system could be affected. At least part of the asset pool providing collateral for the stablecoins would be in the form of bank deposits.[53] However, as indicated above, this recycling of household and firm deposits back into the banking sector would only partially compensate the losses that banks would suffer in the first place as those cheap and more stable deposits migrate to the stablecoins domain. This shift would increase bank funding costs and negatively affect credit supply. Additionally, large stablecoin issuers would likely concentrate their holdings in safer, more liquid banks, further intensifying the effects for other banks in the economy. As stablecoin-managed assets grow, competition for liquid resources would increase their scarcity and price, resulting in still-higher costs for banks to maintain their buffers of liquid assets.

A second scenario imagines a new world with an increasing prevalence of stablecoins that are effectively backed by assets denominated in a foreign currency.[54] Given that the majority of existing stablecoins are linked to the US dollar, this is not a purely hypothetical scenario.[55] At some level, dollar stablecoins make it easier for European households to acquire low-risk dollar assets (typically, it is not easy to open a dollar bank account for European residents). The macro-financial implications of lower frictions in international capital mobility are well understood, both in “normal” times and “crisis” times. However, the open question is whether dollar stablecoins could also gain a foothold in domestic transactions in the euro area, whereby the domestic payments system becomes directly or indirectly anchored by the dollar rather than the euro.[56][57]

While the likelihood of this scenario is hard to quantify, a full risk assessment warrants inspection of even tail-type scenarios. A growing prevalence of digital dollarisation would undermine monetary sovereignty by compromising the ability to control the unit of account within its jurisdiction. This means the domestic currency would risk losing its status as the dominant currency for expressing prices and settling most trades. Although ‘dominant’ lacks a precise defining threshold, as the share of transactions settled in the domestic currency decreases, the capacity of the central bank to implement effective monetary policy and maintain price stability is significantly impaired.[58] For the euro area, the erosion of monetary sovereignty would also have a historic symbolic meaning. Such an erosion would affect the euro as a symbol of European identity and the perceived cohesion of the entire monetary system.[59]

Platform-based payment systems

The challenges and risks associated with a potential fading role of currencies anchored in a public function are amplified if one considers the closed and captive environments in which private digital alternatives are sometimes created. Many privately-issued forms of digital money are offered within ecosystems that are designed to generate such powerful network effects as to make it difficult for users to seek alternatives.[60] By bundling payments with other services and restricting interoperability, platforms can establish so-called walled gardens, leveraging network effects to lock in users and making the loss of convenience or the cost of leaving the platform prohibitively high.[61] Transaction accounts would be reduced to a “club good” offered in return for the payment of a fee or membership of a platform. In addition to the loss of monetary sovereignty, if combined with monetisation of payment data, such a scenario would entail the build-up of market power imbalances, inefficiencies and, ultimately, an unprecedented degradation of a competition-based economy.[62][63]

The digital euro as a robust policy response

The trends I have outlined highlight the potential for technological innovation to disrupt monetary transmission, monetary sovereignty, the singleness of money, and the welfare and fairness of society. Central banks have a mandate to safeguard monetary stability in all circumstances. This responsibility

calls for a cautious yet forward-looking approach, ensuring we are ready to address challenges and forestall risks before they materialise.

A powerful and forward-looking response to these challenges lies in the issuance of a digital euro – a digital form of cash that would be available to the general public. Following a prudent risk management approach, introducing a digital euro would minimise the likelihood of adverse economic outcomes in the future and ensure the resilience of our monetary system in an increasingly digital world.

In a scenario in which the use of physical cash declines substantially, the digital euro can preserve public access to “information insensitive” central bank money and protect the capacity of the central bank to deliver its macroeconomic mandate in a digital world.

The digital euro is also an effective tool to limit the dominance of foreign digital currencies, including the monetary sovereignty risks created by widely-adopted foreign-currency stablecoins.[64] Furthermore, in a world dominated by platform-based payment systems, where payments are bundled with other services in closed ecosystems, a digital euro would provide an open and interoperable alternative, preventing the fragmentation and limited interoperability of money. A digital euro could help to ensure a socially optimal level of data protection and would enable citizens to transact in the digital economy while enjoying the privacy benefits associated with cash.[65] With appropriate design features, the digital euro can deliver these benefits without destabilising financial institutions or disrupting monetary policy implementation or transmission. For example, appropriately calibrated limits on digital euro holdings can prevent excessive outflows from commercial banks while still providing individuals with access to secure digital money.[66]

In essence, issuing the digital euro is not just about adapting to technological change. It is about safeguarding the core principles that underpin our monetary system – stability, trust, and inclusivity – in an era of rapid transformation.

