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Current Development and Future Outlook of China CBDC (e-CNY): A Literature Review

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Abstract:

The great success of Bitcoin has drawn the attention of the world to the field of digital currency. Stablecoins and CBDC have come out right after cryptocurrencies. This study focuses on analyzing CBDC, especially China CBDC (e-CNY), elaborating and comprehending arguments from several outstanding essays in this field. In this study, the author summarizes the development history of e-CNY, concludes the competitive advantages of e-CNY over other types of payment methods, points out the potential shortcomings of e-CNY, and implements possible solutions. In order to provide reliable suggestions and recommendations, the author has compared e-CNY with several existing CBDC from different countries and regions in the world, including CBDC from Singapore, Canada, and England. In the short run, China CBDC can enhance finance monitoring and reduce M0 supply. In the long run, it could stimulate the internationalization of the RMB and boost the evolution of the global monetary system.

Keywords: CBDC, RMB globalization, e-CNY, digital currency

1. Introduction

In 2009, when Bitcoin first came to the public and was a great success, the concept and idea of digital currency started to draw people's attention. This idea was then further broken down into three minor concepts: cryptocurrencies, stablecoins, and central bank digital currencies (CBDC). Till now, cryptocurrencies and stablecoins have attracted billions of dollars into this market, but there is no mature CBDC emerging globally.

A Central Bank Digital Currency (CBDC) is a digital form of a country's fiat currency, issued and backed by the nation's central bank. It represents the virtual equivalent of physical banknotes and coins and is designed to be used as legal tender for all types of transactions. The concept of CBDC aims to modernize the financial system by leveraging technology to improve the efficiency of payments and settlements, enhance financial inclusion by providing accessible digital currency options, and maintain the sovereignty of national currency in an increasingly digital economy. Unlike cryptocurrencies such as Bitcoin, which are not state-backed and operate on decentralized networks, CBDCs maintain the centralized structure of traditional currencies, with the central bank controlling the supply and overseeing the ledger. They can be implemented using various technologies, including distributed ledger technology (DLT) and digital certificate technology. This essay aims to briefly introduce the key characteristics of the Central Bank Digital Currency (CBDC) of China, i.e. E-CNY, and analyze its advantages and disadvantages in both domestic and international contexts.

2. Development history

The People's Bank of China started looking into digital currency in 2014. Mr. Zhou, the former governor of the People's Bank of China, showed great interest in central bank digital currency. In 2017, the PBoC set up the Institution for Digital Currency (IDC) In 2019, China sped up its research progress on CBDC. PBoC has been approved to conduct trials across China on e-CNY with the joint effort of other commercial institutions since 2019, including commercial banks, fintech companies, and three major telecom companies in China. More than 40 patents related to CBDC have been granted by IDC. In April 2020, the development of the digital RMB is progressing steadily, with internal closed pilot tests in Shenzhen, Suzhou, Xiong'an New Area, Chengdu, and future Winter Olympic venues in China. In October, 6 more pilot test regions were added, which were Shanghai, Hainan, Changsha, Xi'an, Qingdao, and Dalian. In July 2021, the trial research was fundamentally completed. People's Bank of China released a White Paper on the R&D Progress of Digital RMB in China, in which it concluded the development process of e-CNY, explained its basic attributes,

and discussed its potential impacts and possible solutions. By the end of 2021, the digital RMB has been applied in three batches and on a pilot basis in 23 cities nationwide, there were more than 8,085,000 pilot scenarios for digital RMB, with a total of 260 million personal wallets opened and a transaction amount of 87.57 billion yuan.

3. Major characteristics of e-CNY

In this part, the author summarizes the major characteristics of e-CNY. The following information is mainly based on the White Paper on R&D Progress of Digital RMB in China, with some lectures and papers of PBoC officers as additional sources.

