Internet Finance Credit Supervision System Innovation

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Abstract
In recent years, Internet finance has been developed and applied widely in people's life, and in 2015 China had paid high attention to Internet finance credit supervision and proposed the corresponding guidance. The paper aims currently the deficiency of Internet finance transaction credit supervision, and combines the business characteristics of Internet finance, proposing to construct Internet finance credit supervision index system and model by using Internet finance credit related big data and based on traditional finance business credit supervision index system and model, and proposing to apply Blockchain technology to Internet finance transaction system to realize the credible proof on Internet finance transaction related big data, on this basis to realize the construction of perfect and reliable Internet finance credit supervision system. At present the application and research of Blockchain is still in the initial phase, the characteristics as heavy volume, low information density etc of big data restrain the application and research of Internet finance credit supervision, so our research has a certain prospective and practicability, the ideal can promote the application of Blockchain in network transaction, and can promote the development of Internet finance credit supervision.

Key Words: Internet finance; Credit Supervision; Blockchain; Big Data
1. Introduction

In recent years, Internet finance\(^1\) has been developed and applied widely in people’s life. In 2015, the Party Central Committee, the State Council and other related ministries of China had jointly proposed to comprehensively promote Internet finance healthy development, improve and perfect Internet finance supervision mechanism\(^2\). This means Internet finance as an important part of “Internet plus”\(^3\) has officially upgraded to national key strategy.

As a finance industry, Internet finance has the fundamental business characteristics and transaction process of finance business, but because of its business activities are fulfilled in Internet, so it also has difference from traditional finance business. Internet finance transaction subject credit evaluation must relay on network transaction data to perform, but the solo transaction platform data can’t perfectly reflect Internet finance transaction subjects’ credit conditions, so in the big data\(^4\) era, we need evaluate Internet finance transaction subjects’ credit with their credit related big data including the transaction platform data. By colligating and analyzing, the theories and methods research development structure on Internet finance transaction subjects’ credit supervision can be described as figure 1.

**Figure 1: The Theories and Methods Research Development Structure on Internet Finance Transaction Subjects’ Credit Supervision**

At present big data is a popular term and is altering people’s life, but there still have many deficiencies for big data technology applying to Internet finance transaction subject credit evaluation, the causes include big data technology still need further be perfected, big data volume is heavy, information density is lower etc. Blockchain\(^5\) is a new technology which
arises in 2009 and rapidly developed in 2015, as a technology, Blockchain can testify all the transaction activities’ authenticity with decentralized mode, so the distinct characteristic of Blockchain is it testifies transaction activities with communication technology as digital signature[6], hash function[7] and timestamping[8], but not a rule or restrain mechanism. Base on this, we will provide a new Internet finance credit supervision system, which will colligate current Internet finance credit supervision theories and methods with Blockchain technology to realize Internet finance transaction subjects’ credit supervision.

2. Blockchain

The Blockchain technology is introduced firstly in Bitcoin white paper which composed by Satoshi Nakamoto in January 9, 2009[9]. Blockchain is a distributed account technology based on Internet, and the account is shared by the users which affiliated Blockchain system. So Blockchain is a basement structure for economics system, sampling election, smart contracts, etc.

Blockchain’s core technology is Hash function pointer, Merkel tree, digital signature, and timestamping etc, meanwhile introducing workload proof mechanism to testify transaction activities’ authenticity. In which, timestamping technology is used for time certification.

2.1 Hash Function Pointer

The main function of Blockchain is the records for the transaction, in the Hash function pointer structure of Blockchain, previous block encrypts its all transaction information using Hash function, then point to the next block with the pointer, and the next block encrypts its transaction information and previous block transaction information Hash function value. The Blockchain Hash function pointer structure is shown in figure 2.

![Figure 2: The Blockchain Hash Function Pointer Structure](image)

2.2 Merkel Tree

For chain structure of Blockchain, it can save hardware space by the next block encrypts the previous block transaction information Hash function value using Hash function, and can
achieve the transaction information undeniable authentication. If the criminals have revised the fundamental data, it will lead the discrepancy between that data function pointer and it’s upper function pointer. So the criminals need revise all the upper pointers for proving the authenticity of the revised data, while the nodes of the Blockchain system will find the criminals revised behavior only by remembering the tree root function pointer value. Therefore, a binary tree structure named Merkel tree is contained in Blockchain chain structure, in this structure, first tree leaf (transaction data) pair, then point to previous layer by pointer, and continue the previous layer pointers pair and point to the higher layer, in the end reach to the tree root. The structure of Merkel tree is shown in figure 3.