Securing the future of the euro area: the strategic importance of the digital euro

The special case of a monetary union

For the multi-country euro area, the benefits of a CBDC are more extensive compared to the calculus for an individual nation state with its own currency. It addresses challenges unique to our monetary union, while strengthening the position of the euro in an increasingly fragmented geopolitical world.

In particular, let me now turn my attention to the domestic payments system in the euro area. The payments system is multi-layered: a customer might pay her mortgage, rent and utilities bills by direct debit from her account but will typically use a card or e-wallet for electronic transactions in-store or online. In this multi-layered system, the customer pre-loads funds onto a card or into an e-wallet, or has a line of credit (as with a credit card).[67] These cards and e-wallets offer many advantages but also pose some risks, especially if the intermediaries offering cards and e-wallets are not European.

Against this backdrop, the digital euro presents a unique opportunity to overcome the persistent fragmentation in retail payment systems across the euro area. Unlike single-nation currency systems, the monetary union faces distinct challenges due to diverse legacy national standards and a non-unified retail payment system.[68] This fragmentation has led to a shortage of pan-European payment options, creating barriers for customers and businesses engaging in cross-border transactions within the euro area.[69] While some of these frictions are so embedded to the point of near-invisibility from the point of view of many households, it is not cost free that customers must generally rely on non-European card or e-wallet providers to make payments across the euro area, with the partial exceptions of some domestic-only or regional card/e-wallet schemes in some countries or if a customer and a merchant happen to both have accounts with a particular fintech firm.

This has inadvertently strengthened the dominance of foreign companies in our payments landscape, especially for card payments, which currently account for the majority of retail payment transactions by value.[70] This fragmented landscape undermines competition, limits consumer choice, drives up costs and restricts the ability of the euro area to fully harness the advantages of digitalisation for its citizens and businesses.[71][72]

By mandating acceptance of the digital euro (by extending the legal tender status of banknotes to the digital world), we can create instant network effects that unify our fragmented market. Moreover, a standardised, pan-European platform would enable private payment providers to innovate, while benefiting from economies of scale, ultimately reducing costs for consumers and businesses alike. While, in principle, an integrated area-wide “fast payment system” (FPS) could alternatively be developed by forceful regulatory initiatives and highly-coordinated investments across the universe of private payment providers, this is less feasible in the context of a multi-country monetary union with possibly non-aligned interests across different legacy payment systems.[73]

For banks and payment service providers, the digital euro would serve as a catalyst for collaboration. It provides an economic incentive for these institutions to join forces to build a unified and innovative payment system that spans all retail use cases – whether peer-to-peer, point-of-sale transactions, or e-commerce. In particular, by linking customers and merchants across the euro area via the system of digital euro accounts, card and e-wallet providers could focus on providing additional payment services under which the underlying payments “travel” via the digital euro system. This unified approach would strengthen the financial ecosystem of the euro area, enabling it to compete more effectively with large foreign technology firms by delivering innovative products at scale and at competitive prices.[74] As a not-for-profit venture, the digital euro would reduce costs for merchants and businesses, thereby increasing bargaining power vis-à-vis international card schemes, both for physical stores and in e-commerce.

Importantly, unlike private entities that often monetise payment data for commercial purposes, the digital euro prioritises user privacy, ensuring that citizens can transact securely in a digital economy without compromising their privacy.[75]

Geopolitical considerations

The digital euro would also play a crucial role in strengthening the strategic autonomy of Europe in an increasingly fragmented geopolitical landscape. We are witnessing a global shift towards a more multipolar monetary system, with payments systems and currencies increasingly wielded as instruments of geopolitical influence and competing jurisdictions seek to assert their independence from foreign monetary powers.[76]

The rise of cryptocurrencies that enable direct, intermediary-free transactions, challenges the traditional financial system. In addition, China's development of the digital yuan, the exploration by the BRICS nations of a platform to link their central bank digital initiatives (the BRICS Bridge), and the mBridge project, involving China, Thailand, Hong Kong and the UAE exemplify how digital currencies can offer efficient cross-border payments. These are clear indicators of the ongoing global multipolar monetary trend.[77]

In this context, Europe faces significant vulnerabilities. In the absence of attractive pan-European digital payment solutions, Europe's reliance on foreign payment providers has reached striking levels. International card schemes such as Visa and Mastercard now process sixty-five per cent of euro area card payments. In thirteen out of the twenty euro area countries, national card schemes have been entirely replaced by these international alternatives.[78] In addition, mobile app payments, dominated by non-European tech firms (such as Apple Pay, Google Pay and PayPal), now account for nearly a tenth of retail transactions and are showing double-digit annual growth.

