

Does blockchain technology promote the development of green finance?

—Evidence from China

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Abstract: In the context of new era, the development and application of fintech has become an important driving force for the growth of the real economy. We analyze the influence of the blockchain technology on the green finance, which provides great support for the green development. Firstly, we summarized the characteristics of blockchain technology and the difficulties facing the green finance, and then identified four main pathes the blockchain technology acting on the green finance. After that, we used Bootstrap and Regression analysis to estimate the actual impact, finding that the blockchain technology has indeed promoted the expansion of green credit balance, although the intensity is small. We proposed to strengthen the integrated application of blockchain technology in the field of green finance in the future.

1. Introduction

The origin of blockchain technology can be traced back to the underlying technology of Bitcoin. Satoshi Nakamoto first proposed the concept of blockchain in "Bitcoin: Apeer-to-peer electronic cash system". The principles of the blockchain are "time is always forward" and "the uniqueness of time". Based on the Internet, it integrates related technologies, such as big data, cloud computing, and cryptography to store the information of each transaction in the block under the context of digital economy. Thus, a distributed ledger provides a timestamp for each transaction and updates it based on the consensus mechanism within a block forms.

American scholar Melanie Swan (2015) first proposed the concept of blockchain finance, thinking that any asset can be registered, stored and traded on the blockchain; all assets will become digital assets and can be directly tracked, controlled, exchanged, and traded on the blockchain system, which would achieve the true interconnection of everything[1]. At present, research on the application of blockchain has expanded from the traditional financial field to payment and settlement (Wang Shuo, 2016) and supply chain finance (Zhu Xingxiong et al., 2018)[2,3]. Some scholars in China have introduced blockchain technology into the related fields of green finance, showing that blockchain technology can solve the pain points facing the development of green finance (Zhang Wei, Lu Wen 2017; Jin Jingyu, Zhao Rui, 2019)[4,5]. Green finance refers to financial activities to support environmental improvement, responding to climate change and efficient use of resources, that is, to provide investment, project operation, and risk management of projects in the fields of environmental protection, energy conservation, clean energy, green transportation, and green buildings [6]. The forms of green finance include green credit, green bonds, green insurance, green funds, and carbon finance. However, the current research between blockchain technology and green finance is mainly focused on the qualitative discussion. Few scholars have conducted empirical tests on whether blockchain technology has promoted the development of green finance. This article selects the relevant data of the blockchain technology and the green credit balance as sample, uses bootstrap, regression analysis to test the influence, with the hope of complementing this field.

2. How to improvement the development of green finance using blockchain technology

2.1 Characteristics of blockchain technology

Compared with traditional data storage and transmission methods, the blockchain has the following threesignificant advantages:

(1) Decentralization. The realization of commodity transactions is centered on credit. Traditional commodity transactions generally need to be implemented through a third-party intermediary as a trust center. There are bottlenecks in terms of transaction costs and efficiency. According to the blockchain, each node is a staged trading center and held a copy of the distributed ledger. It replaced the credit intermediary by "credit self-certification" to achieve decentralization, thereby improving the efficiency of transactions.

(2) Trust is achieved through a consensus mechanism. The rise of the network economy has increased the efficiency of point-to-point information transfer, but has not solved the problem of credit between points. Different from the traditional trust mechanism built on the basis of government credit or laws and regulations, the blockchain adopts PoW (Proof of Work), PoS (Proof of Stake) and PBET (Practical Byzantine Fault Tolerance) consensus algorithms as basic principles.

(3) Time stamps are irreversible and tamper-resistant. Blockchain technology has the characteristics of "chronological sequence and forward-looking verification". Each block is composed of the information set of the previous block, timestamped and integrated with the current new information, which can ensure the traceability of transactions. As each node participates in the verification and synchronization update during the information generation process, it ensures that the information cannot be tampered with.

2.2 The difficulties faced by green finance

(1) Imperfect financial infrastructure has led to high transaction costs. Green finance funds are mainly invested in green industries in the fields of energy conservation, emission reduction and ecological environment protection. The initial inspection and follow-up of energy conservation and emission reduction efforts are the key factors that determine the effectiveness of the green finance. Subject to the relative lag of methodology and technological innovation, the current supervision, verification and reporting (MRV) of energy conservation and emission reduction is mainly achieved by the intermediary agency's assessment report. The cumbersome review and evaluation process and the existence of conflicts of interest have led to higher transaction costs and credit risks.

