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A Review of Central Bank Digital Currencies

Amitoj Singh[*], David Parapallicherayil John[†],
& Arun Pattamookkil Jacob[‡]

Abstract

This is a review paper on the exploratory research done by various central banks and international organisations on CBDCs and the framework to be followed for implementing these CBDCs so that the monetary system of a specific country remains unaffected. CBDCs and cryptocurrency in general as we know have become quite popular and are the talking point for many research scholars, economists and investment analysts. While many believe cryptocurrencies to have no intrinsic value, the value of the underlying technology i.e blockchain is something that can be argued upon. CBDCs remove the major cons of cryptocurrency by providing stability to the volatile cryptocurrency market and by acting as a legal tender thereby gaining the trust of retail public. Many governments believe that the introduction of CBDCs into the economy could simplify the payment's structure thereby increasing the velocity of money leading to higher GDP growth. But one possibility that shatters this glass of optimistic views is the possibility of disintermediation of banks which could adversely affect the credit creation capacity of the country and disintegrate the entire monetary policy formation

[*] Department of Commerce, CHRIST (Deemed to be University), Bangalore, Karnataka, India; amitoj.singh@commerce.christuniversity.in
[†] Department of Commerce, CHRIST (Deemed to be University), Bangalore, Karnataka, India; david.john@commerce.christuniversity.in
[‡] Department of Commerce, CHRIST (Deemed to be University), Bangalore, Karnataka, India; arunjacob@commerce.christuniversity.in

mechanism. Therefore, though the concept of digital currencies may excite many people, its adoption in an economy should be considered only after thorough research and pilot programs conducted by the central banks.

Keywords: Cryptocurrency, Digital Asset, Digital Currency, Central Bank, Monetary System, Blockchain, Central Bank Digital Currencies

1. Introduction

The Cryptocurrency and Regulation of Official Digital Currency Bill, 2021 was presented before the parliament on 29 November 2021. The Government is proposing this bill in a bid to regulate the digital currency space by announcing the GOI's interest in creating its own digital currency, which is legal tender backed by the Reserve Bank of India, and banning almost all private currencies except those whose underlying technology can be leveraged to enhance the prevailing financial infrastructure. The implications of such an act are wide-ranging for institutions, governments, retail participants, cross-border transactions, and international capital flows. As there is much debate about the validity and suitability of the private cryptocurrency market in the current economic landscape, we have aimed at discussing the various implications such a Bill could have at a macroeconomic level, and how institutional and retail participants might be affected.

Central Bank Digital Currencies (CBDCs) are a type of cryptocurrency issued by the Central Bank of a country and are generally denominated in terms of that particular country's currency. Unlike private cryptocurrencies like Bitcoin and Ethereum, which do not have any intrinsic value and are not backed by any government, CBDCs will be supported by the government of a particular country and thus will be accepted as a legal tender. The acceptance as a legal tender gives CBDCs genuine credibility over other private cryptocurrencies. Since they will be pegged to their nation's currency, they will not be as volatile as private cryptocurrencies. Unlike bitcoin and other private cryptocurrencies generally organized in a public blockchain, the CBDCs would have a private blockchain network where only the

Central Bank and some of its commercial banks would have access to the network. Unlike digital wallets and other digital payment alternatives, a CBDC would be digital tokens mined by the Central Banks and would not need to be backed by cash reserves. Dupuis, Gleason, and Wang (2021) had classified CBDCs into three types based on their structure:

- **CBDC Wholesale:** Type of structure in which cryptocurrency usage is limited to the Central Bank and commercial banks.
- **Central Bank Accounts:** Type of structure in which all digital currency users would have to open a KYC compliant account with their Central Bank and is equivalent to having a bank account with the central bank
- **CBDC Popular:** An extension of CBDC wholesale where the usage of digital currencies has been extended to the general public

2. Literature Review

Central Bank Digital Currencies being a relatively new form of currency provides great opportunities for countries to further expand their digitized payments systems. But being a relatively new concept and one that has not been adopted by any country, its implementation into the monetary system is a challenge for the government, as any wrong step could lead to disintermediation of the banking system and thus could do more harm than good. Following is the review of literature that has helped us understand and analyze this concept.

