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The digital euro from a geopolitical perspective: Will Europe lag behind?

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The digital euro is not a monolithic project. On the contrary: The fields of application are broad, and possible solutions are diverse. This paper provides an overview of use cases, application domains, and infrastructures for the digital euro that differ significantly. A comparison with solutions for the digital dollar and the digital yuan leads to the conclusion that, in the most extreme case, the euro could become a regional currency for Europe. The main reason for this argument is the design and prioritization of current approaches within Europe as well as the European Central Bank's digital euro project, and that stablecoin approaches seem to be neglected as solutions for the digital euro.

Introduction

Digital euro as a generic term, not specific to ECB projects. The digital euro is not limited to a single technical platform or infrastructure. Rather, the term "digital euro" describes a variety of solutions that are based on different technologies and that can be used for different needs in different application domains for different use cases. Thus, it is necessary to consider different application domains: the digital euro for individuals, commerce, businesses, industry, the capital market, and international transactions. At the same time, different entities can issue the digital euro: the European Central Bank (ECB) in the form of a central bank digital

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currency (CBDC), commercial banks via a trigger solution, or (un)regulated firms from the financial sector in the form of euro stablecoins.

Scope of this paper. This paper provides an overview of application fields, use cases, and technical infrastructures for the digital euro. It then compares the digital dollar in the U.S. and the digital yuan in China with further initiatives in these jurisdictions and assesses efforts around the digital euro from a geopolitical perspective. The goal of this paper is not to analyze, question, or compare the euro or other currencies to Bitcoin or other decentralized protocols, but rather to analyze the "transfer technologies" of currencies and their implications for the future of these currencies. We describe the transfer technologies that have already emerged or are emerging for the euro, the US dollar, and the yuan and conduct a geopolitical comparison. As a result, we fear that the current approaches within Europe and the deliberate disregard of the improvement of international payment processes through a digital euro could, in the most extreme case, lead to the euro becoming a regional currency for Europe. The core of this argument is that the "digital" aspect of the digital euro is often misunderstood or underestimated. This particularly affects the digital execution of international payments – between individuals, importers, and exporters – and the emergence of decentralized finance (DeFi). This is essential because digital currency infrastructures emerge – or have already emerged – such as the Chinese digital currency eCNY and US dollar stablecoins, which offer solutions for such dynamically growing fields. For this reason, it could lead to regret in the future that the euro does not have a digital equivalent or image in these areas.

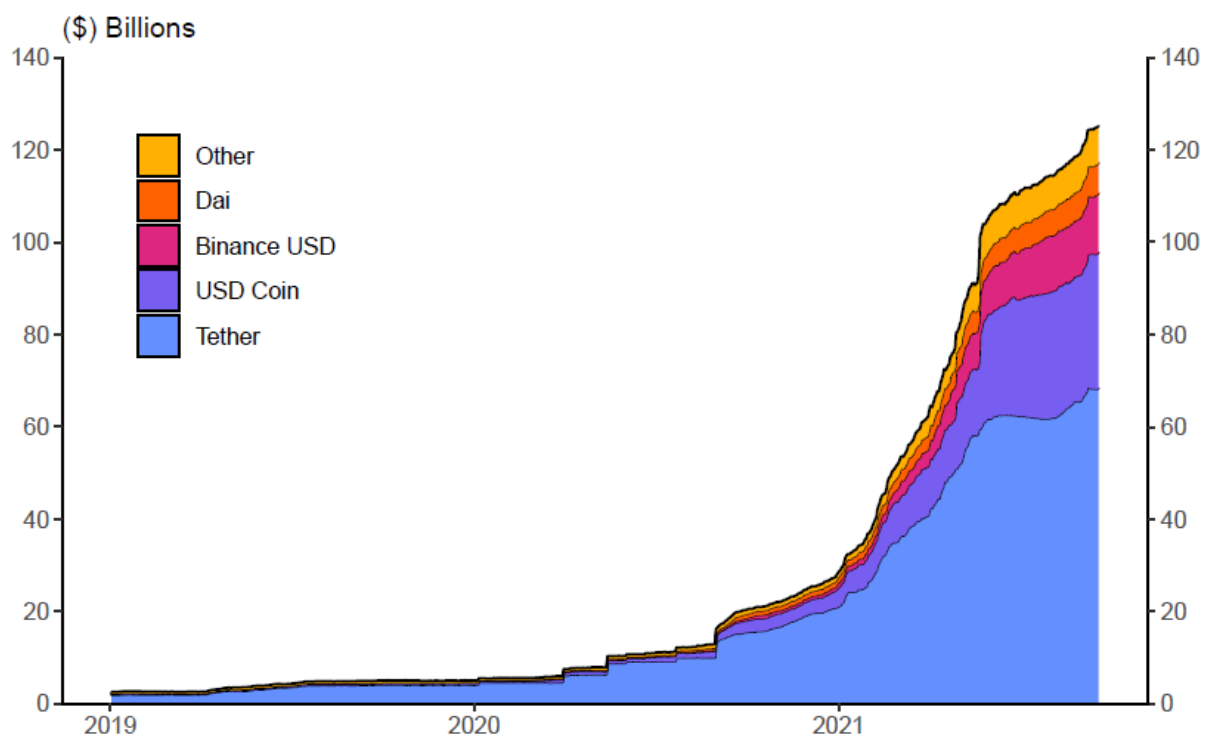
Progressive digitization of the monetary system

