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China's Central Bank Digital Currency: Systems Design and Policy Objectives

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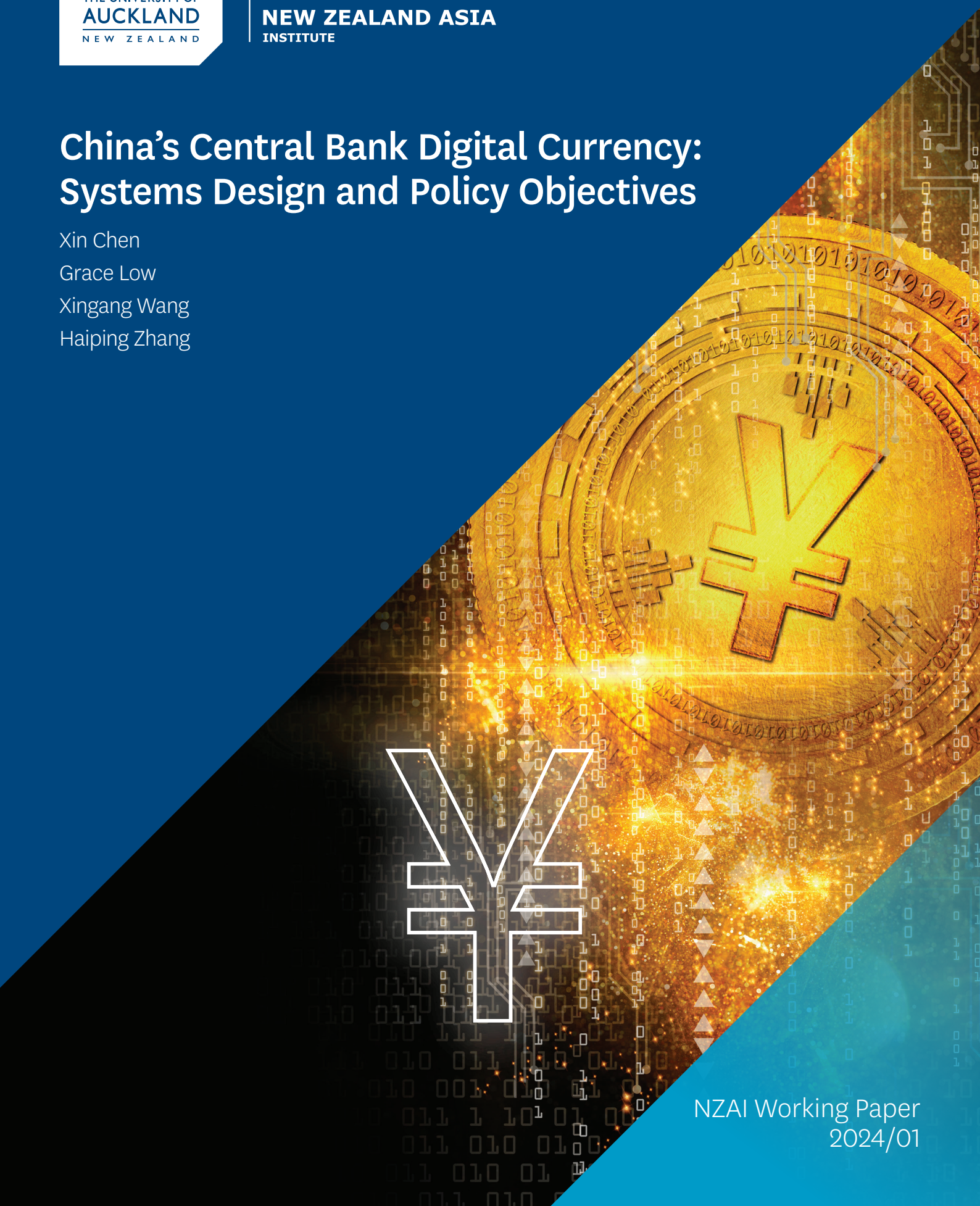

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About this working paper

This is the first paper in a series of working papers that the authors have developed from their digital RMB project report on "China's e-CNY Journey: Design and Development". China began piloting its central bank digital currency in 2019. The trial programme now covers twenty-six cities and involves more than five million merchants. This working paper series examines the digital RMB's systems design and policy objectives, performance expectations and technology support, and hybrid delivery mode.

