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The growing usage of blockchain technology in financial transactions and cryptocurrencies

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by

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Table of Contents

Page Number

ABSTRACT	1
1. INTRODUCTION	2
2. LITERATURE REVIEW	4
2.1 The Concept of Blockchain and Its Development	5
2.1.1 The Concept of Blockchain Technology and Its Characteristic	5
2.1.2 The Shortage of Blockchain Technology	6
2.1.3 The Development Status of Blockchain Technology	7
2.2 The Application of Blockchain Technology in the Financial Industry	7
2.2.1 The Underlying Technical Architecture of the Financial Industry Based on Blockchain Technology	7
2.2.2 Digital Currency	8
2.2.3 Smart Contract.....	8
2.2.4 Financial Institutions Based on Blockchain Technology	9
2.3 Conclusion.....	9
3. METHODOLOGY & DATA	10
3.1 Data and Sample	10
3.1.1 Discussion and Explanation of Dataset	10
3.1.2 Discussion of Sample	11
3.2 Discussion of Methodology.....	11
3.2.1 Discussion and Explanation of Methodology	11
3.2.2 Discussion and Explanation of Model and Hypothesis	11
4. RESULTS	14
4.1 The Development of Blockchain in Finance	14
4.2 The Factors Impact on the Development of Blockchain Finance.....	15
4.3 The Difference Between the Development of Blockchain Finance in China and in US	16
5. CONCLUSION	19
6. REFERENCES	21
7. TABLES AND FIGURES	
Table 1: The regression result of model 1	
Table 2: The regression result of model 2	
Table 3: The regression result of model 3	
Table 4: The summary of hypothesis	
Figure1: The blockchain size from 2010Q3 to 2019Q3 (in megabytes)	

ABSTRACT

Blockchain, as a new technology, develops rapidly in the recent years and are used in various fields, especially in finance industry. This paper reviews the advantages and shortages of blockchain as well as the application of blockchain in finance industry, including the underlying technical architecture of the financial industry based on blockchain technology, digital currency, smart contract and financial institutions based on blockchain technology. Moreover, this paper discusses the development of blockchain finance, the factors which impacts on the development blockchain finance and the difference between blockchain finance in China and that in US. Base on the linear regression analysis, we know the relationship between year and the size of blockchain finance which will get 213944 megabytes in the next year. We also find the result that the number of patent and GDP have significant impact on the size of blockchain finance but the number of blockchain corporation and the venture capital of blockchain corporation not, which means people should more focus on the technology development and the total financial environment, rather than investing or setting up blockchain companies blindly because of popularity. At last, we compare the size of blockchain finance in China and in US. The conclusion we make is that the size of blockchain finance in US is still larger than the size of blockchain finance in China, though it develops faster in China in the recent years. Therefore, China still need to learn the knowledge and experience about blockchain finance from US in few years.

1. INTRODUCTION

In 2009, Satoshi Nakamoto (2009), a cryptographer, published a paper called “Bitcoin: A Peer-to-Peer Electronic Cash System”. The paper introduced a completely peer-to-peer version of electronic cash which allows online payment to be delivered immediately from one party to another without the permission of financial institutions. This is the origin of the bitcoin technology. As the bitcoin circulates all over the world and is widely concerned by people, the value of bitcoin increases rapidly. Up to Oct. 22, 2019, 1 bitcoin equals to 8,211.25 US Dollars.

With the popularity of bitcoin, the technology behind bitcoin, blockchain, is paid attention by people gradually. The characteristics of blockchain including decentralization, tamper-resistant, open and transparent are often talked by people. For Bitcoin, blockchain is a shared public ledger on which the entire Bitcoin network relies. Throwing off the bitcoin, the nature of blockchain is a special distributed ledger technology.(Iansiti & Lakhani, 2017) In the “Blockchain: Blueprint for a New Economy” written by Melanie Swan (2015), the writer divided the development process into blockchain 1.0, blockchain 2.0 and blockchain 3.0 based on the function that blockchain should apply. The blockchain 1.0 should make people think about the concept of digital currency and its market impact, the blockchain 2.0 should pay more attention to the business value showed by the intelligent contract, and the blockchain 3.0 should expand the application of blockchain to various of fields such as government, health care, finance, and culture.

