

■ Digital money: options for payments

The world of payments has been experiencing dynamic structural change for some time now. Advancing digitalisation has spawned new payment solutions, and fintech firms are offering digital solutions for certain stages in the value chain. State-of-the-art techniques, notably distributed ledger technology (DLT), support new forms of digital money that can be sent across innovative and decentralised networks in the form of tokens, while bigtech firms – technology or data-driven platform providers with a large customer base – are offering payment solutions of their own, with some even planning to roll out their own stablecoins. Given these developments, the payments space has come to be regarded as strategically important, not just for the future of Europe’s financial industry but also for European sovereignty in an increasingly globalised and digital world. The Eurosystem likewise sees an urgent need for Europe to develop common payment solutions.

How new forms of digital money are designed should be based first and foremost on its intended functions. To generally qualify as payment instruments, new forms of money need to be stable in value, universal and readily convertible into other forms of money with as little friction as possible, just like their conventional counterparts. As far as the security of payments is concerned, transactions in central bank money have to meet stricter standards. Though distributed networks themselves are unlikely to improve the efficiency of payments, DLT can support integrated settlement and payment processes across firms, allowing automated and synchronised service and money flows. For this to work, payments would need to be programmable either as tokenised money or by creating a technical bridge (trigger solution) between private sector DLT systems and the conventional payments space. All factors considered, money that can be used in programmable applications could deliver efficiency gains.

Work has been picking up worldwide to develop central bank digital currency (CBDC), which would be a third type of central bank money alongside cash and deposits in central bank accounts. Most central bank projects are looking at CBDC that would be available to the general public.

Central bank digital currency offers opportunities, but it also has its risks. In principle, large-scale substitution away from commercial bank money into CBDC could impact monetary policy and financial stability and reduce the importance of banks as intermediaries in the financial system. It is also important to note that the balance of private and public sector activity in the payments space could tilt significantly away from the private sector, with adverse implications for innovation and heightened financial risk as a result of the central bank’s longer balance sheet.

October 2020 saw the Eurosystem publish a report on the possible issuance of central bank digital currency for the euro area. This digital euro would be introduced alongside cash; it would not replace it. At present, various avenues for the potential implementation of CBDC and a variety of possible design options are being explored within the Eurosystem. The ECB Governing Council is expected to decide on the road ahead during the summer.

Digital transformation in payments

Fast-moving digitalisation in payments supporting new payment solutions

The past decade has seen innovative technologies (notably distributed ledger technology, or DLT¹) and new market players accelerate and intensify the digitalisation process in payments. Publication of the Bitcoin white paper in 2008 was a notable event in that it marked the first time a new form of distributed payment system, one that excluded banks or central intermediaries, was brought to the table.² Today's payments space is made up not just of central bank-issued cash, but primarily of book money deposited with credit institutions which can be transferred using credit transfers, direct debits or card payments. Another category that has been emerging of late is "digital money", though there are different interpretations of what this term actually means. It very often refers to money that can be used in the form of digital tokens³ in DLT systems. Pure crypto tokens like Bitcoin and Ether have not managed to gain a foothold in the payments market as yet, however, so the debate is coalescing around digital payment instruments that are linked to existing forms of money but are either delivered in a technically modified form or use existing forms of money to underpin their value.

Payments in flux, ...

For decades now, it has only been possible to cope with the mounting volumes of cashless payments – Germany alone accounts for more than 20 billion transactions each year – by continuously standardising, harmonising and automating operations and processes. Recent years have seen the digital transformation bring fresh momentum to the world of cashless payments, primarily on the back of changes in payment behaviour, regulatory changes and technical innovation. One notable example has been the surge in cashless payments in response to the COVID-19 pandemic. The Bundesbank's detailed study of payment behaviour in Germany in autumn 2020 found that card payments in particular had grown significantly in importance, now accounting for roughly 30% of all

the payments recorded in the study.⁴ The increase in contactless payments was a key factor here. One major driver of digitalisation in payments, besides contactless payments at the point of sale, is the increasing prevalence of digital payment solutions in online commerce, above all those delivered by global card systems and similar solutions offered by new providers like fintech and bigtech firms.

Fintech firms are harnessing new technical solutions like open architecture, sometimes with standardised interfaces (application programming interfaces, or APIs) linking them to banks' account management systems and app technologies for smartphones to either deliver individual stages of the value chain or replace them altogether with new processes. In addition, financially powerful tech companies with an existing platform and large customer base are also pushing into the payments market. What sets these bigtech firms, as they are known, apart from the majority of fintech players is that they are less reliant on cooperating with existing providers. They can leverage their broad customer base to harness significant network effects that can quickly achieve sufficient market penetration.⁵

... driven by digital ecosystems ...

¹ See Deutsche Bundesbank (2019). The technical terms used in this article are explained in the Bundesbank's online glossary: <https://www.bundesbank.de/en/homepage/glossary>

² See Nakamoto (2008).

³ Tokens are digital units of value which can be transferred across a DLT environment and can perform various functions in a network, such as digitally representing a physical asset.

⁴ See Deutsche Bundesbank (2021a). This figure is nine percentage points higher than in the Bundesbank's payment behaviour study in 2017. Meanwhile, cash payments in 2020 accounted for a share of 60%, compared with 74% in 2017.

⁵ Network effects or network externalities exist when the utility an individual user derives from a good or service depends on the number of other users of that good or service. Network externalities are positive when increasing user numbers incentivise the use of a given good, service or technology. Telephone lines are a classic example of this phenomenon: the more people an individual user can reach by telephone, the greater the utility that user can derive from having a telephone of their own. In other words, one additional telephone line benefits not just the new telephone user but increases the utility value of the telephone network for all existing and future telephone users.

The delivery of payment services – and of a broader range of financial services beyond that – can add significantly to the ecosystems of major platforms for two reasons. First, it enables all activities – from the first information on a purchase all the way through to payment – to be integrated on a single platform. Second, payment data and purchases are a more reliable pool of data for understanding customer behaviour. Furthermore, customer transaction data gathered outside the respective platform might also be available for analysis from third-party service providers.

