JEL classification: E4, E5.

https://doi.org/10.35945/gb.2023.15.014

CENTRAL BANK DIGITAL CURRENCY – A PARADIGM SHIFT IN MONETARY ARCHITECT

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ABSTRACT. Money was a centre of economic gravity from its inception. It evolved from gold to fiat currency, and now we face a new era of monetary evolution. Every step of development gives him new power to influence society by reaching more and more aspects of social life. With its influence were unknown risks and concerns toward monetary systems flexibility and sustainability.

Using a promise to pay as money (banknote) has several critical legal and technical inconsistencies with the token-based CBDC system. One significant limitation is that promissory notes may not have a unique serial number like physical currency printed by central banks. In the modern hybrid monetary system where only cash has a unique serial number and banks' electronic payments work on an account-based approach, the incompatibility of promise to pay with real money is not visible widely.

Overall, the role of fractional reserve banking and the money multiplier in a token-based CBDC system will play a different role than in traditional banking systems, given the unique characteristics of digital tokens and the role of central banks in issuing and controlling them.

By analysing these key aspects, this paper aims to provide a comprehensive understanding of the potential effects of CBDCs on fractional reserve banking. The findings of this research will contribute to the ongoing discussions and debates surrounding the adoption and implementation of CBDCs, enabling policymakers, regulators, and banking institutions to make informed decisions in this challenging era of digital currencies.

KEYWORDS: CBDC; MONEY; CREDIT; FRACTIONAL RESERVE BANKING; MONETARY SYSTEM.

INTRODUCTION

Central Bank Digital Currency (CBDC) has emerged as a significant innovation in the field of monetary systems, raising important questions about its potential impact on traditional banking practices, particularly fractional reserve banking. CBDC is a digital form of fiat currency issued and regulated by a central bank, providing a digital representation of a nation's legal tender. As CBDCs gain traction worldwide, it becomes crucial to examine their potential effects on fractional reserve banking, a long-standing practice that underpins the modern banking system.

SOME CRITICAL MISCONCEPTIONS ABOUT MONEY

To calibrate our consciousness about money as an economical category, we must clarify some critical aspects of modern monetary architecture. First, we should explore how the money creation process works and how the quantity of money in the economy is determined.

The vast majority of money held by the public takes the form of bank deposits. However, where the stock of bank deposits comes from is often misunderstood. One common misconception is that banks act simply

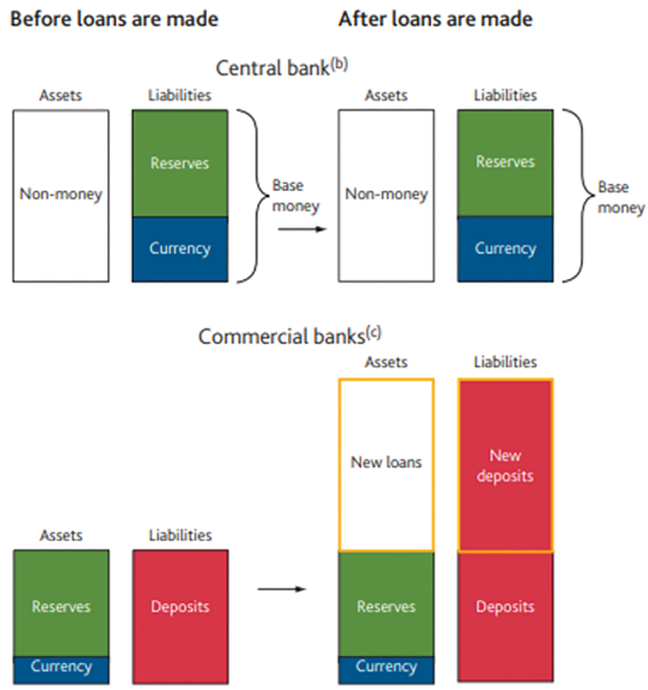

FIGURE 1. Money creation by the aggregate banking sector making additional loans
SOURCE: Bank of England, Quarterly Bulletin 2014 Q1

as intermediaries, lending out the deposits that savers place with them. In this view, deposits are typically 'created' by the saving decisions of households, and banks then 'lend out' those existing deposits to borrowers, for example, companies looking to finance investment or individuals wanting to purchase houses (McLeay, Radia and Thomas, 2014).