At present, the technology and industry are transforming from blockchain2.0 to blockchain 3.0. With the development of technology, the blockchain is widely applied in every yield, such as health care, Internet of Things (IoT), logistics and so on. (Foroglou & Tsilidou, 2015) Meanwhile, the blockchain also plays an important role in finance service. The advantages of blockchain applications are optimizing the business process, decrease the

operation cost and increase the cooperation efficiency which is shown in some fields such as financial service, IoT, and supply chain management. (Alam, Gupta & Zamani, 2019) However, the technology of blockchain is not immature and the infrastructure is not complete which makes the application of blockchain is limited. Besides, the other equipment like storage, private protection doesn't perform a better quality than the traditional method. In general, the blockchain cannot support large-scale commercial use. (Gelis, 2016)

The remainder of this paper is written as follows. Section 2 is the literature review which talks about the application of blockchain in financial transactions and cryptocurrencies, and the benefit when the blockchain is used widely in financial transactions and cryptocurrencies. Section 3 describes the methodology and data sample. Section 4 analyzes the data and discusses the results. The same section also quantifies the factors which impact the development of blockchain in finance and contrasts the different size of blockchain finance between China and the US. At last, section 5 is the conclusion.

These are my research questions:

- 1. How does blockchain use in financial transactions?*
- 2. What is the benefits and problems when the blockchain technology is used in financial transactions?*
- 3. How does blockchain in finance develop in the future?*
- 4. What factors impact the development of blockchain in finance?*
- 5. The difference between the development of blockchain finance in China and in the US.*

2. LITERATURE REVIEW

Blockchain technology is one of the most important technology in the development and construction of the financial industry, as well as its influence on modern financial circles, has surpassed that of traditional bitcoin. William Mougayar (2016) mentioned blockchain can be interpreted from its function in his book “Commercial Blockchain: Open a New Economic Era Encryption”. He considers that blockchain has multiple functional embodied in ten aspects: encryption currency, computing infrastructure, trading platform, database of decentralized, distributed accounting books, development platform, open-source software, financial services market, peer-to-peer networks, credit service layer.

Not only William but also many other financial economists come up with their ideas. Guy Zyskind and Nathan Oz (2015) propose a decentralized personal data management system that grants users possess and control their data through implementing a protocol that turns a blockchain into an automated access-control manager that does not require trust in a third party. Henri Arslanian and Fischer Fabrice (2019) think “blockchain is shifting way in which the financial services community thinks about the potential architectural of the systems that enable financial transaction”. In the report on Blockchain by McKinsey in 2017 named Blockchain Technology in the Insurance Sector, it proposed that blockchain might be the most disruptive innovation after the Internet, and the core technology which most likely triggers the fifth wave of disruptive revolution. (McKinsey Co., 2017)

In general, as a universal underlying technology, blockchain will push the Internet towards the 3.0 era. It has created a new credit system, as well as has changed and will change many things. This literature review will focus on the finance industry that explores the benefit and shortage of the blockchain and the application of blockchain in the finance industry.

2.1 The Concept of Blockchain and Its Development

2.1.1 The Concept of Blockchain Technology and Its Characteristic

Bitcoin is a kind of currency and payment system independent of the modern banking system that is produced, verified and traded through complex technical encryption and management techniques in the process of its use. The technology fundament of cryptocurrencies such as bitcoin is blockchain technology which is a public ledger technology based on encryption technology. With the help of blockchain technology, financial industry practitioners can build an information storage network that has high authenticity and security and its maintenance process is carried out by each node so that the information is not easy to lose and the transaction process will be continuously monitored to avoid record tampering. This technology also creates a credit mechanism different from the traditional financial system and allows direct transactions across the world because of the information disclosure and transparency of the network nodes constructed with the aid of blockchain. (Sheth & Dattani, 2019)

Blockchain, as a shared data network, has the following technical characteristics: first, decentralized p2p network. In the actual construction process, the blockchain systems belong to the point-to-point network, and the damage or disconnection nodes will not affect the operation security and stability of the entire network system, which ensures the security and stability of the trading network; Second, consensus trust mechanism. The network will build the public ledger with the help of an encryption algorithm and complete the construction of the trusted network based on the public ledger. The foundation of this mechanism is the unbreak ability of network technology, which is quite different from the traditional financial trust mechanism; Third, high data security. In the transaction network built based on the blockchain technology, the storage of transaction information can be completed in each node, so it is difficult to tamper with data

which ensure the security of the data. With the expansion of the scale of the network and the increase of the number of nodes, the security of the network has been improved; Fourth, open network. Blockchain technology and the network can be open access and query, and allows access to multiple platforms, which is convenient for users to use and join; Fifth, anonymity. The trust mechanism in the blockchain trading network is based on technology. Therefore, the transaction between users is allowed to be conducted anonymously. This feature not only facilitates users' transactions but also avoids the leakage of user's personal information, providing high confidentiality for the blockchain network transaction process. (Viriyasitavat & Hoonsopon, 2019)