... as a potential driver of "platformisation"

It can be expected that the expansion of the information and purchase process to include payment services fitted with as little friction as possible into these new ecosystems will result in these platforms wielding greater market power.⁶ While it is true that banks and bank accounts will continue to play a major role initially, the new market entrants – bigtech firms and global card systems – and the apps they offer as digital customer interfaces are likely to become increasingly important for customers.

Strategic importance of payments on the increase

One outcome of the European market for payment services being increasingly reliant on non-European infrastructure is a growing view in political circles that payments is a strategically important sector for European sovereignty. This awareness has set in motion a raft of initiatives and political activities aimed at achieving improvements and efficiency gains in payments (see the box on pp. 60 f.).

DLT could provide strong tailwinds for digitalisation

One notable function of new technologies is their ability to automatically link payments with other processes. In a simple use case involving internal company processes, a firm could leverage payment data for analytical purposes in product development or integrate payment transactions into its accounting processes. A more complex case concerns the integration of payment and settlement processes across firms, which is a capability that DLT in particular is able to offer.⁷ Using DLT, it is possible to transfer tokenised digital assets between distinct entities.

Not just that: DLT and in particular what are known as smart contracts⁸ can fully automate the performance of complex legal events, provided that both sides of the transaction (service and money) are either themselves tokenised⁹ and programmable or can be used in programmable applications (see the box on p. 62).

The use of DLT in the settlement of complex processes in which the transaction data might still be needed for downstream processes can lower transaction costs. DLT does away with numerous reconciliation processes because a distributed data ledger means that all the parties involved can access the same set of data. Furthermore, it can be used to automate recurring processes. Ideally, smart contracts can manage all aspects of synchronised and automated service and money flows by following previously defined rules. Thus, the use of DLT could be an important building block in digitally transforming an economy.

... and will ideally result in fully synchronised and automated service and money flows

On the whole, programmability is proving to be the crucial new feature that payments need to have in order to maximise the potential of the digital transformation and harness the potential benefits and efficiency gains of DLT. There are, however, a number of other features besides programmability that characterise today's distributed payment systems and the forms of money used there.

Programmability the crucial new feature

- Direct, intermediary-free transferability from payer to payee: physical money (cash) is transferred under property law without an intermediary because third parties do not need to be involved. This is why fully anonymous payments (transactions that leave no digital traces) are not possible with digital money.¹⁰

⁶ See Brunnermeier (2021).

⁷ See Deutsche Bundesbank (2017a).

⁸ Smart contracts are programmed algorithms that automate the performance of contractual rights by verifying and then autonomously executing actions in the DLT. See Lin (2019).

⁹ See Deutsche Bundesbank (2019).

¹⁰ See Armelius et al. (2021).

Initiatives and political activities in the payments market

The European Commission adopted its Retail Payments Strategy in the autumn of 2020.¹ In this framework, it calls for the introduction of instant payments that are credited to the recipient's account within just a few seconds as the "new normal" and encourages private sector initiatives to establish a common European payments solution.

The Eurosystem, too, believes that developing pan-European payment solutions is indispensable for the digital age in order to be able to ensure that payments are efficient, competitive and anchored in Europe going forward.² Such applications should:

- work online, at the point of sale and between individuals;
- be usable throughout Europe with a card or digital devices such as a smartphone;
- be subject to European governance;
- ideally bundle all services under a common brand.

A number of European payment service providers joined forces to create the European Payments Initiative (EPI) with a view to developing a European solution like this based on SEPA instant payments. At present, however, only around 70% of the relevant payment service providers in the euro area support SEPA instant payments, which currently only make up just under 8% of all credit transfers. Additional efforts are therefore necessary to deepen the EU single market for payments and make it fit for the future through innovation, efficiency and competition. The Eurosystem will meet the key technical prerequisite for the pan-

European reach of instant payments in November 2021 when it becomes possible to settle such transactions between different European infrastructures using the TARGET Instant Payments System (TIPS).

Under the auspices of the Euro Retail Payments Board (ERPB),³ market participants are also working to expand the potential applications of instant payments. The idea is that, in future, individuals should also be able to use them to pay in shops and companies will be able to connect them with a request to pay.⁴

However, given the potential integration of payment services into private sector ecosystems that can be used around the world, the political debate now centres not only on euro-based payments but also on payments across currency areas. These remain relatively slow, opaque – in terms of costs and settlement status – and expensive as compared to European and national payments.⁵

The G20 has, since the end of 2019, increasingly focused on international payments, including remittance payments, and is pushing for concrete improvements. More efficient international payment solutions would have tangible benefits for citi-

¹ See European Commission (2020).

² See Coeuré (2019).

³ The ERPB is a European body that is chaired by the ECB and whose objective is to promote an integrated, innovative and competitive market for retail payments in the European Union.

⁴ In a request to pay, the payee – an online retailer, for instance – sends an electronic request for payment to the payer's bank through their own bank. The request to pay contains all information relevant for the transaction. The payer, by confirming the request to pay in their online banking or their banking app, for example, triggers a payment through credit transfer.

⁵ See Bank for International Settlements (2018a).

zens worldwide and would promote economic growth, international trade, global development and financial inclusion in equal measure. Against this backdrop, the Financial Stability Board (FSB) in October 2020 presented the G20 with a roadmap listing concrete measures to improve international payments, a document which the Bundesbank was closely involved in drawing up.⁶

These G20 activities are supported by the European Commission as well as private sector initiatives (for instance from SWIFT), which are intended to make payments across currency areas more efficient and more transparent. Support for the development of a digital euro, as highlighted in the European Commission's Retail Payments Strategy, also fits in with the overall picture of policymakers increasingly taking a strategic view of payments.

⁶ See Financial Stability Board (2020).