Money is becoming increasingly digital, and cash is being more and more displaced. Overall, a clear trend can be observed: Money is becoming increasingly digital. While digital money has already existed for decades in the form of bank deposits, which are sent, for example, when payments are made via credit cards, mobile payments, or bank transfers, the importance of physical cash as a means of payment is declining steadily – an ongoing trend that is accelerated by the Covid-19 pandemic. To counteract this trend, central banks are currently considering introducing "digital cash" in the form of CBDCs (Boar & Wehrli, 2021). On the other hand, banks,

associations, and industrial companies also work on innovative and new variants of the "digital euro", for example, based on novel technological infrastructures, such as blockchains. Similar developments can also be observed in other currency areas, such as the U.S. or China, with steadily growing momentum.

Figure 1

Circulating supply of US dollar stablecoins¹



Blockchain-based US dollar-denominated stablecoins with trading volume of billions of US dollars. Innovations related to the revolutionary blockchain technology, which is the technological foundation of crypto assets, such as Bitcoin and Ether, also make it possible to completely rethink the concept of money. Based on blockchain technology, secure decentralized monetary systems can be implemented for the first time in history, without intermediaries such as banks or central banks involved. Today, there are thousands of digital crypto assets based on blockchain technology, and their market capitalization and trading volumes are growing rapidly, even if many of these crypto assets are experiencing very high volatility. By the end of 2021, according to Coinmarketcap, the

combined market capitalization of all crypto assets equaled more than two trillion US dollars – 100 billion US dollars worth of crypto assets are transferred daily (Coinmarketcap, 2021). Most recently, El Salvador even became the first country in the world to introduce Bitcoin as legal tender. In addition, crypto assets that ensure stable value, so-called stablecoins, continue to gain traction. According to Statista, the market capitalization of stablecoins has almost increased tenfold in 2021 (Statista, 2021). The development of the circulating supply of US-dollar pegged stablecoins is illustrated in Figure 1. Tether, currently the largest stablecoin by market capitalization, has a daily trading volume of almost 80 billion US dollars. Besides, other US dollar stablecoins emerged that have already gained significant market shares from Tether (Viehof & Bruckner, 2021a; Viehof & Bruckner, 2021b). A new wave of digitalization of the monetary system is currently underway. As described, this also includes crypto assets such as Bitcoin, however, it is not in the focus of this paper.

The geopolitical significance of money

US dollar as the world's reserve currency in 2021. Money also has an immense geopolitical component because the dispersion and worldwide acceptance of a currency impacts the monetary power worldwide. Today, the US dollar enjoys undisputed status as the world's reserve currency – the US dollar symbolizes trust and stability. It is used globally as a "benchmark currency" for payments and loans. For example, according to the ECB, approximately 60% of global debt and 55% of global loans are currently denominated in US dollars (ECB, 2021c). The emerging field of DeFi, which maps functions of the financial system entirely through decentralized computer programs (i.e., smart contracts), also mainly uses the US dollar as its reference currency (Eikmanns et al., 2021). However, the US dollar has gained this prominent role just in the last century. Prior to that, France, Spain, and the United Kingdom, among others, provided the world reserve currency at various points in history. Accordingly, history shows that the dominance or position of a currency can change over time – even if it is a slow process.

Changes in the monetary power due to digital currencies. While high transaction costs are still an obstacle to the global dispersion of national currencies today, digital currencies could significantly change the

monetary power worldwide. Some business transactions are still paid with physical cash, which is sent via airplanes to the business partner. Admittedly, these cash transactions are happening less and less frequently; nevertheless, such anecdotes are very surprising in a more and more digital world. Cash transports, payments, and conversions are associated with high costs. Opening bank accounts in the country of the business partner, on the other hand, is typically not possible or extremely costly for non-domestic entities, also due to regulatory requirements. One reason is that the bank needs to verify the identity of a foreign person. Digital currencies, which can be transferred conveniently, cheaply, and quickly across borders via digital devices, would allow non-domestic citizens to access domestic currency efficiently, which would increase the global importance of the domestic currency. This development could hold for the digital yuan in China (see below) if the digital yuan is easily made accessible to foreign transaction partners via smartphones. This does not primarily apply to EU citizens, but rather to businesses exporting from the EU to Asia or, for example, companies commissioned by China in resource-rich countries in Africa. Furthermore, it has to be stressed that currencies and technical platforms or infrastructures must be considered separately from one another (Bechtel et al., 2020). In addition to the digital yuan, other currencies could also be issued on the Chinese digital yuan infrastructure – theoretically also the euro or the US dollar. All of these possibilities certainly have relevance and could lead to declining dominance of the US dollar and the role of the euro, but a higher role of the yuan.