Firstly, the nature of e-CNY is digital cash. e-CNY has the basic functions of a currency, including a measure of value, a medium of exchange, and a store of value. It is legal tender just like traditional RMB. The issuance and circulation management mechanism of e-CNY is the same as that of physical RMB, but the transfer of value is realized in digital form. One of the final goals of e-CNY is to completely replace physical RMB. However, mobile devices like smartphones are required when using e-CNY, which is an obstacle to progressing the replacement. On 27 August 2021, the China Internet Network Information Centre (CNNIC) released the 48th Statistical Report on the Development of the Internet in China. According to the report, China's mobile internet users reached 1.007 billion by June 2021, while there are still 0.4 billion people who do not use smartphones. Therefore it is impossible for the Chinese government to complete the replacement process in a short period. Mr. Fan, the vice governor of PBoC, committed that physical CNY and e-CNY will co-exist for a long period of time.

Secondly, centralized control and a double-layer banking system are adopted by e-CNY. The currency-issuing right must belong to the Chinese government. In the double-layer banking system, The People's Bank of China (PBOC), as the first tier, is at the center of the digital RMB operation system and is responsible for the management of the digital RMB quota, issuance and cancellation, cross-institutional interconnection and wallet ecosystem management, and supervision and management of the digital RMB exchange and circulation services. As the second tier, Commercial banks with requirements in terms of asset size, profitability, risk management capability, cash service capability, payment service capability, and technological innovation capability are designated as operating organizations to open different categories of digital RMB wallets for users based on the strength of customer information identification and take the lead in providing digital RMB exchange and circulation services. Additionally, e-CNY is categorized as M0, which means that its major function is for transactions, not for storing or financing. Therefore, it will not directly affect the M0 supply and the current functions and status of commercial banks. However, it is important to emphasize the term "directly". Xu, J. (2022) mentioned that "the indirect effects of e-CNY on the money supply are rather complicated and could be very significant." For instance, e-CNY allows money to circulate faster, resulting in less amount of money being necessary. Also, commercial banks are asked to deposit as much cash as the amount of e-CNY they get from PBoC. This may cause obstacles for commercial banks to operate traditional financing activities, as they cannot reserve as much cash as they used to have. As a result, digital transformation becomes urgent to most commercial banks as long as they do not want to run out of business in the market.

Thirdly, e-CNY is mainly token-based rather than account-based. In order to satisfy offline payment and pay-as-settlement (PAS), e-CNY is designed to be encrypted character strings. Due to this design, e-CNY can be stored in devices like smartphones, which can be linked to an account. When the user carries out a transaction, the token can be recognized by another mobile device through Near Field Communication (NFC) technology. This process does not rely on the network connection, which makes it possible for offline transactions of e-CNY. Additionally, unlike third-party payment applications which require some time before the money is transformed to the sellers, e-CNY transforms immediately when the payment is made. However, the transaction will later upload to the account when the mobile device reconnected to the Internet. Therefore, the transactions can still be under monitoring because the transaction information will eventually be uploaded to the accounts of both the seller and buyer. This character explains the reason why e-CNY is superior to both physical RMB and third-party payment applications like WeChat Pay and Alibaba Pay.

Fourthly, e-CNY does not apply the blockchain technology. Private digital currencies like Bitcoin, Ethereum, and Litecoin have applied blockchain technology as the core security method. Their decentralized, traceable, and dis-rewritable features have gained the trust of their users. However, private cryptocurrencies cannot become the major monetary system in the future due to three main reasons. Firstly, blockchain technology cannot handle large amounts of transactions in a short time. This problem is generally concluded as the scalability of blockchain. Secondly, the value of private cryptocurrencies changes greatly over time, which makes it difficult for normal financial transactions. The reason is that cryptocurrencies sacrifice the value stability in exchange for higher security so that

they can be trustful. However, the trust of e-CNY can be gained from the state's credit and legal protection, which allows e-CNY to jump out of the limit of blockchain technology. This problem is also referred to as the instability of cryptocurrencies. Lastly, it is significant for the government to control the right to issue money (Böhme et al., 2015; Yermack, 2015). The decentralization of blockchain cannot be accepted by the government.

