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Research on the Risk Analysis of Supply Chain Finance from the Perspective of Encoding Function Forecast

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Abstract

This paper focus on the research of risk analysis of supply chain finance from the perspective of encoding function forecast. Supply Chain Finance has obtained a faster development. At present, in the financial domain, Supply

Chain Finance is a very popular topic; many contents in it are worth studying. The basic idea of this paper is: based on studying financing model of Supply Chain Finance, the author has carried on analyzing the credit risk of Supply Chain Finance from the perspective of encoding's function forecast.
Keywords: RISK ANALYSIS, SUPPLY CHAIN FINANCE, ENCODING FUNCTION FORECAST

1. Introduction

In recent years, a new financing model called Supply Chain Finance has appeared. Its core idea is: taking main enterprise in supply chain as a breakthrough point, through controlling information flow, material flow and cash flow, or binding the affiliated enterprise, the financial institute provides financing service for the related enterprise in supply chain. Because of its unique superiority, Supply Chain Finance has obtained a faster development. At present, in the financial domain, Supply Chain Finance is a very popular topic; many contents in it are worth studying. The basic idea of this paper is: based on studying financing model of Supply Chain Finance, the author has carried on analyzing the credit risk of Supply Chain Finance.

Su's [1] paper has analyzed financing process of Supply Chain Finance, pointing out the superiority of Supply Chain Finance. His paper has researched the mechanism of credit risk in Supply Chain Finance, Separately from the perspective of complex science management theory, the information asymmetrical theory and the incomplete contract theory. The research priority is financing model of Supply Chain Finance. Su's [2] paper has limited the financing model scope that needs to study. The author has analyzed the structure and basic integrant of Supply Chain Finance, crystallized the connotation of main enterprise in supply chain, and classified the financing model of Supply Chain Finance. The author also has explained process, function and domain of three financing model, which is classified by the innovation standard proposed by the author. The research priority is reckoning financing enterprise's objective credit risks level. According to the nature, He [3] has divide numerous factors that affect financing enterprise's objective credit risk level into different category. Next, the author has changed these categories into evaluating indicators, constructed synthetic evaluation indicator system that can completely reflect the financing enterprise objective credit risks. Then the author has used the AHP method to determine the weight of each evaluating indicator. Finally, the author has appraised financing enterprise's objective credit risks level by Fuzzy Synthetic Decision. The illustrative example of this chapter has indicated: supply chain factor in Fuzzy Synthetic Decision method can lower dynamoelectric bicycle financing enterprise's objective credit risks level, this result has also proven the superiority analysis of Supply Chain Finance. More's [4] research priority is subjective credit risk of Supply Chain Finance came from financial institute's exterior.in order to effectively circumvent exterior subjective credit risk caused by adverse selection, the author has theoretically established a signal screening model and constructed a group of two stage connection contract to solve this problem; in order to effectively circumvent exterior subjective credit risk caused by moral hazard, the author has also constructed a moral hazard supervision model and discussed how to deal with this question under the complete information condition. The research priority is subjective credit risk of Supply Chain Finance came from financial institute's interior. In financing service of supply chain, the income that financial institute obtains is not only decided by its operative activity, to a great extent is also related with financial organ's management and operation level. In order to effectively circumvent interior subjective credit risk, utilizing the principal-agent theory, the author has discussed to design reward contract drive management level question [5-7].

It is unanimously recognized by the theorists in the world that Small and Medium-sized Enterprises (SMEs) will act as the leading role in the economic growth of the 21st century. SMEs play an irreplaceable and vital role in advancing rapid progress of national economy, alleviating employment pressure as well as promoting market prosperity and social stability. However, due to a series of reasons such as small scale, low labor productivity on the whole, low information transparency and so on, SMEs are at a disadvantage in fierce market competition, which is prominently reflected in financing difficulties. The difficulty in financing is the bottleneck restricting the development of SMEs, making impossible their sustainable and sound development. Stable development of supply chain requires SMEs to strengthen financing capacity and reduce financing cost through innovation of financial service in the context of supply chain.

2. The Current State of Risk Analysis of Supply Chain Finance in China

With the deepening of globalization, more and more resources, businesses and people be integrated

into the supply chain. Supply chain plays an important role in the modern business environment. Enterprise survives competition by becoming a member of a supply chain; the market becomes more efficient because of the competition between supply chains; Countries support and regulate the supply chain to strengthen national competitiveness and to achieve macroeconomic goals. Supply chain act as the channel for product flow, information flow and capital flow, reduces the cost of organizing the enterprises to produce and speeds up the flow of resources between enterprises, which achieves more efficient allocation of social resources. Therefore, supply chain research and practice is of highly significance [8].