U.S. discovers US dollar-backed stablecoins. What are the global developments around digital currencies today? To answer this question, one should analyze the three most significant global currencies today – the US dollar, the euro, and the yuan. The US dollar is used as the main currency for stablecoins today. According to Coingecko, at the end of 2021, 17 out of the 20 most significant stablecoins are US dollar-backed, meaning that every stablecoin token is backed by a corresponding amount of US dollar or US dollar-denominated securities. Thus, the clear majority of the current nearly 150 billion US dollar market capitalization of stablecoins can be attributed to tokens backed by US dollars (e.g., Tether/USDT, USDC) (Coingecko, 2021; Viehof, C., & Bruckner, M., 2021a; Viehof, C., & Bruckner, M., 2021b). Based on current dynamics, it can be expected that market capitalization – and thus the importance of US dollar tokens – will continue

to increase in the future. Also, the market capitalization of stablecoins, in general, will increase alike. Most recently, US policymakers have recognized the opportunities for US dollar stablecoins to strengthen their domestic currency so that a corresponding regulatory stablecoin framework will be adopted in the near future to create legal certainty. With regard to the potential issuance of its own digital dollar in the form of a CBDC for the US, the U.S. central bank Federal Reserve remains cautious, which is why a timely introduction of such a digital form of central bank money seems highly unlikely.

The ECB will issue a digital euro not before 2026. In October 2021, the ECB launched a project on a potential ECB-issued digital euro. In the ongoing investigation phase of the digital euro project, the ECB examines the potential design of a digital euro over the next 24 months (ECB, 2021a). Thus, conceptual considerations are currently in the focus of the ECB. However, no decision has yet been made whether such a digital euro will actually become a reality one day. If the ECB decides in favor of the introduction of a digital euro, it will take at least another five years to launch such a digital euro. Therefore, the introduction of the digital euro as a euro CBDC is possible in 2026 at the earliest. In the meantime, no substantial positive impulses from stablecoins are to be expected. Currently, significant euro stablecoins do not exist.

Thus, the euro is in danger of losing ground around digital currencies.

China is focusing on a state solution. China is taking a more progressive approach. While the People's Bank of China (PBoC) made it clear that it would not tolerate yuan-based stablecoins, the PBoC has been working on its own CBDC, the eCNY, since 2014 and has been testing it extensively since April 2020. According to reports, 140 million accounts have already been opened, and 150 million transactions have been made during the tests, showing the maturity of the project (Ledger Insights, 2021). The currency is expected to be introduced in early 2022. Thus, China is about 4-5 years ahead of Western European central banks. If the currency is also made available to foreign citizens or companies, which is not clear yet,

this "first-mover advantage" could benefit the Chinese currency so that, in the end, the yuan might be strengthened.

Monetary innovation around blockchain technology.

Potential behind nanopayments and streaming money. Such novel digital payment options are also highly relevant for businesses in the industry and the financial sector. Blockchain technology promises to drive the digitalization and automation of business models. It also enables novel use cases, for which a blockchain-based, digital money – preferably, a blockchain-based euro – is necessary (FinTech Council at the German Ministry of Finance, 2020). These use cases include, for example, nanopayments, i.e., sub-cent payments or streaming money use cases, where payments are not made discretionarily but steadily based on actual usage. Neither class of use cases can be efficiently implemented with money that exists today. One example of how nanopayments and streaming money can be combined is the usage-based "consumption" of online articles or music streaming. Here, the customer would be charged according to his or her actual usage, i.e., pay for every second he or she reads the article or streams music. Such offers increase the interest of users who seek to access the offer only for a short time or only want to use isolated parts of the source of content. These customers currently shy away from an investment because they cannot – or do not want to – economically justify the acquisition of the entire content. Nanopayments and streaming money applications would also enable novel use cases in businesses, e.g., electricity consumption that can be broken down to individual devices in logistics or production networks. Other use cases include, for example, usage-based billing for all kinds of consumer goods that are not used regularly, for which payments in the sub-cent range are necessary (Sandner et al., 2021). Streaming money has significant potential, especially if the money used is sufficiently (efficiently) fractionated, and sub-cent payments are also possible. Only blockchain-based means of payment can currently achieve such levels of granularity.

Digitization and automation of business processes. Blockchain technology can also support the digitalization and automation of business processes through so-called smart contracts. Smart contracts are scripts stored and executed on a blockchain – they use blockchain and, thus, the

decentralized computing capacity of the network as a system environment. Primarily, smart contracts rely on basic if-then logics, i.e., they trigger certain follow-up actions when predefined events occur and document them reliably without the possibility of manipulation (Sandner et al., 2020). Such conditional, programmable payments via smart contracts offer great automation potential and are much more flexible than currently known, more simple automation of payments e.g., standing orders (FinTech Council at the German Ministry of Finance, 2020). For example, smart contracts can be used to document and control inventories reliably and automate reorders, including payment processing, without human support. Based on the measurements of the sensor, a payment can be conducted directly and in real-time via a blockchain to the supplier in the event of actual consumption, or an automatic follow-up order can be placed. Using blockchain technology for payment processing implies that there is no temporal asynchrony between delivery and payment. Delivery-versus-payment processes (DvP) are possible, in which the delivery of a good or service and the according payment take place simultaneously. As a consequence, counterparty risks are eliminated. In this case, the money for payment is "locked up" in a smart contract until the delivery has actually been provided and confirmed. For example, this can prevent cases where a payment is made for a service that is not provided or where service is provided but not paid for. This means that if the payment process or delivery is interrupted, no transaction is triggered, regardless of the reason. Subsequently, the assets held by the smart contract are then transferred back to the business partner.

