Research in International Business and Finance 62 (2022) 101736

Contents lists available at ScienceDirect

Research in International Business and Finance

journal homepage: www.elsevier.com/locate/ribaf

Central bank digital currencies: An agenda for future research

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ARTICLE INFO

Keywords:
Central bank digital currencies
Monetary policy
Financial stability
Inflation targeting
Blockchains
Cryptocurrencies

ABSTRACT

Central bank digital currencies are engendering concern. As understanding of CBDCs is very limited, further research is warranted which will focus not only on the economic rationale of CBDCs but also on how they will impact monetary policy transmission, financial and price stability, inflation targeting, unconventional monetary instruments, central banks as lenders of last resort, and provision of forward guidance. There are also unsettled questions regarding ethics, privacy and environmental and technological constraints. With the imminent implementation of CBDCs, it is vital to explore these issues.

1. Introduction and motivation

Accelerating financial innovation has brought us into the age of blockchain and cryptocurrencies. While it has been just over a decade since the inception of the first cryptocurrency, Bitcoin, engagement with cryptocurrencies has reached every corner of society including businesses, investors, consumers, and public and private institutions.

Despite a cautious stance to digital or cryptocurrencies, central banks have now started to explore the idea of adopting their own digital currency, commonly known as Central Bank Digital Currencies (CBDC). CBDCs, as blockchain-based versions of existing reserve currencies, are not being initiated as third-party stablecoins such as Tether (Morgan, 2022). Rather CBDCs are envisioned as eventual replacements of national reserve money systems. However, despite the increased popularity of digital currencies, there are many unanswered questions on the feasibility and implementation of the CBDCs. As outlined by the Bank of England, CBDCs will allow households and businesses to make direct electronic payments using money issued by the Central Bank (Bank of England, 2020).

While there are a variety of views regarding cryptocurrencies as investments and as potential global mediums of exchange, with some economists considering them to be the future of money while others consider them to be a short-term investment bubble or inherently unable to eventually meet the world's money supply needs (Roubini, 2018a, 2018b, Prasad, 2021). The effectiveness of CBDCs needs more scholarly reflection considering the challenges of replacing traditional currencies.

CBDC implementation is challenged by technological, economic, social, political, environmental, and ethical concerns. It will require infrastructure, social and political acceptance, environmental sustainability, and addressing privacy issues. However, understanding of how CBDCs will address these challenges and what are their implications remains limited. Perhaps, because of concerns,

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https://doi.org/10.1016/j.ribaf.2022.101736
Received 27 July 2022; Received in revised form 7 August 2022; Accepted 8 August 2022
Available online 10 August 2022

many central banks, including the Bank of England, Bank of Japan, European Central Bank, the US Federal Reserve, and the People's Bank of China, while attracted by the opportunities of CBDCs, are moving cautiously toward their adoption.[1] Central banks ideally should evaluate the adoption of CBDCs in the context of their mandate on not only price stability but also with concern for a wide number of aspects of the public good (Bank of England, 2021). The transmission of monetary policy, functioning of the banking and financial sectors, price stability, labour and goods and services markets, are various concerns to take into account ideally before proceeding CBDCs. While digital currency adoption by central banks is of profound importance, our understanding of underlying challenges is limited, thereby constraining formations of optimal strategies.

Despite the importance of this topic, literature on CBDCs is very limited and many related research questions are yet to be answered including: how CBDCs will impact monetary policy transmission, conventional and unconventional monetary instruments, financial and price stability, inflation targeting, central banks as lenders of last resort, and the provision of forward guidance? To this end, this paper aims at highlighting the implications of CBDCs for the macroeconomy and financial systems and identifying emerging trends, and research areas and constructing an agenda for future research.

The remainder of the study is organized as follows. Section 2 provides a review of the current state of the literature. Section 3 concludes and suggests potential research avenues for future research.

2. Background

2.1. CBDCs and economic theory

Since their inception, the raison d'être of cryptocurrencies has been debated. Regarding whether cryptocurrencies serve the function of money as a medium of exchange, a store of value, and a unit of account, it is argued by some that they are more of a speculative asset than money (Yermack, 2015). Money can be classified as public money that is issued by the state with an 'I promise to pay the bearer' pledge. Alternatively, money can be regarded as private money issued by commercial banks through bank lending. Private money creation is however based on a monetary base of notes and coins in the denomination of a sovereign currency. In contrast, regarding cryptocurrencies as money implies a decoupling of private money from public money. This is inherently in opposition to the historical Chartalist view that money's value derives from its issuance by governments (Knapp, 1905). Chartalism considers money as a provenance of the state (Wray, 2011). Though the credit theory of money (Mitchell-Innes, 1913, 1914)[2] sees money as credits or debits, the principle of its denomination and base remains the same with public money underpinning the private money.

