The Application of Blockchain Technology in Financial markets

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Abstract. In recent years, blockchain technology has been developing rapidly in social economy. As blockchain technology has many excellent properties, it is used for the transaction of Bitcoin at first. With the rise of Bitcoin, the connection between blockchain technology and financial market will be closer more integrative. And then more and more financial institutions have recognized the importance of blockchain technology and started to try to use this technology in financial operations, such as R3CEV, Hyperledger and Qiwi. Many financial institutions have started trying to apply blockchain technology into financial transactions in order to decrease transaction costs and increase operational efficiencies, especially in financial note, cross-border payment and asset-backed securitization. It can be seen that blockchain technology will have widely application prospects in financial fields in the future.

1. Introduction
Blockchain technology, which is a new technique emerged in recent years, has been widespread concern from all sectors of the society, especially financial institutions and high-technology corporations [1]. Blockchain technology was firstly invented by Satoshi Nakamoto in 2008, who tried to design a decentralized electronic cash transaction system in order to solve the problem of double payment and improve the security of information verification [2]. For this reason, blockchain technology is quickly used in financial field. At the same time, the advantage of blockchain technology such as decentration, openness, autonomy, tamper-resistant information and anonymity can reduce the operation cost of commercial bank and improve the efficiency of capital utilization to some extent [3].

With the rise of Bitcoin, blockchain technology generally becomes one of the most important core technologies in the Bitcoin transaction. Although Bitcoin has drawn more and more public concern, it still is a highly controversial topic in academic world and real world in consideration of its currency attribute. It is well known that Bitcoin can be used to trading goods and services in some markets, but not all markets [4]. In spite of the drastic fluctuation of Bitcoin price in recent years, blockchain technology has been applied widely in financial market. For example, the United Nations and the United Kingdom issued separately the research reports of blockchain which are “How Can Cryptocurrency and Blockchain Technology Play a Role in Building Social and Solidarity Finance” and “Distributed Ledger Technology: Beyond Blockchain” in 2016 [5][6]. In China, blockchain technology has arouse widely attention from the official to the folk. The Chinese Government issues the report on blockchain development every year, titled “White book on blockchain technology and application development in China” from 2016 to 2018 [7].
At the same time, the financial institutions also start to reinforce the research of blockchain technology via blockchain consortia [8]. R3CEV that is the most famous blockchain consortia in the world, has more than 180 professionals in 13 countries, built in 2015. In order to research distributed ledgers better, R3CEV launches a distributed ledger platform, Corda. At the technical level, blockchain technology is defined as a decentralized database, which is a private database of independent parties. In certain conditions, this private database can synchronize data between participants. Hyperledger which is the biggest rival to R3CEV, is a global collaboration, launched by The Linux Foundation in 2016 [9]. The goals of Hyperledger are to create open source and distributed ledger frameworks, to provide neutral and community-driven infrastructure, to develop blockchain and shared ledger, to educate the public about the blockchain technology, and to promote the application of toolkit and platform. With the rise of blockchain technology, Qiwi, as the largest online-payments service provider in Russia, saw the huge potential of blockchain technology for developing the domestic economy, and launched a blockchain consortia similar to R3CEV in 2016 [10]. The members of blockchain consortia included many famous financial institutions, such as Qiwi, B&N Bank, Khanty-Mansiysk Otkritie Bank, Tinkoff Bank, MDM Bank and Accenture.

Blockchain technology is a combination of computer algorithm and cryptography. Although this technology is wildly used in digital currency exchange, it has a broader application prospect in financial market. The reminder of this paper is organized as follows. In section 2, the application of blockchain technology in financial notes is systematically discussed. Next section 3 analyzes the application of blockchain technology in cross-border payments. Then, section 4 shows the application of blockchain technology in asset-backed securitization. Finally, section 5 draws the conclusions of this paper.