4. Competitive advantages of e-CNY over other payment method

In the above session, we have fully discussed the four characteristics of e-CNY, but why the public and financial institutions would prefer e-CNY rather than existing payment methods? This session is going to compare the advantages of e-CNY over physical RMB, third-party payments, and private cryptocurrencies.

First, e-CNY has overwhelming advantages over physical RMB. e-CNY is more convenient, more environmentally friendly, and faster. People no longer need to carry stacks of cash and heavy coins to buy goods, what they only need to do is to tap their phone on the inductor. Also, paper is no longer needed, which is more environmentally friendly. Lastly, the payment process is faster, as people do not need to take out cash and ask for changes.

Secondly, e-CNY is safer and more convenient than third-party payment. There are mainly two types of third-party payment, which are bank card payment and online payment software such as WeChat Pay. Compared to third-party payment, e-CNY directly belongs to the Chinese government, which legally protects your properties. However, the nature of the third party like commercial banks is mainly financial institutions and entities, which do not have the same credit as a country. Additionally, third-party payment usually requires some time to transform the money from the buyer to the institution, and then, to the seller, but e-CNY transforms the money directly from the buyer to the seller the moment when the transaction occurs.

Thirdly, e-CNY is more stable and safer than private cryptocurrencies. As mentioned above, the value of private cryptocurrencies changes fiercely from time to time, while the value of e-CNY is strictly tied to the value of physical cash. Additionally, although blockchain can protect cryptocurrencies from being tampered with by someone most of the time, they can still be broken through as long as the attacker owns more than 50% of the crypto pool. e-CNY uses digital certificates as its security method, which does not have this fatal defect.

5. Potential shortcomings of e-CNY

Although e-CNY is superior in many aspects compared to the existing payments, it has its own potential defects as well.

5.1 Fraud

Up to the written date, there isn't a CBDC that has been completely open to the public for retail or wholesale trading. However, there could be some potential fraudulent activities that may happen after e-CNY is launched. Identity theft, criminals could steal the identity credentials of legitimate users to gain unauthorized access to their CBDC wallets or accounts. This could allow them to transfer funds illegitimately. Phishing Attacks: Fraudsters could attempt to trick users into revealing their private keys or other sensitive information through phishing scams, enabling unauthorized transactions. Distributed Denial of Service (DDoS) Attacks: While not directly a means of stealing funds, DDoS attacks could disrupt the availability of CBDC services, potentially shaking the trust in the system and creating opportunities for fraud during periods of instability.

5.2 Device compatibility

As mentioned in the first session, there are about 0.4 billion people in China who do not use a smartphone, so it will be difficult to ensure this group of people can use e-CNY. This group of people is mainly elderly people and people in undeveloped and rural areas. Easy and necessary guidelines and feasible devices must be provided to them to make sure they can use e-CNY by themselves. According to the update speed of current digital devices, there is are high chances that the versions of devices in the future will be much larger than that nowadays. Therefore, to make sure the majority of the public can use CBDC payment on their devices, the device compatibility must be wide enough.

5.3 Liquidity management challenges

Liquidity management challenges are about the ability to make payments when they become due, thus related to the movement speed of a given financial asset. If the movement speed of e-CNY cannot satisfy the needs of banks and PSPs, they may not be willing to choose e-CNY as a potential payment. According to the suggestions given by the BIS, a DLT-based platform for wCBDC may increase the complexity of liquidity management, and cause changes in the market structure. Therefore, innovative liquid-saving models are needed. In Project Helvetia Phase II, it is found that "the wCBDC design and the integration with the RTGS system and the core banking systems mitigate the complexity of liquidity management." Such an in-

novative practice can be seen as one of the solutions to the liquidity management challenges. However, if the money is transformed immediately, it would be difficult for the monitoring authority to recover the money when crimes happen. A possible solution could be that all the countries using e-CNY payment set up an easy tracing-back procedure so that the government has the right to recover the stolen money back even though it is transformed to foreign countries.