- 24/7 availability: this feature is already offered in many jurisdictions by today's real-time payment systems.
- Global reachability: at present, the benefits of conventional payment systems are usually confined to individual currency areas. Payments from one currency area to another are often still relatively costly, but competition is picking up amongst providers, and transaction costs are on the decline.¹¹ However, as work by the G20 shows, action is still urgently needed to push back comprehensively against weaknesses of this kind in cross-border payments.

tions: central bank money in the form of cash and in the form of deposits in central bank accounts,¹² and commercial bank money in the form of transferable deposits (including electronic money). These three forms of money today cover the wide variety of transactions used by the real economy and financial industry, households and government, ranging from the smallest of payments at the point of sale all the way to transactions in the billions in the interbank money market. All three forms of money are denominated in euro and support one-to-one convertibility: commercial banks, say, can withdraw credit balances with the central bank as cash and use it to pay out commercial bank money held by their depositors in the form of cash. The perception among users that

Digital money should be universal ...

■ Standards for digital money

Universality of money

There are not many forms of money nowadays that can settle many different types of transac-

¹¹ See Bank for International Settlements (2018a); there is also a website dedicated to remittance prices: <https://remittanceprices.worldbank.org/en>

¹² In the Eurosystem, only a limited group of customers (mainly commercial banks) are able to hold deposits with the central bank.

Money in programmable applications

Within DLT (distributed ledger technology) networks, services and money can be transferred only in tokenised form. Book money at commercial banks and balances on a central bank account may also be digital in the conventional meaning of the word, but they are not tokenised and cannot therefore be used directly by DLT in automated procedures. For that, money would have to be available in a programmable format as digital tokens. The settlement of textbook DLT use cases, where smart contracts take over process management and settlement – machine-to-machine, internet-of-things or pay-per-use services, for instance – requires the use of programmable forms of money.¹ In this context, there is a distinction between programmable payments and programmable money.²

Programmable payments are defined as transfers of money for which the time, amount and/or type of transfer are determined by conditions that are specified in advance rather than being set ad hoc during the payment process. In the simplest case, these may be regular payments executed, for instance, by standing order. Going forward, they can, however, also be used to settle the cash leg of complex business processes after ascertaining that predefined conditions have been met.

Programmable money, meanwhile, is defined as a digital form of money where users can program an inherent logic for conditional uses based on the attributes of the digital money itself. To really be able to speak of programmable money, the program would have to be stored in the respective “digital coin”. In many cases, the current need for money in programmable applications can be sufficiently met with a

programmable payment that does not necessarily require programmable money.

¹ Conceivable use cases: fully automated settlement between devices – for instance, an electronic vehicle independently pays the charging station at the car park; payments in the internet of things that are triggered by interaction with the end user, for instance for partial consumption from an energy network; direct payment of an amount depending on consumption or use, say where a leased machine invoices the cost of the units used and subsequently processes the associated payment independently. See Deutsche Bundesbank (2020).

² At the initiative of the Federal Ministry of Finance and the Bundesbank, a working group consisting of 19 representatives of the real and the financial sector last year produced and published a position paper entitled “Money in programmable applications”. See Deutsche Bundesbank (2020).

these three forms of money are equal in value is supported by the general legal framework, which guarantees the one-to-one convertibility of cash and book money at all times, and, on that basis, by the supervision of commercial banks and the deposit guarantee scheme. This is why no distinction is commonly made between one euro of commercial bank money and one euro of central bank money. That said, credit institutions that are able to do so tend to prefer the cashless settlement of financial market transactions and other large-value payments in default-free central bank money.

... and be frictionlessly convertible into other forms of money

The aforementioned equivalence boosts the universality of money and lowers transaction costs for the economy. Ideally, new payment solutions should fit into this arrangement such that they are not only formally denominated in the same currency but can also be effectively converted into other forms with as little friction as possible, i.e. with no gains or losses in value.

Function-driven design

New forms of money should be designed primarily with their intended functionality in mind (form follows function¹³). Thus, they particularly need to be measured against fundamental requirements resulting from money's general functionality as a means of exchange, unit of account and store of value. Given that all manner of goods are exchanged for, and bought with, one and the same medium, forms of money that offer vastly different functionalities as a means of exchange or store of value will be less functional and likely to be substituted by others. It is important to ensure that one euro remains one euro. The value of the euro needs to be the same, no matter what form it takes, where it is used and for what purpose. This basic requirement for a successful currency area is conditional on payment systems being efficient and secure.¹⁴

Efficiency in payments

The Bundesbank's mandate¹⁵ in cashless payments boils down to compliance with the fun-

damental principles of security and efficiency. To allow the frictionless use of money as a means of exchange, it must be possible to transfer that money with a maximum of efficiency throughout the currency area, using systems whose security is assured at all times.

Payments based on fundamental principles of security and efficiency

New forms of money can act to boost efficiency levels in payments if they improve upon existing functionalities or support new ones or, quite simply, if they unleash fresh competitive pressure. There are high hopes, for instance, that the emergence of innovative payment media can improve cross-border payments and financial inclusion. There are also hopes of a more general nature concerning the use of money in distributed networks. Technically, however, the necessary consensus mechanisms mean that the simple act of sending money across distributed networks is slower and more costly than it is in centralised solutions.¹⁶ Digital money, by contrast, could simplify process chains in payments. Furthermore, digital – in the sense of tokenised – money supports the cash leg settlement of DLT-based procedures which themselves can drive down the cost of settling complex transactions. Viewed as a whole, then, the issuance of digital money could have a particularly beneficial impact on efficiency if it can be used in programmable applications.

New settlement technologies could unlock efficiency gains, ...

¹³ This axiom coined by US architect Louis Sullivan in 1896 is a touchstone in the worlds of architecture and design. Essentially, it means that a product's purpose should be the starting point for its design.

¹⁴ See Deutsche Bundesbank (2009a).

¹⁵ Section 3 sentence 2 of the Bundesbank Act (*Bundesbankgesetz*) reads as follows: [The Bundesbank ...] shall arrange for the execution of domestic and cross-border payments and shall contribute to the stability of payment and clearing systems." This mandate has its equivalent at the European level (Article 127(2) of the Treaty on the Functioning of the European Union, EU Treaty, Article 22 of the Statute of the European System of Central Banks and of the European Central Bank).