This dependence exposes Europe to risks of economic pressure and coercion and has implications for our strategic autonomy, limiting our ability to control critical aspects of our financial infrastructure.[79] When we rely on international cards, apps or stablecoins, we effectively outsource our payment infrastructure. This leaves European payments vulnerable to changing terms of use or to service withdrawal threats.[80] As discussed in the previous section, these risks could be further compounded by the growing dominance of foreign technology companies and a potential increase in the holdings of foreign-currency stablecoins. Currently, ninety-nine per cent of the stablecoin market is linked to the US dollar, and European interest in these instruments is increasing rapidly.[81][82]

The digital euro is a promising solution to counter these risks and ensure the euro area retains control over its financial future. It would provide a secure, universally-accepted digital payment option under European governance, reducing reliance on foreign providers. From a strategic perspective, the digital euro would curtail the risk that domestic-currency stablecoins might gain a significant market share in the domestic payments system, which would be highly disruptive for the banking system and credit intermediation. Likewise, the availability of the digital euro would also limit the likelihood of foreign-currency stablecoins gaining a foothold as a medium of exchange in the euro area.[83] However, especially taking into account the power of network externalities, these risks would increase if there were delays in launching a digital euro.

Conclusion

Let me conclude.

The monetary system – and the currencies within that system – has seen a substantial transformation over the centuries. This transformation continues today. As societies become increasingly digital, central banks are exploring the benefits of introducing CBDCs to align with the needs of consumers and keep the monetary system fit for purpose in the digital age. The case for a CBDC is especially strong for a monetary union, especially in the context of a fragmented and externally-dependent payments system.

At a time of geopolitical uncertainty and shocks, the euro has maintained its reputation as a strong and stable currency. Well over three-quarters of citizens in the euro area now support the single currency – a record high.[84] And at eighty-nine per cent, Irish support for the euro is among the highest in the euro area.[85] However, as technology and the economy evolve, we need to ensure that we retain the monetary autonomy to preserve monetary stability under all circumstances.

The digital euro is not just about making sure our monetary system adapts to the digital age. It is about ensuring that Europe controls its monetary and financial destiny, against a backdrop of increasing geopolitical fragmentation.

1.

I thank Ramón Adalid, Lea Bitter, Roberta Fortes, Simon Mee and Cyril Max Neumann for their contributions to this speech. The views expressed in this speech are personal.

2.

My focus in this speech is on the monetary theory underpinning the digital euro discussion. For a complete guide to the digital euro project, see the ECB's dedicated web page.

3.

Irish Examiner (2022), "1,000-year-old coin among finds in Cork archaeological dig", 27 September.

4.

The periods 1797-1820 and 1824-1845 are considered to have been two free banking episodes in Ireland. See The experience of free banking, edited by Kevin Dowd (IEA publications, 2023).

5.

ECB (2024), "Study on the payment attitudes of consumers in the euro area (SPACE)".

6.

Three countries have already launched a CBDC while a further 134 countries and currency unions are exploring whether to launch one. The countries that have launched a CBDC are the Bahamas, Jamaica and Nigeria. See Atlantic Council Central bank digital currency tracker data for February 2025. See also Di

Iorio, A., Kosse, A. and Mattei, I. (2024), "Embracing diversity, advancing together - results of the 2023 BIS survey on central bank digital currencies and crypto", *BIS Working Paper*, No 147.

7.

As my colleagues in the ECB Governing Council have also argued over the years. See Cipollone, P. (2024), "Monetary sovereignty in the digital age: the case for a digital euro", speech at the Economics of Payments XIII Conference organised by the Oesterreichische Nationalbank, 27 September; Cipollone, P. (2024), "Maintaining the freedom to choose how we pay", *The ECB Blog*, 25 June; Panetta, F. (2023), "The cost of not issuing a digital euro", speech at CEPR-ECB Conference "The macroeconomic implications of central bank digital currencies", 23 November; Panetta, F. (2023), "The digital euro: our money wherever, whenever we need it", introductory statement at the Committee on Economic and Monetary Affairs of the European Parliament, 23 January.

8.