Considering cryptocurrencies as digital gold is disputed by metallism, as there is no intrinsic value to digital currencies in the sense that they are not, of course, included in the periodic table. However, CBDCs are theoretically reconcilable with Chartalism, since, as, for instance, announced by the Bank of England, CBDCs will be denominated in pound sterling and complement cash and bank deposits rather than replace them. Similarly, sovereign digital currencies in China will be but how that complementary role can be performed and what implications it will have, remains a question that will eventually be answered by the outcomes of their implementation.

The intention to extend the cryptocurrencies' role as 'money' is indeed stepping into the territory of public money held by sovereigns and, hence for that reason CBDCs might be seen as an effort to reclaim that ground. Furthermore, it is also stepping into the territory of private money.

As CBDCs allow electronic money, issued by central banks to be available to all households and businesses, they allow everyone to make electronic payments in central bank money. The implications of this expansion of central bank money to private money motivate further exploration.

2.2. CBDCs and the global monetary system

As highlighted by Goodell and Shen (2021), the ongoing introduction of a Chinese sovereign digital currency (DCEP) will certainly be particularly impacting given the size of the Chinese economy and the extent of China's ongoing international development interests. Considering the competition between the US and China, as well as the massive flows of liquidity between the US and China, it is likely that China's adoption of a digital fiat currency will enhance the role of the RMB as a stabilizing currency (Howell, 2020; Jia et al., 2020), as well as prompt many countries to follow with sovereign digital currencies of their own. How will the hegemony of the US dollar (Le et al., 2021) be impacted? As we are geopolitically in a period of progressively competing for global payment systems between SWIFT and CHIPS, DCEP will be central to China crafting its own current cross-border payment system. Will the US be compelled to establish its own sovereign digital currency—along with all developed nations? This seems imminent in the long term.

CBDCs denominated in national currencies will act as complements rather than substitutes to cash and bank deposits (Goodell and Shen, 2021). This implies a potential to 'protect' national currencies against competition from cryptocurrencies, with implications for the global monetary system.

[1] As noted by Goodell and Shen (2021), China is likely progressing much more rapidly than other countries, but it is difficult to discern as widespread digital payment systems may or may not be using sovereign digital currency.

[2] See Keynes (1914) for further discussion. To Schumpeter (1954) debate on the money and Mentalism vs Chartalism goes back to Aristotle and Plato.

2.3. CBDCs and financial stability

It has been argued, at least by some, that, although there could be some losses to investors, cryptocurrencies do not pose a substantial risk to the monetary or financial stability (Ali et al., 2014). CBDCs on the other hand, being required to contribute to the functions of central banks. Recent reports from the Bank for International Settlements posit that "a central bank should not compromise monetary or financial stability by issuing a CBDC." But there is a lot of uncertainty surrounding the CBDCs and their impact on financial stability. Uncertainties include uncertainty about the future structure of financial systems; uncertainty about the design of CBDCs and their underlying systems; and uncertainty about the magnitude of eventual adoption.[3] While central banks, being more stable than commercial banks, with a monopoly over deposit-taking through CBDCs, appear to have innate stability, seminal transformations are inherently disruptive (Fernández-Villaverde et al., 2021).

2.4. CBDCs, lenders of last resort and unconventional monetary policies

Central Banks as commonly understood act as lenders of last resort, as prescribed by Bagehot (1873). How this crucial responsibility will be discharged in the age of CBDCs should be considered. Since the 2008–09 global financial crisis, unconventional monetary policies in the form of large-scale asset purchases, quantitative easing, forward guidance, and negative interest rates have been employed toward economic and price stability (Nasir, 2021). How will these more recent policies will be conducted differently under CBDCs is uncertain. For instance, will there be scope for a negative interest rate policy? Will there be any possibility of forward guidance under CBDCs and what implications it will have for central bank communication? these are the crucial aspects that have not been explored yet.

2.5. CBDCs, price stability and inflation targeting

The remit of central banks includes price stability. For this purpose, a number of central banks, including the Bank of England, the US Federal Reserve, and the ECB, have adopted explicit inflation targeting (Nasir et al., 2020a, 2020b). Central banks have also been made independent in the formulation of their monetary policy to achieve price stability. However, CBDCs bring new challenges in this regard. What implications CBDCs do central banks have for achieving price stability? Goodell and Shen (2021) suggest that CBDCs, because of their support from blockchain ledgering through all money expanding activities will likely provide a new level of accuracy for monitoring money supplies.

2.6. CBDCs and green monetary policy

In many instances, central banks have evolved into advocates of environmental sustainability through green monetary policy (Bailey, 2021). In some nations, the remit of the central banks has been extended from mere price and financial stability to contributing to environmental stability (Bank of England, 2021). In this context, cryptocurrencies have significant implications for the environment. As of November 2018, Bitcoin's increasing annual electricity consumption was about 45.8 TWh, corresponding to about 22–22.9 million metric tons of CO2 emissions per year (Stoll et al., 2019).