2.1.2 The Shortage of Blockchain Technology

After a long time of development and improvement, blockchain technology has achieved great development and is gradually mature. However, there are still some problems in the practical use of this technology, which affect its widespread use in the financial industry.

The first problem is related to network security. While blockchain network encryption technology and the characteristics of network technology have made its security higher than traditional transaction network, it is very easy to be attacked by hackers in the process of use due to the digital characteristics. With the improvement of the computing power of modern computers, the possibility of encryption technology being cracked is increasing, which affects the security of the network platform.

Second, there is a problem of control right in the operation of the blockchain network. Due to the decentralized nature of the blockchain network, network developers and technicians have relative higher management rights. Therefore, the network user management ability insufficiency causes that the network movement has a bigger influence on national economic security.

Third, the shared blockchain network has a large delay in account recording and processing speed during operation, which cannot satisfy the needs of modern financial transactions. Moreover, the contradiction between decentralization, security and operation efficiency reduces the management ability of financial managers on the network.

Legal supervision is also a problem. As blockchain technology allows customers to the anonymous transaction, the current financial system the law failed to provide rules for the transaction behavior, which often leads to the contrary to laws and regulations in the actual application, causing a great impact on the application stability of this technology, and hindering the large-scale use of blockchain technology in financial industry. (PR Newswire, 2019)

2.1.3 The Development Status of Blockchain Technology

Currently, the financial industry and technical personnel have a high interest in blockchain technology. In the process of technology development, blockchain is considered as the basis for the future development of the Internet with high application value. The application of the current blockchain technology can be divided into three categories: the first is monetary encryption and payment process with the help of decentralizing network; the second is to use the blockchain network for the automated trading assets, also called smart contracts; the third application is digital currency encryption technology based on the confidentiality of blockchain. (Nikbakht, E., Shahrokhi, M., & Corriette, A. 2019)

2.2 The Application of Blockchain Technology in the Financial Industry

2.2.1 The Underlying Technical Architecture of the Financial Industry Based on Blockchain Technology

Blockchain technology can be applied in the reform process of Internet technology. With the help of this technology, the transaction process and other fundamental parts of the financial industry can be greatly reformed. In the future development process, the financial industry can use blockchain technology to build the underlying structure of transactions and improve the security and efficiency of transactions. With the aid of blockchain, the financial industry can optimize the current trading tools, promote the development of business models, and improve the developing efficiency of the financial industry. (Guo & Liang, 2016)

2.2.2 Digital Currency

In order to ensure security and supervision, a digital currency usually requires several features such as security, low cost, high flexibility, and monitoring, which is an ideal form of currency in the future development of the financial industry. The use of digital currency will reduce the current use of paper currency, thus affecting banks and other financial institutions. Therefore, countries should strengthen the supervision of digital currency to avoid affecting the construction of the market in the future. The usage of digital currency will affect the main functions of banks. In the future development process, the main function of banks should be information collection and processing. With the intensification of competition, the concentration degree of the banking industry will be enhanced. (Foroglou & Tsilidou, 2015)

2.2.3 Smart Contract

Blockchain technology can complete automatic transactions during the development of the financial industry called smart contract which runs on the blockchain network and can accept, store and process financial information according to the program setting, and complete specified transactions. With the aid of smart contracts and blockchain technology, the financial sector can build network financial platform in the future, as well as automatic smart contract transaction improves efficiency and accuracy. It also has played an important role in promoting

the development of financial market trading tools, reducing the cost of the current financial asset transaction, and enhancing security. (Buterin, 2014)

2.2.4 Financial Institutions Based on Blockchain Technology

Decentralization is an important feature of blockchain technology. The financial institutions which regard decentralization as infrastructure are emerging organizations in the modern financial industry. They optimize the shortcomings of traditional financial transactions, improve the security of transactions and reduces transaction costs. However, the decentralized financial organization is vulnerable to external network attacks so that security problems appear. Therefore, network security should be further improved in future development. (Pilkington, 2016)

2.3 Conclusion

Blockchain technology combines security technology and data transmission technology. Its features such as decentralized, consensus trust mechanism and high data security grantee the security of assets and personal information in the transaction process. Although the application of blockchain still has certain restrictions in the current development of the financial industry, it will become the main tool of the financial industry in the future with the improvement of its technology.