6. International & cross-border transactions

Although one of the main purposes for developing e-CNY is to accelerate the internationalization of RMB, the effects may be minor in the short term. The reason is that the key to the internationalization of a currency depends on the country's political, economic, and military power. According to Liu and Woo, "A higher level of economic integration and stable macroeconomic conditions increase the international use of major currencies" (Liu et al., 2019). Therefore, the digitalization of the RMB cannot affect its internationalization from the root of the problem. Yet it does not mean that e-CNY brings no benefit to the international and cross-border trade. Instead, e-CNY can greatly improve the trading efficiency and security. Also, some countries have already done some research on the cross-border trade of CBDC, which can be used as examples for e-CNY to improve itself.

Traditional cross-border payments are inefficient and costly due to multiple intermediaries. The payer and payee have to pay extra money to both domestic and foreign bank institutions to finish a cross-border transaction. The processing time is usually long because of the different opening hours of the bank institutions. However, this problem can be greatly eased by using CBDC for cross-border payment. According to the 4 experiments conducted by several governments and the Bank of International Settlement, different CBDCs can trade on DLT-based platforms without intermediaries.

There are several countries already launched experimental practices on CBDC. The Monetary Authority of Singapore, the Bank of Canada, and the Bank of England have tested several models that could enable cross-border payments. The MAS has successfully applied a blockchain network for a payment system in its Ubin, which provides faster, safer, and cheaper cross-border transactions, compared to traditional setups. According to BIS, CBDCs can be categorized into 2 types based on the intended users. One type is the wholesale CBDC system (wCBDC), and the other is the retail CBDC system (rCBDC). Additionally, Themistocleous et.al. (2023) mentioned that there are 3 choices for banks and other Payment service providers (PSPs) to access CBDC systems, direct, interact, and closed access. First, direct entry is most probably for the foreign PSPs to hold and trade wCBDCs issued by central banks directly, so that no intermediary exists. Second, interact entry needs an intermediary to connect between PSPs and central banks. Last, the closed-access entry is more probable for domestic use only, and wCBDC can only be held, used, and circulated among local entities. Based on the above classification, BIS concluded five criteria for establishing a CBDC for cross-border trade: "(a) CBDCs are designed to not harm, (b) enhance efficiency, (c) increase resiliency, (d) enhance financial inclusion and (e) ensure co-existence and interoperability with systems other than CBDC" (BIS, 2022a).

In conclusion, the e-CNY could learn from the existing foreign examples to improve itself on convenience, safety, efficiency, and versatility. Meanwhile, the Chinese government needs to establish a refined legal structure for regulating and monitoring the transactions through e-CNY. Based on the previous pilot projects of e-CNY in several cities, the retail mode of e-CNY has been proven to be successful. However, it still takes a long time for e-CNY to be used in cross-border transactions. Some experimental and validation projects are needed to prove the possibility of e-CNY in cross-border trade.

7. Conclusion

In this study, the author introduces the development process of China CBDC (e-CNY). Even though the e-CNY has not been open to citizens all across China, we can still draw a brief picture of it based on official reports and information about the contained experiments of e-CNY in the past ten years. Generally speaking, e-CNY is a token-based centralized digital cash type that applies a double-layer operating system and digital certificate security system. However, blockchain technology has not been adopted by e-CNY so far due to its decentralization, scalability, and value instability. On the one hand, e-CNY showed clear advantages over existing payment methods, ranging from physical cash to third-party payments. On the other hand, e-CNY still has its potential shortcomings, such as fraud, device compatibility, and liquidity management.

e-CNY can not only greatly enhance domestic finance monitoring and circulation, but also become one of the milestones of RMB internationalization. However, it cannot solve the fundamental problem of the RMB's internationalization, which is the political and economic strength and power of China in the world. Therefore, the influence of e-CNY on RMB internationalization is limited in the

short run. In the long run, however, e-CNY can serve as a new trading channel that facilitates the internationalization of RMB.

Due to the lack of research data on e-CNY and other CBDCs, this study is largely based on theoretical arguments while lacks quantitative data to support them. Quantitative research can be conducted to further examine the arguments in this study.

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