The Race for Supremacy in the Digital Currency Landscape – Positioning Central Bank Digital Currencies in a World with Stablecoins and Commercial Bank Money Tokens

By

Andrej Planinsek

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Abstract

As the development of the digital currency landscape is happening at an unprecedented pace, this paper aims to review the latest literature connected with central bank digital currencies and bring it into context by examining the big picture–how central bank digital currencies fit into the world of digital money. It aims to become a single source of information on the technical design, advantages, and disadvantages of their issuance, while also offering a brief overview of alternatives like stablecoins and commercial bank money tokens. It concludes by examining the interactions between new forms of money, highlighting that coexistence is possible but heavily dependent on regulation.

Keywords: blockchain, central bank digital currencies, commercial bank money tokens, deposit tokens, digital currencies, digital money, distributed ledger technology, stablecoins, tokenised deposits

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List of Abbreviations

- AML/CFT Anti-money laundering and countering the financing of terrorism
- API Application Programming Interface
- ART Asset-referenced token
- BCB Bank of Brazil (Banco Central do Brasil)
- BIS Bank of International Settlements
- CBDC Central Bank Digital Currency
- CBMT Commercial Bank Money Token
- CFTC Commodity Futures Trading Commission
- DLT Distributed ledger technology
- EBA European Banking Authority
- ECB European Central Bank
- EDPS European Data Protection Supervisor
- EMT E-money token
- ESCB European System of Central Banks
- EU European Union
- EUBOF European Union Blockchain Observatory & Forum

FDIC – Federal Deposit Insurance Corporation

FINMA - Swiss Financial Market Supervisory Authority

HKMA – Hong Kong Monetary Authority

I-CBDC - Indirect Central Bank Digital Currency

IMF -- International Monetary Fund

KYC - Know-your-customer

M-CBDC-Multi-CBDC

MiCA - Markets in Crypto-Assets Regulation

NBER - National Bureau of Economic Research

P2P-Peer-to-peer

PRC – People's Republic of China

PSP – Payment service provider

R-CBDC - Retail Central Bank Digital Currency

RLN - Regulated liability network

RTGS - Real-Time Gross Settlement

S-CBDC – Synthetic Central Bank Digital Currency

SBA - Swiss Bankers Association

SEPA - Single Euro Payments Area

SPV – Special-purpose vehicle

SVB – Silicon Valley Bank

TFEU – Treaty on the Functioning of the European Union

TIPS - TARGET Instant Payment System

UK – United Kingdom

US - United States

USDC – USD Coin

USDT-Tether

UST-TerraUSD

W-CBDC – Wholesale Central Bank Digital Currency

Introduction

The digital payments landscape has undergone massive changes since the minting of the first cryptocurrency. Several new innovations called digital currencies have emerged, categorised into Central Bank Digital Currencies (CBDCs)-a form of public money-and Commercial Bank Money Tokens (CBMTs) and stablecoins-a form of private money. Stablecoins were invented to fill the gap in the cryptocurrency market where investors were looking for stable assets to decrease their exposure to volatility, and have since taken centre stage (Yadav, Fernandez da Ponte, and Davine Kim 2023). In response, traditional markets started developing CBDCs¹. A likely reason for the acceleration of CBDC projects came in 2019 when Facebook (now Meta Platforms Inc.) announced a plan to launch Libra, a private digital currency backed by various financial assets. Considering a company as big as Meta could get an enormous share of the payments market were it to release Libra, the proposal presented a threat to central banks' role in ensuring monetary sovereignty and financial stability (Diez de los Rios and Zhu 2020). One motive for introducing CBDCs is for central banks to retain control in a world where private sector innovations are causing its erosion (De Bode, Higginson, and Niederkorn 2021). The CBDC proposition in turn opened a new conflict between central and commercial banks, as the banks fear losing the core of their business model (Wolcott 2022).

To aid in navigating the resulting debates and in keeping up with rapid developments in the CBDC landscape, this paper aims to concisely explain CBDCs while referring to the latest and the most important papers. It is worth emphasising that the CBDC literature is full of inconsistent terminology with varying opinions on the future of CBDCs. This paper seeks to provide consistent terminology and summarize the main arguments in the CBDC debate.

¹ Although many insiders from the industry believe this is the case, the Bank of International Settlements (BIS) seems to deny the claim that the development of CBDCs is a response to stablecoins like Libra (Nelson 2020)

Although the focus is on CBDCs, the paper acknowledges the existence of stablecoins and CBMTs since it concludes with an overview of their potential coexistence with CBDCs and theorises about the future of money.

I proceed by introducing the definition, technical design, advantages, and disadvantages of CBDCs–something which has already been discussed in an academic context. The last section–which I see as the main contribution to the digital currency dialogue–will briefly explore interactions between CBDCs and new private forms of money.