Commercial banks play a crucial role in the money creation process. When you deposit money into a bank account, the bank does not simply hold onto your money in a safe deposit box. Instead, the bank uses your deposit to make loans and investments, expecting that the loans will be paid back with interest and that the investments will generate returns.

When a bank makes a loan, it creates new money by promising to pay the borrower a certain amount. This promise takes the form of a bank deposit, which the borrower can use to make purchases or pay bills. In effect, the bank's promise to pay is accepted as a form of currency (Fig. 1).

When you use a credit card or write a check, you essentially transfer the bank's promise to pay from one person to another. The promise is backed by the bank's assets, including the loans and investments it has made with its deposits.

So, in a sense, money in a commercial bank account represents a promise from the bank to pay the account holder a certain amount upon request. The bank's assets and reputation back this promise, which is widely accepted as a form of currency.

Another common misconception is that the central bank determines the number of loans and deposits in the economy by controlling the quantity of central bank money — the so-called 'money multiplier' approach (McLeay, Radia, and Thomas, 2014), (Carpenter, S, Demiralp. 2012).

It is a common misconception that the central bank determines the quantity of loans and deposits in the economy. While the central bank plays an important role in regulating the money supply, it does not directly control the number of loans and deposits in the economy.

Commercial banks create money through fractional reserve banking, meaning they hold only a fraction of their deposits in reserve and use the rest to make loans and investments. This process of money creation by commercial banks is a key driver of the money supply in the economy (*see Fig.1*).

The commercial banks and only commercial banks, in other words, possess a widow's cruse. And because they possess this key to unlimited expansion, they must be restrained by reserve requirements. Once it is done,

TABLE 1. Forms of money

Money type	Description	Seigniorage
Credit money	Created as a private bank liability through credit extension	Positive as long as interest on credit exceeds interest on liability
Central bank money	Issued as a non-redeemable liability by a central bank as a bank note or token with only indirect backing by assets	Positive as long as interest on assets exceeds interest on liability
Private payment token	Issued as non-redeemable electronic scrip by a coin issuer on trust in its exchange value	Positive as long as increase in token supply covers the cost of coin issuing and validation of transactions
Private asset token	Issued as claim on assets and exchangeable into these assets by the issuer	Positive or negative depending on whether the return on assets exceeds or falls short of the costs of coin issuing and validation of transactions

SOURCE: The Economists' Voice. 2019; 20190033

determining the aggregate volume of bank deposits is just a matter of accounting and arithmetic: dividing the available supply of bank reserves by the required reserve ratio (Tobin J, 1963) (*see Table 1.*).

The central bank can influence the money supply by setting interest rates, adjusting reserve requirements for banks, and engaging in open market operations. For example, by lowering interest rates, the central bank can encourage more borrowing and lending, increasing the amount of money in circulation. Similarly, by increasing reserve requirements, the central bank can limit the ability of banks to create money through lending.

However, the central bank does not have direct control over the lending and borrowing decisions made by commercial banks, which are influenced by various factors such as economic conditions, the creditworthiness of borrowers, and market demand for loans. Therefore, while the central bank can influence the overall level of lending and borrowing in the economy, it does not determine the number of loans and deposits in the economy.

The emergence of Bitcoin and other cryptocurrencies has been a significant development in the world of finance and technology. Since then, thousands of other cryptocurrencies have been created, each with its unique features and characteristics. Bitcoin and cryptocurrencies operate using a decentralized ledger technology called blockchain, which offers secure and transparent transactions without the need for intermediaries such as banks or payment processors. The decentralized nature has led to widespread interest in cryptocurrencies, with some people seeing them as a potential replacement for traditional currencies and financial systems. The emergence of cryptocurrencies has also led to the development of new financial products and services, such as cryptocurrency exchanges, wallets, and investment funds. This has helped to increase the accessibility of cryptocurrencies to a wider audience, making it easier for individuals to invest in and use cryptocurrencies. An alternative monetary system was born in front of the monetary authorities' eyes. Such development of the money order has led to increased interest in digital currencies and has prompted some central banks to explore the development of Central Bank Digital Currencies (CBDCs).