In recent years, financing difficulties of enterprises has always been one of main factors hindering the economic development of China. And the government introduced many policies and measures, trying to solve these problems, but the effect is still to be improved. The root of them lies in the lack of financing credit qualification; high default probability resulted from low default cost, and tough supervision and management. However, with the development and innovation of supply chain finance business, supply chain financing makes it possible to solve the problems. The most striking feature of supply chain lies in the closed property of enterprise finance on supply chain, namely the partial closure derived from capital and goods flow within the supply chain. The small and medium-sized enterprises occupy an crucial position in the upstream and downstream of the supply chain, forming a close symbiotic relationship with core enterprises, whose good operating performance and creditworthiness will be efficiently passed on to them through the integrity of supply chain. In the supply chain financing, the financing default probability is low, in that by supervising and managing the real rights and accounts, the bank can directly get business dynamic information and effectively guard against and even evade the defaults. For Banks the risk management is mainly focus on evaluating the risk before financing, so an objective and accurate risk measurement can make the bank effectively evade financing defaults. Therefore, to satisfy the needs of enterprises, meantime, considering the business features of supply chain financing, providing a brand-new risk measurement and monitoring system becomes a priority. Most people in domestic focus more on the operation, management and theories of risk types of supply chain and pay less attention on risk measuring. And more qualitative analysis methods, more summarily analyzing the types and features of risk, less intuitively assessing methods and quantitative model; In terms of supply chain financing risk measurement, more from the perspective of financing enterprises, measuring single-enterprise financing default risk, less from the perspective of financial institutions to assess the risk of the whole supply chain, ignoring the integrity of the supply chain financing. However, the integrity is the most striking feature.

In the context of the supply chain.it has become an essential requirement for the stability of supply chain to enhance the financing ability and reduce the financing cost for small and medium enterprises (SMEs) through the innovative financial products. As a system innovation, Supply-chain Finance collects variety resources of business, finance, financial products to achieve the optimization welfare of the parties, which provides a solution of financing and technology bottlenecks for SMEs, which brings new profit models for the bank and explores business models innovation for developing third-party intermediary companies. Supply-chain Finance based on the real economy of supply chain can provide a range of financing products on the relationship between the upstream and downstream of supply chain which can reduce financing costs for SMEs. Supply-chain Finance achieves the leap from static to dynamic of SMEs production study, to achieves the leap from the physical security to the property control of supply chain in risk prevention method, achieves the leap from the control of large enterprises financing to the attention SMEs financing. This financing model solves the problem of financing SMEs. From the background and significance of Supply-chain Finance, the paper summarized the literature reviews in recent years, summed up the four theoretical foundation of Supply-chain Finance. Because the existing research of Supply-chain Finance not completed and systemic, the paper analyzed the concept of Supply-chain Finance, compared with the traditional financing model to show up its unique advantages. By building mathematical models, through analyzing model-benefit, weakening the information asymmetry, reducing credit risk and improving capital utilization, Supply-chain Finance has four advantages on the issue of SMEs financing. Based on this framework, the paper proposed Storage-financial model to solve the financing problems of SMEs, illustrated the core concept, operational processes and business models of the Storage-financial model, making the qualitative and quantitative analysis of the specific operation. Based on risk management theory, the paper analyzed financial risk control indicators of Storage-financial model, analyzed the optimization credit risk and the choice of the pledge rate using mathematical model.

As a new financing model, Supply-chain Finance not only brings new market and profit model to commercial bank, but also highly welcomed by small and medium enterprises because of their lower threshold for financing and accelerated capital flows. As a win-win financial service product, through the integration of financial resources and the main body, Supply-chain Finance provided a broad network of SMEs financing road, and formed a great social needs, which has a good prospects for development. Market should promote the model operation with positive and effective attitude to make use for economic development. Supply-chain Finance development needs the active participation of the main and effective cooperation promotion; it also needs the external environment of government and policy guidance.

