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The Function Transformation of Central Banks and Commercial Banks under the Application of Digital Fiat Currency[1]

Since the advent of Bitcoin, digital currency and its underlying distributed ledger technology have been spread and applied rapidly around the world. Traditionally, currency issuance and circulation are based on binary tree structure, with the central bank as the highest node, commercial banks in the middle and the public and enterprises at the bottom. However, in the distributed ledger system, all nodes have similar privileges and can transact with each other directly. Hence, the advocators promote the potential of digital currency to subvert the monetary control of sovereign countries and alter the traditional business of commercial banks with the characteristics of decentralization, trust-free intermediary, non-tampering and encryption security. On the other hand, the dissenters believe that transaction nodes in distributed ledger system will be greatly increased, and hence reducing the professionalism of transaction processing and forfeiting the authenticity of original information, which then becomes difficult to play a significant role in the future economy.

In recent years, digital currency has also attracted the attention of central banks.

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Several digital fiat currency projects have been launched, such as the e-krona project by the Swedish Central Bank, the Jasper project by the Bank of Canada and the Ubin project by the Singapore Monetary Authority. The implementation of these projects revealed the difficulties for digital currency to outperform substantially in improving credit and efficiency, so it could not have subversive impact on central banks and commercial banks at this stage. If the traditional financial institutions could actively transform functions by virtue of their own advantages, this would make up for the defects of the current digital currency system, hence supplementing the digital fiat currency system with higher security and effectiveness.

1. The Function Transformation of Central Banks under the Application of Digital Fiat Currency

Central bank is the monetary authority in a country, responsible for currency issuance, circulation and supervision. Thus it could be summarized as ‘the bank of issue’, ‘the bank of banks’ and ‘the bank of the government’. Digital currencies, which are based on distributed ledger technology, are often characterized by ‘de-centralization’ and regarded as a challenge to the authority and traditional functions of central banks. However, as private digital currencies lack credit support, digital fiat currencies issued by central banks will still play essential roles in the future economy. When digital fiat currencies come into application, the three functions of central banks mentioned above would be maintained but with different manifestations.

A country’s central bank is ‘the bank of issue’, which has the power to issue money and is usually the only money issuing institution authorized by the government. Bitcoin has made it possible for the private sector to issue digital money, which poses a big challenge to the central bank as the currency issuer. In recent years, various kinds of private digital currencies have emerged with more than 800 private digital currencies introduced by the end of 2017. A great number of private digital currencies are created by "mining" but they lack the support of real assets; many other projects use initial coin offering (ICO) mechanism to issue tokens which are actually digital assets rather than real money. Endlessly emerging private digital currencies might also cause the problem of currency abuse and sharp price fluctuations in the secondary market due to the lack of value anchors. Thus digital currencies are still unable to play the monetary functions such as unit of account, medium of exchange and store of value. Therefore, only the digital fiat currency

issued by the central bank and backed by the national credit could completely perform the monetary functions. Besides, issuing digital fiat currency could also help central banks solve the problems of high cost, inconvenient carrying and easy forgery of traditional paper currency.

The central bank is ‘the bank of banks’, which makes it responsible for managing and regulating commercial banks, and one of its essential functions is to handle the currency clearing and settlement among commercial banks. The introduction of digital fiat currency will reform the underlying structure of the inter-bank clearing and settlement system, and push forward function transformation of the central bank. The Bank of Canada and the Singapore Monetary Authority have launched pilots of distributed interbank clearing and settlement system based on the Corda platform developed by the R3 Corporation respectively. As a node on the platform, the central bank does not directly participate in every transaction. All the transactions are handled, verified and recorded by the sending and receiving banks. Even with the gridlock problem which usually needs a centralized resolution, the Corda workstream has developed a new cycle-based algorithm called ‘Cycle-solver’, by which commercial banks on the platform could detect, plan and execute the queued payment instructions in a gridlock by themselves. However, the central bank still plays an important role in settlement finality, providing uniqueness and/or validating consensus on received transactions by providing signature to indicate transaction finality. Then the sending and receiving banks could record the transaction in their ledgers. Hence, in the distributed inter-bank clearing and settlement system, the central bank is no longer the most powerful central node integrating the functions of account management, liquidity optimization and settlement finality, and transforms to a role of third-party certification authority in the clearing and settlement process.