E-CNY AND OTHER MONETARY EXPERIMENTS

China has been at the forefront of developing Central Bank Digital Currencies (CBDCs), with the People's Bank of China (PBOC) conducting successful pilot tests of its digital yuan or e-CNY.

In terms of policy implications, there have been intense discussions around the specific designs of CBDCs. First, there is the question of whether the CBDC should be a wholesale instrument used for settlement between financial institutions or a retail system where the CBDC is a central bank liability accessible to all consumers. Second, if it is a retail system, there is the question of whether the financial system architecture should have the central bank interacting with the general public directly or whether the private sector (including banks) should handle all the customer-facing activities. Third, there are questions about what would be permissible in creating

CBDC, with different features resulting in different implications on monetary policy effectiveness and financial stability overall. (Allen a, Xian Gu b, Jagtiani J, 2022).

Traditional central bank money has three major functions, i.e. payment, pricing and investment. Hence, a general CBDC is also expected to serve as an almost cost-free medium of exchange, a stable account unit and a safe store of value under ideal conditions. However, the e-CNY, which has been more famous as the 'Digital Currency Electronic Payment', will only focus on facilitating payment at the current stage and aims at replacing cash in circulation rather than bank deposits or other financial investment products. For the PBC, payment would only be the first and relatively conservative step, and the e-CNY will play a more momentous role in pricing and investment in the future. (Li Sh & Huang Y, 2021).

The monetary architecture of the e-CNY, China's digital currency, is based on a two-tier system. The People's Bank of China (PBOC) issues the e-CNY to commercial banks, distributing the currency to their customers.

Individuals and businesses can store the e-CNY in digital wallets accessed through mobile phones or other electronic devices. The wallets are linked to users' bank accounts and can be used to make payments and transfers.

E-CNY transactions are conducted through a digital payment system designed to be fast, secure, and reliable. The system uses QR codes and other forms of digital payment to facilitate transactions, and each transaction is recorded on a decentralized ledger maintained by the PBOC.

The e-CNY is designed to be a "two-tier" digital currency, which means that it is issued by the central bank but distributed by commercial banks. This system is intended to ensure that the e-CNY is widely accepted and can be easily integrated into existing financial systems.

One potential advantage of the e-CNY's architecture is that it provides a way to digitize China's financial system without disrupting existing structures. By working within the framework of China's existing banking system, the e-CNY can be integrated with other digital payment platforms and financial services.

In 2015, the Dutch central bank developed a blockchain-based CBDC prototype, DNBcoin/Dukaton. The first version of DNBcoin was adapted from the Bitcoin blockchain and focused on sustainability in the payments system. Then Dutch central bank tested different consensus and validation mechanisms in the subsequent four blockchain prototypes. Finally, Dutch Central Bank concluded that blockchain technology could not be an option for financial infrastructures for its limitations on capacity, efficiency and certainty of payment. Unfortunately, there are no public technology details on the Dukaton project (Zhang T, Huang Z, 2021).

The United States and the European Union have been exploring the possibility of developing their own Central Bank Digital Currencies (CBDCs). However, the projects are still in the early stages, and no concrete plans have been announced yet.

In the United States, the Federal Reserve has been studying the potential benefits and risks of CBDCs and has researched and tested various technologies and designs. However, no decision has been made yet about the future development of a CBDC.

In the European Union, the European Central Bank (ECB) has also been studying the potential benefits and risks of CBDCs. The ECB has launched a public consultation on the possible introduction of a digital euro and has also conducted experiments to test the technical feasibility of a CBDC.

CBDC monetary system has some variations and differences, especially when discussing the monetary architect. For a better understanding, we have to explore all possible variants and their characteristics.

RETAIL OR WHOLESALE CBDC

Retail CBDCs are designed for everyday retail transactions between individuals and businesses. As a result, the monetary architecture of retail CBDCs is designed to ensure that they are accessible, efficient, and secure for the general public. Retail CBDCs are typically designed to be held in digital wallets accessible through mobile devices, computers, or other electronic devices. Commercial banks or other authorized intermediaries may issue digital wallets and be linked to traditional bank accounts or other payment systems. The central bank would issue and manage the retail CBDC, which the central bank's reserves would back.