3. The Encoding Function Forecast Algorithm

The sparse coding algorithm was originally developed as a neural model for natural images, in order to simulate the visual processing of simple cells in the primary visual cortex (area V1) of mammals. The principle of sparse coding could be expressed that only a small number of simple cells are significantly activated for a given image signal. Equivalently, the idea of sparse coding is that a given simple cell is only rarely significantly active for a series of different image signals. Because it can successfully model the response properties of simple cells in the primary visual cortex of mammals, and can learn the characteristic basis functions from the statistics of the input images, the sparse coding algorithm is regarded as an effective neural coding method with an adaptive learning mechanism, which certainly has a promising feature. Actually, the sparse coding algorithm has been applied in image coding, image denoising, image retrieval, blind source separation, feature extraction and pattern recognition, etc. However, the sparse coding algorithm is still at a developing stage, for there remains a great deal that is still unknown about how the primary visual cortex works. Therefore, the theory and application study of sparse coding should be enhanced and improved further. After a brief introduction to the neuro-biologic background of sparse coding, a simple mathematic description of sparse coding was given, and then the development history, the current research status and the shortcomings of sparse coding were introduced. In the following, some unresolved adaptive problems in the sparse coding algorithm were investigated at large, and three effective solutions were proposed to solve such problems. As a result, not only at the preprocessing stage, but also at the learning stage, the adaptive ability of sparse coding was improved, which was testified separately in the experiments of feature extraction, face recognition and source blind separation.

Assuming the triangle nodes in direction are P_i, P_j and P_k, the basic encoding function is shown in the following equation (1):

$$\boldsymbol{K}_{fem}^{e}=\begin{bmatrix} K_{i,i} & K_{i,j} & K_{i,k} \\ K_{j,i} & K_{j,j} & K_{j,k} \\ K_{k,i} & K_{k,j} & K_{k,k} \end{bmatrix} \tag{1}$$

Where

$$K_{i,k}=\frac{Et}{4A\left(1-\nu^2\right)}\begin{bmatrix} y_{jk}y_{ij}+x_{kj}x_{ji}\frac{1-\nu}{2} & y_{jk}y_{ji}\nu+x_{ij}x_{kj}\frac{1-\nu}{2} \\ y_{ij}y_{kj}\nu+x_{jk}x_{ji}\frac{1-\nu}{2} & y_{kj}y_{ji}+x_{jk}x_{ij}\frac{1-\nu}{2} \end{bmatrix}$$

The equations of static equilibrium can be shown as

$$\boldsymbol{K}_{msm}^{e}\boldsymbol{d}_{msm}^{e}=\begin{bmatrix} \boldsymbol{K}_{mm}^{e} & \boldsymbol{K}_{ms}^{e} \\ \boldsymbol{K}_{sm}^{e} & \boldsymbol{K}_{ss}^{e} \end{bmatrix}\begin{Bmatrix} \boldsymbol{d}_{m}^{e} \\ \boldsymbol{d}_{s}^{e} \end{Bmatrix}=\begin{Bmatrix} \boldsymbol{F}_{m}^{e} \\ \boldsymbol{F}_{s}^{e} \end{Bmatrix} \tag{2}$$

We can obtain the relation between the external force and the displacement in the master nodes.

$$\boldsymbol{F}_{m}^{e}=\left(\boldsymbol{K}_{mm}^{e}-\boldsymbol{K}_{ms}^{e}\left(\boldsymbol{K}_{ss}^{e}\right)^{-1}\boldsymbol{K}_{sm}^{e}\right)\boldsymbol{d}_{m}^{e} \tag{3}$$

Where

$$\boldsymbol{K}_{msmtn}^{e}=\boldsymbol{K}_{mm}^{e}-\boldsymbol{K}_{ms}^{e}\left(\boldsymbol{K}_{ss}^{e}\right)^{-1}\boldsymbol{K}_{sm}^{e}$$

$$J=\left\|\boldsymbol{K}_{msmtn}^{e}-\boldsymbol{K}_{fem}^{e}\right\|_{2}^{2} \tag{4}$$

Apparently, the objective function J can be denoted as:

$$\begin{cases} \partial J/\partial k_1=0 \\ \partial J/\partial k_2=0 \\ \partial J/\partial k_3=0 \\ \partial J/\partial k_c=0 \end{cases} \tag{5}$$

Then we have:

$$J\left(\alpha,\beta,\nu,\eta,\theta\right)=0 \tag{6}$$

The simplified equation (6) is a quadratic equation of variable η, so two different solutions of η can be solved as

$$\eta=\frac{f_1(\alpha,\beta,\nu,\theta)\pm\sqrt{g(\alpha,\beta,\nu,\theta)}}{f_2(\alpha,\beta,\nu,\theta)} \tag{7}$$