Wu Tong and Chen Jiayou, in their paper examine the global development and competition of digital currencies and investigates the design of China's central bank digital currency (CBDC) from a theoretical and a practical perspective. Moreover, on the basis of correcting shortcomings in the existing literature, they undertake a quantitative analysis of the economic impact of the issuance of DC/EP based on a four-sector DSGE model. The results demonstrate that the substitution effect of DC/EP on bank deposits is limited, while the unit impact can enhance economic growth rate

by 0.15%. The overall economic effect is positive and at the same time it reduces the leverage ratio to a certain degree, which is conducive to reducing systemic financial risk.

Beindseil and Ulrich in their research paper for European Central Bank analyze the IT progress and its application to the financial industry and analyzes the merits of central bank digital currencies (CBDC) accessible to the broad public. This paper first reviews the advantages and risks of such CBDC. It then discusses two prominent arguments against CBDC, namely (i) risk of structural disintermediation of banks and centralization of the credit allocation process within the central bank and (ii) risk of facilitation of systemic runs on banks in crisis situations.

Orla Ward and Sabrina Rochement in their working paper for the Institute and Faculty of Actuaries explores the rise and volatility of cryptocurrencies which have captured the interest of many commentators, particularly due to the excitement over a new technology, known as Blockchain, to resolve some economic development limitations and power decentralized payment systems. This paper provides a comprehensive overview of the topic of CBDCs for Finance and Investment professionals, including an overview of Central Bank thinking and the possible implications of introducing a CBDC.

Tsai, Zhao, Zhang and Deng in their research paper titled "A Multi Chain Model for CBDC" explore the impact of new digital currencies on a nation's monetary system. RS Coin is the first CBDC model sponsored by the Bank of England, and it uses the UTXO model from Bitcoin. This paper proposes a new CBDC model Panda model that can store account balances like current banking systems, but use efficient consensus protocols to ensure that relevant parties have consistent views of transactions and accounts.

Michael Kumhof and Clare Noone in their research paper for the Bank of England set out three models of central bank digital currency (CBDC) that differ in the sectors that have access to CBDC. It studies sectoral balance sheet dynamics at the point of an initial CBDC introduction, and an attempted large-scale run out of bank deposits into CBDC.

Meaning, Dyson, Barker, and Clayton in their research paper for the Bank of England discuss central bank digital currency (CBDC) and its potential impact on the monetary transmission mechanism. The paper investigates how CBDC could affect the various stages of transmission, from markets for central bank money to the real economy. It concludes that monetary policy would be able to operate much as it does now, by varying the price or quantity of central bank money, and that transmission may even strengthen for a given change in policy instruments.

Niepelt and Dirk in their research paper analyze policy in a two-tiered monetary system. Noncompetitive banks issue deposits while the central bank issues reserves and a retail CBDC. Monies differ with respect to operating costs and liquidity.

Florian Boser and Hans Gersbach in their paper examined how the introduction of an interest-bearing central bank digital currency (CBDC) impacts bank activities and monetary policy. At any time, households can switch from bank deposits to CBDC which is a safe medium of exchange. As banks might face digital runs, either because depositors have a preference for CBDCs or fear bank insolvency, monetary policy can use collateral requirements and penalties for illiquidity to initially increase bankers' monitoring incentives in the presence of CBDCs.

Nurjannah Ahmat and Sabrina Bashir in their research evaluated the costs and benefits of the issuance of CBDCs to the functioning of the economy, and its implications on the central bank mandates of monetary and financial stability and most directly, to the currency issuance and payment systems. This article reviews the current thinking on the potential impact of issuing CBDC on the conduct of monetary policy.

Viktor Koziuk in his research paper identifies the amount of trust in digital money, among CBDCs and other cryptocurrencies. The trust in centralized and decentralized types of digital money is stronger in societies with a bigger proportion of younger generations. This puts into doubt the traditional view of money, as well as the function of monetary stability institutions in the digital era. Only when fiat money institutions become vulnerable is digitalization regarded as an enhancement in welfare. Central

banks' efficiency and trustworthiness do not add to CBDC's credibility. This is an issue for the future digital-based monetary order's institutional design.