2. The application of blockchain technology in financial notes

A financial note is a type of securities. The drawer issues a security to the drawee, and promises to pay a certain amount of money to the drawee unconditionally. Financial notes have many forms, including bills of exchange, promissory notes and cheques. In general, financial notes have many functions, such as payment function, exchange function, credit function, settlement function, financing function and circulation function. The payment function of financial notes can simplify payment processes and enrich payment means in social economy. The exchange function of financial notes can help traders reduce the risks of cash payment in trans-regional trades, especially in international trades. The credit function of financial notes is that the drawer issues financial notes depending on his excellent credit standings, and gets future cashes at present. The settlement function of financial notes brings more convenience to offsetting debts for trading parties, relative to cash settlement. The financing function of financial notes is easy to be realized by selling them again. For example, if the holders of financial notes have funding needs, they can sell these financial notes to other traders and obtain the money by discount, rediscount or transfer discount. The circulation function of financial notes is that financial notes can be transferred by endorsement without further notice to the debtors. Although financial notes have many positive effects on trades and businesses, there are some problems in the transactions of financial notes, such as counterfeited notes, default risks and rogue-trading problems.

Blockchain technology makes it possible to develop electron notes by taking advantage of technology and overcome the above-mentioned drawbacks. Blockchain digital notes are different from traditional electron notes. It is an entirely new form of digital notes, which has all functions and benefits of electron notes and the advantages of blockchain technology fusion [11]. Firstly, blockchain digital notes can realize the decentralization of value delivery for notes. By using the blockchain technology, the transaction of notes doesn’t need a third party to supervise the transfer of value for two parties, and doesn’t need a real asset as a trading guarantee. Blockchain digital notes can not only realize the value delivery by point-to-point transmission, but also eliminate the original intermediary between the two parties. Secondly, blockchain digital notes can defense against financial risks to a certain degree. For example, a paper note is sold to different individuals many times in order to fraudulently obtain funds from commercial banks. For an electron note, it is possible that the endorsement and the payment are not synchronous. But, for a blockchain digital note, the entire
process of transaction is open and tamper-resistant, and greatly reduces transaction risks. Thirdly, blockchain digital notes can enhance operating efficiency of note market. The exchange of information of traditional note market often adopts the one-to-one way, which easily causes the asymmetry of information. But blockchain technology can realize all information is open online and reduce the degree of information asymmetry. Thus, blockchain technology makes the enterprises easier to do business decisions. Fourth, blockchain digital notes can decrease the government’s regulatory costs. The supervision of paper notes always relates to on-site audit, which requires a large amount of manpower and resources. Depending on the intelligent contract of blockchain system, blockchain digital notes can automatically set the amount of transaction value and the direction of transaction, and effectively decrease the regulatory costs.

At present, there are some successful cases about blockchain digital notes. For example, the People’s Bank of China (PBOC) announced that the system of blockchain digital notes can be developed in 2016. This system could finish the entire process of transaction, similar to the transaction of paper notes. In 2017, China Zheshang Bank (CZB) completed the first transaction about blockchain digital notes. In 2018, Shanghai Commercial Paper Exchange declared the trading platform of digital notes was online, and then Industrial and Commercial Bank of China (ICBC), Bank of China (BOC), Shanghai Pudong Development Bank (SPDB) and Bank of Hangzhou (HCCB) finished the issue, acceptance, discount and transfer discount of digital notes, successively.

3. The application of blockchain technology in cross-border payments

Cross-border Payments can finish the transfer of funds in at least two countries or regions. If a domestic consumer purchases a product of foreign manufacturers, the consumer needs depend on a settlement tool and a payment system to finish cross-border payments. The most common payment tool is foreign currency, and the most common payment system is cross-border interbank payment system. For example, domestic consumers can conveniently buy imports overseas by bank payment channels, including VISA card, MASTER card, JCB card, and so on. The mainstream cross-border payments include bank telegraphic transfer, transfer by remittance company, credit card payment and third-party payment. Firstly, the bank telegraphic transfer is based on the payment network of Society for Worldwide Interbank Financial Telecommunications (SWIFT). A remitting bank at home sends a remittance message to a receiving bank abroad, and then the receiving bank abroad pays the money to the payee. This kind of payment needs to pay high fees and wait a long time. Secondly, the cross-border payment can also be finished by a remittance company, which confirms the payment transaction by authorized agencies overseas. The entire transaction process only cost very little time. Thirdly, the credit card payment bases on the bank payment and clearing system. Although the credit card payment is often used for shopping online or in a retail store, the shops need cost a great deal of money to equip hardware and software facilities. Fourthly, the third-party payment is a new payment method in recent years. If the government permits third-party payment institutions to offer their payment services to traders at home and abroad, consumers can finish a payment by a third-party payment tool, such as Alipay and WeChat Pay.