The central bank is also ‘the bank of the government’ with the function of regulating national finance system by the government, including supervising financial institutions, making monetary policy and so on. Under the application of digital fiat currency, the central bank will participate less in inter-bank clearing and settlement process, but its regulatory function will not be weakened. In recent digital fiat currency projects carried out by various countries, most central banks have full access to all account information. Due to the strong traceability of digital fiat currency, central banks could monitor the movement of funds, restrict the flow of black money, reduce corruption, tax evasion and other illegal acts

more easily. At the same time, digital fiat currency also brings more possibilities for monetary policies made by central banks. Bordo & Levin (2017)[2] have pointed out that applying digital fiat currency has enabled the central bank to set a constant price level target, to push market interest rates below zero more effectively, and to provide an appropriate degree of monetary accommodation without quantitative easing. Moreover, with the digital fiat currency system, the central bank could timely trace capital flow and assess financial risk, so as to adopt monetary policy tools more quickly and accurately. In addition, the digital fiat currency system could further load smart contracts to accurately achieve monetary policy objectives.

2. The Function Transformation of Commercial Banks under the Application of Digital Fiat Currency

Commercial banks play an important role in the economy. They are not only payment and credit intermediaries, but also important carriers in the currency circulation system. However, the distributed system of digital fiat currency has the characteristic of "de-intermediation" which brings challenges to the traditional functions of commercial banks. Although Block Chain technology has the advantages of non-tampering information on the chain and high efficiency of point-to-point transactions, it fails to ensure authenticity of the original data at each node. The consensus mechanism involving many nodes may also bring serious efficiency loss. Therefore, commercial banks still have the potential to play active roles in the digital fiat currency system.

As payment intermediaries, commercial banks are mainly responsible for currency settlement, currency receipt and payment, currency exchange and deposit transfer for customers. In traditional business model, each commercial bank has its own clearing and settlement system, in which the bank is not only the intermediary in capital transferring, but also the "center" with the highest authority, so faces efficiency and security challenges. In contrast, the digital fiat currency system adopts distributed architecture, which leads to advantages in payment process and data protection. Its characteristics of "de-intermediation" helps to reduce the time and cost of payment, and the characteristics of "de-centralization" significantly reduces the probability of data tampering and attacking. But for clearing and settlement, the distributed mode of current digital currencies has not

[2] Michael Bordo and Andrew Levin, “Central Bank Digital Currency and the Future of Monetary Policy”, NBER Working Paper No. 23711, Issued in August 2017.

shown absolute advantage over the traditional centralized model, as finalizing a transaction in the distributed ledger needs much more nodes to participate and reach an agreement, which is fair but not efficient. Obviously, the digital fiat currency system needs a more effective governance structure and consensus mechanism, which provide opportunities for commercial banks to participate in the digital fiat currency system. In this new system, commercial banks could exist in the form of super-liquidator, jointly create and maintain a shared ledge, and complete real-time clearing and reconciliation of transactions. Therefore, not only the transparency of the whole payment system will be improved, the problems of resource waste and efficiency loss faced by current private digital currencies could also be solved.

As credit intermediaries, commercial banks are mainly responsible for collecting idle social funds through liability business, and then placing them to the economic departments, which have capital demand, through asset business. In this process, commercial banks' roles are mainly reflected in two aspects: one aspect is to solve the problem of asymmetric information between depositors and lenders to improve the efficiency of capital financing; the other aspect is to solve the problem of asymmetric information about the borrowers' credit by guaranteeing the depositors' interests with commercial banks' own credit. However, in the era of technology, information asymmetry between depositors and lenders has been greatly weakened, and funds could circulate bypassing commercial banks easily in a distributed ledger system. But the above technologies are unable to solve the credit problem of capital demanders that may disclose false original information and cause great risks in debit and credit transactions. With long-term accumulated business advantages, commercial banks could continue undertaking the function of assessing borrowers' credit ratings in the future and providing the credit information to lenders. In addition, as a low risk financial product guaranteed by commercial banks, it is predictable that bank deposits will remain favored by the market. Therefore, even in the distributed ledger system of digital fiat currency, commercial banks could still play an active role of credit intermediary in improving the security and effectiveness of economic operation.