The encoding parameters can be deduced and simplified as

$$k_1=9(-12\alpha^3+6\alpha^4+12\alpha^2(-2+\beta^2)-6\alpha(-5+2\beta^2)+\beta^2(-5+6\beta^2-9\nu))k_0 \tag{8}$$

$$k_2=-9(1-2\alpha+\alpha^2+\beta^2)(-66\alpha^2+30\alpha^3+30\alpha(1+\beta^2)+\beta^2(-25+9\nu))k_0 \tag{9}$$

$$k_3=9(\alpha^2+\beta^2)(6-24\alpha^2+30\alpha^3+6\alpha(-2+5\beta^2)-\beta^2(5+9\nu))k_0 \tag{10}$$

$$k_{c1}=2(7-\alpha+\alpha^2+\beta^2)(18\alpha^2-18\alpha+\beta^2(5+3\nu))k_0 \tag{11}$$

$$k_{c2} = 2(7-13\alpha+7\alpha^2+7\beta^2)(-36\alpha^2+18\alpha^3 +18\alpha(1+\beta^2)+\beta^2(-13+3\nu))k_0 \quad (12)$$

$$k_{c3} = -2(1-\alpha+7\alpha^2+7\beta^2)(-18\alpha^2+18\alpha^3+18\alpha\beta^2 -\beta^2(5+3\nu))k_0 \quad (13)$$

where $k_0 = \frac{Et}{36\beta^3(1-\nu^2)}$.

That was to say that although the Lorentz prior model could be adaptive to the data for a variable scale parameter, the flexibility of which was still limited for the fixed tail index. To solve such a problem, in this paper, it was further suggested that one possibility to improve the flexibility was to introduce into the Lorentz density function a shape parameter which could describe the tail properties of the distribution function. Actually, such a generalized Cauchy distribution was the Pearson VII probability distribution. In this paper, the Lorentz distribution was regarded as a generalized Cauchy distribution with only one scale parameter; while the Pearson VII distribution was regarded as a generalized Cauchy distribution with a scale and a shape parameter both. For the sake of the added shape parameter, the flexibility of the Pearson VII distribution was stronger than that of the Lorentz one. Naturally, in the sparse coding framework, the Pearson VII adaptive prior model can capture the higher-order statistics from the input data to the better detail. Therefore, compared to the sparse coding algorithm with Lorentz adaptive priors, the sparse coding algorithm with Pearson VII adaptive priors could achieve a better coding efficiency, which was testified again in the experiment of feature extraction from natural images. Fourth, to apply the two generalized Cauchy prior models into the special sparse coding algorithm, that is ICA, to separate blind sources. The goal of this study was two-fold: One was to improve the separation performance of the conventional ICA method; the other was to further testify the effectiveness of these two prior models. It was well known that an appropriate selection of the nonlinear contrast function was the key for achieving successful separation. Therefore, if the nonlinear contrast function could be estimated adaptively from the input data, the separation performance could be enhanced for sure. In this paper, it was first suggested that the adaptive estimation of the nonlinear contrast function could be implemented by the way of adjusting the prior densities of the sources adaptively from the data; it was then discussed how to apply the two generalized Cauchy prior models, that were the Lorentz and the Pearson VII adaptive priors, into the ICA algorithm. In the simulation experiments, the two ICA algorithms with Lorentz and Pearson VII adaptive priors had proved more effective than the conventional ICA method with fixed priors; while the separation performance of the ICA algorithm with Pearson VII adaptive priors was better than that of the one with Lorentz adaptive priors.

4. Results and Discussion

Supply chain finance is to provide financial services to all related businesses of both upstream and downstream industries as a whole. As a result, the supply chain-related enterprises receive financing support and grow rapidly, so as to solve the supply chain problem of uneven distribution of funds and upgrade the entire supply chain, even the whole industry's competitiveness. And the commercial banks providing the service of supply chain have also opened up their own business channel, and even dominate the chain of all relevant financial business enterprises. This innovative model has brought dramatic improvement in the rationalization of allocating resources and performance to the banks and enterprises on the supply chain. For example in 2006, Shenzhen Development Bank integrated resources and provided such financial services as RMB, foreign currencies and integrative off and on shore financial services in full-chain to chain-oriented industries. Trade financing customers and business volume both had the 50% growth, and that year the total amount of finance was up to 300 billion, at the same time their ratio of non-performing loans kept below 1 percent, and the overall ratios of non-performing loans were only 0.4%.In the process, business cash flow has been ensured, then doubled sales growth, such as Yongan corporation in Chongqing, cooperated with Shenzhen Development Bank for three years, their sales increased from 600 million yuan to 2.5 billion. The figure 1 shows the framework of risk assessment index system.