1. Central Bank Digital Currencies

1.1 Definition

As defined by a BIS report, CBDCs are a digital form of central bank money, denominated in the national unit of account, and a direct liability of the issuing central bank. Currently, central banks issue two forms of money, namely fiat (or cash) which can be used by anyone and is peer-to-peer (P2P), and electronic central bank deposits (or reserves) which are only available to select financial institutions. They also offer infrastructure to support the creation of private money, an example of which is commercial bank money. CBDCs would, therefore, be a third form of money issued by the central bank (Bank of International Settlements 2020b), or the second form (next to physical money) available to the public. Because it would be a liability of the central banks like the Federal Reserve, it would not require deposit insurance like the one provided in the United States (US) by the Federal Deposit Insurance Corporation (FDIC). Without liquidity or credit risks attached, it would become the safest digital asset available (Board of Governors at the Federal Reserve System 2022).

Although the term CBDC contains the phrase "digital currency", it should not be confused with cryptocurrencies (or crypto assets) like Bitcoin which cannot perform the basic functions of money–store of value, medium of exchange, and unit of account (Bank of England 2020).

As Giaglis et al. note in a report prepared by the European Union Blockchain Observatory & Forum (EUBOF), central banks are still deciding to whom CBDCs should be available, which is why they are categorised into two forms in terms of availability: "retail" CBDC (R-CBDC) and "wholesale" CBDC (W-CBDC). The former is meant to fulfil all the necessary functions of money so that it can be used by everyone, whereas the latter is supposed to be used only by approved financial institutions and commercial banks to facilitate payments (Giaglis et al.

2021), closely resembling the current settlement systems used between banks. When speaking about CBDCs in general, we are mostly referring to R-CBDCs considering they are the ones attracting most attention from central banks around the world (Lavayssière and Prat 2022), which is why they will remain the core focus throughout the rest of the paper under the CBDC abbreviation.

1.2 Technical Design

Visualised as a cube, Figure 1 illustrates the various design options for a digital euro (Giaglis et al. 2021).



Figure 1: CBDC Design Space (Giaglis et al. 2021)

1.2.1 Management or Operating Model

The first choice is the decision of who would be managing the underlying infrastructure. The authors differentiate between different CBDC models, best summarised by Auer and Böhme whom Giaglis et al. refer to. As the name implies, CBDCs are always issued by the central bank. Under the "centralist" CBDC model, a term coined by Giaglis et al. (also called "direct" or "one-/single-tier" by Auer and Böhme, and "unilateral" by Soderberg), customers would have an account with the central bank against whom they hold a claim. Despite its simplicity originating from the elimination of intermediaries, this option is problematic because central

banks would have to take on a more active role. Central banks lack the means to conduct customer-facing activities like identity verification and do not have the technical capacity to build and maintain networks the size of today's credit cards. In contrast, under a "federalist" CBDC model, conceptualised by Giaglis et al., some (or even all tasks) would be delegated to payment service providers (PSPs)². Under this concept, we can further differentiate between a "hybrid" CBDC (also called "intermediated" CBDC by Soderberg) and an "indirect" CBDC (I-CBDC), sometimes referred to as "synthetic" CBDC (S-CBDC) or "two-/multi-tier" CBDC. The main difference is that with the former, the claim remains on the central banks, whereas with S-CBDCs the claim shifts onto the intermediary like a PSP, exposing the customer to default risks (Auer and Böhme 2020, Giaglis et al. 2021, Soderberg et al. 2022).

The S-CBDC model is a big cause of confusion as it is not even a CBDC but, as Anthony and Mitchel write, a stablecoin with reserves held in an interest-earning central bank master account (Anthony and Michel 2023). Because it does not conform with the CBDC framework, BIS defines S-CBDCs as narrow-bank money with the definition originating in the full-reserve banking theory (Bank of International Settlements 2020b).

Figure 2 aims to capture different CBDC operating models while showing existing synonyms within the same box, whereas Figure 3 shows the differences between S-CBDCs, hybrid CBDCs, and direct CBDCs. As the development of CBDCs progresses, it is likely that we are going to end up with one standardised model.

² Third-party financial institutions providing businesses and merchants with different services (European Merchant Bank n.d.)



Figure 2: CBDC Operating Models with Existing Synonyms (adapted from Auer and Böhme

2020, Giaglis et al. 2021, Soderberg 2022)



Figure 3: Overview of CBDC Operating Models (Auer and Böhme 2020)

1.2.2 Infrastructure

The second choice comes down to the decision of what kind of underlying infrastructure should be the backbone of our CBDC system. It could be based on the already-existing Real Time Gross Settlement System (RTGS)³ of the EU called TARGET Instant Payment Settlement (TIPS). It is a standardised and harmonised service working 24/7/365, based on the Single Euro

³ Fund transfer system used between banks for instant high-value transactions (European Merchant Bank n.d.)

Payments Area (SEPA)⁴ Instant Credit Transfer scheme, and offers settlement in central bank money (European Central Bank 2019).

TIPS makes sense as an underlying infrastructure in an account-based E-Own scheme. In contrast, if a token-based infrastructure is decided upon, TIPS would prove incompatible with different data structures and insufficient in bridging various blockchain solutions (Giaglis et al. 2021).