The above traditional ways of cross-border payments involve many trading parties and intermediaries, and the operational efficiency is lower. In such situations, blockchain technology can be used in cross-border payment business, in order to overcome the disadvantages of traditional ways of cross-border payments and reduce the transaction risks [12]. And blockchain technology can create a point-to-point payment, which discards a third-party financial institution and provides all-weather service. Concretely speaking, a global foreign exchange settlement system can be set up based on blockchain technology. In this settlement system, a gateway system is introduced to deal with the trust issues between parties in the transfer payment. The relationship between the gateway and the party reflects a kind of debtor-creditor relationship. For example, party A remits money to party B by blockchain. At first, the gateway, as a creditor for party A and a debtor for party B, is responsible for clearing the debtor-creditor relationship between party A and party B. In a blockchain system, the debtor-creditor relationship is stored on several servers though the distributed network technology.

In the practical application, Ripple is a very popular cross-border payment network, which accepts not only all kinds of legal tenders, but also virtual currencies. Comparing with traditional ways of
cross-border payments, the transaction cost of Ripple nearly equals to zero and the transaction time only takes a few seconds. And it is possible for a trader to use any one currency, either the legal tender or the virtual currency, to realize a free trade. For example, if party A holds Bitcoin or gold, he can finish a payment by US dollars, Euros in Ripple. So far, many financing institutions and organizations are cooperating with Ripple, including Accenture, Andreessen Horowitz, CME Ventures, Core Innovation Capital, Google Ventures, and so on.

4. The application of blockchain technology in asset-backed securitization

Asset-backed securitization (ABS) is based on future cash flow to issue the asset-backed securities. The key of asset-backed securitization is whether there will be a steady cash flow in future [13]. According to the different types of assets, the asset-backed securitization can be divided into the securitization of physical assets, the securitization of credit assets, the securitization of securities assets and the securitization of cash assets. Firstly, the securitization of physical assets relates to the transformation from physical assets to securities assets. Secondly, the securitization of credit assets emphasizes on the process of assets re-organize and the asset pool, which can be a theoretical basis of securities issue. Thirdly, the securitization of securities assets is a securitization process that securities assets are securitized again. Fourthly, the securitization of cash assets reflects a transformation of assets from cashes to securities, for cash holder. The basic flow of asset-backed securitization can be summarized as follows. An initiator sells securitization assets to a special purpose vehicle, and then the special purpose vehicle pools all securitization assets into an asset pool. Afterwards, the special purpose vehicle issues asset-backed securities based on cash flow generated from the asset pool. Finally, the cash flow can be used to pay off the issued securities. The traditional asset-backed securitization involves many kinds of assets and various individuals. And every asset is likely to involve a variety of financial risks. Considering blockchain technology has the advantages of decentralization, distributed consensus and tamper-resistant information, the application of blockchain technology in asset-backed securitization can greatly reduce financial risks in traditional asset-backed securitization.

![Diagram](image)

**Figure 1.** The application of blockchain technology in asset-backed securitization

Blockchain technology can protect the data security, especially in the aspect of trading data of financial assets. By a real-time monitoring in asset-backed securitization, financial risks can be effectively prevented, and investor confidence can be enhanced further. And the information of different parties is synchronous by using distributed ledgers and consensus mechanism, so the settlement between different parties becomes easier. All phases of asset-backed securitization cannot leave the blockchain platform. Figure 1 shows the application of blockchain technology in asset-backed securitization. In China, Billions Finance, Baidu Finance and Huaneng Trust co-sponsored asset-backed securities based on blockchain technology in 2017. In this project, the above three companies played different roles as an originator, an asset service provider and an administrator,
respectively. Because the underlying asset realizes transparent operation by blockchain technology, the asset-backed securities got a high external rating.

5. Conclusion
At present, blockchain technology has been extensively applied to financial market, especially in financial note, cross-border payment and asset-backed securitization. Blockchain technology has a great advantage in the aspect of information transaction, such as decentralization, openness, autonomy, tamper-resistant information and anonymity. Although blockchain technology is based on asymmetric cryptography, distributed consensus and intelligent contract, the application of blockchain technology is still at starting stage. In the future, blockchain technology can be further applied to financial fields and financial products.

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