Commercial banks are also important carriers of currency circulation, and are responsible for putting the money issued by the central bank into economic departments. However, the digital fiat currency issued by the central bank is not necessarily circulated through commercial banks, and thus commercial banks' roles would be less important in the new financial system. Ordinarily, there are two modes for the central bank to issue digital fiat currency, i.e. single-tier mode and double-tier mode. In some underdeveloped

countries, their commercial banks and inadequate financial infrastructure are of limited scale, so it may be more convenient to establish a single-tier circulation network directly from the central bank to the public in order to promote inclusive finance. In contrast, most developed countries have relatively mature banking system granting them greater efficiency to make full use of the existing financial infrastructure, human resources and service network of commercial banks in the "central bank-commercial bank" two-tier mode or the single-tier & double-tier combination mode. In China, the People's Bank of China (PBoC) has expressed its interests in issuing digital fiat currency in a two-tier mode. In the initial stage, the digital fiat currency will mainly replace cash and will not involve M1 and M2. Therefore, commercial banks may continue playing the role of currency circulating carriers in the financial system.

3. Suggestions on the Banking System Development under the Application of Digital Fiat Currency

From the above analysis, we could see that although the application of digital fiat currency poses challenges to traditional banking system, it also brings opportunities and momentum for banking system development. Under the background that digital fiat currency may become an inevitable trend, the PBoC and commercial banks in China should actively carry out relevant research, appropriately adjust their functions, and jointly establish a more secure, effective and internationally competitive digital fiat currency system.

The PBoC has a positive attitude towards digital fiat currency and has been studying feasible schemes suitable to China. At present, the central banks of several other countries have done pilot programs and given their proposals. If China wants to hold an invincible position in the international arena, it needs to, as soon as possible, come up with a scheme that has strong feasibility and long-term. As for the design of digital fiat currency, some monetary authorities of other countries have suggested that interest rates should be set in order to make digital fiat currency become a powerful monetary policy tool. However, the PBoC tends to use digital fiat currency only to replace cash and does not consider the interest rate tool at this stage. In the short run, cash replacement by digital fiat currency are highly feasible and would reduce the intensity of the financial system reform. In the long run, we need a more comprehensive design of digital fiat currency which not only helps stabilize the domestic financial system, but also prepares for the implementation of

monetary policy and the exertion of regulatory functions in the future. As the design of inter-bank clearing and settlement system, several central banks have launched the pilots of distributed ledger system which indicate the future trend of digital fiat currency clearing and settlement. The PBoC would continue to adopt the current inter-bank clearing and settlement platform in the early stage of digital fiat currency application, but this is not an excuse to neglect the development of the distributed ledger system. The PBoC should actively draw lessons from the experiences of other central banks, cooperate with domestic commercial banks and financial technology companies to develop prototypes with different technical characteristics and functionalities in order to choose the most forward-looking and reliable one.

China's commercial banks have not shown much interest in digital currency development and block chain technology. However, many large multinational banks have already carried out research and cooperation in these fields, so our commercial banks should quicken their paces to catch up. Firstly, commercial banks should build their own financial technology R&D platforms to break through the technical bottlenecks in distributed ledger system , based on which further establish financial technology R&D cooperation mechanism among one another. Secondly, as payment intermediaries, commercial banks should actively participate in the design of consensus mechanism and clearing node functions under the digital fiat currency system. Thirdly, as credit intermediaries, commercial banks should make full use of their advantages in resolving the problem of information asymmetry to expand their business, including but not limited to issuing information of loan products and assessing borrowers' credit ratings. Finally, commercial banks should take the opportunity of emerging financial services brought by the application of digital fiat currency to broaden their functions. For example, with the advantages in payment and settlement, commercial banks have the potential to carry out more payment business on behalf of customers.

The application of digital fiat currency changes the functions of the central bank and commercial banks, so the laws and regulations of financial supervision should also be designed to adapt the new system. Firstly, current laws and regulations that create obstacles should be abolished in time. They should be designed to reduce the complexity of digital fiat currency’s issuance, circulation, clearing and settlement, and to provide institutional space for making monetary policy and implementing fund supervision in the digital fiat currency era. Secondly, the new functions and business forms of the central bank and commercial banks need to be regulated in time, and the regulations on market access and

risk control should be strengthened. For example, digital fiat currency would bring commercial banks the opportunities to expand into new financial business, which requires the central bank to strengthen prudential supervision to stabilize the banking system. Thirdly, since privacy protection has always been an important issue faced by distributed ledger system, it is necessary to strengthen relevant laws and regulations to protect the private information security of customers. Finally, in order to enhance the discourse right on the international stage, the PBoC should actively participate in developing international standards with other central banks and international organization. China's commercial banks should also strengthen international communication and cooperation.