Wholesale CBDCs, on the other hand, are designed for large-value and interbank transactions. The monetary architecture of wholesale CBDCs is designed to ensure that they are efficient, secure, and scalable for use in large financial transactions. Wholesale CBDCs are typically designed to be held in digital wallets accessible through a secure network of financial institutions, including central banks and commercial banks.

TABLE 2. Key design features of central bank money

	Existing central bank money		Central bank digital currencies	
	Cash	Reserves and settlement balances	Retail	
			Token	Accounts
24/7 availability	✓	✗	✓	(✓)
Anonymity	✓	✗	(✓)	✗
Interest-bearing	✗	(✓)	(✓)	(✓)

✓ = existing or likely feature; (✓) = possible feature; ✗ = untypical or impossible feature.

SOURCE: SUERF Policy Note. Issue No 66, April 2019

The wallets may be issued by the central bank or other authorized intermediaries and would be used to settle large-value financial transactions in real-time. The central bank would issue and manage the wholesale CBDC, which would back the bank's reserves.

Overall, the monetary architecture of retail and wholesale CBDCs reflects their different intended use by cases, with retail CBDCs designed for everyday retail transactions and wholesale CBDCs designed for large-value and interbank transactions.

In the indirect CBDC architecture (top panel), this is done indirectly, and an ICBDC in the hands of consumers represents a claim on an intermediary. In the other two architectures, consumers have a direct claim on the central bank. In the direct CBDC model (centre panel), the central bank handles all payments in real-time and thus keeps a record of all retail holdings. The hybrid CBDC model (bottom panel) is an intermediate solution providing for direct claims on the central bank while intermediaries handle real-time payments. In this architecture, the central bank retains a copy of all retail CBDC holdings, allowing it to transfer holdings from one payment service provider to another in the event of a technical failure. All three architectures allow for either account – or token-based access (Auer R, Böhme R, 2020).

TOKEN-BASED OR ACCOUNT-BASED CBDC

The monetary architecture of a token-based or account-based CBDC will differ from the chosen approach.

In a token-based CBDC system, the central bank would issue and manage the digital tokens. The tokens would be designed to represent a certain denomination of CBDC, similar to physical cash. These tokens would be stored in digital wallets accessible through electronic devices, such as mobile phones or computers. Transactions would be conducted by transferring tokens directly between wallets, with each token being linked to a unique identifier to ensure its authenticity and prevent counterfeiting.

In contrast, an account-based CBDC system would link the CBDC to specific accounts held by individuals or businesses. These accounts would be similar to traditional bank accounts that store and transfer CBDC. Transactions would be conducted by transferring CBDC between accounts, with each transaction being recorded and linked to specific account identifiers to ensure transparency and traceability (*see Table 2.*).

The monetary architecture of a token-based or account-based CBDC would have different implications for factors such as privacy, security, and scalability. Token-based CBDCs may provide greater anonymity and privacy for users, as transactions would not be tied to specific accounts. However, they may also be more susceptible to fraud and counterfeiting. Account-based CBDCs would provide greater transparency and traceability but may also raise concerns about data privacy and surveillance. Additionally, account-based CBDCs may require a more complex infrastructure to ensure account-based transactions' secure and efficient management.

A general-purpose variant (i.e. a CBDC available to the public) can be based on tokens or accounts. This would be widely available and primarily targeted at retail transactions (but would also be available for broader use). A token-based variant would resemble a type of "digital cash", which could be distributed differently to a more direct account-based variant to the public (Boar C, Holden H and Wadsworth A, 2020).

In a modern globalized world where one of the key functions of money is to support international trade, the critical question about CBDC is whether it could be a better alternative to the existing monetary system.

CBDC AS INTERNATIONAL MONETARY UNIT – CHALLENGES AND OPPORTUNITIES

Central Bank Digital Currencies (CBDCs) have the potential to be used as an international monetary unit. This means they could be used as a global reserve currency or a means of exchange in international transactions. However, several challenges must be overcome before CBDCs become an international monetary unit.

One of the key challenges is the need for global cooperation and coordination among central banks and financial institutions. Different countries have different regulatory frameworks and priorities, which could make it difficult to establish a globally accepted CBDC.