Currency and deposits represent only one third of the total financial investment of euro area households, with insurance and pension schemes, shares (mostly unlisted), and investment fund shares accounting for practically all of the remaining two thirds.

9.

I focus on the main assets acquired by the central bank; it can also purchase foreign-currency assets and gold.

10.

Typically, the nation state is the shareholder in the central bank and the profits of the central bank are remitted to the national treasury. In any given year, the central bank may hold back some profits to build up buffers to offset possible future losses.

11.

In practice, as will be explained later in the speech, there can be several layers to the settlement of an electronic transaction but it ultimately results in a debit from the bank account of the customer and a credit to the bank account of the merchant.

12.

According to the Study on the payment attitudes of consumers in the euro area (SPACE), in 2024 cash was still the most frequently used payment method in physical locations: more than half (52%) of payments in those locations were carried out using cash. This share has declined from 59% in 2022, 72% in 2019 and 79% in 2016.

13.

An RTGS (real-time gross settlement) system is a payment system that facilitates the continuous, real-time settlement of high-value or time-critical financial transactions on an individual basis. Typically operated by a central bank, RTGS systems entail settlement in central bank money (each participating institution has a reserves account at the central bank). The euro area RTGS is known as the T2 (previously Target2) system and is run by the ECB. For a comprehensive introduction to payments systems, see Bindseil, U. and G. Pantelopoulos, *Introduction to Payments and Financial Market Infrastructures*, Springer, 2023.

14.

Narrow definitions of money, such as euro area M1 include banknotes and overnight deposits, while broader definitions, such as M3, also include savings instruments, such as time deposits and debt securities up to two years, as well as money market fund shares.

15.

For a recent account of the historical development of money, see D. McWilliams (2024), *Money: A Story of Humanity*, Simon & Schuster.

16.

Herger, N. (2019), *Understanding central banks,* Springer, 2019.

17.

P'eng, H., (1993), *A Monetary History of China, Volumes One and Two (Zhongguo Huobi Shi)*, East Asian Studies Press. See also Herger, N., op. cit. This paper money was first issued by private merchants but this task was subsequently abrogated by the government.

18.

Pickering, J. (1844), "The history of paper money in China", *Journal of the American Oriental Society,* Vol. 1, No 2, pp. 136-142.

19.

See Usher, A.P. (1934), "The origins of banking: the primitive bank of deposit, 1200-1600", *The Economic History Review*, Vol. 4, No 4, pp. 399-428 and P'eng, H., op. cit.

20.

Double-entry bookkeeping was first documented by medieval merchant Luca Paciolo in 1494 in *Summa de arithmetica, geometria, proportioni et proportionalita*, Paganini, Venice, but it is said to have been first used by Amatino Manucci at the end of the 13th century (see Lee, G.A. (1977), "The Coming of Age of Double Entry: The Giovanni Farolfi Ledger of 1299–1300", *Accounting Historians Journal*, Vol. 4, No 2, pp. 79–95.

21.

The Florentine florin and subsequently the Venetian ducat dominated trade across Europe and the Mediterranean over the 13th and 14th centuries. See Spufford, P. (1988), *Money and its use in medieval Europe*, Cambridge University Press and Lane, F. C. and Mueller, R.C. (2020), *Money and Banking in Medieval and Renaissance Venice: Volume I: Coins and Moneys of Account*, JHU Press.

22.

For instance, Taula de Canvi of Barcelona (1401) and the Casa di San Giorgio of Genoa (1047) practiced state-sponsored centralised giro banking in which their deposits were used for giro transfers and settlement of claims in a highly liquid and secure manner, while the Naples system of public banks issued “fedi di credito”, deposit certificates that could be passed on as a decentralised paper means of payment in central bank money. See Bindseil, U. (2019), *Central banking before 1800: a rehabilitation,* Oxford University Press.

23.

The Bank of England decided to issue “running-cash notes” from its onset, it did not issue banknotes in fixed denominations until 1725. In Sweden, the Stockholms Banco, a precursor of today’s Sveriges Riksbank, issued the first banknotes in Europe in 1661. Faced with an outflow of deposits when the fixed exchange rate between copper and silver was changed in 1661, Stockholms Banco replaced the cumbersome copper coins with credit notes, i.e. notes issued by the bank with printed and round denominations that could be transferred to third parties. These notes worked very well initially and became very popular due to their convenience. They were not linked to any deposit, and their acceptance was based on the general public's confidence that the bank would pay the value of the note in coins upon demand. However, demands to redeem the notes led the bank to fail in 1664 and the Council of the Realm banned the use of the banknotes. Paper money in Sweden was not issued again until 1701 in the form of Transport notes. See Ögren, A. (2024), "Johan Palmstrüch, a Copper Money Doctor: Stockholm Banco and the Emergence of Banknotes in Seventeenth Century Sweden." in *Money Doctors Around the Globe: A Historical Perspective*, pp. 33-53, Singapore: Springer Nature Singapore. See also Nicolaisen, J. (2017), "What should the future form of our money be?." and Sveriges Riksbank "1661 - First Banknotes in Europe." .