Šiaudinis and Sigitas in their research paper discuss of the many implications with either broad or restricted accessibility. Even in a cashless environment, CBDC-related promises for monetary policy to abolish the effective lower limit constraint are found to be overblown. They suggest that central banks' responses to the digitization trend should be an integrated solution that meets public demand for a secure payment method, protects private innovation, and assures financial stability. They conclude that in advanced economies, there is no visible type of CBDC that would serve as a best-choice central bank response. However, in emerging economies with little financial inclusion, such a reaction would be regarded as a transitory answer.

Christian Barontini and Henry Holden in their research paper analyze the pros and hazards of central bank digital currencies. Based on a global survey of central banks, this BIS report adds to these conversations by taking stock of progress and ambitions in this area. The responses reveal that central banks are treading carefully and that most of their efforts are still in the conceptual stage. However, a small number of central banks have begun to address practical difficulties, and a few central banks with unique conditions may issue a digital currency in the near or medium future.

Manoj Kumar Singh in his study investigates the impact of digital currency decisions, as well as numerous other scenarios, including those based on the establishment of central bank digital currencies (CBDCs), that would influence supervisory resource allocation in one way or another.

Bargonovo, Caselli, Cillo and Masciandro provide a theoretical foundation for analyzing demand for a central bank digital currency (CBDC). They identify the causes of the political consensus in favor of or against new currency using a financial portfolio method and assuming that individual preferences and policy votes are consistent. Given the different opportunity costs of the various currencies, the CBDC issuing is more likely to occur the

more people prefer to use legal tender and/or are unconcerned about anonymity; at the same time, the likelihood of the CBDC introduction increases, if a return can be earned on it and/or its implementation can ensure at least counterparty anonymity.

Syed Mohammad Yawar & Rahul Shaw say that the number of participants in the cryptocurrency takeover has reached an all-time high, and what was formerly scorned as a theoretical construct might now be realized internationally. The cryptocurrency revolution is guided by an attitude that is diametrically opposed to the existing economic framework and hence looks to be in direct confrontation with existing fiat currencies. In this essay, the authors consider the regulatory problems surrounding cryptocurrencies, especially via the prism of competition law, and propose some potential solutions to help tame this volatile resource.

Marion Laboure, Markus HP, Müller, Gerrit Heinz, Sagar Singh, and Stefan Köhling shows us that this study attempts to present an overview of the evolving environment of cryptocurrencies and central bank digital currency (CBDC) in order to make predictions regarding their future roles and prospects. From a socioeconomic and historical standpoint, we highlight the primary drivers of the current digital currency wave. From an investing aspect, we examine the benefits of including a cryptocurrency in a diversified portfolio, as well as other elements to consider when making asset allocation decisions. We also look at the ESG (environmental, social, and governance) consequences of such digital currencies.

Brian D Feinstein and Kevin Werbach states that as a counterbalance, they compiled real data on cryptocurrency legislation from around the world and utilized it to objectively investigate trade activity at a number of exchanges following important regulatory pronouncements. They discovered that practically all of the models produced null findings. These findings give an empirical foundation for regulatory choices involving bitcoin trading for the first time. They dispute whether capital flight or chilling effects should be a first-order concern, among other things.

Alexey Mikhaylov explains that the purpose of this study is to examine the cryptocurrency open innovation industry in order to

forecast future growth. The most effective and promising cryptocurrency, according to the findings of the investigation, is the EOS cryptocurrency, which has the lowest complexity and commission level among the evaluated digital currencies and allows third-party apps to be implemented in the system.

Donato Masciandaro and Alessandra Cillo explain that the goal of their paper is to examine the demand for both traditional and new forms of exchange, such as cryptocurrencies and central bank digital currencies, and to propose a new definition of money demand. The medium of payment (MOP) has three qualities in this specification: the first two are traditional functions of the MOP as a means of exchange and a store of value, and the third is a new function as a store of privacy (anonymity value).

