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Analysis of the Typical Model of Supply Chain Finance Based on Credit Risk Evaluation

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Abstract: *Supply chain finance is widely used in logistics and financial industries. For the financial service structure of the supply chain, the credit risk assessment model was designed. Around the production and sales process of enterprises, enterprises that involve the financial supply chain were linked together, and the financial credit situation in the supply chain was analyzed as a whole. The starting point of this research is the construction of the mathematical model of the credit risk assessment of the international financial supply chain. Finally, the MILP linear rule method was used to evaluate the credit risk of the enterprise's financial supply chain.*

Keywords: *Supply chain finance, Credit risk assessment, MILP*

1. Introduction

Since the beginning of the last century, the international financial industry and service work has entered a stage of rapid, stable and mature development. Due to the influence of economic globalization, the purchase of raw materials in various countries or regions has been transformed into the competitive structure of self-procurement, and the intensity of competition increases with each passing day (Su Y, et al. 2015) [1]. The most direct expression of the use of the enterprise is the risk assessment characteristics of the financial. Many small and medium-sized enterprises in China have gradually understood the operation mode of supply chain of large enterprises, and have begun to understand the benefits and the potential advantages brought by the overall operation (Shi J, et al. 2015) [2]. Researchers have long been concerned with the relevant operating model, describing the specific laws of the specific financial chain. Although there are many models that can be used as a reference, there are many models that can be used in the design and operation of the supply chain, but many research results ignore the initial decision-making and income, the impact of marketing activities on high-level decision making is relatively large, but these problems have become a powerful driving force in the global supply chain in the composition of economic factors (Zhang L, et al. 2015) [3]. In this study, the financial supply chain model was constructed. Based on the international typical supply chain, the financial theory was proposed, and the centralized supply chain model was proposed. The MILP method was used to analyze the structure of the typical model.

The basic idea of the supply chain first introduced abroad, the initial design concept, is also a very important part of supply management for foreign countries (Su Y, et al. 2015) [4]. After decades of development, the global material management and information technology continue to improve, the core of supply chain management begins to shift to the management of funds (Hartono B, et al. 2015) [5]. How to complete the basic order purchase and follow-up business management through the financial supply chain is the focus of future supply chain management (Zhang C L, et al. 2016) [6]. Although supply chain funding has been able to withstand a lot of tests, however, foreign countries still regard supply chain management as a kind of financial management means (He Y, et al. 2016) [7]. The evaluation methods of supply chain management for financial products in China are more and more. For example, the gray assessment method, qualitative and quantitative explanation of the effectiveness evaluation of financial capital chain, the risk evaluation model of financial supply chain was established, the evaluation was carried out in the main body of the evaluation and debt perspective, regression analysis model was established, which opens up the financing difficulties of small and medium-sized enterprises (Bi X, et al. 2013) [8].

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2. Methodology

2.1 Risk Assessment Model

Users need a standard area to divide the historical data of demand with more effective segmentation and prediction (Qiao L S H, et al. 2013) [9]. The specific needs of users need to be implemented in a specific form through the network structure of the supply chain, the basic capital and quoted funds of an enterprise need to be subject to certain conditions. The warehouse can complete the distribution of the distribution center by producing the communist goods, can complete the cost budgets of the distribution centers, warehouses, and all aspects of the supply chain and form the overall cost structure of the supply chain network, which allows the financial to have a basic estimate of the overall financial level (Li L J, et al. 2013) [10]. The flow of material and the processing costs of the plant require a supply chain to complete the initial budget (Zhou X F, et al. 2013) [11]. Our model design needs to consider these operations as well as the sum of financial constraints, to carry out financial credit risk assessment, so as to build MILP's structural model to maximize the value of the supply chain.

A mixed linear formal planning model needs to be utilized to describe the underlying model described above (MILP), to define the basic attributes of the product as piecewise basic functions, and to set special assignments over a period of time (Jokinen R, et al. 2015) [12]. Different requirements can be designed for different situations, and the stage functions have different assignments. The proposed model has the probability of occurrence of the event in the assumed scheme, expression as:

$$\sum_{s=1}^{Ns} \varphi_s = 1 \tag{1}$$

From an economic point of view, the results of a business can be considered as a result of a profit statement and the results of a balance sheet. According to the calculation formula given by accounting, each operation stage of the data will affect the final business results, and income statement also needs to carry out regular rectification, so as to reflect the real operation of the enterprise. Specific sales and the limit are:

$$NTS_t = \sum_{s=1}^{Ns} \varphi_s \left(\sum_{i,l} PRICE_{ilt} DM_{ilt} \right) \tag{2}$$