¹⁶ See Deutsche Bundesbank (2017a, 2018) and Ludwin (2017).

... but need to satisfy security requirements at the same time

Guaranteeing security

Potential welfare gains from efficiency improvements should not come at the expense of security, however. This applies to both the issuance and circulation of new forms of money and even more so when novel, as yet untested technologies are deployed. Applications promoting the digital transformation need to provide comprehensive protection in terms of information security and the resilience of IT systems. Where distributed networks are used, security standards need to be met by all agents. To safeguard the responsible governance of payment system operations and ensure compliance with anti-money laundering and anti-terrorist financing regimes, only administered and permissioned networks make sense where all the participants are clearly identifiable by the operator.

Innovative nature of digital money actually lies in its programmability

Innovative added value

Given the technological factors driving developments in the payments space that have been presented here, the range of functions possessed by digital money could go beyond those of cash and account-based commercial bank money, thereby serving as a useful complement to what they have to offer. To deliver innovative added value, a new digital form of money could aim at being usable in programmable applications.¹⁷

As a concept, the way in which the infrastructure for digital money is designed needs to be conducive to innovation and not bound to any one technology. This approach will ensure its technical adaptability. With that in mind, interoperable standard solutions are preferable to stand-alone ones. While the latter can bring about improvements within their limited ecosystem in the short term, this would not result in any welfare gains for the European payments space as a whole.

Implications within the realm of control

For their part, new forms of money cannot be permitted to jeopardise the functions served by existing ones. Their use as a medium of exchange, unit of account and store of value requires a high degree of stability in terms of value, which is achieved through central banks' stability-oriented monetary policy and accompanied by a stabilising effect on the financial system. Irrespective of the other properties that new forms of money may have, it is therefore crucial that monetary policy transmission remains an effective process.

In particular, the regulatory implications of issuing new forms of money need to be taken into consideration. The current monetary and payments system is a two-tier arrangement in which central banks and commercial banks control central bank money and book money, respectively.¹⁸ This division mitigates risk whilst at the same time protecting innovative drive, customer focus and efficient capital allocation. Should the provision of digital money be a solely public sector affair, it will probably not be possible to ensure either of these things to the same extent.

The implications of digital money need to be analysed in sufficient depth. These concern not only monetary policy and financial stability ...

... but also regulatory requirements

Conceivable approaches to digital money

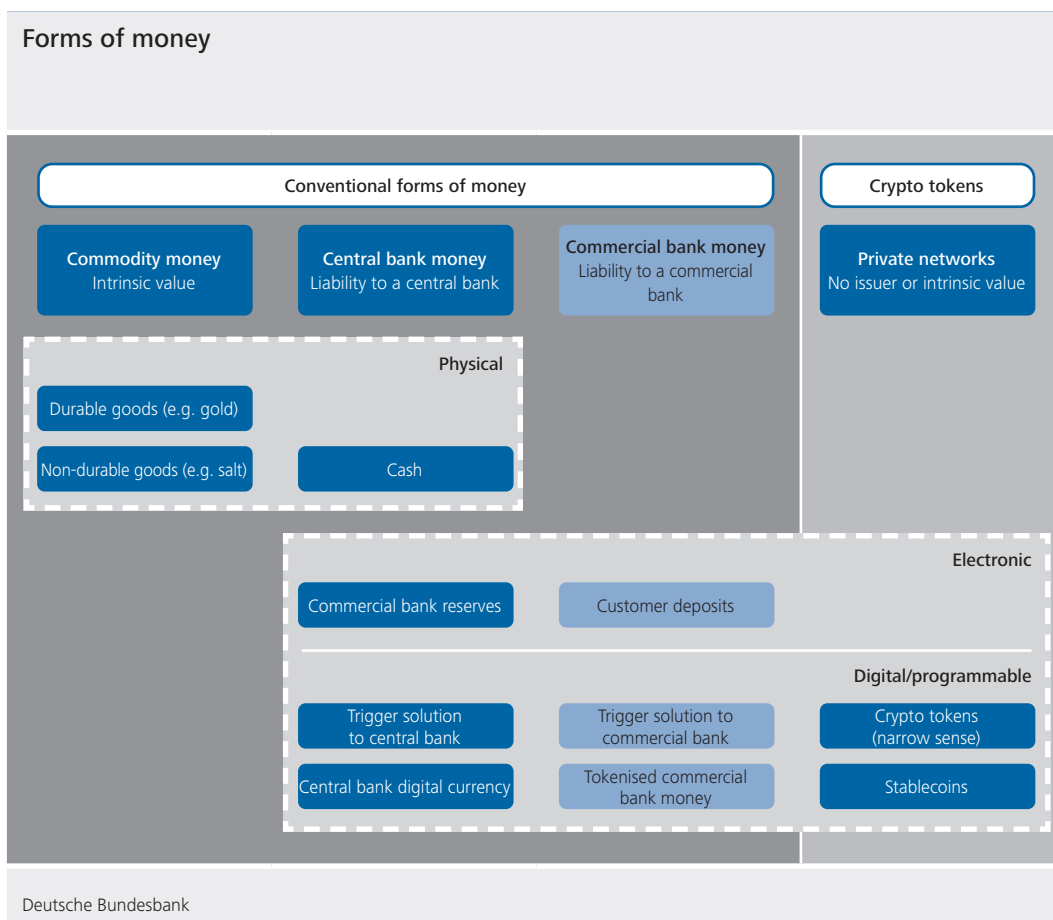
Owing to new technical capabilities and the standards set for modern payment methods, a number of new solutions for the development of digital money are conceivable.¹⁹ These approaches have economic implications to varying degrees. As a rule, the first question to ask when innovating is not "How?" but "Why?" Despite pronounced network effects and economies of scale in the payments space, the diversity of transaction types means that, going

Given varying requirements, large number of solutions expected

¹⁷ See Deutsche Bundesbank (2020).