Another possibility would be building the CBDC system on top of a distributed ledger technology (DLT), which Krause et al. from the World Bank define as an approach to recording and sharing data across multiple data stores (or ledgers), maintained and controlled by a distributed network of computer servers called nodes. The origins of DLT are in the P2P technologies (e.g., email) enabled by the invention of the internet. Blockchain, although often used interchangeably with DLT, is a type of DLT which uses algorithmic and cryptographic methods to create and verify data structures in the form of a chain of transaction blocks, functioning as a ledger. New additions to this chain can be added by nodes which create new blocks of data containing transaction records, which are then shared across the entire network. Participants then collectively determine the validity of the block as per the algorithmic validation method called consensus mechanism. After validation, each network member acquires an identical copy of the ledger with its entire history (Krause, Natarajan, and Gradstein 2017).

A CBDC deployed on a DLT/blockchain would, regardless of an E-Own scheme, enable interoperability with potential blockchain solutions. This means that applications developed in the open blockchain space could be run on a CBDC, achieving programmability. However, a

⁴ Initiative streamlining euro transactions in EU member countries, saving time and costs (European Merchant Bank n.d.)

DLT/blockchain system is not necessarily more resilient than the already-existing TIPS and comes with added costs of deployment, as well as the lengthy procedure of adjusting new infrastructure to the EU's regulatory landscape (Giaglis et al. 2021).

1.2.3 Evidence of Ownership (E-Own)

Unlike cash where evidence of ownership not recorded by the central bank as possession serves as sufficient proof, CBDC will have to rely either on a token- or an account-based system of ownership and transaction authorization considering its digital nature. The current financial system is heavily reliant on individual identities which are the prerequisite of having any bank account, giving birth to the notion of "I am, therefore I own". A CBDC utilising this approach would not bring many changes since commercial banks already operate on such a model, which is why it is considered a reliable, simple, and interoperable choice (Giaglis et al. 2021).

In contrast, a token-based approach is popular in the open blockchain space as it can replicate a lot of benefits of fiat money–ownership of an asset does not have to be tied to someone's identity. This is possible by utilising public and private keys–a method of cryptography used to produce and verify digital signatures. Ownership of the private key gives full access to the asset, building the notion of "I know, therefore I own" (Giaglis et al. 2021). Auer and Böhme emphasise that this option would offer good privacy by default but highlight that the model is incompatible with existing anti-money laundering and countering the financing of terrorism (AML/CFT) regulations and know-your-customer (KYC)⁵ frameworks, meaning the tasks of law enforcement authorities like tracking illicit money flows and identifying suspects would become more difficult (Auer and Böhme 2020).

⁵ Standard guideline for financial industry service providers on confirming their client's identity and identifying possible risks for continuing business relationships (European Merchant Bank n.d.)

1.3 Advantages

The introduction of CBDCs has many benefits but as the purpose of the paper is not to capture all of them nor dive deep into the characteristics of each one, I have collected six which I deem most important.

1.3.1 Improving Cross-Border Payments⁶

Cross-border payments are fund transfers where the sender and recipient are located in different jurisdictions. They are slower, more costly, and less transparent, characteristics referred to as frictions by the BIS, summarised in Figure 4 (Bank of International Settlements 2020a).



Figure 4: Challenges and Frictions in Cross-Border Payments (Bank of International

Settlements 2020a)

⁶ Although the cross-border payment topic is mostly connected with benefits of W-CBDCs, the same can be achieved by interlinking domestic R-CBDCs systems (Auer, Haene, and Holden 2021)

When comparing existing measures designed to tackle the shortcomings of cross-border payments, CBDCs benefit from a perspective of a "clean slate". As they are being designed from scratch, central banks are incorporating the international dimension into the concepts and pilot projects. This has led to the proposals of three multi-CBDC (M-CBDC) models as presented in Figure 5. Model 1 proposes interoperability of separate CBDC systems by adhering to common international standards, Model 2 suggests additional interlinkages (e.g., a common clearing mechanism which would reduce the number of relationships by linking systems through settlement accounts), and finally, Model 3 considers a single CBDC system across all jurisdictions–all with a single set of rules, a single set of participants, and a single technical system. Regardless of which one is decided upon, CBDCs would reduce frictions in one way or another (Bank of International Settlements 2021a).



Figure 5: CBDC Interoperability via M-CBDC Arrangements (Auer, Haene, and Holden

2021)

1.3.2 Promoting Competition and Diversity

In the Bank of Canada staff discussion paper, Usher et al. refer to the modern financial system as one with worsening competition, with financial institutions, card networks, and technology platforms exerting their market dominance. In Canada (and in other jurisdictions), this leads to a monthly charge for maintaining a bank account together with little interest earned on deposits. With the issuance of a CBDC, commercial banks would have to start offering value above that of a CBDC which would lead to increased competition in the retail deposit market (Usher et al. 2021). A similar point is brought up by BIS which gives an example of payment systems infrastructure as benefiting from strong network effects. These give rise to monopolies which work against the interests of society by raising barriers to entry as well as costs. A CBDC could, on the other hand, break up fragmented proprietary systems and allow for low-cost transfers between them (Bank of England 2020).