Philipp G. Sandner and Jonas Gross and their paper target the technological and digital aspects of CBDC implementation. The paper contrasts three types of digital currency - CBDCs, Libra, and the Digital Programmable Euro and their impact on the European banking environment. Payments systems across the globe are getting disrupted. With this disruption happening at an ever-faster pace than ever before, it is essential that the technological infrastructure that is being used is robust and able to handle millions of transactions both effectively and securely. These technologies have been reviewed by more than 50 experts in the space, and they came to the conclusion that these could heavily affect the European banking space.

John Miedema, Cyrus Minwalla, Martine Warren and Dinesh Shah in their research note prepared by the team at the Bank of Canada talks about the inclusivity of CBDCs and how they must be designed to improve financial inclusion and ensure universal access to digital currencies (in specific) and financial services. The article highlighted the importance of improving access to CBDCs, the technological imperatives to implementing CBDCs, and addresses the 'Cash plus Digital' mode of payment.

Bindseil takes a pragmatic view of the implementation of CBDCs as a medium of exchange, without having to deal with extrapolations with regard to the transformation of the banking and monetary system. This could be a gradual shift and nobody can predict with

accuracy how market participants and relevant actors would behave. The source also evaluates the pros and cons of implementing a CBDC. It also gives a broad roadmap into the control over CBDCs and how they can be effective tools for successful monetary policy decision-making.

Bijlsma, van der Cruijsen, et al. suggest Central Banks all over the planet are inspecting the chance of presenting Central Bank Digital Currency (CBDC). The authors have conducted a survey on the likelihood of implementing a CBDC in the Netherlands. Based on the results of the survey, more than 50% of Dutch consumers are looking forward to implementing a CBDC. The same holds true for CBDC investment accounts. These outcomes recommend that Central Banks can guide buyers' reception of a CBDC by a plan that considers the public's requirement for security and protection, and by clear correspondence regarding what CBDCs involve.

Alonso, Jorge-Vazquez and Forradellas evaluate the current state of CBDCs and the state of their development in different economies. Several countries have adopted CBDCs or are in the process of adopting one, such as the Bahamas, China, and Uruguay. Based on the parameters and variables that might have impacted the adoption of the CBDC in these areas, the authors have identified other target economies where a CBDC could be implemented. The Balkan nations seem to be well poised for the adoption of a CBDC in Europe. The same would be applicable to Malaysia in Asia and South Africa in Africa

Laboure, Muller, et al. further suggest that the nature of CBDCs are highly dynamic and require a great deal of sophistication in terms of technology and the degree of control by regulators and relevant actors. The article evaluates the socioeconomic implications of the adoption of digital assets or digitals currencies such as CBDCs which are backed by the government. With many CBDC rollout programs in the pipeline for many countries across the globe, the article evaluates the impact of such changes on the global macroeconomic landscape.

Grym suggests that Central Bankers and regulators around the world are evaluating the idea of rolling out CBDCs in the medium term. In many ways, the Bank of Finland’s Avant Smart Card

technology which was implemented in the 1990s can be viewed as the world's first CBDC. This technology worked similar to debit and credit cards but were based on the smart card technology. The development, rapid adoption, spin off to the commercial sector, and subsequent decline of the Avant Smart Card serves as a great source of insight to the CBDCs which find itself in a similar state.

Foster, Blakstad, et al. believe that while the world moves towards the era of digital finance and decentralized finance, the technological infrastructure that is required for the mass adoption of these technologies are simply inadequate in Least Developed Countries (LDCs). These countries are crippled by heavy deficits, lack of investment (public and private), debt-laden and suffer from many socioeconomic evils. The paper evaluates various types of digital currencies such as stablecoins, BFTs, etc. and their possible implementation in LDCs. The state of LDCs can be used as a proxy for the economically backward and underdeveloped parts of India where the adoption of the CBDC would seem very difficult due to a multitude of factors.