¹⁸ See Deutsche Bundesbank (2017b).

¹⁹ See Balz et al. (2020).



forward, multiple payment solutions will probably continue to exist in parallel in a competitive market. The implementation of such solutions is likely to involve the use of various technical infrastructures, which need to be standardised and interoperable to the greatest extent possible.

Trigger solutions

Where transactions require payments to be programmable, a settlement medium is needed that can be used in digital networks. However, it is not strictly necessary to incorporate a settlement medium of this kind directly into these networks. Technical bridging solutions can make it possible for digital networks to interact with existing infrastructures. Linking them up in this way allows payments to be automatically initiated (or “triggered”), with confirmation of settlement likewise being automated. One major advantage of this kind of so-

lution is that existing payment systems can be used even though they themselves are not designed for programmable applications. Cash leg settlement would therefore meet all regulatory requirements more or less from the outset, and account and liquidity management would remain unchanged for users. The technical adjustments that have to be made to systems in order to implement trigger solutions are minimal at most. At the same time, there is no need to expand system access requirements. In addition, trigger solutions can be implemented relatively quickly and used in a wide range of applications. However, it would also be useful for existing payment systems to be accessible for trigger solutions at any time and every day (24/7).

Trigger solutions could build technical bridges for cash leg settlement, ...

... which is why the Bundesbank and other providers are working on their implementation

Like other stakeholders,²⁰ the Bundesbank is actively working on a trigger solution (see the box on p. 67). Using trigger solutions, the digital network can be linked to central bank systems, making it possible to settle transactions in central bank money, but also to privately operated clearing systems or directly to commercial banks' account management systems.

Tokenised commercial bank money

Tokenised commercial bank money could replicate existing delineation of roles in financial system

Another option is tokenised commercial bank money, which would closely tie in with the existing delineation of roles in the current payments environment. Nowadays, transactions conducted by households and enterprises are settled for the most part in commercial bank money. In future, commercial banks could offer their book money in tokenised form in order to meet the standards set for modern payment methods. One advantage of this would be that the private sector would continue being able to develop efficient payment solutions for the customer, while the division of tasks between the public and private sectors would not change in any substantial way. Solutions developed by individual banks or groups of banks that could deliver efficiency gains in a defined set of applications are one possible innovation here. Applications of this kind could, for example, take the form of internal settlement systems or applications for certain customer segments.²¹

Number of areas in which tokens could be used would increase if banking sector took a uniform approach

If cross-bank applications are to become a reality, it needs to be possible to convert one commercial bank token for another. This poses a challenge, as interbank transfers would lead to a buildup of bilateral claims and liabilities and, consequently, exposures. The private sector would need to take a concerted and uniform approach in order to minimise risks, e.g. by means of intraday clearing for such trades. If a banking group jointly issues a commercial bank token, the party against which the holders of this token can assert their claims needs to be clearly defined. One conceivable solution to

this would be to establish a legally independent entity that would assume the task of issuance and to which all holders of this tokenised book money could direct their claims. These could be secured by backing them with collateral or central bank money.

Stablecoin applications

Stablecoins take various forms

The concept of the "stablecoin"²² covers a variety of models. Stablecoins are crypto tokens designed to minimise major fluctuations in value. They are therefore potentially more attractive than other crypto tokens as a store of value and means of payment, and they are especially well suited for use in DLT networks. Given that applications can vary hugely in terms of underlying corporate structure (governance), business model, stability mechanism and technological basis, the economic implications would be highly diverse. In particular, the rights assured to consumers to redeem crypto tokens for conventional currencies differ from product to product. Users of stablecoins may incur credit, liquidity and exchange rate risk, amongst others. The main types of stablecoin that would come into consideration here are those designed to be firmly pegged to a conventional currency and that are backed, for example, by bank deposits or securities in said currency. However, concepts pegged to a basket of

²⁰ Examples include DLT2Pay by Targens (https://targens.de/engine/wp-content/uploads/2021/03/Factsheet_DLT2Pay_DE.pdf), a proof of concept completed by Iberpay (<https://www.europeanpaymentscouncil.eu/news-insights/insight/programmable-instant-payments-dlt-networks-and-distribution-digital-money>) and studies by the Bank for International Settlements, SIX and the Swiss National Bank as part of Project Helvetia (see Bank for International Settlements (2020a)).

²¹ Examples are the JP Morgan Coin, which bank customers can use to make payments, and a project run by Wells Fargo piloting internal settlement services.

²² Generally speaking, stablecoins are crypto tokens that are designed to have a stable value in relation to another unit of value. However, this does not always mean that they come with a guarantee of, or legal claim to, stability in terms of value. One way in which this stability is achieved is by backing them with assets or fiat currencies. Another option would be to use algorithms to adjust the supply of stablecoin units. See Deutsche Bundesbank (2019).

The Bundesbank's trigger solution

Blockbaster (blockchain-based settlement technology research) was the name given to a project that saw the Bundesbank team up with Deutsche Börse to develop a trigger solution for testing purposes.¹ This project involved experts from the two institutions using a trigger chain to build a technical bridge (interface) between a private DLT² environment for securities (asset chain) and the Eurosystem's real-time gross settlement (RTGS) system, TARGET2. Transactions on the asset chain are able to use this interface to automatically initiate (trigger) payments in TARGET2.

In the test itself, the German Finance Agency issued a ten-year Federal bond (Bund) digitally in a DLT system. The trigger solution meant that it was possible for primary and secondary market transactions between multiple market participants to be settled in TARGET2 on a delivery-versus-payment (DvP) basis using smart contracts.³

The proof of concept demonstrated the general functionality of a trigger solution for settling the cash leg of DLT-based use cases in a conventional payment system. In monetary policy

terms, the trigger solution is neutral because it does not change conditions for accessing central bank money and makes use of the existing payments infrastructure. The Bundesbank's trigger solution could be used for asset chains of any kind, given the fact that it is a technology-neutral approach.