DvP transactions. Digital DvP transactions are not yet widely used. When money is sent for a service or goods via conventional payment infrastructures today, the actual payment execution usually takes at least one working day. The settlement of a securities purchase, for example, typically still takes several days (T+2). In the case of a securities purchase, a central securities depository such as Clearstream performs the settlement (clearing) and ensures a legal transfer of ownership of the money and the security. However, the transfer of the security does not occur at the same time at which the payment is made – because it is documented in a separate infrastructure. For this reason, payments are only considered legally settled by a central securities depository days later. The use of blockchain makes it possible to conduct and document the service (e.g., the transfer of a

security) and the corresponding payment (e.g., payment for the security) via the same platform. Overall, a blockchain in combination with smart contracts can thus efficiently enable complex business models, which are based on automated payments, and link them to a corresponding real-time settled payment (Sandner et al., 2020).

Reduction in the number of intermediaries. In addition, blockchain technology enables a reduction in the number of intermediaries involved in a business process, which leads to efficiency gains. This is particularly relevant for cross-border payments, which, at the moment, involve a large number of intermediaries. As a result, according to the World Bank, cross-border payments still cost an average 6.8% in transaction fees (World Bank, 2020) – costs that the use of blockchain technology can reduce. In addition, we are currently experiencing increasing decentralization around use cases in the financial sector. DeFi has started to form a large market in recent years, offering financial services on a decentralized basis that do not require intermediaries at all or reduce the number of intermediaries. DeFi use cases include, for example, decentralized exchanges and decentralized loans.

Blockchain technology and the importance of currencies. Due to the described advantages of blockchain-based business models and blockchain-based payments, currencies that provide blockchain-based payment will benefit in the future so that their currency can be strengthened. This applies to both CBDCs and stablecoins.

Digital money solutions

Different ways of representing money digitally. There are different approaches as to how money can be represented digitally, i.e., how the euro could become "digitized". This includes conventional payment solutions not based on blockchain technology, as well as innovative payment solutions that are based on blockchain technology (Bechtel et al., 2020). Figure 2 shows the different variations (including physical cash) and their application domains. It should be noted that not every solution by which money can be digitally represented can be used equally broadly. First, conventional types of money – digital and physical – will be described briefly.

Figure 2

Application domains of (digital) money solutions

	Main Driver	Retail and Merchants	Industrial Payments	Capital Market	International (With KYC)	International (Without KYC) ¹
Traditional Solution						
Physical Cash	Central Banks	Yes	No	No	No	Yes
Payment via deposits	Commercial Banks	Yes	Yes	Yes	Yes	No
Novel Digital Money Solutions						
CBDC	Central Banks	Yes	Yes	Yes	Yes	Rather No
Trigger Solution	Commercial Banks	Rather No	Yes	Yes	Yes	No
Stablecoins	Financial Companies as Issuers	Yes	Rather No	Rather No	Rather No	Yes

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Notes: ¹ Includes the entire space of Decentralized Finance (DeFi) in a peer-to-peer manner

Cash transactions primarily between individuals (peer-to-peer) and in commerce.

Today, cash – i.e., banknotes and coins – is a frequently used means of payment in commerce and for payments between individuals. However, cash can also be used for payments in an international context, especially in situations where identification of the transaction parties is not required – or should even be circumvented (see Figure 2). The US dollar is often used in the form of cash internationally, even if it is not the official currency of a particular country. However, the dollar is also legal tender in some countries. For example, in El Salvador, the dollar was the only legal tender before Bitcoin was established as the second legal tender in 2021. Furthermore, in addition to licit uses, cash is also used internationally for criminal activities due to its high privacy-preserving features.

Account-based digital payments via bank accounts. Payments via credit cards, PayPal, mobile payments, or bank transfers require bank accounts. This seemingly trivial fact is nevertheless subject to strict requirements. Accordingly, a customer must have previously identified him- or herself to a bank or payment service provider (see Figure 2). Once this

has been done, money can be transferred from the customer's own account to other accounts – which also belong to identified customers. Customers can be both natural persons and legal entities (e.g., companies, public authorities). Accordingly, account-based payments are suitable for the needs of the economy and its supplier structures – i.e., for industries and the capital market, to name the two most important pillars. It should be noted that "industry" includes all types of manufactured goods and the provision of services, i.e., also the areas of logistics, mobility, production, medical technology, etc. The "capital market" sector includes payments for all types of financial services, e.g., securities, loans, etc. In both national and international contexts, account-based payments are useful and, above all, necessary when both transaction partners need to be identified.

Novel digital money solutions. As novel, innovative solutions for digital money, CBDCs, trigger solutions, and stablecoins are presented and briefly described below (Bechtel et al., 2020). There are several sub-variations of these solutions; in addition, there are other solutions of lesser importance that will be excluded here. It should be noted that it is only stablecoins that already today have trading volumes within the billion-dollar range.