24.

The convenience gain of using banknotes can be illustrated by the bulkiness of some of the coins circulating at that time. For instance, during the 16th and 17th centuries, Swedish copper coins reached

weights of up to 20 kilogrammes, which was the weight of the 10 daler coin, equivalent to about €1,500 in today's money.

25.

For a detailed account of the various free-banking experiences, see Dowd, K. (ed.) (2023) *The experience of free banking* IEA publications.

26.

Many other central banks in Europe were moving toward similar roles, but the timing and nature of these developments varied.

27.

The Hamburger Bank also seems to have been the central bank first acting as a full-scale lender of last resort – in 1763.

28.

The state theory of money or "chartalism" emphasises the role of the state in declaring what constitutes legal tender and its capacity to levy taxes payable in that currency, which underpins the acceptance of money and its value in an economy. See for instance Knapp, G. F. (1924). The state theory of money.

29.

A fiat currency is not backed by a commodity such as gold but rather is backed by the trust of the general public that the central bank (and the sovereign) is committed to preserving its stability.

30.

Eichengreen, B. (1992), *Golden fetters: the gold standard and the Great Depression, 1919-1933*, Oxford University Press. See also Keynes, J. M., (1925), *The economic consequences of Mr. Churchill*, L. and V. Woolf in which Keynes criticises the decision made by Winston Churchill, then Chancellor of the Exchequer, to return Britain to the gold standard in 1925. Keynes argued that this decision was economically unsound and discussed the potential negative consequences, which foreshadow the eventual crisis of 1931.

31.

The Great Depression was a pivotal event: Britain abandoned the gold standard in 1931 and the United States enacted the 1933 Glass-Steagall Act, establishing deposit insurance and an enhanced regulation and supervision of banks. These moves paved the way to the regime forged in the Bretton Woods agreements. By combining the anchor of the gold standard and the flexibility of the adjustable rate regime, that system provided monetary and macroeconomic stability. However, the lack of credible enforcement incentives also contributed to its relatively short-lived nature.

32.

"Scriptural money" refers to money that exists in the form of account balances rather than physical cash. It is essentially digital or electronic money that is recorded in bank accounts and can be transferred through various electronic means, such as bank transfers, debit cards or online payment systems.

33.

A digital wallet (or electronic wallet) is a software-based system or an application that runs on any connected device. It stores your payment information and passwords of numerous payment methods and websites.

34.

See ECB (2024), Study on the payment attitudes of consumers in the euro area (SPACE).

35.

See also Brunnermeier, M. K., James, H. and Landau, J. P. (2019). “The digitalization of money”, *National Bureau of Economic Research Working Paper*, No 26300; Chiu, J. and Wong, T. N. (2022), “Payments on digital platforms: Resiliency, interoperability and welfare”, *Journal of Economic Dynamics and Control*, Vol. 142, No 104173.

36.

See also information on the Eurosystem cash strategy and remarks by Stefan Ingves, Jon Cunliffe and Fabio Panetta on the role of cash and public money more generally.

37.

See Lagos, R., and Zhang, S. (2022), “The limits of ONETARY economics: On money as a constraint on market power”, Econometrica, Vol. 90, No 3, pp.1177-1204.

38.

The scope for monopoly power in payment systems has also been addressed by regulation: since 2015, the European Union caps interchange fees at 0.2 % of the value of the transaction for consumer debit cards and at 0.3% for consumer credit cards.

39.

The ECB offers several options for banks that wish to borrow from it (on a collateralised basis). The main refinancing operations (MROs) offer loans on a seven-day basis; the longer-term refinancing operations (LTROs) offer loans on a 90-day basis; and the marginal lending facility (MLF) offers loans on an emergency basis at a penalty rate. These facilities are not much used at present: around €7.9 billion is currently outstanding in the MRO facility, €17 billion in the LTRO facility and just €20 million in the MLF. When warranted by the prevailing monetary conditions, the ECB has, in the past, also offered very long-

term refinancing operations (VLTROs) and targeted long-term refinancing operations (TLTROs). The ECB does not pay interest on the minimum reserves that must be held by banks in the current account facility (currently about €188 billion) but does pay interest on the "excess" (above minimum) reserves held by banks in the deposit facility (currently around €2.81 trillion). This deposit facility rate (DFR) is the rate through which the ECB steers the monetary policy stance.