![Figure 3: The Structure of Merkel Tree](image)

2.3 Digital Signature

In Blockchain, the whole transaction is anonymous, the public key of the transaction subject who digitally signed widespread in the whole network, the transaction subject digitally signed the transaction Hash function value with itself’ private key, and the other nodes can validate the digital signature with this transaction subject’s public key, to confirm the transaction subject’s identity. After signing, this transaction subject submit the signature transaction Hash function value to the next transaction subject by the next transaction subject’s public key Hash function value. The digital signature principle figure is shown in figure 4.

![Figure 4: The Digital Signature Principle](image)

2.4 Workload Proof Mechanism

By exhaustive calculation every node that affiliates Blockchain can acquire transaction...
subject transaction Hash function value to testify the transaction content validity, because no short cut, anyone node can and only can validate with exhaustive calculation, so it is called workload proof. If some node can first testify the transaction content validity, it will widespread the information in the whole network, and the other nodes will include this transaction content into its block.

3. A New Credit Supervision System Description

As we know, big data technology has enlarged the scope of Internet finance credit supervision data source, making accurately evaluate transaction subjects’ credit become possible, but in view of the characteristics of big data, the data efficiency problem still need to solve for the achievement of accurately evaluating Internet finance transaction subjects’ credit.

With Blockchain technology we can use encryption algorithm to realize Internet finance transaction subject transaction related big data validity’s certification, so we can colligate big data technology and Blockchain technology to realize perfectly Internet finance transaction subjects’ credit evaluation. So we need induce Blockchain technology to Internet finance transaction business system. Internet finance transaction business system based on Blockchain technology is shown in figure 5.

Figure 5: Internet Finance Business System based on Blockchain Technology

In figure 5, the data validity for Internet finance business system is verifiable. So, the big data based on this system can provide more credible credit evaluation datum for Internet finance subjects.

So, we construct a new Internet finance credit supervision system, and its structure can be described in figure 6.
4. The New Internet Finance Credit Supervision System Analysis

The new Internet finance credit supervision system can be divided into two parts: credit evaluation model and Blockchain data validity proof system. Thereinto, the research for credit evaluation model includes credit evaluation index system construction and evaluation model construction.

4.1 Index System

Apart from traditional finance business activities, Internet finance business activities related big data is more complicated in the aspects as data type, data content, data source, business operation process etc. So, we can construct more complicated credit evaluation index system for Internet finance business activities, some inner surrounding factors such as Internet finance transaction subjects’ social activities, work judgment, network access records, network friend evaluation, etc, and some external surrounding factors such as national economics level, social and political surrounding, etc. In the process of traditional finance business, these factors aren’t considered generally, but in the process of Internet finance business credit evaluation, sometimes these factors are important and we can acquire their related data datum, so, we will construct obviously different credit evaluation index system for Internet finance business activities.

At present, the categories of Internet finance business are plentiful, and the characteristic of each category Internet finance business activity is different, so, for different category Internet finance business activity, we will construct different credit evaluation index system, but in view of sometimes the information of Internet finance transaction subjects’ credit
evaluation related big data are incomplete, so we will construct dynamic credit evaluation index system and index weight on the basis of concrete data content and Internet finance business category. Because of the dynamic variability of Internet finance business data, we will construct Internet finance business index system and index weight using Stepwise regression, and in the same time invite some experts to evaluate the index system and index weight.

So, the index system and index weight construct process can be described as figure 7.

**Figure 7: Index System and Index Weight Construct Process**

As figure 7 is shown, before using Stepwise regression, we need construct initial Internet finance business index system and reserve Internet finance business indexes according to the category of Internet finance business activity.

**4.2 Credit Evaluation Model Construction**

In the early stage of credit evaluation research, because the credit evaluation index system is simply and the index weight is specific, so the scholars usually construct linear credit evaluation model to evaluate the transaction subjects’ credit, but with the big data technology development, and the credit evaluation index system go complicated and the index weight go variable, in nearly years, more and more scholars use nonlinear credit evaluation model. Because Internet finance transaction subjects’ credit related big data more reflect the variability and dynamic of credit evaluation index system, so we will use Neural Network Model or Support Vector Machine Model, these models put the credit evaluation indexes into multi-dimensional space to construct Internet finance transaction subjects’ credit evaluation system.

Internet finance business transaction subjects’ credit evaluation model construction process is shown in figure 8.
Figure 8: Internet Finance Business Transaction Subjects’ Credit Evaluation Model Construction Process

As figure 8 is shown, in the initial stage of credit evaluation model construction, we need experts attend to ascertain the transaction subjects’ credit evaluation result.

4.3 Internet Finance Credit Evaluation Related Big Data Blockchain Structure

With Internet finance business transaction characteristics and Blockchain work principle we can know:

1. Internet finance credit evaluation related big data are stored in the blocks of Blockchain;
2. Every block of Blockchain doesn’t contain all the transaction subjects’ transaction data;
3. Every block of Blockchain doesn’t contain all the transaction data of every transaction subject.