CBDC theoretically available to all identified economic participants, but KYC required. CBDCs have a very large conceptual diversity (Auer & Böhme, 2021). Of course, a (retail) CBDC can be used as an official means of payment for payments between individuals and in (e-)commerce. If a CBDC is designed accordingly, commercial enterprises and businesses in the capital market (wholesale CBDC) could also use it. In addition to access for companies in the industry and the financial sector, another prerequisite for such use is that there are no maximum amounts on CBDC payments or on CBDC account balances, which are currently being discussed in the context of the digital euro (ECB, 2021b). No final decision has yet been reached regarding such limits. As of today, CBDCs are mostly theoretical constructs, so that the adoption and use cases of a CBDC depend on its actual design, which, however, has so far only rarely been specified. Only the development of such a CBDC – which is a very complex project – will show to what extent and for which use cases a CBDC can and will actually be used due to implementation obstacles and restrictions. Up to the point of implementation and introduction of a CBDC, virtually anything is possible in feasibility studies, concepts, and pilot projects – in theory. This is why

concrete plans for CBDCs and their implementations are so important but do not exist in the U.S. and Europe yet.

CBDC and KYC. Typically, it is assumed that users must register, identify themselves and consequently go through know-your-customer (KYC) processes in order to use a CBDC, although it is imaginable that identification is not required for smaller CBDC payments or CBDC balances (Gross et al., 2021). In this respect, a CBDC is not planned on being used in cases, in which transaction parties are unable or unwilling to identify themselves. This eliminates significant use cases for CBDCs – by design. An important and very quickly growing dynamic area is DeFi. Already today, hundreds of billions of US dollars are transacted per day, but identification of transaction partners is not a necessary condition since decentralized networks follow a peer-to-peer approach. The DeFi sector is, therefore, conceptually rather less compatible with CBDCs. The paradigms in the CBDC space systematically ignore the DeFi field despite its immense growth; an exception is the Brazilian Central Bank (Brazilian Central Bank, 2021), targeting innovative CBDC use cases around DeFi and the internet-of-things. It seems unlikely that a CBDC in Europe in the near future can be used in decentralized networks (see Figure 2).

Trigger solutions to be used for payment processes between companies in industry and the capital market. In simple terms, the trigger solution connects conventional bank accounts with blockchain networks to take advantage of the described benefits of blockchain technology. When a bank account is linked to a wallet address on a blockchain network, the digital euro can be used on a blockchain basis. Thus, it can be used for business processes in the industry or for DvP services in the capital market. From the perspective of the blockchain network and the smart contracts used, a "simulation" of the digital euro is generated and transferred. The digital euro itself is moved between bank accounts through bank account integration. This digital euro can, for example, be made available to the industry by commercial banks (e.g., by LBBW) and to the capital market by central banks (e.g., by Deutsche Bundesbank). Even though this is only a "simulation" of the digital euro, the trigger solution is still a promising approach to provide a digital euro for the industry and the capital market, although it has certain limitations, e.g., it does not enable nanopayments (Sandner et al., 2021). This applies to both

national and international application domains. However, because it requires a bank account, user identification is a requirement, as well (see Figure 2). Thus, also the trigger solution cannot be used for solutions in which users do not want to, cannot, or must not be identified. Thus, it seems unreasonable to provide and use the trigger solution for decentralized networks such as DeFi. Use in commerce or between private individuals does not seem to offer promising benefits and consequently cannot be expected on a large scale.

Stablecoin use primarily for transactions between individuals.

Stablecoins are tokens on blockchain systems that stabilize their price, e.g., through collateralization in the form of a (fiat) currency. Stablecoins are, thus, subject to low volatility. Each individual token should represent exactly one unit of currency, e.g., one US dollar. Consequently, fiat-backed stablecoins should be 100% collateralized. Therefore, legislators in some jurisdictions proposed legislation to enforce 100% collateralization by law. Under these regulatory requirements, a certain number of tokens must ultimately be backed by an equal amount of fiat currency in some sort of escrow account. The largest projects today include US dollar stablecoins from Tether, Circle, Paxos, etc. The daily transaction volume currently exceeds 100 billion US dollars, i.e., it adds up to several trillion US dollars per month (Coinmarketcap, 2021). It is known that some stablecoins have not always had 100% collateralization. Nevertheless, it can be observed that especially newer projects, e.g., from Circle and Paxos, do not shy away from regulatory requirements but, on the contrary, want to meet them. As a result, a shift from regulatory weak to regulatory strong projects can now be observed (Viehof & Bruckner, 2021b). The only currency for which there are significant stablecoins today is the US dollar. Conversely, the euro does not play a significant role as a stablecoin. There are two main reasons for this development: First, issuing a euro stablecoin is unprofitable. A stablecoin is not allowed to bear any interest, and yet, in the background, the issuer has to pay negative interest to the ECB (or on invested government bonds). It is understandable that issuers avoid euro stablecoins for this reason, as the operation of a euro stablecoin is not profitable. Further, the Markets in Crypto Assets (MiCA) regulation, a comprehensive stablecoin regulatory regime for Europe, is expected to come into force in 2023 or 2024. Accordingly, a strict stablecoin regulation can be expected (Sandner, 2020;

Sandner & Blassl, 2020). Also anticipating this regulation, issuers seem to avoid the euro for stablecoins.