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China's Central Bank Digital Currency: Systems Design and Policy Objectives

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Highlights:

- The Chinese public's embracing of mobile payment and Bitcoin spurs its curiosity about differences between the e-CNY and cryptocurrencies and between the DC/EP and the money stored in the e-wallet app on cell phones serviced by China's third-party payment platforms.
- Public discussions continue in China about whether positioning the digital RMB as a substitute for cash in circulation will restrict the potential scale and impact of its applications.
- There is an expectation that the DC/EP will help mitigate the time lag in monetary policy transmission, accomplish precise monetary distribution, and reduce tax evasion and fraud.
- Chinese continue to debate whether the digital RMB will increase the money multiplier and stimulate growth in the money supply.

Introduction

In their discussions concerning Chinese currency, many in China's financial industry and research circles break its evolution into three phases. "RMB 1.0" was the phase when physical banknotes and coins were the predominant form of money in circulation. "RMB 2.0" saw the electronification of the Chinese *yuan* (CNY), driven by the booming fintech industry and its constituent third-party payment platforms and mobile wallets. "RMB 3.0" signifies the digitisation of the CNY.[1] These phases and the different accompanying features of the RMB are generally expected to continue coexisting in the foreseeable future. Yet a digitised currency is also widely anticipated to rapidly become the most critical financial underpinning of China's digital economy. The decisive importance of a digital currency in China's shift towards a cashless society is further acknowledged to require the strong presence of the central bank.[2] Accordingly, the People's Bank of China (PBC) has launched the e-CNY and has been rapidly expanding its pilot programmes and application scenarios.

When interacting with the public about the purpose of the digital RMB, China's financial policy and research communities often invoke its project name, the Digital Currency and Electronic Payment (DC/EP), to highlight that the e-CNY has both legal tender status and payment instrument functionalities. They underscore that while central bank issued digital currencies (CBDCs) may vary in design and payment system, they will also embody several essential principles. These include: providing convenience and security; striking a harmonious balance between safeguarding privacy while maintaining social order and combating illicit activities; facilitating the effective operation and transmission of monetary policies; retaining robust control over monetary sovereignty.[3]

Accordingly, the PBC has endowed the DC/EP with ample flexibility to facilitate transactions of goods and services. This design aims particularly at including products and services that are not currently traded in the market. The DC/EP is also envisioned to progressively incorporate all viable economic activities, which are currently reliant on cash transactions, into the statistical data of national accounts and the calculation of real GDP.[4]

The development of the DC/EP also prioritises personalised services to cater to the diverse demands of the public for small-value, high-frequency payment transactions. This effort aims to provide streamlined and secure payment experiences, which will help foster social interactions and convenient travel and thereby advance the growth of inclusive digital finance.[5] Furthermore, the "controllable anonymity" of the DC/EP means that banks and businesses must obtain customer permission to access users' transaction records and information. This feature is intended to safeguard both data security and customer privacy. It is also expected to enable the central bank to efficiently capture the circulation details of each currency transaction, so as to effectively counter money laundering, identity manipulation, and other illegal activities.[6]