3. METHODOLOGY AND DATA

3.1 Data and Simple

In this section, I will discuss the variables in this research including the dependent variable, independent variable, and control variable and explain why it influences the development of blockchain finance. Then, I will determine the scope of the sample and the source of the data.

3.1.1 Discussion and Explanation of Dataset

In this research, I will analyze the factors which influence the development of blockchain finance. Up to now, I determine technology, the situation of the finance industry, venture capital of blockchain finance and the number of blockchain finance corporation as the factors which influence the development of blockchain finance.

As for technology, I use the number of patents about blockchain as an independent variable. Although the number of patents about blockchain cannot reflect the development of blockchain technology completely, it can show the situation of the development of blockchain technology to some extent. Undoubtedly, the development of blockchain finance is related to the development of the finance industry. In general, the developing of the finance industry will cause the developing of blockchain finance. Therefore, I regard the Gross Domestic Product (GDP) as an independent variable. Besides the technology and the development of the finance industry, blockchain corporations also play an important role during the development of blockchain finance. Thus, I also regard the venture capital of blockchain and the number of blockchain corporations as independent variables.

As for the dependent variable, I use the size of blockchain finance to present the situation of the development of blockchain finance. The size of an industry can reflect the situation of this industry straightly.

Besides the independent variables I discussed before, the intention to accept the blockchain technology is also a vital factor to influence the development of blockchain finance. (Kim & Gim, 2017). However, it is hard to measure and quantified so that this factor is regarded as a control variable.

3.1.2 Discussion of Sample

Because blockchain is an emerging technology which is come up in 2009, I collect the 10 years data from 2010Q3 to 2019Q3 of the dependent variable and independent variables in China by quarter. The total sample size is 37. Based on these data, I can test the correlation between the dependent variable and independent variables and test the hypothesis.

3.2 Discussion of Methodology

In this section, I will discuss the methodology I use in this research and how I use them. Then I will build the models and come up with the hypothesis.

3.2.1 Discussion and Explanation of Methodology

At first, I will use linear regression to examine the development of blockchain finance and predict the revenue of blockchain finance next year based on the historical data. Then, I will adopt the multiple linear regression model of econometrics to test what factors impact the development of blockchain finance or to examine the correlation between the selected variables and the dependent variables. At last, I will use the means test to find the difference in blockchain finance between China and the US.

3.2.2 Discussion and Explanation of Model and Hypotheses

Model 1: $y = \beta_0 + \beta_1 X_1$

y is the revenue of blockchain finance corporations each year.

X₁ is the year

Hypothesis:

The year has no significant impact on the size of blockchain finance.

Model 2: $y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e_i$

y is the revenue of blockchain finance corporations

X₁ is the number of patents about blockchain

X₂ is the Gross Domestic Product

X₃ is the venture capital of blockchain

X₄ is the number of blockchain corporations

Hypothesis:

1. The number of patents about blockchain has no significant impact on the size of blockchain finance.

2. The Gross Domestic Product has no significant impact on the size of blockchain finance.

3. The venture capital of blockchain has no significant impact on the size of blockchain finance.

4. The number of blockchain corporations has no significant impact on the size of blockchain finance.

Model 3:

$$\bar{y} = (y_1 + y_2 + \dots + y_n) / n$$

$$\bar{x} = (x_1 + x_2 + \dots + x_n) / n$$

y_i is the size of blockchain finance in US

x_i is the size of blockchain finance in China

Hypothesis:

The size of blockchain finance in China has no significant difference in the size of blockchain finance in the US.

4. RESULTS

This section explains the three research questions including how blockchain in finance develops in the future, the factors impact the development of blockchain in finance and the difference between the development of blockchain finance in China and in the US.

4.1 The Development of Blockchain in Finance

The first model I discuss is about the development of blockchain in finance in China. As Figure 1 shows, the blockchain size starts to increase rapidly from 2014.