Stablecoins and KYC. For tokens on public blockchain systems such as Ethereum, identification of the transaction parties is not a mandatory requirement (see Figure 2). This makes stablecoins very interesting for DeFi use cases because they can be used to offer financial services through smart contracts in a straightforward manner without KYC. It can further be observed today that US dollar stablecoins are already being used sporadically by private individuals or in commerce (e.g., paying freelancer invoices, purchasing digital services). They are also said to have considerable potential regarding lower transaction costs and higher financial inclusion.

Significant use of digital money solutions

Narrowed perspective of central and commercial banks. The previous section presented solutions for digital money, including blockchain-based money, and how they could be *conceptually* developed. However, there is no strategic timeline for the implementation of these solutions. Instead, they must be "developed" from the demand side and gain acceptance in the market. A purely theoretical presentation of the solutions from the (currently theoretical) supply side is not sufficient. It is necessary to consider (i) at which point in time which solutions may be ready from the supply side (e.g., China) and (ii) at which point in time which solutions may show or have significant demand from the demand side (e.g., US dollar stablecoins). A pure consideration of regulated solutions – developed by central banks or commercial banks – also ignores the fact that there are already US dollar-denominated stablecoin solutions that already show significant volumes, even though corresponding regulation has not yet been introduced. From the perspective of central banks and commercial banks, however, stablecoins are typically not recognized as serious alternatives, for example, for international payments, because they (still) lack regulatory clarity today – and consequently also the system-immanent requirement to identify the transaction parties. However, this should not obscure the facts and actual figures. Figure 3, therefore, shows the points in time (depending on the application domain) at which we expect a significant proportion of payment transactions to be processed with the corresponding digital money

solution. Of course, this is a rough estimate and should be interpreted with caution.

Figure 3

Expected time for significant transaction volumes per digital money solution

	Relevance for Euro	Main Driver	Retail and Merchants	Industrial Payments	Capital Market	International (With KYC)	International (Without KYC) ¹
CBDC	€	European Central Bank	≥2026	Not in focus	Not in focus	Focus unclear	Not in focus
	\$	Federal Reserve	Timeline unclear	Focus unclear	Focus unclear	Focus unclear	Focus unclear
	¥	People's Bank of China	≥2022	Not in focus	Not in focus	≥2023	Not in focus
Trigger Solution	€	Commercial Banks; Deutsche Bundesbank	Not in focus	≥2022	≥2023	Not in focus	No
Stablecoins	€	Basically no significant projects	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
	\$	Private Issuers Partly Regulated	≥2022	Not in focus	Not in focus	Not in focus	≥2019

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Notes: ¹ Includes the entire space of Decentralized Finance (DeFi) in a peer-to-peer manner

US dollar stablecoins are already used significantly; euro stablecoins quasi non-existent. US dollar stablecoins have already existed for several years. The regulatory (un)clarity and (in)transparency of these projects has been widely criticized. Nevertheless, these approaches continue to exist. Furthermore, they are growing in terms of transaction volume and size (i.e., market capitalization) at a very dynamic rate (see Figure 3). A large number of stablecoin providers have emerged. Competitive dynamics suggest that "higher-value" US dollar stablecoins with low risks are gaining market shares to the account of "lower-value" approaches that are losing market share. "Higher-value" in this context, however, does not mean "perfectly regulated," but simply "sufficiently well regulated" at the time of assessment. The European Commission is also seeking to regulate stablecoins with its proposed MiCA regulation (European Commission, 2020). However, these regulatory requirements are very strict so that providers are sometimes not interested in this "perfect regulation" for this reason but are likely to switch to the US, where "higher-quality" regulation

is sufficient. Another reason for the stablecoin momentum is the high demand from the crypto asset space (including DeFi). This, combined with the need to pay negative interest rates in the euro area on reserve assets, means that euro stablecoins with some relevance are virtually non-existent. There are only small euro stablecoin projects, which have thus far primarily not progressed beyond test stages and are thus insignificant as of today. From the perspective of national and European authorities – i.e., the ECB, the European Commission, national governments, and national finance ministries – this non-existence leads to euro stablecoins being assessed as non-existent and generally as hardly relevant. Another reason for this misconception is that recognized and well-known organizations do not use stablecoins but rather other decentralized crypto assets (including DeFi). However, more than 100 billion US dollars are moved day by day through various US dollar stablecoins. With high growth rates, sufficiently stable blockchain infrastructures, and a >95% market share of the US dollar, this misjudgment of the European authorities could have tremendous consequences, namely the (already occurring) dollarization of the DeFi sector, including the workforce in this area. It should be emphasized that this very sector which continues to grow dynamically, is by *definition* an international space without borders and binds and employs tens of thousands of young people who in turn already accept and will increasingly accept US dollar stablecoins as an "on-chain currency" for payment purposes.