It can be seen from the basic model of supply chain finance that the effect of such a mode of financing is the concentration of more financial resources toward those core groups of enterprises. In practice, the domestic banks will usually enlarge the credit of core business by 10%-20% to develop more business through greater credit support to enterprises in the supply chain. This results in a series of practical problems. First, if this core group companies have business links with 10 banks and each bank provides similar credit support, the credit for those companies will be invisibly expanded by 100% -200%; however, enterprise whether its strength and capacity can support such a huge credit growth is still in doubt ? Second, how do the banks supervise risks from the tremendous growth in credit? Third, given the lower degree of information technology in China, how to

review and evaluate authenticity of the large number of trade documents? Fourth, how to guard against and prevent the financial risks and moral risk? Risks of financial supply chain will be analyzed below to tackle these problems. The figure 2 shows the average income curve of supply chain finance and figure 3 shows the average revenue of supply chain finance before and after adding encoding algorithm.

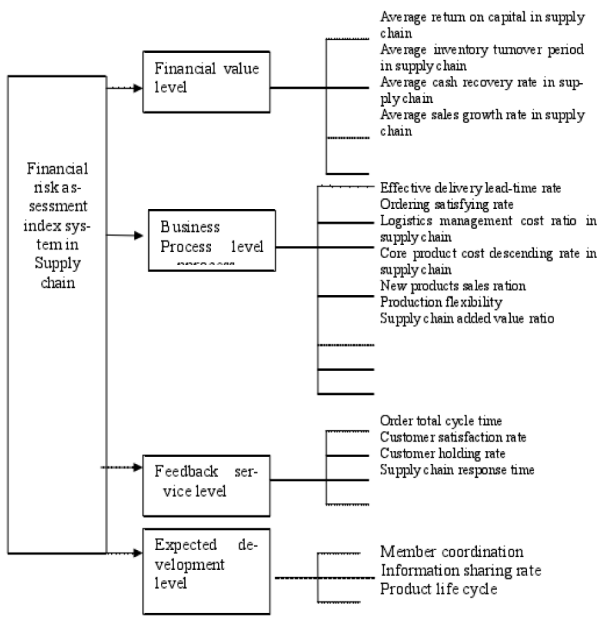

Figure 1. The framework of risk assessment index system

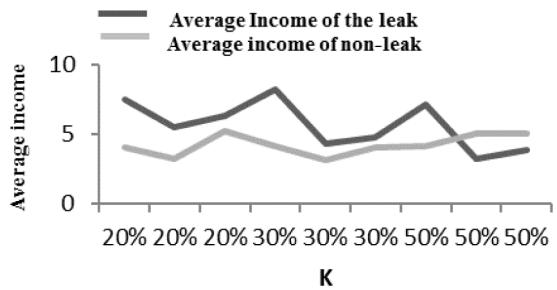

Figure 2. The average income curve of supply chain finance

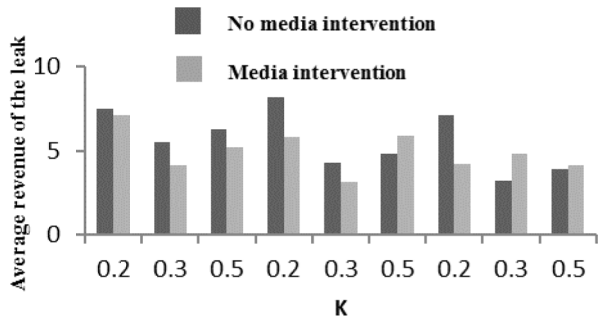

Figure 3. The average revenue of supply chain finance before and after adding encoding algorithm

Conclusions

This paper focus on the research of risk analysis of supply chain finance from the perspective of encoding function forecast. Supply Chain Finance has obtained a faster development. One was to improve the separation performance of the conventional ICA method; the other was to further testify the effectiveness of these two prior models. It was well known that an appropriate selection of the nonlinear contrast function was the key for achieving successful separation. Therefore, if the nonlinear contrast function could be estimated adaptively from the input data, the separation performance could be enhanced for sure.

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