So, in the condition of confirming transaction data validity, quickly, accurately and no redundancy acquire every transaction subject transaction data is one important factor for improving credit evaluation efficiency.

Because all the transaction data are stored in Internet finance Blockchain, so we can crawl to any block by Blockchain’s chain structure and find it’s transaction data. If we construct some personalized virtual paths for Blockchain some concrete transaction subject or some concrete transaction content, with these virtual paths we will collect or analyze big data more effectively. So, we construct the virtual chain according to every transaction subject transaction data. That is, for every transaction subject, there is a virtual chain, and the virtual chain connect the block according to the transaction time and transaction subject’s transaction content, because it isn’t every block contains every transaction subject transaction data, so the structure of virtual chain is different from Blockchain, comparing to Blockchain, some blocks...
that don’t contain some a transaction subject transaction data won’t embody in virtual chain. Meanwhile, we will also construct the other virtual chains that contain Internet finance transaction credit evaluation related data and classified by content, such as national economics development level, social or political surrounding, etc.

These virtual chains record some transaction subject credit evaluation related all the previous transaction data storage address in the subsequent blocks by its hash function value, so, with these virtual chains we can quickly traverse some transaction subject all credit evaluation data. For the other virtual chains that aren’t related to transaction subject transaction behaviors but are related to credit evaluation, we can also traverse the related data quickly. So, every block of Blockchain will not only contain transaction data hash function value, but also contain the connect pointer hash function value that constructed by transaction subject identity, and contain the other virtual chain connect pointer hash function value that aren’t relative to some transaction subject but are related to credit evaluation.

Based on these, the protocol model of Internet finance credit evaluation related big data Blockchain structure is shown in figure 9.

**Figure 9: The Protocol Model of Internet Finance Credit Evaluation Related Big Data Blockchain Structure**

Based on these, the protocol model of Internet finance credit evaluation related big data Blockchain structure is shown in figure 9.

**4.4 Internet Finance Blockchain Big Data**

It is an indisputable fact of big data technology bringing secrete leakage to people in the course of applications. In using big data, some institutions generally need sign confidentiality agreement, but in the course of concrete using, because driven by interests big data secrete leakage cases still occurrence frequently, and because of the security measure disadvantage and management system network openness, some criminals and hackers can use some advanced network data crawl technology to collect personal’s or institution’s secrete data.
Such as some hackers can with big data technology to break management system password, steal management system data datum, some criminals collect personal’s or institution’s data with big data technology from network, for malicious spreading etc.

Comparing to traditional big data, Internet finance Blockchain big data have its own characteristics:

1. High density. Internet finance transaction system big data content is controllable, it can generate for transaction subjects’ credit evaluation, it is different from data passive acceptance of traditional big data system, Internet finance Blockchain big data can active generate according the system requirement, therefore, Internet finance Blockchain big data unit capacity value is high.

2. Data style is uniformity. The data type is pre defined for Internet finance transaction subjects’ transaction data, so the data type of each block is always keeping the same, this will bring convenience for big data analysis, avoiding the data value influenced because of data type conversion.

3. Data anonymous storage, protecting privacy. In the whole Blockchain, all transaction data are managed anonymously, and the public key and private key represent the transaction subjects’ identity, so even after data having been collected, analyzing big data also won’t reveal transaction subjects’ privacy, the measures of system inner protect transaction subjects’ privacy are more reliable than artificial anonymous handle data for protecting transaction subjects’ privacy.

4. Strong computing ability. In Blockchain system, many nodes that participate calculation gather together, we can use cloud computing technology and these nodes strong computing ability to analyze Internet finance transaction subjects’ transaction credit related big data, omitting the cost for constructing special cloud computing platform, the dynamic cloud computing hardware system is managed by each node, saving the management cost.

Internet finance Blockchain big data analysis system structure is shown in figure 10.

As figure 10 is shown, because some Internet finance Blockchain big data are qualitative data, so we need construct data dictionary for Internet finance Blockchain system.
5. Conclusion

Since Internet finance generation, its credit problem always is focused by experts and industrial circles, because of Internet finance’s business characteristics, its credit data only source of network big data, whereas network big data are complicated, and the valuable information collection are difficult, that lead to at present Internet finance credit evaluation problem is still not solved effectively. The decentralization and transaction behavior can’t be denied characteristics of Blockchain provide the data quality guarantee for Internet finance credit supervision. The paper proposes to combine traditional finance business credit evaluation system, Internet transaction characteristic and Blockchain technology to construct Internet finance credit evaluation system that ensures Internet finance credit evaluation big data’s authenticity and high value density.

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