In addition to serving the advancement of the digital economy, the motivation for the DC/EP research and development is generally considered to also include mitigating rapidly growing "too big to fail" risks in China's digital finance sector. This specifically alludes to the activities of some large technology companies that capitalise on their "data monopoly" advantages to engage in mixed operations in which they can employ improper means to control the market and charge elevated prices, creating a "winner takes all" situation. Aimed at maximising the value of their data resources, mixed operations of large fintech firms pose potential risks to the financial system, which still has regulatory blind spots. Also, allowing a substantial amount of newly generated digital wealth to exist outside established economic and financial statistical and measurement systems may pose challenges for the formulation of monetary policies, the prevention and resolution of major risks, and the maintenance of the national credit system. Chinese economic and financial policymakers thus anticipate that the DC/EP, currently being piloted and promoted by the central bank, will someday play a pivotal role in rebalancing production relations within the digital economy.[7]

DC/EP: Concept and Nature

"RMB 2.0" and "RMB 3.0" represent the digitisation stages of China's sovereign credit currency. "RMB 2.0" created an "electronic currency", encompassing the RMB transacted and circulated through electronic payment platforms such as Alipay, WeChat Pay, and other third-party and banking electronic payment systems. "RMB 3.0" is recognised as a "digital fiat currency", referring to the DC/EP developed and piloted by the PBC.[8] On 4 September 2017, the PBC and six other Chinese regulatory bodies jointly announced the cessation of all token offerings and financing. They further emphasised that the DC/EP being created would represent only the digitisation of sovereign money and would encompass no element to make it a novel cryptocurrency.[9]

Thus, the formally adopted conceptualisation signifies that the DC/EP is technically China's legal tender introduced by its central bank. The centralised digital currency stands as a direct liability of the PBC and is credit guaranteed by the bank. The unlimited legal tender status, or unlimited payment capacity, enables the e-CNY to serve as an effective supplement to the existing monetary system.[10] Moreover, the digital attributes of the RMB enable it to function both as a valuation tool for assessing digital assets and as a medium of exchange for digital asset transactions. The direct integration of currency and digital assets in turn effectuates the birth of a real Chinese "digital currency".[11]

Unsurprisingly, the understanding of the nature and characteristics of the DC/EP that has emerged from China's public discourse is quite simple and straightforward. For the average Chinese, the digital RMB is equivalent to the real but intangible banknotes and coins stored in the e-wallet app on his/her mobile phone that is serviced by Aplipay, Wechat Pay, UnionPay, or any other third-party payment platform.[12] To help the public gain a more comprehensive understanding, many in China's financial policy and research circles communicate through multiple channels to explain that the transition of the RMB from a physical to an electronic form has indeed altered only its technical format. The transition has thus exerted no effect on the RMB's four fundamental functions: intrinsic value; medium of exchange; payment capability; store of value. However, monetary statisticians place the digital currency ("DC") issued by the PBC in the "cash"

category, but group the funds on third-party platforms used by the public into the category of deposits in non-deposit financial institutions. Furthermore, given that the DC/EP represents legal tender issued by the central bank, merchants cannot reject payments made through it as they often do with cash for various reasons. Also, the DC/EP constitutes a guaranteed currency backed by a 100% reserve requirement. It therefore signifies a debt issued by the central bank to the public, with the central bank providing guarantees and national credit furnishing value support. All this establishes the DC/EP's status as a sovereign currency. More importantly, the central bank is exempt from the possibility of default or bankruptcy, resulting in higher fund security than that allowed by third-party payment platforms.[13]

Moreover, China is not only a global leader in the e-commerce market and the mobile payment industry, but has also been a pioneering nation by enthusiastically embracing cryptocurrencies.[14] Although the PBC's escalated regulatory efforts have seen China's global share of Bitcoin trading volume rapidly dropping from over 90% to 10%, it remains the world's second-largest "Bitcoin mining hub". This situation has spurred the Chinese public's curiosity about the difference between the DC/EP and other virtual currencies and whether they can replace each other.[15]