40.

In a seminal paper, Woodford (1998) argued that, under specific conditions, monetary policy would remain effective in a cashless economy (understood as an economy without central bank money). However, the assumptions and conclusions of his analysis remain fundamentally debated. For instance, Rogers (2006) critically reviews Woodford's assumptions and points out conceptual and methodological errors. Moreover, Rogoff (2014) raises the point that it is not necessarily established that the economy converges to the same equilibrium with and without central bank money. Lastly, De Grauwe and Storti (2001) argue that the absence of central bank money would render monetary policy ineffective, thus threatening the capacity of the central bank to control inflation. However, the academic discussion remains purely theoretical, with models abstracting from important considerations relevant in practice. See Woodford, M. (1998), "Doing without money: controlling inflation in a post-monetary world", *Review of Economic Dynamics*, Vol. 1, Issue 1, pp. 173-219; Rogers, C. (2006), "Doing without money: a critical assessment of Woodford's analysis", *Cambridge Journal of Economics*, Vol. 30, No 2, pp. 293-306; Rogoff, K. (2015), "Costs and benefits to phasing out paper currency", *NBER Macroeconomics Annual*, Vol. 29, Issue 1, pp. 445-456; and De Grauwe, P. and Storti, C. (2001), "Monetary Policy in a Cashless Society", *CEPR Discussion Paper Series*, No 2696, CEPR Press, Paris and London.

41.

A regulatory source of demand for central bank money is imposed via minimum reserve requirements, i.e. the obligation on banks to hold a certain proportion of their liabilities in the form of electronic or physical cash. In the euro area, the minimum reserve requirement for banks corresponds to one per cent of deposits. However, as noted in the main text, banks like to hold substantial amounts of reserves in excess of the minimum requirement in order to have sufficient liquidity to cope with high and volatile volumes of interbank payments and to be in a position to meet deposit withdrawal requests.

42.

See Garratt, R. and Shin, H. S. (2023), "Stablecoins versus tokenised deposits: implications for the singleness of money", *BIS Bulletin*, No 73, Bank for International Settlements; and Cipollone, P., (2024), "Towards a digital capital markets union", keynote speech at the Bundesbank Symposium on the Future of Payments, 7 October.

43.

In truth, there might be several layers in the payments system. A household might upload funds from its bank account to an e-wallet and in turn use the e-wallet account to buy stablecoins. In reverse, the proceeds of a sale in stablecoins could be initially lodged in the household's e-wallet and an additional step would be required to draw down these funds back to the household's bank account.

44.

See CE Coste (2024), "Toss a stablecoin to your banker," ECB Occasional Paper No. 353.

45.

See the Financial Stability Board's definition and more detailed explanations in Bullmann, D., Klemm, J. and Pinna, A. (2019), "In search for stability in crypto-assets: are stablecoins the solution?" *Occasional Paper Series*, No 230, ECB, August.

46.

See, for example, Adachi, M. et al. (2022), "Stablecoins' role in crypto and beyond: functions, risks and policy*", Marcoprudential Bulletin*, No 18, 11 July.

47.

See also Waller, C.J. (2025), "Reflections on a Maturing Stablecoin Market", speech at A Very Stable Conference, San Francisco, 12 February.

48.

See BIS, IMF and The World Bank (2021), *Central bank digital currencies for cross-border payments: Report to the G20*.

49.

A smart contract is a self-executing program that automates the actions in a blockchain transaction. Smart contracts automatically enforce and execute the terms of an agreement when predefined conditions are met, without the need for intermediaries or manual intervention.

50.

However, money market funds are not a commonly used savings instrument for households and are not backed by a deposit insurance scheme.

51.

See Duan, K. and Urquhart, A. (2023), "The instability of stablecoins", *Finance Research Letters*, Vol. 52, and Anadu, K. et al. (2023), "Runs and Flights to Safety: Are Stablecoins the New Money Market Funds?" *Federal Reserve Bank of New York Staff Reports*, No 1073, September.

52.

See Gorton and Zhang (2022), “The Orkney Slew and Central Bank Digital Currency”. Harvard National Security Journal, Vol 14:1.