(2) Imperfect information disclosure mechanism has resulted in limited participation and difficulty in financial innovation. At present, although some listed companies have disclosed environmental information, as China has not yet issued mandatory environmental information disclosure requirements and uniform disclosure standards, many companies have not disclosed or selectively disclosed the impact of corporate operations on the ecological environment. The lack of information increases the uncertainty faced by green financial institutions.

(3)Information asymmetry leads to the accumulation of risk factors such as limited business coverage and mismatched funds. Information asymmetry can easily induce "adverse selection" in green project approval, "false green" in project operation, and difficulties in realizing the project or meeting predetermined emission reduction standards. Taking green credit as an example, large enterprises are usually well-funded and capable of being equipped with more advanced environmental protection equipment. On the contrary, smaller enterprises often cannot bear the heavy burden of environmental protection equipment. When applying for loans from banks and other financial institutions, large companies have a good credit history and many guarantee channels, so it is easy to obtain credit; small companies often have difficulty obtaining financing at the expected cost due to lack of credit history information and assets available for guarantee. The mismatch of funds reduces the environmental benefits of green credit.

2.3 The pathes of blockchain to promote the development of green finance

There are four main ways to use blockchain technology to enhance the effectiveness of green finance:

(1) Relying on blockchain technology to optimize the existing green financial business processes such as green credit, green securities, and green insurance. Taking green credit as an example, according to the statistics of the former China Banking Regulatory Commission, from the end of 2013 to the end of June 2019, the scale of green credit of China's 21 major commercial banks increased from 5.20 trillion RMB to 10.6 trillion RMB, which promoted the "greening" of financial resource allocation. The use of blockchain technology can link "information islands" between different commercial banks, improve the transparency and reduce the cost of repeated review and evaluation, improve the efficiency of resource allocation.

(2) Using blockchain to create a new green financial format. Use the blockchain consensus mechanism and distributed ledger to construct a peer-to-peer trust mechanism to replace the credit enhancement model endorsed by third-party intermediaries. Taking green securities as an example, securities-related information can be integrated in the blockchain, and both parties of the transaction can directly initiate transactions without the need of the channel of a securities company. At the same time, market participants can use automation code to simulate business logic and create smart contracts. Through automatic execution and mandatory performance, blockchain technology improves the efficiency of business operations.

(3) Restructuring the financial infrastructure and improve the efficiency of carbon emissions trading. China started seven carbon emissions trading pilots in 2011 and officially launched the construction of a national carbon market in December 2017. The optimization of carbon emission MRV mechanism and the construction of carbon emission trading record, settlement and clearing system are of great significance to improve the efficiency of carbon emission trading. Blockchain technology can ensure the timeliness, accuracy and immutability of carbon emissions and transaction data, reducing the risk and costs of transaction.

(4) Preventing and control green financial risks. Blockchain has improved the transparency of information and is expected to assist supervisory authorities in achieving penetrating supervision. In the short term, a regulatory framework can be established in the form of alliance chains, with core participants in green finance such as regulatory authorities, financial institutions, third-party environmental certification agencies as different nodes, to achieve cross-institutional information sharing and improve the effectiveness of supervision and compatibility with the current "one party, two meetings" model. In the long run, we can take advantage of the decentralization of the blockchain, strengthen the ability of financial institutions to intelligently identify and control real-time risks to ensure the sustainable development of green finance

3. Empirical test

We take Chinese relevant data as a sample, and uses bootstrap and linear regression to conduct an empirical test about the influence of blockchain technology in promoting the development of green finance. As green credit, which using credit to optimize resource allocation and promote green development, accounts for more than 95% of all green financing channels[7],we selects the green credit balance published by the CBRC to characterize the development of green finance; selects the number of patents authorized on the blockchain technology to characterize the development of blockchain technology, the sample data are selected from the IPTOP patent retrieval system, using "blockchain" as a keyword to search for the authorized patents, and counting the total number of authorized patents up to the corresponding time point. In view of the availability of sample data, this article selected semi-annual sample data from 2013 to June 2019. Since the green credit balance is stock data, the quantity of patented blockchain technology also uses stock information.