1.3.3 Facilitating Monetary Policy Implementation

Researchers of the National Bureau of Economic Research (NBER) point out that CBDCs could facilitate more effective implementation of monetary policy. This is due to two reasons—the first being the end of the nominal zero lower bound. Throughout history, central banks were unable to implement negative nominal interest rates due to the availability of cash, a zero nominal interest rate instrument, the positions of which individuals could always increase. With new tools like CBDCs and trends like physical cash in decline, central banks could pre-announce a rate by which they would then decrease the amount from individuals' wallets, essentially an effective way of implementing negative nominal interest rates. In case fiat money ends up coexisting with CBDCs, a limit would have to be imposed as to how low central banks could drive the interest rate (Allen et al. 2020). The negative rate could, theoretically, disincentivise households from hoarding savings and encourage spending, thereby increasing

consumption and benefiting the economy in times of need when people are reluctant to spend. This is referred to by Copic and Franke from cLabs as increasing the velocity of money (Copic and Franke 2020).

The second way CBDCs could help with monetary policy implementation would be through helicopter drops or lump sum transfers to eligible individuals in need. This would be easy to implement in an economy where everyone has an official electronic wallet into which governments could transfer benefits. However, coordination would be required to prevent double-/multiple-dipping in case of a hybrid CBDC where citizens could have multiple wallets held at various financial institutions (Allen et al. 2020).

1.3.4 Enabling Programmability of Money and Payments

Although heavily interlinked with the previous chapter, it is worth noting that CBDCs are also opening doors to another technological development of turning money "smart". Here, we must distinguish between two concepts often used interchangeably, namely programmable money and programmable payments. European Data Protection Supervisor (EDPS) report written by Leucci et al. defines programmable money as a CBDC with built-in rules, imposing restrictions on its usage. This would range from imposing spending conditions like restricting or disincentivising the holder from purchasing certain goods to making money expirable (Leucci, Attoresi, and Lareo 2023). Expiring money would achieve the same as imposing a negative nominal interest rate mentioned in the previous category–increasing the velocity of money. Although the proposal of expiring money is not new⁷, Copic and Franke argue that now is the first time in history that technology enables us to create an effective "Gesell currency" (Copic and Franke 2020). The second concept, programmable payments, is defined by Leucci et al. as

⁷ Its origins date to 1916 when a German economist Silvio Gesell introduced the idea of stamped money to solve the conflict between money's role as a store of value versus that of a medium of exchange (Copic and Franke 2020)

automatic transfers of money when pre-determined conditions are met. An example is a machine-to-machine payment scenario where money is automatically sent once a package is delivered to a store (Leucci, Attoresi, and Lareo 2023).

Although programmability could be achieved both through a DLT/blockchain and a traditional RTGS/TIPS CBDC infrastructure, the first would entail the use of smart contracts⁸, whereas the second would require the use of something like application programming interfaces (APIs)⁹ which the RTGS/TIPS operator would have to expose to external participants (Wong and Maniff 2020).

1.3.5 Strengthening Financial Supervision

Department of Economic and Social Affairs at the United Nations (UN) suggests that the introduction of CBDCs could minimize the risk of counterfeiting, money laundering, and tax evasion (United Nations 2022). As Scarcella explains, the desire for digital payments can already be seen from the perspective of tax authorities who have been encouraging (and sometimes mandating) the use of traceable payment methods to combat the use of cash, perceived as a facilitator of shadow economies. Tax administrations prefer traceable payments not only because they provide data, making it possible to tighten their controls, but also to increase their efficiency in tax collection, administration, and processing. Writing from the perspective of the EU, the author highlights that it would be wise to give CBDCs the status of legal tender¹⁰ for it to be successfully included in national tax policies. If not, EU member

⁸ Automatically-executing programs written on a distributed ledger, theoretically replacing any instruction executed by a computer (Krause, Natarajan, and Gradstein 2017)

⁹ Software intermediary enabling applications to communicate, improving speed and automation (European Merchant Bank n.d.)

¹⁰ The Treaty of the Functioning of the European Union (TFEU) and the Statute of the European System of Central Banks (ESCB) recognize that only banknotes issued by central banks have status of legal tender (Scarcella 2021)

states could be accused of interfering with monetary policies when taking measures limiting the use of the only form of legal tender–fiat money (Scarcella 2021).

However, it is worth noting that the strength of financial supervision is heavily dependent on the degree of anonymity of CBDCs. Wang studied the implications of tax evasion for the optimal design of CBDCs and concluded that if they are designed to offer less privacy than cash, they will likely decrease tax evasion. In contrast, if introduced as cash-like (high anonymity but a low interest rate), output from agents who report their income truthfully and those evading taxes would decrease. Lastly, if designed as deposit-like (low anonymity but a high interest rate), output and aggregate welfare in society should increase (Wang 2020).