In part because of the 'proof-of-work' nature of cryptocurrency mining, emissions related to all cryptocurrencies are likely to increase significantly. For instance, it's expected that the annual energy consumption of the Bitcoin blockchain in China is expected to peak in 2024 at 296.59 Twh annually, generating about 130.50 million metric tons of CO2 emissions (Jiang et al., 2021).

There are reasonable concerns that cryptocurrencies may significantly contribute to nations failing to achieve Paris Agreement targets (Mora et al., 2018). But, as argued by Tom Mutton, director of the central bank digital currency unit at the Bank of England, Bitcoin does not necessarily define a technology baseline, with CBDCs, depending on their design, perhaps providing a more efficient and greener money creation process (Mutton, 2021).

2.7. CBDC infrastructure

Technological innovation has brought us innovation in payment technologies. For instance, the use of Wrappers (Google Wallet, Apple Pay and Paym etc.) and Mobile Money (M-Pesa, a popular service in Kenya) where the underlying currency remains the national currency (Ali et al., 2014b). As with the Bank of England's platform modelling, CBDC platforms would work alongside existing real-time gross settlement services. Private sector payment interface providers would connect to this platform to provide customer-facing CBDC payment services. Goodell and Shen (2021) note that the Chinese sovereign coin, DCEP, easily interfaces with existing WeChat Pay and Alipay services.

While the cryptocurrencies are based on distributed ledger technology cryptocurrency systems with a strong element of anonymity and decentrality do not meet CBDC requirements (Auer and Boehme, 2021). Currently, there is no global consensus regarding the underlying technology of CBDCs, especially with respect to privacy. CBDCs, by being based on distributed ledgers (blockchains) engender concerns regarding privacy and security (Bank of England, 2020). As noted by Goodell and Shen (2021), blockchains of

[3] Central bank digital currencies: Financial stability implications, September, https://www.bis.org/publ/othp42_fin_stab.pdf

CBDCs will afford a record of all economic transactions that, absent costly patches,[4] will be open to state monitors. Certainly, this is an opportunity to control global financial corruption (CITE); while also, however, raising concerns about individual privacy. While, according to Auer and Boehme (2021), CBDC design should ideally be minimally invasive, questions regarding technology and design are not settled. Most CBDC projects are naturally in economies that are more digitized (Auer et al., 2020), raising questions regarding technological disparities among nations.

2.8. CBDCs and ethics, privacy, and laws

Cryptocurrencies, as their name would suggest ('crypto'), are by their design and original intent meant to eschew state monitoring and control. As peer-to-peer systems imply with no central bank oversight. In contrast, the CBDCs depart entirely from cryptocurrencies as they are issued, controlled and ledgered by central banks. This implies issues of privacy as all transactions involving CBDCs would, absent corrective patches, would be recorded for government monitoring. On the other hand, by the ease of use in existing digital payment systems, and digital wallets, sovereign digital currencies provide opportunities for financial inclusion of the unbanked. As CBDCs will be amenable to smart contracts, they will be competitive with mainstream platform cryptocurrencies in financing evolving decentralised finance ecosystems (Corbet, Goodell, and Günay, 2022). Particularly from the point of Ethics and Privacy. For CBDCs, there are also issues around regulations, enforcement of contractual obligations and property rights that need clarification (Goodell, 2021).

3. Conclusions

Central Bank Digital Currencies (CBDC) are being considered or are in the process of being adopted, by many central banks around the world. Despite the importance and potential impacts of such seminal changes to national currencies, there are still many unknowns.

There are many unanswered questions about the impact of CBDCs on financial, economic, and environmental stability such as how CBDCs will impact monetary policy transmission, conventional and unconventional monetary instruments, financial and price stability, inflation targeting, central banks as lenders of last resort, and the provision of forwarding guidance. Other areas of potential investigation would be the impact of CBDCs on liquidity creation, the interaction between monetary, fiscal and prudential policies under the Central Bank Digital Currencies (CBDC), monetary policies transmission and spillovers across countries in the age of digital currencies …etc. Further, there remain issues regarding social impacts, ethics, privacy, and technological and environmental constraints. The need to add to our knowledge and understanding of these crucial issues motivates research into CBDCs, with a view toward facilitating understanding for financial institutions, policymakers, and citizens.

CRediT authorship contribution statement

All authors have contributed equally.

Data Availability

No data was used for the research described in the article.

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[4] Technologies such as programmable money through smart contracts that are delivered by either building the functionality into the core ledger, establishing a separate module, or by providing it through third parties.

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