53.

Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937 (MiCAR) establishes some constraints on the reserves of assets held by issuers of asset-referenced tokens (ARTs) and e-money tokens (EMTs). For instance, the draft regulatory technical standards establish that significant EMTs must always keep at least 60% of the funds received in deposits with credit institutions, although for significant ARTs that percentage refers to the amount referenced in each official currency (for ARTs that are not significant, that percentage is 30%, while EMTs that are not significant are not subject to reserve requirement unless established ad hoc by the supervisory authority).

54.

In 2019 the Libra consortium of private firms outlined a scheme in which a stablecoin would be pegged to a basket of currencies; in 2020 the consortium (rebranded as Diem) envisaged a collection of single-currency stablecoins. This project was abandoned in 2022.

55.

See, for example, Box 5 of Ferrari Minesso, M. and Habib, M.M. (2022), “The International role of the euro”, June.

56.

It is possible to envisage scenarios in which a dollar stablecoin provider offers a synthetic euro stablecoin to European customers, calculating that it could afford to absorb the associated currency risk. Of course, the cost of hedging currency risk can move sharply under stressed conditions, such that these commitments might not be fully reliable.

57.

Brunnermeier, M. K., James, H. and Landau, J. P. (2019), “The digitalization of money”, *National Bureau of Economic Research Working Paper Series*, No 26300, September.

58.

Landau J.P. and S. Nicole (2024). “Monetary Sovereignty in a digital world”. SciencesPo Policy Brief, June 2024.

59.

See Brooks, S. (2021), “Revisiting the monetary sovereignty rationale for CBDCs”. *Staff Discussion Paper*, No 2021-17, Bank of Canada, December; and Ikeda, D. (2023). “Digital money as a unit of account and monetary policy in open economies”. *IMES Discussion Paper Series*, No 2020-E-15, December.

60.

See also P. Cipollone (2024), “Monetary sovereignty in the digital age: the case for a digital euro”, speech at the Economics of Payments XIII Conference organised by the Oesterreichische Nationalbank, Vienna, 27 September.

61.

Interoperability refers to the ability of different systems, devices or applications to exchange data and allow information-sharing.

62.

Lee, M., and Garratt, R. (2021), “Monetizing Privacy with Central Bank Digital Currencies”, *Federal Reserve Bank of New York Staff Reports*, No 958, January; Garratt, R. J., and Van Oordt, M. R. (2021), “Privacy as a public good: a case for electronic cash”, *Journal of Political Economy*, Vol. 129 No 7, pp. 2157-2180; Agur, I., Ari, A., and Dell’Ariccia, G. (2025), “Bank competition and household privacy in a digital payment monopoly”, *Journal of Financial Economics*, Vol. 166, April.

63.

Brunnermeier, M. K., James, H. and Landau, J. P. (2019), “The digitalization of money”, *National Bureau of Economic Research Working Paper Series*, No 26300, September. See also Panetta, F. (2020), “From the payments revolution to the reinvention of money”, speech at the Deutsche Bundesbank Conference on the “Future of Payments in Europe”, Frankfurt am Main, 27 November.

64.

Cong, L. and Mayer, S. (2022), “The Coming Battle of Digital Currencies”, *The SC Johnson College of Business Applied Economics and Policy Working Paper Series*, No 2022-04, December.

65.

The design of the digital euro ensures that transactions and accounts would remain anonymous to the Eurosystem. Just as banknotes are sourced via the ATM of a commercial bank, an individual would maintain a digital euro account with a commercial bank, which would be responsible for “know your customer” procedures and related checks. See also Garratt, R. J. and Van Oordt, M.R. (2021), “Privacy as a public good: a case for electronic cash”, *Journal of Political Economy*, Vol. 129, No 7, pp. 2157-2180 and Ahnert, T., Hoffmann, P. and Monnet, C. (2025), “*Payments and privacy in the digital economy*”, Journal of Financial Economics, forthcoming

66.

See, for example, ECB (2023) "A stocktake on the digital euro – summary report on the investigation phase and outlook on the next phase", October, or the ECB's first and second progress reports on the preparation phase of a digital euro as well as the digital euro legislative proposal and the corresponding ECB opinion.

67.

An important type of card is a debit card which draws funds from the customer's current account as needed.

68.

National communities have often preferred to preserve the legacy of investments made in the past. See Cipollone, P. (2024), "Innovation, integration, and independence: taking the Single Euro Payments Area to the next level", speech at the ECB conference on "An innovative and integrated European retail payments market", Frankfurt am Main, 24 April.