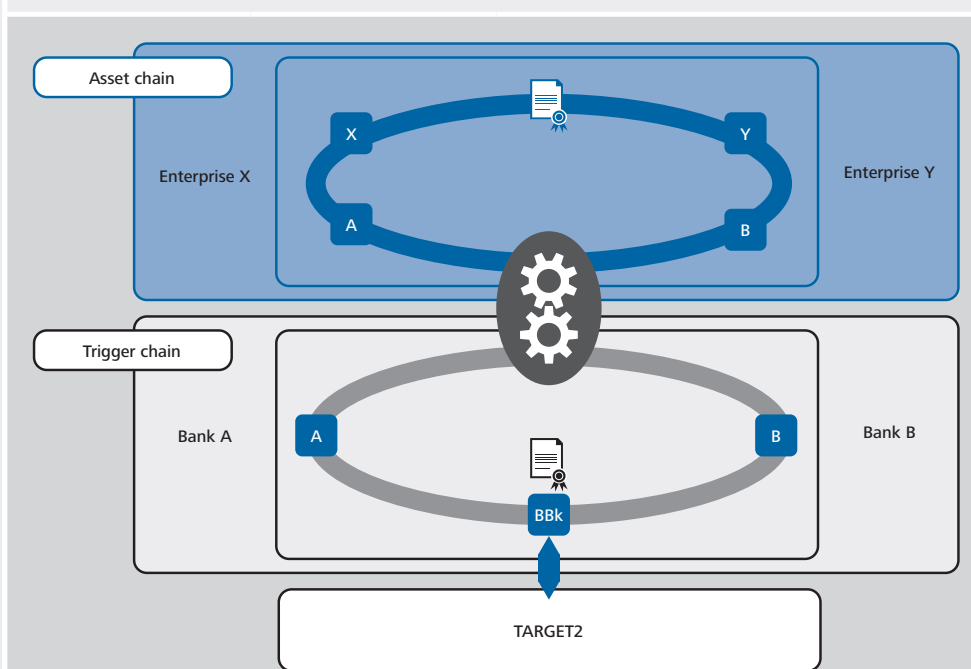
The project saw the creation of an interface between the conventional payments space and a DLT-based securities system. Two software modules, a trigger chain from the Bundesbank and a transaction coordinator from Deutsche Börse, connect TARGET2 and a DLT securities system. DvP settlement of the securities and central bank money only takes place when all the parties involved have confirmed the transaction. This mode of settlement minimises counterparty risk for both the buyer and the seller.

¹ See Deutsche Bundesbank (2021b).

² Distributed ledger technology.

³ This project, which operated within the given regulatory and organisational framework conditions, was designed as a proof of concept and consisted only of functional and technical test transactions.

The Bundesbank's trigger solution



major international currencies are also a conceivable option.

Risks and regulatory issues associated with stablecoins need to be examined

At present, the role played by stablecoins in the payments space is practically non-existent, as the concepts are still at a relatively early stage of development. However, they have the potential to become more commonplace. For this to happen, they would need to be adequately stable in value and offer users significant advantages over conventional payment procedures, e.g. with regard to ease of use or cost. It must be ensured that providers of applications used widely in the European payments space are subject to regulation providing sufficient protection against potential risks in connection with the use of stablecoins. Whilst a legal framework for current accounts and payment systems is already in place, a regulatory framework for crypto tokens, including stablecoins, is currently being discussed in the European Union: this is known as the MiCA Regulation.²³

While globally available stablecoins pose risks to monetary policy and financial stability, ...

Stablecoins launched by large platform providers entering the market are a particularly big talking point. One of the best-known examples of a global stablecoin system is Facebook's Diem (formerly Libra). Globally available stablecoins could have broadly far-reaching implications for the financial markets – with repercussions for the implementation and transmission of monetary policy as well as financial stability that are still unknown.²⁴ In particular, stablecoin systems could be vulnerable to runs. More specifically, it is conceivable that periods of stress would see customers buy or redeem stablecoins on a large scale and in a short space of time. In response, it would be necessary to buy, sell or withdraw the assets, such as government bonds or bank deposits, held to back the stablecoins. Depending on the scale of the run, this could have significant implications for the markets affected. However, it is also possible for market prices to be influenced by these systems even when they are operating normally. For example, the operator of a stablecoin system could adjust the asset pool for the stablecoin, i.e. buy or sell assets on a larger scale.

Even the anticipation of such a response could lead to market price adjustments, which gives rise to the potential for speculative price movements. If stablecoins were used as a store of value or for large-value payments between credit institutions, particular attention would need to be paid to a legally enshrined one-to-one convertibility between them and euro book money in order to prevent the emergence of separate cash cycles. In this context, the risk of issuer default could likewise have implications for financial stability. Amendments and additions to the draft MiCA Regulation that would mitigate potential risks to financial stability in connection with stablecoins are currently being discussed. One particular area of interest in this regard is the regulation of the reserve funds backing stablecoins. Close cooperation at the international level with standard-setting regulatory bodies and central banks, together with the careful monitoring of such systems, is also essential.²⁵ Furthermore, regulatory issues that have yet to be resolved and implications regarding the stability mechanism need to be considered.²⁶

Applications designed to facilitate high-value payments between credit institutions need to be highly resilient to service outages. Backing a stablecoin with central bank money would create a close, but not perfect, substitute for existing central bank money. However, as long as the central bank makes no guarantees, it remains commercial bank money. Even so, market participants might think of stablecoins backed by central bank money as a substitute of sorts for central bank money. This is a source of risk because, unlike in the other RTGS sys-

... stablecoins backed by central bank money entail reputational risk for central banks

²³ The entry into force of the European Commission's proposed Regulation on Markets in Crypto-assets (MiCA), which has not yet been adopted, is scheduled for 2022. MiCA aims to harmonise the regulatory treatment of crypto-assets across all EU Member States. In addition to establishing legal certainty, MiCA's objective is to safeguard financial stability, foster innovation in the field of crypto-assets, and ensure adequate protection for consumers and investors.