1.3.6 Encouraging Financial Inclusion

Financial inclusion topic has been promoted as an important benefit of CBDCs by central banks in developing countries, where cash has been playing a big role in making sure the underbanked are part of the economy. However, with the future of fiat in question (seen through its declining use and closure of physical bank branches due to digitization) the same risk group could gradually become left out–an addition to the 1.7 billion already outside the formal financial system (Auer et al. 2022).

To show how CBDCs could boost financial inclusion, an International Monetary Fund (IMF) researcher created a model which incorporates financial inclusion as a factor. Especially important for low-income and emerging market economies, it could be increased through two important channels. First, by assuming CBDCs are introduced as S-CBDCs with commercial banks doing the onboarding and opening of wallets, Tan expects CBDCs to incentivise the unbanked to open bank accounts to access their wallets, offsetting the potential outflow from deposit accounts to CBDC accounts from already-existing users. Second, the data from CBDC payments would help borrowers establish credit history (called credit building), thereby

decreasing credit-risk information asymmetry for lending. The second channel should greatly increase the surplus in lending and increase overall welfare, whereas the first channel would decrease the risk of disintermediation, considered one of the biggest disadvantages of CBDCs (Tan 2023).

1.4 Disadvantages

It is worth noting that the topic of potential CBDC disadvantages is a heavily politicised one with misunderstandings of concepts present throughout the media landscape. I have collected the three most common ones, together with possible methods of decreasing their negative impact.

1.4.1 Decreasing Financial Stability

Giaglis et al. explain that CBDCs could pose a threat to the financial sector in two scenarios. The first is the issue of disintermediation of financial institutions in calm times, and the second is an increased possibility of bank runs in times of crises (Giaglis et al. 2021).

The first problem is introduced in a House of Lords session report explaining disintermediation as a shift of money out of people's bank accounts into CBDC wallets, reducing bank balance sheets but increasing that of the central bank. This would have negative implications on the stability of the financial system, availability of credit, and monetary policy. Banks would not only have to resort to expensive practices like wholesale funding but also be significantly more exposed to market conditions due to lesser diversification. However, the outcome depends on how attractive CBDCs would be to hold and use (House of Lords 2022), which Giaglis et al. term as substitutability with other forms of money (Giaglis et al. 2021).

The second issue refers to the fact that in times of financial distress, households and businesses tend to convert their deposits into safer assets. CBDCs would likely be viewed as a safer asset than commercial bank money considering the chance of a central bank defaulting is lower than individual financial institutions (Giaglis et al. 2021). A BIS report also points out that simply converting bank deposits into CBDCs at low transaction costs, an easy task done with a push of a button, could greatly increase the speed and severity of a bank run. This can already be

seen when comparing bank runs prior to the invention of internet banking¹¹ (Bank of International Settlements 2021b).

To counter these risks, central banks are considering measures like imposing hard limits on transfers or holdings of CBDCs. BIS calls these quantity limits, categorised as either flow-based with restrictions on the amount of CBDCs transferred within a certain time period, or stock-based meaning a limit on the amount of CBDCs owned by individuals (Bank of International Settlements 2021b). The ECB has been considering a limit of 3,000 euros per capita which should be enough to cover the normal payment function as per the average monthly net income of EU households (Bindseil 2020). In contrast, the Bank of England and HM Treasury propose an initial limit between 10,000 and 20,000 pounds per individual¹² (Bank of England and HM Treasury 2023).

The diagram in Figure 6 is a visualization of how CBDCs could cause the disintermediation of commercial banks. Its authors, Giaglis et al., predict various commercial bank responses and show the possible solutions to mitigate the threat of financial instability (Giaglis et al. 2021).

¹¹ It took failed Japanese banks a week for their deposits to fall by 10% in the Japanese financial crisis of the 1990s, in contrast to the Greek banking crisis (fuelled by concerns over "Grexit") when deposits fell by over 30% between 2010 and 2012 (Bank of International Settlements 2021b)

¹² Discussions are also taking place about expanding digital pound's access to businesses meaning the proposed limit would have to be significantly higher considering the size of corporate balance sheets (Bank of England and HM Treasury 2023)



Figure 6: CBDC Financial Stability Risks (Giaglis et al. 2021).

1.4.2 Increasing Cybersecurity Risks

Threats to existing payment infrastructures are a long-known phenomenon, originating from state or non-state actors. An entire financial infrastructure built on a CBDC network could potentially, as claimed by the Board of Governors of the Federal Reserve System, open more entry points through which bad actors could achieve disruption (Board of Governors at the Federal Reserve System 2022). The House of Lords session report categorised these as two clear but different security risks with the first being the risk to individual CBDC accounts managed by the private sector. The second, however, would be the security risk to the CBDC system itself as a piece of critical national infrastructure, targeted by nation-states or criminal actors. Regardless of the design, complete security can never be achieved meaning the system would have to be designed as adaptable to the constantly emerging security threats (House of Lords 2022).