Usher, Reshidi, et al. from their preliminary observations about the introduction of a fully functioning digital economy, say that one cannot simply ignore the vibrancy and the level of innovation that can be promoted through the adoption of a CBDC. The CBDC acts as a great competitor to age-old payment mechanisms and related systems that, at the current stage, are ripe for disruption.

Auer, Boar, et al. evaluate the role that CBDCs would play in the relative ease of conducting cross-border financial transactions. The ability of a CBDC to integrate cross-border functionality will boost the level of foreign exchange transactions, giving economies an opportunity to strengthen foreign exchange reserves.

3. Research Gap

Central banks all across the globe have been fascinated by the idea of cryptocurrencies, and countries like China and Sweden are already initiating the concept experimentally. Countries plan to go ahead with this concept mainly to reduce the cost of issuance of physical currencies, prevent the use of physical cash in hand, and to explore other private currencies like Bitcoin. The promoters of

these digital assets are firmly opposed to central bank policies that critique fiat currencies. They've set out to create a world without central banks and regulatory oversight, ruled by these promoters wholly. Many users however are straying away from CBDCs due to their user identities and privacy being sacrificed for the purpose. Many users have reported suffering distressing consequences of blockchain-type CBDCs. Many banks have reported that cryptocurrencies also pose a threat to the entire payment ecosystem, and are trying to find a balance between privacy for the user and following the regulatory compliances.

4. Study Design

The scope of this study is limited to the socioeconomic implications of the introduction of a CBDC in the Republic of India. The objectives of this research paper are to identify the structure of Central Bank Digital Currency and the economic and financial implications of such a currency issued by the Central Bank. This would include how the financial system would change and all the advantages and disadvantages of implementing such a digital currency.

The introduction of CBDCs would significantly impact the way agents transact in the economy. With the growing volume of digital transactions in the country, the importance of CBDCs cannot be ignored considering the same. An increasingly digital global economy only strengthens the case for a detailed investigation into the possible implications if a CBDC was to be introduced. The methodology to be followed will be an examination of research papers of different countries planning on issuing their CBDC and their structure. This would give us useful insight into the impact these currencies would have in such economies and the subsequent effect of a CBDC in India. Due to time and financial constraints, the data collection will be limited to secondary research available in the public domain.

With all the debate and discussion surrounding the introduction of a digital currency or the legalization of specific private cryptocurrencies, the main question that poses both regulators and market participants alike is whether or not this will alter the

financial landscape for institutional and retail participants. With a larger population having access to financial services, the financial services industry would significantly benefit, resulting in massive growth for the sector. The spillover-benefits to the general public from a robust and efficient financial system are numerous. The introduction of CBDCs will create new jobs and services that will serve as an ancillary to the introduction of such a digital currency. This would create massive opportunities for innovation, technological advancement, and entrepreneurship for the country.

5. Analysis & Findings

Our research on Central Bank Digital Currencies and their implementation in different currencies is based on secondary research reports published by central banks as well as many institutions which oversaw the implementation of this currency in a controlled environment and reflected on their findings. No surveys or primary data could be collected largely due to the nature of this research.

In our analysis, we found out that many countries (like China, the UK, Sweden, and even India) have shown great interest in the emerging blockchain technology and how the currencies based on this digital ledger would influence the economy and its monetary structure. While many professionals believe the futures of CBDCs to be bleak, terming it as "a millennial trend" that could harmfully impact the functioning of the economy and destroy the monetary base of a country, some professionals believe it to be a "revolution" that could positively change the buying and spending habits of consumers and the economic structure of the country.

The Indian Government believes that the introduction of blockchain-based CBDCs provides many advantages such as reduction of settlement risk in cross-border transactions. Exchanging CBDCs would be similar to exchanging paper currency which would remove the requirement of banks to facilitate and complete the transactions. CBDCs would also enable real-time and cost-effective payment systems, bringing down the cross-party transaction costs (especially foreign transactions) to zero. A pilot survey conducted by RBI on the spending habits of individuals in

six cities shows that cash remains the preferred mode of payment and for receiving money for regular expenses, especially for small value transactions (500 Rs and less). As a result, there is great scope for the advancement of digital payments, especially for small value transactions but the fact that people prefer to hold physical cash for these transactions can act as an impediment to the adoption of CBDCs by working-class people.