After the linear regression analysis, I get that it is shown to be statistically significant with a p -value equals to 6.9E which is smaller than 0.1. It suggests that we reject the hypothesis that year has no significant impact on the size of blockchain finance corporations. Therefore, the year has a significant impact on the size of blockchain finance. Moreover, we know

$$\text{Size of Blockchain Finance} = - 56738 + 6596 * \text{Year}$$

Therefore, we can predict the size of blockchain finance in 2019Q4 which equals 213944 megabytes.

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-56738.41644	9687.967671	5.856586063	1.19301E-06
X Variable 1	6596.926057	444.5144426	14.84074627	1.13852E-16

Table 1: The regression result of model 1

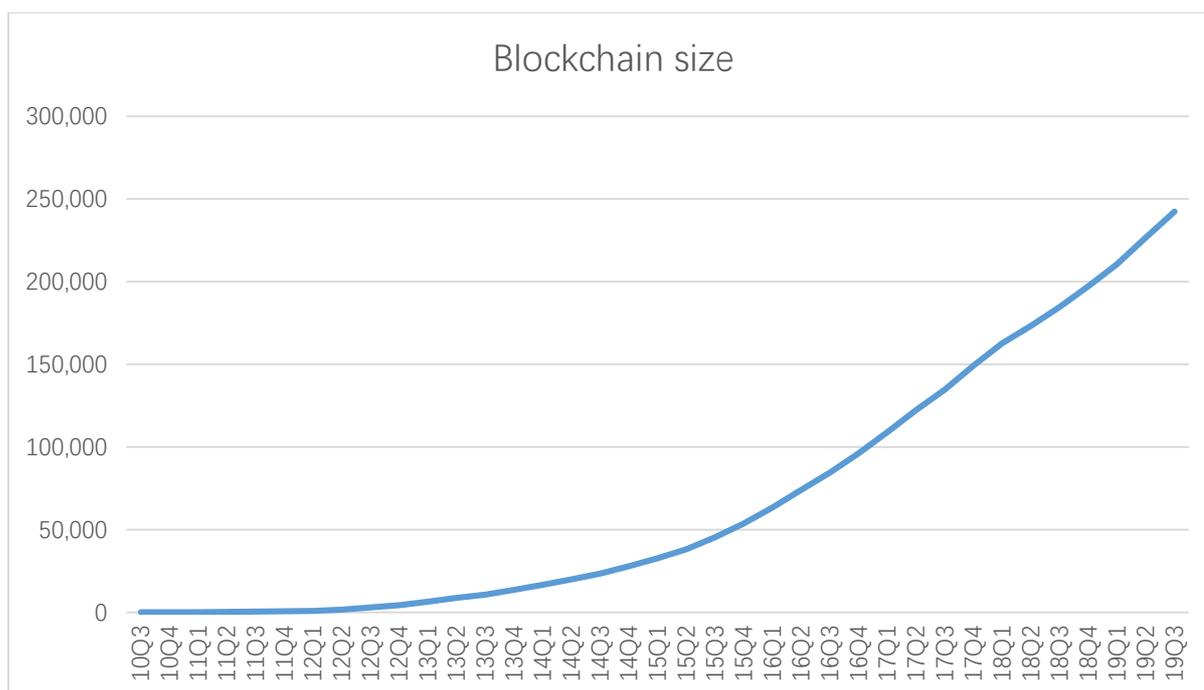


Figure1: The blockchain size from 10Q3 to 2019Q3 (in megabytes)

4.2 The Factors Impact on the Development of Blockchain Finance

As I discuss in section3, I choose four different independent variables which are the number of patents about blockchain, the Gross Domestic Product, the venture capital of blockchain and the number of blockchain corporations corresponding X_1 to X_4 .

Our hypotheses are that each independent variable has no significant on the size of blockchain finance. And the result is as following:

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-86255.47122	38264.9762	-2.254162416	0.065067929
X Variable 1	107.9180482	50.365072	2.142716049	0.075865327
X Variable 2	0.208930574	0.08680224	2.406972279	0.052791095
X Variable 3	-90.82631173	58.4528303	-1.553839416	0.171216199
X Variable 4	47.19955349	65.3620216	0.722125056	0.497384034

Table2: The regression result of model 2

In this research, we determine that significant value is 0.1 which means we reject the

hypothesis if the p -value less than 0.1. In this rationale, our statistical inference is presented as follows.