Another challenge is establishing a system of exchange rates for CBDCs. Currently, there is no agreed-upon exchange rate system for CBDCs, which could make it difficult to use them as a means of exchange in international transactions.

There are also concerns about the potential impact of CBDCs on the traditional banking system. If CBDCs are widely adopted, they could lead to bank disintermediation, where banks are bypassed in financial transactions. This could potentially lead to a loss of profitability for banks, which could have negative consequences for the overall stability of the financial system.

For CBDCs to be used as an international monetary unit, there would need to be a clear regulatory framework to address concerns related to privacy, security, and illicit activity.

Additionally, there would need to be a system in place to ensure that CBDCs can be used in a way that is transparent and beneficial for all users.

Overall, while the use of CBDCs as an international monetary unit presents both opportunities and challenges, it has the potential to significantly transform the global financial system and increase financial inclusion, transparency, and efficiency.

So, CBDC in the current stage is an issue of the local economy. It could be a crucial point for banking, especially from a money-creation point of view.

FRACTIONAL RESERVE BANKING IN TOKEN-BASED CBDC MONETARY ENVIRONMENT

Fractional reserve banking and the money multiplier are concepts closely related to traditional banking systems where physical currency is used. In a token-based CBDC monetary system, fractional reserve banking may not apply in the same way as traditional banking.

Fractional reserve banking is a system where banks keep only a fraction of the deposits they receive as reserves and lend out the rest. This allows banks to create new money through the process of lending, and the amount of new money created is determined by the monetary multiplier. The monetary multiplier is the ratio of the money created through lending to the amount of reserves held by banks.

There are three main economic differences between the special case of a monetary deposit and a monetary loan. First, the monetary loan contract exchanges present goods and future goods. The borrower receives monetary units now and will pay the lender monetary units in the future. In contrast, there is no exchange of present goods for future goods in the monetary deposit contract. Depositors do not give up the availability of the monetary units but retain the right to withdraw them on demand (Bagus, Howden, Block 2013).

In a token-based CBDC system, the tokens are digital units issued by the central bank and held directly by individuals or institutions. Banks do not need to hold reserves or create new money through lending. Instead, the central bank can directly control the money supply by issuing or withdrawing tokens as needed.

In a free-market economy, where there is no fractional reserve banking practice, the source of credit resources is saving, temporarily free money funds, which, through the banks as the mediators, flow from the savings holders to business operators in the form of loans. The existence of savings is, on the one hand, the means for obtaining credit resources for business, and on the other hand, the indicator of the existence of additional demand, which should provide support for economic growth, as well as the application of the additional issue (Khidasheli M, 2022).

Using a promise to pay as money (banknote) has several critical legal and technical inconsistencies with token-based CBDC systems. Using promissory notes, such as banknotes and other payment instruments, as a form of money has been a common practice through-

out history. However, their use as a monetary unit is subject to various limitations and risks.

One significant limitation is that promissory notes may not have a unique serial number like physical currency printed by central banks. This lack of unique identification can make it difficult to track and verify the authenticity of promissory notes. In the modern hybrid monetary system where only cash has a unique serial number and banks' electronic payments work on an account-based approach, the incompatibility of promise to pay with real money is not visible widely.

In addition, promissory notes as a form of money are subject to legal and regulatory considerations. The issuance and use of promissory notes are subject to various laws and regulations, which can vary by jurisdiction. This can create additional costs and complexities for issuers and users of promissory notes.

In conclusion, while promissory notes have been used as money throughout history, their limitations and risks must be carefully considered. All bank panics and financial crises (boom and bust) result from unbaked credit expansions. In the end, as in 2008, central banks must exchange this credit money (promises to pay) with real ones through different monetary easing programs.

Monetary interventions implemented for the economy's stability distort the impact of market forces on the economy, causing the postponement of the crisis consequences and not their neutralization (Khidasheli M, Chikhladze N 2019).

In conclusion, using tokens in a CBDC system creates a more transparent and accountable monetary system, where the creation and circulation of new tokens are tied directly to reserves held on the blockchain. This makes it virtually impossible for banks to engage in fractional reserve banking practices without proper oversight and regulation. Furthermore, token-based CBDC systems have the potential to increase financial inclusion and accessibility, making it easier for individuals to transact and exchange value without relying on traditional banking systems.