In answering the question, Chinese finance researchers and professionals consistently and openly acknowledge that the advent of cryptocurrencies, exemplified by Bitcoin and Libra, has ushered in the era of digital currency.[16] At the same time, they also stress that while cryptocurrencies are designated as "currency", they are not issued by monetary authorities, do not have legal and mandatory monetary attributes, and cannot be circulated and used in the market. They are thus not real currencies but a specific type of virtual commodity with no intrinsic value.[17] Even fiat-currency-backed stablecoins, including the envisioned Libra, are regarded as "super-sovereign" digital assets or "digital gold" developed by private enterprises and requiring regulation from multiple jurisdictions.[18] In short, neither cryptocurrencies nor stablecoins possess some of the essential attributes inherent in the DC/EP that are required by currency in modern society. For instance, they lack the backing of national credit and do not have stable value fluctuation range, both of which are vital for effectively serving as a store of value.[19] Moreover, they are unable to be adjusted in total quantity to maintain price stability and prevent the occurrence of severe inflation or deflation.[20]

It is worth noting, however, that as the development and trials of the DC/EP progress, increasing numbers of Chinese finance academics and professionals acknowledge that China's CDBC must play catch up in some legislative and regulatory areas. They point out that the prevailing view in civil law theory categorises the RMB as a distinct form of movable property, but the "Civil Code of the People's Republic of China" does not specify boundaries of objects classified as property. As a result, the e-CNY may still face the question of whether it can enjoy protection under the property rights provisions of the Civil Code.[21]

In simpler terms, due to its intangible nature, the digital RMB is bound to diverge from traditional forms of the RMB in terms of what kind of protection it warrants and how it should be protected. For example, how the ownership of the digital RMB can be ascertained remains an open question. Should the judgement be aligned with the traditional "who-has-who-owns" notion of movable property so that the ownership of a unit of digital RMB should be attributed to the possessor of the digital wallet where it is located? Or should the registered holder of the digital wallet, whose name is in the central bank system, be recognised as the proprietor of all money held in the wallet?[22]

Moreover, Article 127 of the Civil Code stipulates that all laws providing for the protection of data and online virtual assets should be followed. However, the digital RMB faces a lack of specific legislation that explicitly stipulates its protection systems or measures. The question is then whether the digital RMB can be categorised as a form of data or network virtual property, and whether it can subsequently qualify for protection under relevant legislation. These pending issues are expected to inspire Chinese finance policy and research communities to speed up their exploration of the legal protection framework for the "new

form" of the RMB. Their findings are believed to be essential for the development of laws and regulations applicable specifically to the DC/EP.[23]

DC/EP: Features and Functions

In China, the penetration rate of payments using mobile platforms has now reached nearly 90%, permeating all aspects of daily life.[24] This leads many Chinese to wonder out loud whether the massively popular Alipay and WeChat Pay have already allowed people to "embrace the cashless era", and thus whether a genuine need for a central bank digital currency still exists.[25] The widely shared official explanation of the primary distinctions between the DC/EP and Alipay/WeChat Pay points to the fact that the central bank digital currency is a substitute for M0, and mobile payment platforms function as a replacement of M1 and M2.[26] Specifically, M0 refers to the cash in circulation, including banknotes and coins. Thus, transactions made through Alipay and WeChat Pay fall outside this category. M1, also known as "narrow money", encompasses the entirety of M0, demand deposits of non-financial corporations, and deposits of government agencies and public organisations. Accordingly, since the money in a personal bank card constitutes personal demand deposit, transfers through online banking do not fit into M1. M2, "broad money", includes all components of M1, household savings deposits, corporations' time and savings deposits, and other forms of deposits.[27]

Recognising the potential challenge for the general public to understand the differences and correlations among these three "M" categories, finance researchers and professionals further elucidate the relationship by comparing a country to a household. It follows that when assessing the family's financial situation, M0 represents "cash on hand" that is immediately available for use. M1 involves money that needs to be transacted through bank channels, and M2 entails money that is owned by the family but can be used only after it is converted into M0 or M1. Put differently, the family's overall wealth status hinges on M2, while its capability to make payment depends on M1. In emergency situations, such as when a family member suddenly becomes seriously ill, only M0 is truly valuable. Similarly, in assessing a country's money supply and impacts on the economy, the higher the M0 level, the more cash in the hands of people, and the safer their lives. Meanwhile, the elevated level of M1 signals greater purchasing power for citizens, while uplifted M2 indicates heightened demand of the entire society and hence inflationary pressure in the near future.[28]