Chinese central bank far ahead regarding CBDCs; central banks in Europe and the U.S. slower. On the central bank side, the ECB has been studying the phenomenon of digital currencies for years. In the summer of 2021, it has formally announced that it will study the introduction of a digital euro for two more years (ECB, 2021a). This marks the beginning of a two-year investigation phase within which the ECB's digital euro concept will be outlined. This will possibly be followed by the implementation phase. The ECB emphasizes that it is approaching this entire development with an open mind – i.e., it has not yet decided in favor of or against a digital euro. If the ECB's solution is implemented, it will not be launched before 2026 (see Figure 3). Due to the complexity of the project, and necessary regulatory adjustments, a later market launch for the ECB's digital euro is also imaginable. Studying the ECB's statements on the digital euro, the current interpretation is that the primary aim is to create a

solution for euro area citizens. This naturally includes commerce (see Figure 3). Today's banks and financial service providers are also involved; for example, for the purposes of customer service and identification, as well as money laundering checks. In this respect, the identification of transaction parties seems to be a mandatory requirement for the ECB – at least for larger payments. This allows for the interpretation that the ECB is working on a similar solution as today's credit card or payment systems such as PayPal, although in the background, it is central bank money that is being moved, rather than commercial bank money. These systems already work well today – consider payments with smartphones, for example – and such solutions are developed again by the ECB, but with a market launch in 2026 or later. A clear differentiation from such existing digital payment infrastructures has not been made so far; the unique selling proposition is not clearly communicated. This focus leads to the conclusion that the ECB is not working on a solution for companies, i.e., for businesses, industry, or the capital market. This is understandable for the industry because in the industry, bank accounts are typically the instruments for transactions. This means that commercial bank money is being used. In the industry, the ECB's digital euro would thus not play a major role. The situation is different for the capital market. Here, a digital euro provided by the central bank would be very helpful to significantly increase efficiencies (i.e., a wholesale CBDC). It is therefore surprising that the ECB does not place any importance on the capital market application domain in its digital euro and has not publicly pursued any other projects around wholesale CBDCs in recent years. The Federal Reserve in the U.S. seems to have a similar timeline but has not yet publicly committed to it. Therefore, the focus of such a digital dollar cannot be clearly identified at this time (see Figure 3). The Chinese central bank has been working on a CBDC since 2014 and has conducted large-scale testing with up to 140 million people in 2021 (Ledger Insights, 2021). Therefore, it can be assumed that the Chinese payment infrastructure could start its regular operations in 2022. Here, the focus can very roughly be analyzed as follows: China is also developing a solution for individuals and commerce (see Figure 3). This solution also appears to require the identification of transaction parties. It is conceivable that the Chinese solution is also intended for the economy, industry, and the capital market, especially since initial test projects have already been carried out around the digital yuan for the capital market: In particular, international payments of imports of goods to China are an important element as well,

because European exporters may have to connect with the Chinese payment infrastructure to pay their invoices in the future. Nevertheless, the information situation – as of today – is unclear, thus, no solid estimates can be made.

The trigger solution is driven by banks and the Deutsche Bundesbank. The trigger solution offers a simulation of the digital euro on a blockchain basis for the industry or the capital markets. The advantage of the trigger solution is that companies already have bank accounts and the adaptation effort is therefore limited. Against this background, this solution, which feels like a kind of "workaround", but can be seen as a very good solution. In particular, the trigger solution can be implemented practically in the short term and could start its regular operation in the near future. It should be emphasized that the trigger solution, with its pragmatic nature, should therefore be clearly distinguished from CBDCs, because CBDCs are currently mostly theoretical concepts and will not be implemented soon. The digital euro for the industry, i.e., the trigger solution for the industry, could start regular operations in 2022, while the trigger solution for the capital market on which the Deutsche Bundesbank is working could possibly launch in 2023.

Figure 4

Expected timing of significant volumes of different digital euro solutions

	Main Driver	Retail and Merchants	Industrial Payments	Capital Market	International (With KYC)	International (Without KYC) ¹
CBDC	European Central Bank	≥2026				
Trigger Solution	Commercial Banks; Deutsche Bundesbank		≥2022	≥2023		
Stablecoins	No significant euro stablecoins					

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Notes: ¹ Includes the entire space of Decentralized Finance (DeFi) in a peer-to-peer manner

The euro as a digital regional currency?

Future payment infrastructures in Europe. The euro is the medium for payments in a wide variety of application domains: individuals, commerce, business, industry, capital markets, international transactions. If we now study these fields and examine which variants of the digital euro could be used for each domain, we obtain interesting findings (see Figure 4).

A new form of the digital euro for individuals and commerce is not necessary unless there is a clear unique selling proposition as compared to currently existing digital payment solutions, which are efficient and widely used (e.g., PayPal). It can be expected that a digital euro for retail use cases will not be introduced until 2026 in the form of a CBDC. For individuals and retailers, who in turn pay with euros, cash, credit cards, PayPal, etc. are used as payment methods today. This field, in particular, is dominated by US providers (e.g., Visa, Mastercard, PayPal, Apple, Google). From the perspective of European sovereignty, therefore, an introduction of such a digital euro seems reasonable. Other reasons are, as already described, difficult to find so far.