Firstly, because the p -value equals 0.075 which is less than 0.1, we reject the hypothesis that the number of patents about blockchain has no significant impact on the size of blockchain finance. It suggests that the number of patents about blockchain is related to the size of blockchain finance.

Second, in terms of the Gross Domestic Product, it is shown to be statistically significant with a p -value smaller than 0.1. That is to say, the size of blockchain finance is related to the Gross Domestic Product. Moreover, the coefficients between GDP and the size of blockchain finance are 0.2 which is positive, which means the size of blockchain finance will increase if the GDP increases.

Third, as we analyzed the venture capital of blockchain, it is not shown to be a strong variable in explaining the size of blockchain finance with a p -value of 0.1712. Therefore, the size of blockchain finance is not influenced by the venture capital of blockchain.

Fourth, the number of blockchain companies is not statistically significant with a p -value of 0.4973. It tells that the number of blockchain companies is not related to the size of blockchain finance.

4.3 The Difference Between the Development of Blockchain Finance in China and in US

In model 3, I discuss whether the development of blockchain finance in China is different from that in the US or not by the means test. And the result is as Table 3.

As the t -test analysis below, we reject the hypothesis that the size of blockchain finance corporations in China has no significant difference with the size of blockchain finance

corporations in the US with the p -value of 0.068. It suggests that the size of blockchain finance corporations in China is different from the size of blockchain finance corporations in the US. As the data of the size of blockchain finance in the appendix, we can get the size of blockchain finance in China grows late but rapidly, as well as the size of blockchain finance in the US grows early but relatively smooth. However, through the compare the means of two countries, we know the size of blockchain finance in the US is still higher than the size of blockchain finance in China.

	US	CN
Mean	484.4	182.2
Variance	693305.3778	141997.2889
Observations	37	37
Pearson Correlation	0.991327654	
Hypothesized Mean Difference	0	
df	9	
t Stat	2.069581686	
P(T<=t) one-tail	0.034205187	
t Critical one-tail	1.383028738	
P(T<=t) two-tail	0.068410374	
t Critical two-tail	1.833112933	

Table 3: The regression result of model 3

Finally, the results of the hypothesis testing are shown in Table.4

Hypothesis	Result
<i>Year has no significant impact on the revenue of blockchain finance corporations</i>	Reject
<i>The number of patents about blockchain has no significant impact on the revenue</i>	Reject

<i>of blockchain finance corporations</i>	
<i>The production value of finance industry has no significant impact on the revenue of blockchain finance corporations</i>	Reject
<i>The venture capital of blockchain has no significant impact on the revenue of blockchain finance corporations</i>	Accept
<i>The number of blockchain corporation has no significant impact on the revenue of blockchain finance corporations</i>	Accept
<i>The size of blockchain finance corporations in China has no significant difference in the size of blockchain finance corporations in the US.</i>	Reject

Table 4: The summary of hypotheses

5. CONCLUSION

This paper reviews the application of blockchain in finance, and discuss the advantages and disadvantages of these applications. Moreover, this paper also analyzes the development of blockchain finance, the factors which impact the development of blockchain finance and the difference between blockchain finance in China and that in the US.

Firstly, we find the development of blockchain finance has entered an upswing. From 2014 to now, the size of blockchain finance increases rapidly. Based on the regression analysis, we know the relationship between year and the size of the blockchain, which makes us predict that the size of blockchain will still have a sharp rise getting 213944 megabytes in the next year.

Second, we determine the factors which influence the development of blockchain. After the analysis, we find the number of patents about blockchain and GDP is positively related to the size of blockchain finance, but the venture capital of blockchain corporation and the number of blockchain corporations have no relation with the size of blockchain finance. These results suggest that if we want to actively develop blockchain finance, we should more focus on the technology development and the total financial environment, rather than investing or setting up blockchain companies blindly because of popularity.

At last, we determine the difference of blockchain finance developing process between in China and in the US. Actually, blockchain finance in the US developed earlier than in China that is emerged in 2009, but it in China developed much faster than in the US from 2017. In total, we conclude that the size of blockchain finance in China is different from the size of blockchain finance in the US, as well as the size of blockchain finance in US is still larger than in China. Therefore, China still needs to learn the experience and knowledge about blockchain finance from the US in a few years.

Furthermore, this paper also has limitation such as ignoring the influence of the intention to accept the blockchain technology. In the future, I will consider more independent variables and make the model more complete.

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