3.1 Statistical analysis

Fig.1 depicts the absolute value of green credit balance and the number of authorized patents on the blockchain since June 2013. It shows that the green credit balance has a continuous growth trend, but the growth rate has been slow; authorized blockchain patents began to appear in the second half of 2015, when there were only two. One year later, the number of patents suddenly increased to 59. After that it has shown a growth trend, but the growth rate has also gradually decreased.

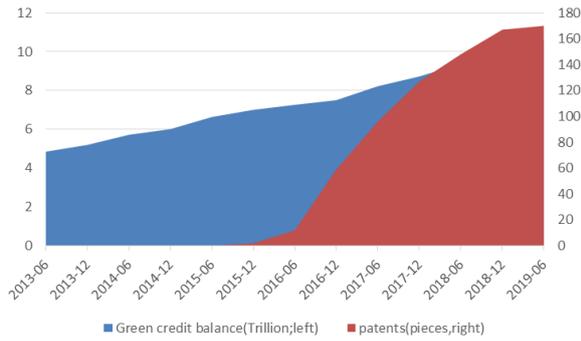


Figure 1: The absolute value of Green credit balance authorized patents on blockchain

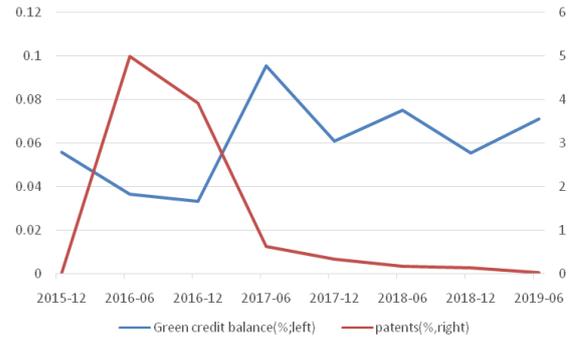


Figure 2: The growth rate of Green credit and balance and authorized patents on blockchain

Fig.2 depicts the growth rate of green credit balance and authorized patents. It can be seen that both of them have large volatility. With the decline of the blockchain industry's popularity, the growth rate of authorized patents shows a cliff-like decline. In addition, Fig. 2 shows that the change in the balance of green credit lags slightly behind the change in the authorized patents. It can be inferred that the impact of blockchain technology has some time lag.

3.2 Correlation analysis based on Bootstrap

In order to reduce the dependence of empirical analysis on the selection of sample data, we uses R language and uses Bootstrap to repeatedly sample to compute the correlation coefficient between variables. We find that there is a significant positive correlation between blockchain technology and green credit balance, that is 0.0313. As shown in Table 1.

Table 1: Correlation analysis

	balance	patents
balance	1.0000	0.0313
patents	0.0313	1.0000

3.3 Regression analysis

In order to further identify the impact of blockchain technology on the development of green finance, we construct a binary regression model to measure the intensity of blockchain technology's effect on green credit.

$$y = c + bx$$

y represents the green credit balance; c is a constant term; x represents the number of authorized patents on the blockchain technology.

Table 2: Regression analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
patents	0.0240	0.0027	8.9968	0***
C	6.0235	0.2424	24.8536	0***
R ²	0.88036			

Note: “***” represents significant at 1% significance level

Table 2 shows that the number of granted patents aboutblockchain has a significant positive impact on the balance of green credit, but the impact is small relatively, only 0.024, which may be closely related to the limited implementation of blockchain projects in the green finance field.

4. Summary

In this article, we analyzes how the blockchain technology resolve the pain points facing the development of green finance through the pathes as reshaping the business processes of traditional green finance, innovating new forms of green finance, restructuring the infrastructure of carbon

emissions trading, and preventing and controlling green financial risks. The result of empirical test further shows that the blockchain technology has indeed promoted the expansion of green credit balance, although the intensity is small. It is essential to strengthen the integrated application of blockchain technology in the field of green finance, accelerate the implementation of related projects, make use of the synergy of fintech and green finance, so as to promote the high-quality development of green finance in China.

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