CONCLUSIONS

Fractional reserve banking and the money multiplier are closely related to traditional banking systems where physical currency is used. In a token-based CBDC monetary system, fractional reserve banking may not apply in the same way as traditional banking.

In a token-based CBDC system, where digital cash is represented by tokens on a blockchain network, fractional reserve banking becomes virtually impossible. This is because each token on the blockchain is a unique unit of value that cannot be duplicated or created out of thin air.

Unlike in traditional fractional reserve banking, where banks can create new money by lending out a portion of their deposits, creating new tokens in a CBDC system would require actual reserves to be deposited and held on the blockchain. In other words, banks would be unable to create new tokens without having the reserves to back them up.

Using tokens in a CBDC system creates transparency and accountability not present in traditional banking systems. Each token on the blockchain represents a specific amount of value tied directly to the reserves held by the issuing authority. This means that the creation and circulation of new tokens can be easily tracked and verified, making it difficult for banks to engage in fractional reserve banking practices without proper oversight and regulation.

Token-based CBDC systems also have the potential to increase financial inclusion and accessibility. With each token representing a specific unit of value, it becomes easier for individuals to make transactions and exchange values without relying on traditional banking systems. This can be particularly beneficial for individuals who may not have access to traditional banking services, such as those living in remote or underdeveloped areas.

However, in some token-based CBDC systems, banks may still have a role in providing services such as custody, payment processing, and lending. In these cases, fractional reserve banking may still apply, but the money multiplier would be determined by the central bank's issuance of tokens rather than by banks' reserves.

Overall, the role of fractional reserve banking and the money multiplier in a token-based CBDC system will depend on the specific design and implementation. It is likely that these concepts will play a different role than they do in traditional banking systems, given the unique characteristics of digital tokens and the role of central banks in issuing and controlling them.

REFERENCES:

1. Allen A., Xian Gu B., Jagtiani J. (2022). Fintech, Cryptocurrencies, and CBDC: Financial Structural Transformation in China. Journal of International Money and Finance, from https://www.sciencedirect.com/science/article/pii/S0261560622000286 (last visited 1/06/2023).
2. Auer R., Böhme R. (2020). The Technology of Retail Central Bank Digital Currency. BIS Quarterly Review. From https://www.bis.org/publ/qtrpdf/r_qt2003j.htm (last visited 1/06/2023).
3. Bagus P., Howden D., Block W. (2013). Deposits, Loans, and Banking: Clarifying the Debate. The American Journal of Economics and Sociology, from https://www.jstor.org/stable/23526054 (last visited 1/06/2023).
4. Boar C., Holden H., Wadsworth A. (2020). Impending Arrival – A Sequel to the Survey on Central Bank Digital Currency. BIS Paper No. 107, from https://www.bis.org/publ/bppdf/bispap107.htm (last visited 1/06/2023)
5. Carpenter S., Demiralp S. (2012)."Money, reserves, and the transmission of monetary policy: Does the money multiplier exist? "Journal of macroeconomics 34.1: 59-75.
6. Khidasheli M. (2022) – Conventional results of unconventional monetary policy. Economic Profile, Vol. 17, 2(24).
7. Khidasheli M., Chikhladze N. (2019). Financial system stability threats after 2008 anti-cyclical policies. Social sciences bulletin 1 (28). Daugavpils University.
8. Li Sh., Huang Y. (2021). The genesis, design and implications of China's central bank digital currency, China Economic Journal, 14:1, 67-77.
9. McLeay M., Radia A., Thomas R. (2014). Money creation in the modern economy. Bank of England, Quarterly Bulletin Q1, from https://www.bankofengland.co.uk/quarterly-bulletin/2014/q1/money-creation-in-the-modern-economy (last visited 1/06/2023).
10. Tobin J. (1963). Commercial Banks as Creators of 'Money. Cowles Foundation Discussion Papers. 388.
11. Zhang T., Huang Z. (2022). Blockchain and central bank digital currency. ICT Express Volume 8, Issue 2, June, Pp. 264-270.