²⁴ See G7 Working Group on Stablecoins (2019) and Balz and Paulick (2019).

²⁵ See G7 Working Group on Stablecoins (2019).

²⁶ See, for example, Kahn et al. (2020) and Diehl (2020).

tems it operates, the central bank is unable to directly address disruptions by means of action such as liquidity measures. The central bank could also be exposed to reputational risk if disruptions to private systems were to damage confidence in central bank money. A high degree of transparency would still be needed, as would an arrangement to prevent access to central bank money from being inadvertently expanded through access to a private system backed by central bank money. Expanding access in this way could have implications for the financial system that are difficult to predict.

■ Central bank digital currency

In response to the challenges and demands posed by digital money, another subject to attract increasing attention is CBDC. This topic is currently being explored in a number of countries (see the box on p. 70).

CBDC as a wholesale token

Wholesale variant of CBDC could offer efficiency gains

If the users of CBDC were to remain largely restricted to banks and their current counterparties (wholesale CBDC), the structure of the financial system would probably not change in any transformative way. Any negative implications for monetary policy implementation and financial stability, such as those potentially associated with retail CBDC of the kind described in the next section, might therefore be manageable. The advantage of such a solution would be that wholesale payment systems offer 24/7 settlement and programmability. This could pave the way for a higher level of automation and process optimisation in securities settlement, in particular, especially through the tokenisation of securities, as is to be achieved, for example, with the act on digital securities in Germany or the planned DLT pilot regime for market infrastructures in the European Union. Furthermore, a wholesale token of this kind would be designed for integration into institutions' liquidity management sys-

tems, although a further component of non-cash central bank money besides deposits in central bank accounts would be tied up in the wholesale token, with potential implications for monetary policy implementation.

CBDC for the general public

Unlike the wholesale variant, a retail variant of central bank digital currency would provide for issuance to a broad set of users, including households. The issuance of retail CBDC is associated with numerous unresolved issues and risks and could have far-reaching consequences for the financial system and monetary policy purely because more parties would be using it.²⁷ This is why a retail variant complementing other forms of money should be designed in such a way that it allows potential welfare gains to be achieved – through efficiency gains in payments, production and in financial markets, for example – and, at the same time, keeps risks to a minimum.²⁸

Retail variant harbours greater risks

Considerations around a digital euro

In October 2020, the ECB published a detailed report on the potential issuance of a digital euro compiled by a high-level working group of the Eurosystem.²⁹ The considerations presented in this report relate to retail CBDC for the euro area. Alongside supporting the digitalisation of the European economy, scenarios that could justify the introduction of a digital euro include a decline in the use of cash and a

Eurosystem starts investigating a digital euro

²⁷ In addition, the introduction of CBDC may entail a clash of objectives. In a model-theoretical framework, Schilling et al. (2020) demonstrate a trilemma between price stability, efficiency and financial stability when CBDC is issued. Various studies look into the potential trade-off between disintermediation and efficiency gains as a result of better fulfilment of the functions of money. See, inter alia, Andolfatto (2021), Chiu et al. (2019) and Keister and Sanches (2019).

²⁸ For a literature review on implications and risks, see Carapella and Flemming (2020).

²⁹ See European Central Bank (2020).

Global trends in the field of central bank digital currency

The possibility of issuing central bank digital currency (CBDC) was first discussed among central banks on a larger scale by the Committee on Payments and Market Infrastructures (CPMI) in the 2017-18 period.¹ The CPMI conducted an initial analysis of potential variants and the implications for central banks' areas of activity. At the same time, a number of central banks began launching early CBDC-related projects.

Central banks' activities in the area were catalysed by the publication in June 2019 of private market players' plans to issue global stablecoins. Since then, more and more central banks have been engaging with the topic. Surveys conducted by the Bank for International Settlements revealed that 64% of the central banks surveyed were exploring CBDC in 2017, while that figure had risen to 86% by 2020.² Most of these had embarked on setting up technical experiments.

Retail CBDC, meant for use by the broader public, has garnered the most attention. The frontrunner in Europe is Sweden, where the Riksbank began work on the topic in 2017.³ Looking beyond Europe, the People's Bank of China has been working on plans to introduce a digital yuan since 2014. Initial real-world trials have already taken place in a selection of Chinese cities and are being continuously expanded.⁴

In addition to the conceptual studies being conducted on retail CBDC, some central banks are looking into the notion of wholesale CBDC, that is to say central bank digital currencies designed for a limited set of users. Their primary focus is on developing a medium which the financial sector can use to settle securities transactions. The

Monetary Authority of Singapore (MAS) and the Swiss National Bank (SNB) are among the institutions exploring such possibilities. With Project Ubin, the MAS is aiming to develop a settlement system to boost Singapore's economy and competitiveness and position the financial centre as a future-proof blockchain hub.⁵ The SNB is collaborating with the clearing house SIX and the Bank for International Settlements on a project named Helvetia, concentrating on feasibility studies with a near-live set-up for settling tokenised assets in central bank money on distributed ledger technology (DLT) networks.⁶

¹ See Bank for International Settlements (2018b).

² See Bank for International Settlements (2021).

³ See Sveriges Riksbank (2018).

⁴ See Phillips (2021).

⁵ See Monetary Authority of Singapore (2017).

⁶ See Bank for International Settlements (2020a).

broad take-up of stablecoins or foreign digital money. The report makes it clear that the digital euro outlined should – if introduced – operate as a complement to cash, not as a replacement. Furthermore, a public consultation on the digital euro was launched. In parallel to this, the Eurosystem has initiated an experimental phase in which various avenues for the potential implementation of a digital euro are being explored. The ECB Governing Council has not yet made a policy decision concerning a potential investigation phase and the subsequent introduction of a digital euro.