1.4.3 Reducing Privacy

From October 12th, 2020, to January 12th, 2021, the ECB ran a public consultation aimed at collecting views on the benefits and challenges of a digital euro. It observed that privacy is one of the biggest concerns regarding CBDCs expressed by citizens and professionals alike. Irrespective of this preference, the respondents still supported identification measures to prevent illicit activities (European Central Bank 2021).

It is just because of these measures, aimed at preventing large-scale criminal activity, that CBDCs will likely never be able to support anonymous transactions to the degree that physical money can. That is why there are widespread concerns about the potential rise of state surveillance, with 32% of Redfield & Wilton Strategies survey respondents in the United Kingdom (UK) believing that the Bank of England is interested in issuing CBDCs only to monitor how its citizens spend their money. However, the reality is that even countries with a lower democratic standing like the People's Republic of China (PRC) are actively implementing measures to preserve user privacy to some degree by designing wallets of five different grades, with low-grade used for low-value transactions and higher transactional privacy, as explained by professor Prasad to the Economic Affairs Committee (House of Lords 2022).

Although there is a trade-off between privacy and legal compliance with AML/CFT, there are several technologies available for achieving this balance. A lot of it depends on the E-Own scheme with a token-based system having the possibility of attaining transaction privacy properties of cash, unlike an account-based scheme like DLT where achieving privacy is a challenge (Grothoff and Moser 2021).

3. New Forms of Private Money

Before exploring interactions between CBDCs on one side, and CBMTs together with stablecoins on the other, we first have to define the latter two in a similar way as done with CBDCs. Whereas CBDCs represent the second form of public money (the first being banknotes and coins), stablecoins and CBMTs fall under a new form of private money.

3.1 Stablecoins

The first stablecoin called BitUSD was released on July 21st, 2014, but many more have emerged (and collapsed) since (Chalopin and Scott 2022). As summarised by Ferreira, there is no agreed-upon definition besides promising to maintain a stable value in relation to an asset, currency, or pool of such instruments. Despite the term "stable", the Swiss Financial Market Supervisory Authority (FINMA) points out that stablecoins should not be considered safe and interprets the term as a marketing ploy, a view matched by the European Central Bank (ECB) which suggests using a term that would shift the focus away from the promise of stability. The latter, however, depends on various characteristics of stablecoins like stabilization mechanisms, financial preconditions, trading volume, and issuer's reliability (Ferreira 2021). While the earliest classifications distinguished only between algorithmic and asset-backed stablecoins, the more advanced taxonomy built by Bullman et al. from a policymaking perspective incorporated the most important promise, stability, to identify four different classes, summarised as three for the sake of simplicity: tokenised funds, collateralised stablecoins (further divided into on-/off-chain), and algorithmic stablecoins. The latter are not fully backed and work by software matching supply with demand, whereas collateralised stablecoins are backed only to the extent that the volatility of collateral against which they are issued (e.g., gold) is catered for by the margins applied. Lastly, tokenised funds represent existing currency units (e.g., US dollar) and may be truly stable as long as the entity backing them enjoys trust from its clients (Bullmann, Klemm, and Pinna 2019).

Yadav et al. illustrate how promises of stablecoins issuers have been broken on several occasions with devastating consequences. A prominent algorithmic stablecoin called TerraUSD (UST), totalling almost 18 billion US dollars in issuance, collapsed in a matter of days in May 2022 by entering a "death spiral" after the algorithm failed to maintain the peg under heavy selling pressure. Less than a year later, Silicon Valley Bank (SVB) collapsed after depositors withdrew 40 billion US dollars from the bank after rumours that the bank could go bankrupt spread through social media. People were shocked to find out that the entity behind the world's second-largest tokenised fund, Circle Internet Financial, held 3.3 billion US dollars with SVB. This resulted in a panic and USD Coin (USDC) failed to maintain the 1:1 peg and fell to 0.87 USD before returning to normal (Yadav, Fernandez da Ponte, and Davine Kim 2023). However, there is another tokenised fund which remains at the centre of controversies-Tether (USDT). The issuing company, Tether Operations Limited (owned by iFinex Inc.), was caught in a lie about its reserves being fully backed for which New York's attorney general fined the firm 18.5 million US dollars, followed by the Commodity Futures Trading Commission (CFTC) fine of 41 million US dollars after finding that between 2016 and 2018, Tether held sufficient reserves only a quarter of the time (Yaffe-Bellany 2022).

3.2 Commercial Bank Money Tokens

A paper released by Die Deutsche Kreditwirtschaft (DDK)¹³ writes that CBMTs (sometimes called tokenised deposits, deposit tokens, or tokenised commercial bank money) are the response of private credit institutions to CBDCs. Although commercial banks support the idea of CBDCs, they are concerned about their disintermediation which is most likely what they mean by warning about discrimination against other forms of money. Instead, they are proposing an ecosystem ¹⁴ where different forms of money, namely CBDCs, regulated stablecoins, and their own CBMTs defined as digital versions of scriptural money, could coexist (Bouchetob 2021).