The digital euro for business, industry, and the capital market will be provided by commercial and central banks. The digital euro for business, industry, and the capital market, will probably be based on today's account-based system. The trigger solution connects a blockchain system – with securities, products, services, etc. represented as tokens – with today's bank accounts. This creates a simulation of the digital euro for businesses, the industry, and the capital market. The fact that it is only a simulation should not be interpreted as a flaw because this means that the digital euro can be used by blockchain systems; and these solutions can be implemented on short notice and provide solutions for the economic participants already onboarded with banks – i.e., without re-identifying a company, which can be extremely costly in the corporate context. In this respect, while it sounds like a workaround at first, it actually is a clever move to provide a solution for the industry and capital markets that can be used quickly while minimizing administrative efforts while building on today's infrastructures. In the short term, this means that such solutions for the digital euro can go into regular operation as early as 2022 or 2023. It is already becoming apparent that such a digital euro for businesses and the

industry will be provided by commercial banks. For the capital market, it appears that such a digital euro can be provided by national central banks. The Deutsche Bundesbank, for example, has been working with Deutsche Börse on such a solution for some time now. This variant of the digital euro can therefore be a functioning solution for Germany in the short term. However, greater interest in the trigger solution by other European banks, companies, and governments is desirable.

No digital euro for international or non-identified transaction parties. For international transaction parties, such as individuals and companies located outside the euro area, no dedicated solution for the digital euro is planned. Although the digital euro could be available to these transaction partners in the future, based on current reports from the ECB, substantial use abroad does not seem desirable, also to avoid affecting capital flows and exchange rates. Of course, the ECB's digital euro, as planned for individuals and commerce, can in principle also be used internationally, given that the transaction parties can be identified and the ECB permits its use for foreign transaction partners. Trigger solutions for businesses and the capital market could, in theory, also be used by foreign companies or developed by these institutions as well. But a dedicated solution for international transaction processes outside the euro area is currently not planned by any European entity. This may sound acceptable at first glance. And yet, industries exporting goods or services outside the euro area, or importing into the euro area, are significant pillars of the European economy. The crypto assets sector (including DeFi), which has been growing for years, will also (have to) function without a digital euro. For these aforementioned areas with a clearly international profile – areas that are already of significant importance today and, moreover, continue to grow – the digital euro will therefore not be able to play a relevant role. Other solutions such as a Chinese state infrastructure or US dollar stablecoins could therefore close this gap that exists for international payments – with both identified and unidentified transaction partners. If this scenario would indeed occur, the euro could, in extreme cases, become a European regional currency. The focus only lies on citizens and companies in the euro area. The focus, therefore, does not lie on citizens or companies outside the euro area who could imagine paying in euros or would be happy to do so if respective solutions would be provided. It is interesting to note that none of the aforementioned players or institutions have at least the ambition or are

considering making the euro, with the help of variants of the digital euro, a currency with a supraregional profile.

Digital money is geopolitics. Currencies will become even more digital in the coming years. There are good reasons for introducing the digital euro, the digital dollar, or the digital yuan. It is about efficiencies in business processes and international transactions. Currency areas that are able to digitize their currency may be able to expand their global importance – because the digitization of the currency is used as a geopolitical tool. Currency areas that fail to recognize the digitization of the currency could lose importance.

Gap between China on the one hand and Europe and the U.S. on the other. China is in the process of putting a state-initiated infrastructure for the digital yuan into operation. In Europe and the U.S., such a strategic project for the digital transformation of their currencies cannot be observed. Instead, institutions in Europe and the U.S. are struggling to emulate Chinese speed in terms of blockchain infrastructures – as the technical implementation gap between China on the one hand and Europe and the U.S. on the other has now been recognized.

China was and is successful with "state-initiated" networks. China is continuing its tradition of setting up IT systems: State-initiated rather than organic. Under state control, rather than decentralized and anonymous. Integrated into the global economy where it makes sense. China's "political philosophy" is thus reflected in the structuring and the architecture of IT systems.

U.S. and Europe have been successful with applications based on open and decentralized networks. China's efforts around a digital yuan could be worth emulating for the euro and the US dollar, although not all dimensions of the digital yuan should serve as a role model. This does not mean that it would be useful or feasible from a European or US perspective. The reason is that in Europe and the US, IT systems tend to emerge openly, instead of "state-initiated" but organically and driven by private initiatives. US companies, in particular, have succeeded around this philosophy, e.g., considering networks and solutions built by corporations such as Apple, Alphabet, or Meta, which reach billions of people. But the central element is

the development of such solutions based on open networks and an open IT infrastructure – the decentralized internet. Crypto assets such as Ether enable such open and decentralized networks. Perhaps this is another reason why stablecoins launched on such open and decentralized networks are growing in such a rapid and dynamic manner.

Stablecoins are ultimately a solution for the digital US dollar. This leads to the consideration that the gap between China on the one hand and Europe and the US on the other could possibly be addressed if Europe and the US recalled a development that had led to the construction of the Internet in the last 20 years: the recognition of open and decentralized networks. According to this logic, the US dollar as a stablecoin can be issued centrally but is technically running on decentralized networks. As outlined above, this already works today. However, the perspective of open networks – namely crypto assets – is still negatively connotated. In Europe and the US, it should be questioned whether this negative sentiment may be a barrier for stablecoins not being widely recognized for what they are: a technically solid and well-working variant of digital blockchain-based money. The US dollar is already digital and blockchain based, even if the regulation of stablecoins needs to be implemented or adjusted. If the US, in a geopolitical sense, recognizes these potentials, the gap between the US and China will be addressed. However, a gap for the euro area remains. A gap that may not be closed in time.

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¹ Source: Liao and Caramichael (2022).