CBDC cannot replace cash

Features of cash cannot be fully replicated in digital form

Although, in quantitative terms, the majority of central bank money is in cashless form, cash in the form of banknotes is currently the sole unrestricted legal tender in the euro area,³⁰ and the Eurosystem has committed itself to maintaining cash as a means of payment.³¹ Digital money cannot fully substitute all of the functions and benefits of cash, nor is it intended to. The fact that it is simple to use, can be used anywhere and is easily accessible are considered to be advantages of cash.³² It can be used securely by almost all population groups, requires no technical knowledge or set-up and its use does not depend on electronic infrastructure. In addition, further typical features of cash, such as the complete anonymity of transaction parties and the fact that its provenance cannot be tracked³³ – notwithstanding regulatory requirements, e.g. for the prevention of money laundering and terrorist financing – are also not fully realisable with digital money. Transfers of digital money – whether personalised, anonymous or pseudoanonymous – are always recorded in an electronic register so that digital money cannot be copied or used multiple times. The register can either be operated and monitored centrally by an operator or in a decentralised manner via the network.³⁴

The Eurosystem’s public consultation revealed privacy to be an important feature for users.³⁵

The protection of personal data should therefore be a key concern when designing a digital euro. Unlike in the case of private providers who have commercial interests in data, a digital euro could be deliberately designed in such a way that the power over personal data remains fundamentally with the user. However, the issue of whether data can be used commercially should not be confused with the question of whether payments can be settled in a completely anonymous way. It would be virtually impossible for an electronic payment instrument that is fully anonymous like cash to be compatible with the existing regulatory requirements. Therefore, alongside individuals’ right to privacy and data protection, the design must also take into account public interest in preventing money laundering and terrorism financing and the relevant regulatory standards.

Privacy as a user need and regulatory standards, particularly for the prevention of money laundering and terrorism financing

Stringent security requirements for CBDC

Central bank money is subject to special security requirements. The central bank makes sure that the banknotes and coins in circulation for cash payments are of high quality. In the Eurosystem, any transfers of non-cash central bank money, which is quantitatively more significant than the physical equivalent, are executed exclusively within TARGET2 – a system developed, operated and overseen by the Eurosystem. This RTGS system, which settles transactions between participating banks in real time, is highly systemically important for the stability of the European financial system, not least given the settlement volumes involved. All of the Eurosystem’s monetary policy operations are settled

Central banks ensure the compliance of central bank money with security standards

³⁰ Article 128(1) of the Treaty on the Functioning of the European Union and Article 16 of the Statute of the European System of Central Banks and of the European Central Bank; see also Section 14(1) sentence 2 of the Bundesbank Act.

³¹ See European Central Bank (2020) and Weidmann (2020).

³² See Deutsche Bundesbank (2009b).

³³ The transaction history of cash is not traceable.

³⁴ See Armelius et al. (2021).

³⁵ See European Central Bank (2021).

using this system. The central bank is responsible for the system and can intervene to stabilise it at any time, which should prevent disruptions and delays during settlement spilling over to the entire system and the connected ancillary systems and having a destabilising effect. Central banks are tasked with developing, operating and monitoring these systems in view of the significant role RTGS systems for settling individual payments in central bank money play in the stability of the financial system as a whole. Ultimately, problems experienced in central bank money settlement also jeopardise the reputation of the central bank and consequently dent confidence in central bank money.

Principles for the introduction of CBDC

Risks to monetary policy and financial stability must be minimised

CBDC could have a significant influence on monetary policy implementation and transmission. Moreover, it could substantially expand the Eurosystem's balance sheet, meaning greater exposure to financial risk. Structural changes in the wake of the introduction of CBDC could also have implications for financial stability. These implications could stem from, amongst other things, potential substitution away from commercial bank deposits into CBDC and an associated reduction in the banking system's intermediation capacity, or from abrupt deposit shifts, for instance in the case of a system-wide crisis in confidence, if market participants' behaviour is guided by the safety aspect of central bank money. Further examination into how significant these risks are and whether they can be avoided is required.³⁶ The increased focus on CBDC has already prompted seven central banks and the Bank for International Settlements to set out common foundational principles that they wish to observe in the event of a potential introduction of CBDC. These include coexistence with cash, no disruption to monetary policy and financial stability, and the promotion of innovation and efficiency.³⁷

Conclusion

With the discussion about digital money in the euro area increasingly centring around the potential development of a digital euro, the question arises as to how such an initiative could meet the general standards for digital money outlined in this article. The primary focus needs to be on striking a sensible balance between the benefits of wide use of this potential new form of the euro and its risks. From a user perspective, it is important that a means of payment be quick and straightforward for wide acceptance to be achieved.

Ensuring broad public acceptance and availability

Programmability plays a special role in this context. Although a digital euro should be able to be used in conventional payment situations, such as at the point of sale, in e-commerce and ideally offline using wearable devices that even sections of the population who are not tech-savvy can operate, its innovative benefits would particularly come to the fore if a digital euro could be seamlessly integrated into DLT-based processes. However, it is also crucial to have a fundamental understanding of the potential risks and their transmission mechanisms and to take these into account through appropriate design choices.

Programmability and ease of use would be desirable

The need for digital money for settling large-value transactions in securities trading should also not be neglected. It is important to monitor this demand and to develop solutions that are either directly connected to central bank systems (triggered) or enable wholesale use of a digital euro.

Stakeholders, particularly in the banking industry, should be involved in discussions about the potential design of a digital euro from the outset so as not to jeopardise the benefits offered by the existing division of tasks between commercial and central banks. Another aspect that should be considered here is consolidating the

³⁶ See Panetta (2021) and Weidmann (2020b).

³⁷ See Bank for International Settlements (2020b).

Eurosystem's discussions on the potential design of a digital euro and political support for private sector pan-European payment solutions, such as the European Payments Initiative.

It will be a matter of finding well-designed, secure and convenient solutions. Otherwise nei-

ther the ambitious political expectations regarding a digital euro as an alternative to private sector stablecoins, nor the simultaneous responsibility of the central bank for the stability and maintenance of the market-based functioning of the financial system, can be met.

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