The value proposition of CBMTs is to ensure the stability of the two-tier financial system which CBDCs, based on the design choices discussed by the ECB, undermine, as well as to satisfy the need of the industry for the integration of payments transactions regarding process automation utilising blockchain (Holeczek 2023). An important distinction from stablecoins is mentioned in a House Committee on Financial Services hearing by Robert Morgan of USDF Consortium¹⁵ who emphasised that tokenised deposits are not meant to connect to the crypto ecosystem and are only designed to improve traditional banking services. They will not trade on cryptocurrency exchanges and will remain a liability of insured depository institutions like all bank deposits (House Committee on Financial Services 2023).

Despite not being available to the public, the blockchain business unit Onyx of JPMorgan Chase writes that CBMTs can become a fundamental part of the digital currency landscape and further drive the development of the tokenization asset ecosystem. It is this compliance with

¹³ Joint committee operated by the central associations of the German banking industry (Bouchetob 2021)

¹⁴ One of the proposed environments is the regulated liability network (RLN) envisioned by McLaughlin from Citigroup (McLaughlin et al. 2022)

¹⁵ Association of insured depository institutions furthering the adoption of bank-minted tokenised deposits (House Committee on Financial Services 2023)

the regulatory frameworks mentioned by USDF that makes them well-positioned to become a stabilising anchor while existing in symbiosis with CBDCs built atop a DLT/blockchain infrastructure (Toprak et al. 2023). The Swiss Bankers Association (SBA) writes about how CBMTs could work in practice. So far, we have examples of banks like JPMorgan Chase releasing their own proprietary deposit tokens, but they could also be designed to be more interoperable. The latter is an example of what SBA calls a "coloured token" as each commercial bank can determine its technological basis as well as which assets to back it by, whereas an alternative would be a "joint token" released by a special-purpose vehicle (SPV), owned jointly by commercial banks. The last option would be a "standardised token" released by each commercial bank but with rigid technical norms. A "joint token" would be preferred as it would allow for a degree of freedom in money creation while strengthening CBMT's character as a public good (Swiss Bankers Association 2023).

Figure 7 illustrates the various design options for CBMTs whereas Figure 8 provides an overview of the entire digital currency landscape and how each form relates to various criteria.



 "Coloured Token": Each commercial bank issues its own DT and is free to determine its technological basis and the underlying reserves. The only common feature in this scenario is that all issuers are regulated.

Figure 7: CBMT Design Choices (Swiss Bankers Association 2023)

	Ext. Stablecoins	Retail CBDCs	6	8	%			
Issuers	Unregulated, unsupervised companies	Central banks	(Multiple) individual banks, but with economic and technical standardisation	Consortium of commercial banks via SPV	(Multiple) individual banks			
Potential use cases								
Digital asset transactions								
Payments								
CHF DLT-financial ecosystem								
Client protection								
Stability/ convertibility								
Market penetration/ network effects								
Private CHF money creation								
Not possible Theoretically possible, but practical implementation unreasonably complex or unclear Possible								



4. Interactions between Central Bank Digital Currencies, Stablecoins, and Commercial Bank Money Tokens

This section will dive deeper into the interactions between all forms of digital money. The first part reaffirms four different paradigms for the future envisioned by de Lima et al. from the management consulting firm Oliver Wyman. The second part provides an overview of the current state and explains why there is no fifth paradigm–one I term "continuation of the status quo".

4.1 Addressing the Four Visions for the Future of Digital Money

Figure 9 is a three-dimensional visualisation of future scenarios in the digital currency landscape, followed by an expanded two-dimensional version in Figure 10.



Figure 9: Visualisation of Future Scenarios (de Lima, Ekberg, and J. Elliott 2023)



Figure 10: Visualisation of Four Visions for the Future of Digital Money (de Lima, Ekberg, and J. Elliott 2023)

The four paradigms are based on the types of actors currently building solutions in the digital currency space. In the first paradigm, the evolution of traditional finance (TradFi) takes place. The future of commercial banks is secured by successfully demonstrating the value of innovations like CBMTs, as seen through a rising number of proposals¹⁶ highlighting the benefits of tokenised assets and deposits. Although commercial banks dominate via innovation, regulators strengthen their position by slowing down their competitors–digital intermediaries. The next vision named "sovereign expansion" is where CBDCs are introduced, a likely reality in the short- to medium-term. In this paradigm, central banks successfully capture a big part of

¹⁶ See Holeczek 2023, Toprak et al. 2023, and Swiss Bankers Association 2023

payment flows, enabling them to start utilising various CBDC potentials mentioned in the previous chapters. As individual CBDC holding limits are in effect¹⁷, this development does not completely disintermediate commercial banks but forces them to adapt their business models. The second-last vision refers to the rise of digital intermediaries (or digital natives) like big tech companies which include stablecoin issuers. This happens by expanding their financial services and overtaking TradFi which struggles to innovate and pivot new business models. The likelihood of this vision is dependent on regulatory compliance and carving key areas for differentiation from the CBDC and CBMT alternatives which is still taking place. Unlike all the former, the last paradigm is a revolution of the financial system which now collaborates on new cross-country platforms¹⁸. Transactions are powered by smart contracts, enabling market participants to deal with few intermediaries. Business models of digital natives and commercial banks are disrupted by the expansion of capital markets, blurring the line between banking and commerce (de Lima, Ekberg, and J. Elliott 2023).