69.

While the implementation of the Single Euro Payments Area (SEPA) in the early 2000s successfully addressed cross-border payment challenges for credit transfers and direct debits within the euro area, a similar degree of harmonisation has not been achieved at the retail level. Retail payments remain narrowly focused on national markets, addressing only specific use cases and lacking the comprehensive reach needed across the euro area. See, e.g., Cipollone, P. (2024). "Innovation, integration, and independence: taking the Single Euro Payments Area to the next level", speech at the ECB conference on "An innovative and integrated European retail payments market", Frankfurt am Main, 24 April.

70.

A unified European card scheme was never developed, leaving existing national card schemes non-interoperable and unable to facilitate cross-border transactions in the euro area. As a result, international card schemes have become essential for card payments across European borders and increasingly within national EU markets. These international schemes have expanded beyond their traditional sectors – such as travel and entertainment – into areas typically served by national card schemes. See Plooij, M. (2020), "A future-proof retail payments ecosystem for Europe – the Eurosystem's retail payments strategy and the role of instant payments therein" *Financial Stability Review*, Banco de España, Autumn.

71.

For instance, the average net merchant service charges in the EU increased from 0.27% in 2018 to 0.44% in 2022 (see European Commission (2024), *Study on new developments in card-based payment markets,*

including as regards relevant aspects of the application of the Interchange Fee Regulation – Final Report, 5 February). This increase occurred despite regulatory efforts to contain it, as international card schemes exploited their strong negotiating position to raise the non-regulated components of the merchant service charge, such as scheme fees. See also Cipollone, P. (2024), "Monetary sovereignty in the digital age: the case for a digital euro", keynote speech at the Economics of Payments XIII Conference organised by the Oesterreichische Nationalbank, Vienna, 27 September.

72.

Ahnert, T., Hoffmann, P. and Monnet, C. (2025), "*Payments and privacy in the digital economy*", Journal of Financial Economics, forthcoming.

73.

Examples of fast payment systems include the PIX system in Brazil and the UPI system in India.

74.

Assenmacher, K. and Smets, F. (2024), "A digital euro: Monetary policy considerations", *SUERF Policy Note*, No 346, 12 April.

75.

Daman, M. (2024), "Making the digital euro truly private", *The ECB Blog*, ECB, 13 June.

76.

States have utilised international currency relationships and arrangements as tools of coercive power to further their security interests. See, for example, Kirshner, J. (1994), *Currency and Coercion: The Political Economy of International Monetary Power*, Princeton University Press.

77.

See, for example, Rosa, B. and Larsen, C. (2024), *Smart Money: How Digital Currencies Will Shape the New World Order*, Bloomsbury Publishing.

78.

See Cipollone, P. (2025), "The role of the digital euro in digital payments and finance", speech at Crypto Asset Lab conference organised by the University of Milano-Bicocca, 17 January.

79.

Lagarde, C. (2022) "Digital euro - a common European project", video address to the "High level conference: Towards a legislative framework enabling a digital euro for citizens and businesses", Brussels, 7 November.

80.

According to Stephan Miran, if the reserve asset is considered the lifeblood of global trade and financial systems, then whoever controls this reserve asset and currency can exert some degree of control over trade and financial transactions. Since the US dollar serves as the world's reserve currency, this enables the United States to impose its will in foreign and security policy using financial force rather than physical force. See Miran, S. (2024), *A User's Guide to Restructuring the Global Trading System*, Hudson Bay Capital, November.

81.

ECB calculations based on the Consumer Expectations Survey.

82.

ECB (2024), *Study on the payment attitudes of consumers in the euro area (SPACE) – 2024*, December.

83.

Scholarly research suggests that countries are incentivised to digitise their fiat currencies, such as by launching CBDCs, due to the need to enhance currency adoption in a digital world and to address the growing competition from private digital money like stablecoins. The decision to digitise currencies is strategic and a pecking order appears: countries with strong but non-dominant currencies have the highest incentives and are likely to digitise their currencies first. Those with dominant currencies, like the United States, follow next in response to competition. By contrast, countries with very weak currencies have little to gain and may forgo digitisation. Although competition from private digital money can hinder digitisation, rivalry among fiat currencies actually speeds it up. For further details, see Cong, L. and Mayer, S. (2022), "The Coming Battle of Digital Currencies", The SC Johnson College of Business Applied Economics and Policy Working Paper Series, No. 2022-04.

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