Chinese finance researchers and professionals further point out that China has at present basically completed the electronic and digital transformation of M1 and M2. The several commonplace network payment methods that support M1 and M2 are also well-equipped to meet the needs of both social and economic development.[29] Nonetheless, there are still regions in China that grapple with inadequate banking services and communication network coverage. Those areas remain largely dependent on M0, or cash. Hence issuing an M0-positioned CBDC is expected to not only accommodate the demands of small-value, high-frequency payments, but to also empower the DC/EP to function effectively in all payment scenarios involving cash in circulation, especially in offline environments. The offline functionality of the digital RMB is widely viewed as an important breakthrough in efforts to expand financial services coverage and to improve transactional efficiency and convenience.[30]

In addition to the "three M" differences, the DC/EP uses the central bank currency for transactions, whereas Alipay and WeChat Pay and other similar mobile payment platforms employ commercial bank deposit money. Chinese finance researchers and professionals stress that the main difference in this regard lies in consumers' assets stability and security. For example, should a commercial bank become insolvent or go bankrupt, the "money" stored in Alipay and WeChat Pay accounts by users may lose the guarantee for its normal use, or even become the failed bank's "bonds". In such a circumstance, Alipay and Wechat Pay users may at best receive some compensation, if the bank's liquidation process yields money. Although the probability of occurrence is low, risks of this nature cannot be ruled out.[31]

It may be prevented, however, by the DC/EP, as the digital RMB stored in mobile phones is the same as "holding a bundle of cash in the hand" and is thus not affected by the risk of intermediary institutions going bankrupt. Furthermore, the DC/EP aims to achieve interconnection and interoperability across operating institutions through a unified "Digital RMB App" gateway. This strategic move is intended to rectify the current fragmented situation in which Alipay, WeChat Pay, and other third-party payment platforms cannot fund transfers amongst themselves. The effort will in turn break down existing payment barriers and enhance the efficiency of the payment system.[32]

Yet questions have also arisen within Chinese academic and financial circles about the M0 positioning of the DC/EP. Those who raise doubts point out that among the most significant changes that come with the advent of mobile payments is that more and more Chinese carry almost no cash, effectively converting a substantial amount of money spent on Alipay and WeChat Pay into M0 equivalents.[33] More serious still is that the central bank's clear-cut positioning of the digital RMB as cash in circulation and its plans to include it into the M0 data may be interpreted to mean that the CBDC is limited to replacing or supplementing physical cash and confined to small-scale retail transactions. Such an understanding may easily lead to the conclusion that the digital RMB cannot be used for large-value payments, bank loans, derivative deposits, or other financial services. Yet amidst the widespread use of digital settlements and mobile payments, the proportion of cash in circulation relative to the overall money supply continues to decline, and the share of cash-based payments within the total payment volume is even lower. In this context, if the digital RMB developed with substantial resource allocation can only function as a cash substitute within a limited scope, its potential scale and impact will be severely restricted. Concerns and doubts about its real-world value and viability are then warranted.[34]