Although all visions seem different from one another, they are not mutually exclusive which is noted by the authors themselves. A future reality is likely to be a combination of all, if not even of new paradigms making their appearance in the coming years.

¹⁷ See Bank of England and HM Treasury 2023

¹⁸ See McLaughlin et al. 2022

4.2 Addressing the Status Quo

Although one might think there is an obvious fifth paradigm–one I term "continuation of the status quo"–I argue that there is no such likelihood, as seen by looking at several recent developments like the EU's approach to regulation.

In the status quo, stablecoins' market capitalization stands at 136 billion US dollars as of February 2023 (Yadav, Fernandez da Ponte, and Davine Kim 2023). Their issuers still employ unprofessional practices which is why it makes sense that authorities are worried about potential spillovers to TradFi. Research conducted by Wu and Leung from the Hong Kong Monetary Authority (HKMA) focused on the potential collapse of Tether and concluded that its failure (and that of other asset-backed stablecoins) could result in large-scale redemptions and panic selling of their reserve assets, posing material impacts (Wu and Leung 2022).

The EU seems to agree with HKMA's conclusion which can be seen by Examining the Markets in Crypto Asset Regulation (MiCA), officially adopted by the EU Council on May 16th, 2023 (Council of the European Union 2023). Although not focusing solely on stablecoins, it does bring important changes to how they operate. Beck et al. from Mayer Brown law firm explain that MiCA classifies stablecoins into two groups: asset-referenced tokens (ARTs) which reference a basket of multiple fiat or crypto assets, and e-money tokens (EMTs) which reference a single fiat currency. It sets strict rules on issuers of ARTs and EMTs like requiring prior authorization of stablecoin issuance, and most importantly, requiring that issuers' reserves fully match the full value of the total outstanding holders' claims. If a token is denominated in a currency other than the official currency of the EU, a quarterly average limit of 200 million euros and 1 million transactions per day will apply. Benzler from Clifford Chance law firm explains that this low limit was added to prevent the US dollar-pegged stablecoins from becoming a global reference currency for crypto assets. In addition, supervision of stablecoins which have over 10 million users or reserve assets worth more than 5 million euros will fall under the European Banking Authority (EBA) which will retain veto rights over any stablecoins (Benzler 2022).

Although CBDCs could be designed as a substitute for stablecoins¹⁹, it seems that regulation (especially in the EU) is moving faster than any development of CBDCs. This makes it unlikely for CBDCs to get the opportunity to crowd out stablecoins in time. Therefore, the real question should be whether CBDCs are in conflict with stablecoins as much as the former are with the regulators.

The Central Bank of Brazil (BCB) has reached an interesting conclusion by theorising about the coexistence between public and private money which is to be regulated by the BCB. Araujo explains that stablecoins issued by commercial banks (essentially CBMTs) would have to adhere to frictional reserve requirements whereas stablecoins issued by PSPs would have to follow full reserve requirements. Unlike completely crowing out private money, this option would foster innovation as financial technology companies (fintechs) could simply opt to use PSP-issued stablecoins with simpler regulation and put more effort into developing their business model. This idea is similar to the previously mentioned RLN concept proposed by McLaughlin (Araujo 2022), and is a general hint that we might be slowly heading towards the revolutionary scenario of "universal networks".

¹⁹ Gorton and Zhang argue this should be done because stablecoins would hinder the effectiveness of monetary policy, as well as trade at time-varying discounts like private money did over 150 years ago (Gorton and Zhang 2021)

5. Conclusion

As central banks finalise their CBDC pilot projects and conclude research surrounding their issuance, we should expect a rise in CBDC-related discussions. Unfortunately, the current dialogue is limited to professionals with publicly available resources often being too hard to comprehend, resulting in overblown concerns already resembling conspiracy theories dominating the media. To successfully debunk the myths behind CBDCs, the gap between academia and the industry should be addressed, possibly with more contributions like this one. As with any other paper, it is not without its limitations–some of which are the literature selection bias and the inability to capture all developments in the field which is changing too fast to keep up with.

Nevertheless, the paper has scratched the surface of CBDC design options in the technical design chapter, whereas the advantages and disadvantages sections have highlighted their benefits while diving deeper into the most frequent concerns expressed by industry experts and surveyed citizens alike. After briefly examining new private money alternatives and addressing the four visions for the future, we can conclude that regulation will be playing a bigger role by preventing unregulated forms of money from competing with the regulated ones. In this way, CBDCs, CBMTs, and stablecoins are likely to coexist in the near term, with the line between them becoming increasingly thinner until reaching the point where their differences are often forgotten. In the end, the thing that matters most is the ease of use.

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