Despite its advantages, one harmful effect that the introduction of CBDCs could have on the Indian economy would be the disintermediation of banks. Commercial banks hold deposits as well as provide loans to both the retail public as well as to business enterprises. With these deposits, the banks engage in the activity of credit creation (lending a portion of deposits) which is imperative for the implementation of monetary policy. Controlling the rate of credit creation (by reducing or increasing the reserve requirements) is one of the ways through which the central bank controls inflation or deflation. The Central Bank fears that with the advent of central digital currencies, the number of bank deposits with banks would reduce drastically. These digital currencies would be a safer and risk-free alternative for many people and therefore people might prefer holding CBDCs rather than holding bank deposits. Also with reduced deposits, the interest margin might come under stress leading to an increase in the cost of credit. This would not only reduce the borrowings by small business enterprises but would also reduce capital expenditure by businesses and the general public leading to a well plausible situation of recession.

But since CBDCs are currencies and would not carry any interest on them, their impact on bank deposits is believed to be rather limited. The Central Bank believes that people would continue to hold bank deposits but would sweep it with the CBDCs while making any transactions. Also, if the Central Banks decide to implement the CBDC Popular model (which in our opinion it should), the disintermediation of commercial banks would be limited as the commercial banks would distribute the CBDCs to the general public instead of the public holding their account with the Central Bank (Central Bank Accounts) directly. This would ensure that the commercial banks stay in the loop of credit creation and that the flow of credit creation in the economy would remain

uninterrupted as people can deposit these CBDCs with the commercial banks and earn some interest on it. The important thing to note is that while this framework may sound feasible theoretically, the practical implications could be different as the general public could respond differently to the introduction of digital currencies.

The Indian economy has made great strides in implementing and improving its digital payments system (a 55% CAGR over the last 5 years) and the advent of UPI (United Payments Interface) has made it easy for people to make small volume payments on a real-time basis, with the cost of transactions that is the lowest in the world. Such an impressive case of digitization really makes one question the need for the introduction of CBDCs. We believe that the reserve bank should conduct further studies and should also launch pilot programs to gather data on the impact of CBDCs and their usefulness.

6. Conclusion

Central Bank Digital Currencies (CBDCs) are a type of cryptocurrency issued by the Central Bank of a country and are generally denominated in terms of that particular country's currency. Private cryptocurrencies like Bitcoin and Ethereum do not have any intrinsic value and are not backed by any government. CBDCs, on the other hand, will be supported by the government and is accepted as a legal tender. The Government of India's interest in creating its own digital currency, backed by the Reserve Bank of India, and allowing only those private currencies whose underlying technology can be leveraged to enhance the prevailing financial infrastructure suggests that the country's financial landscape is headed in the right direction. CBDCs would have a private chain where only the Central Bank and some of its commercial banks would have access to the network. Dupuis, Gleason, and Wang (2021) had classified CBDCs into three types based on their structure: CBDC Wholesale, Central Bank Accounts and CBDC Popular.

With more and more people having access to financial services under the government's various financial inclusion schemes, the

financial services industry would create massive opportunities for innovation, technological advancement, and entrepreneurship in the country. The ripple effect of its adoption and the benefits to the general public from a robust and efficient financial system are numerous. Transactions with CBDCs would be similar to exchanging paper currency which would remove the requirement of banks to facilitate and complete the transactions.

The Indian Government believes that the introduction of CBDCs provides many advantages such as reduction of settlement risk in cross-border transactions. Some professionals believe it could be a "revolution" that could positively change the buying and spending habits of consumers and the economy.

The main question facing both regulators and market participants alike is whether or not this will alter the financial landscape for institutional and retail participants. With a larger population having access to financial services, the financial services industry would benefit significantly. This would create massive opportunities for innovation, technological advancement, and entrepreneurship in the country. The spillover of benefits to the general public from a robust and efficient financial system is numerous.

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