Those who hold this, or similar viewpoints do express their understanding that a cautious and risk-management approach suggests that the DC/EP should first focus on cash and retail applications and expand to deposits and wholesale transactions when conditions are ripe. However, they also caution that such a strategy may lead to varied conceptual and operational definitions of the digital RMB, creating multiple challenges and contradictions in its design, operation, and management. The desired result — in the envisioned progression of "cash first, deposits later; retail first, wholesale later" — might not materialise. To avoid this situation, some financial experts assert that the digital RMB should not be confined to cash, nor should it follow the same production process of physical money. They stress that it should proactively replace the existing RMB holdings, including, among others, cash, deposits, and mobile wallets, and its supply should be expanded through avenues such as central bank refinancing and bank credit. They believe that the introduction of the DC/EP should strive to diminish, rather than inflate, the proportion of cash within the total money supply, and hasten the decline of cash-based payments within the overall payment volume. Hence, they argue that positioning the digital RMB as cash and incorporating it into the M0 measurement is not something that can be definitively recommended.[35]

DC/EP: Economic and Monetary Policy Implications

A prevailing viewpoint in China's financial community holds that while the DC/EP may be used as cash upon implementation, its new character string, or sequence of code units, and other unique digital features set it apart from any previous form of base currency. Therefore, the digital RMB will inevitably lead to changes in the existing structure of the central bank's base currency.[36] Furthermore, the issuance of digital currency by the PBC may facilitate a complete substitution of cash for demand deposits, transforming digital currency into a non-interest-bearing asset. This shift will have implications for the existing money supply level and the financial system.[37] Specifically, the base currency comprises cash in circulation and reserve balances. Designed to replace the cash, or M0, in circulation, the digital RMB will reduce the frequency of traditional cash transactions, but will have a small impact on the total amount of M0.[38]

Nevertheless, according to the central bank's policy, there is no difference in the required reserve ratio between the digital and physical RMB. Yet as the utilisation of the e-CNY introduces new risk variables for banks, and as individuals may opt to store more funds in commercial banks, the total amount of excess reserves held by commercial banks will rise. In other words, the introduction of the digital RMB makes it more convenient to perform seamless conversions between monetary assets at varying liquidity levels. It also speeds up the diminishing of the public's interest in holding cash, resulting in a decreased cash-to-deposit ratio. Meanwhile, given that the digital RMB does not accrue interest, people may become more inclined to convert cash into time deposits, which will effectuate an increased proportion of time deposits relative to demand deposits. As a result, the digital RMB will likely increase the money multiplier and stimulate growth in the money supply.[39]

When elaborating on this evaluation, however, many in China's financial community also call attention to the fact that the velocity of money is determined not just by the form of currency, but more importantly by exogenous factors such as the frequency of transactions for which money serves as a medium. It follows that the issuance of the DC/EP, on the whole, should not exert a significant influence on inflation. Similarly, although the digital RMB makes negative interest rates possible, its coexistence with banknotes in circulation will limit the effect of negative interest rate policies.[40]

As for using the digital RMB to help enhance the efficacy of monetary policy transmission, the PBC is anticipated to steer digital fund flows and oversee their subsequent circulations through presiding over the DC/EP. This approach is widely seen as having a good potential for the central bank to facilitate immediate effectiveness of the e-CNY upon issuance, mitigate the time lag in monetary policy transmission, and thereby achieve the objective of precise monetary distribution.[41] A shared view in China's academic, media and social platform discussion circles points to Covid-like emergencies and government financial responses as an example in this regard.

Notably, to offset the pandemic's impact on small and medium-sized enterprises (SMEs), the Chinese government increased the provision of low-interest credit lending to them, and implementing agencies strove to "targeted-drip-irrigate" businesses needing the loans. However, with "no name on the money", large firms ended up securing a greater share of the funds. Upon receiving the money, many financially stable enterprises engaged in risk-free arbitrage in the banking system. Even companies that needed help with cash flows did not all allocate the funds to production. Some instead invested the money in the stock and housing markets, resulting in an explosive growth of the real estate sector. Yet "mismatches" such as these would be reduced or even stamped out in the DC/EP era because each digital currency transaction is essentially a smart contract attached with distinct terms and conditions that specify its designated purpose and make it traceable and verifiable.[42]

On the taxation front, the DC/EP is believed to pave the way for reducing value-added tax (VAT). VAT accounts for about one-third of China's fiscal revenue and therefore is an important component of the public budget. However, VAT is not the most efficient tax mechanism as it is an income tax based on revenue rather than on profit. Therefore, as long as the VAT rate is positive, there may be companies that would be profitable when taxed on profits, but not profitable under the value-added tax system. Although the government is aware of the issues related to the current VAT system, it is concerned that a more profit-based tax system may lead to an increase in tax evasion due to inability to verify transactions accurately and promptly. After all, the volume of transaction verification required by the VAT system is relatively small. Even so, data from the Organisation for Economic Co-operation and Development (OECD) indicate that tax evasion, fraud, and mismanagement result in China failing to generate approximately 55% of potential VAT revenue.[43]

Here again, the DC/EP may help with solutions as it can create an environment where real-time tracking of transactions becomes possible and transaction monitoring more direct, which allows tax authorities to gain a more comprehensive understanding of when businesses generate income. If tax avoidance

becomes more difficult, which in turn broadens the tax base, the fiscal authorities should be able to lower tax rates while maintaining stability in fiscal revenue. Additionally, the DC/EP is expected to also reduce the difficulties that tax authorities face in confirming business costs and verifying income and profits. It can be envisioned that the government may eventually move away from the VAT system and adopt a profit-based taxation mechanism, thereby boosting economic growth and helping businesses stay viable and profitable.[44]

Indeed, the digitalisation of the economy implies the digitalisation of decision-making activities, which inevitably requires a breakthrough in monetary instruments. The functional goals of the DC/EP are accordingly reported to meet diverse and multi-level transaction demands. Its loaded smart contracts are further expected to automatically perform financial audits and dispute resolutions.[45] Chinese finance scholars and professionals who question the M0 positioning of the DC/EP more specifically suggest that as a legal tender, the digital RMB should be able to be applied to the current business functions of the RMB, such as deposit formation, payment settlements, tax payments, and loan disbursements. Again, their reasoning is that for the DC/EP to achieve its goal of changing the manifestation and operational mode of the RMB, it should not be limited to cash and only used for retail payments, but should also possess the essence and functionality of deposits and wholesale transactions.[46]

Conclusion

It is ever more widely acknowledged in China that the DC/EP is both a logical outcome of the country's rapid digital economic transformation and a growth imperative for its digital economy.[47] In other words, mobile payment systems and digital currency have already become indispensable to the financial infrastructure of the "fourth industrial revolution" set off by the digital economy.[48] Furthermore, China's digital economy has not only made it possible for Chinese fintechs and bigtechs to generate "digital wealth", but also elevated it to the "wealth domain" of the entire society.[49] The digital RMB is thus also increasingly noted as an accommodating response to the growing public demand for "low-amount" but "high-frequency" payments and transactions.[50]

Indeed, China UnionPay's annual data continue to demonstrate that online/mobile payments account for more than 80% of China's total per capita consumption expenditure. Also, 70+ percent of mobile phone users make mobile payments in more than 10 application scenarios every day.[51] Thus, many Chinese expected the e-CNY to come into full operation before the 2022 Beijing Winter Olympics and for China to become the first country launching its CBDC. To this day, however, the PBC has yet to clarify the launch timetable for the digital RMB, and only keeps "expanding the pilot programme in an orderly manner".[52]

The conclusion drawn in many Chinese research and discussion circles is that the five "all-encompassing genes" of digitalisation, namely, encompassing all airspace, processes, scenarios, analyses, and value, have unequivocally reshaped China's financial ecology and subverted personal payment habits. Yet the question remains open: what kind of central bank digital currency should China issue that will effectively serve its socioeconomic development and monetary policy goals, preserve its financial stability, and enhance the overall financial regulatory compliance?[53] The on-going public discussions in China do signify, however, that the development of the digital RMB is a continuous exploration process and should be pushed forward "sensibly" and "prudently".[54]

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