The production process of an enterprise must have undergone cost control, control of raw materials, and cost control of warehousing and transportation, which requires a certain conditional constraint in the mathematical model. The method of describing the cost is:

$$COGS_t = PC_t + TC_t + HC_t + SC_t \tag{3}$$

The most common phenomenon in the manufacturing sector is depreciation, and the additional costs arising from depreciation are the additional costs of non-current assets that need to be considered. If the amount of the sale and the corresponding profits are deducted from the tax revenue, the constraints can be translated into:

$$\begin{aligned} DPR_t &= DR_t FA_t \\ EBIT_t &= NTS_t - COGS_t - DPR_t \end{aligned} \tag{4}$$

When the enterprise carries on the financial financing and the bank interest payment in the different time, the enterprise needs to carry on long-term and short-term debt budgets, especially long-term margins and short-term debt ratios. When the final income tax was calculated, the enterprise profits after tax were obtained. Its expression is:

$$IP_t = LTR_t LTL_t + STSR_t STL_t \tag{5}$$

The determinant of the firm's most business level is NOPAT, whose monetary value is not entirely realized by cash and part of the value is reflected by the collection of money, these more complex things are distributed with the financial supply chain management, in which the basic constraint expression is:

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$$NRA_t = (1 - CFP_t)NOPAT_t \tag{6}$$

The calculation formula of the assets and liabilities of the enterprise is the owner of the liabilities of the enterprise. The flow and non-flowing state of capital constitute the basic assets. The short-term and perinatal liabilities form the basic liabilities of the enterprise, and the new constraint expression is:

$$FA_t + CA_t = A_t + STL_t + LTL_t \tag{7}$$

The probability of a firm's financial control of finance requires a specific economic role to achieve it, and a deeper step is the distribution of the probability of movement (Yan H L, et al. 2014) [13]. For different enterprises, these design rates, such as the liquidity ratio; the management ratio of the asset; the turnover of fixed assets; the debt ratio of an enterprise, have some differences, there are acceptable beyond the value, the expression for:

$$\frac{CA_t}{STL_t} \geq CUR_t \tag{8}$$

The financial environment of an enterprise requires a certain risk assessment in the international supply chain system. Here we design an optimized solution to maximize the flow of funds in the shortest possible time. The objective function of the MILP structure based on the typical model supply chain is constructed. The constructed function takes into account the basic financial costs of all the assets of the firm and can represent the basic financial attributes and characteristics of an enterprise. The expression is:

$$\max \sum_t (NOPAT_t - WACC_t IC_t) \tag{9}$$

2.2 MILP Structural Analysis and Analysis Method

The acquisition of basic information for small and medium-sized enterprises is not easy, because the financial situation of these enterprises is not very transparent, leading to a relatively disordered management system for many enterprises' supply chains (More D, et al. 2013) [14]. Financing is common among Listed Companies in China, as well as in iron and steel vehicles and similar energy companies, so it is particularly important to assess the financial risk through the supply chain (Wang Y, et al. 2013) [15]. This study chose several empirical sample companies of listed companies to carry out the basic accumulation of data. The description of the original data is shown in Table 1.

Table 1: Raw data statistics

	X1	X2	X3	X4	X5
N	69	69	69	69	69
Min	0	4	4	-.0977	-.1506
Max	7	10	10	.4252	.2514
Mean value	3.30	7.00	6.61	.091938	.0878
Standard deviation	2.457	2.358	1.353	.069564	.0618

By using the different evaluation indexes, the matrix variance of the total variance and the composition was obtained from the data analysis of the samples, as shown in table 2.

Table 2: Total variance explained

	1	2	3	4	5
Total	4.412	2.860	2.344	1.694	1.341
Variance%	22.058	14.302	11.721	8.468	6.704
Cumulative%	22.508	36.306	48.802	56.550	63.253
Total	4.412	2.860	2.344	1.694	1.314
Variance%	22.508	14.302	11.721	8.468	6.704
Cumulative%	22.508	36.306	48.802	56.550	63.253`

The structural analysis model was set up as the data forecasting model of credit evaluation. The expression of the composition was used to calculate the financial information status of the enterprise

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and the specific value of the observation. The data of the collected data were analyzed by the statistical software of the data. The variables in the equation are shown in Table 3.

Table 3: Equation variable

	1	2	3	4	Constant
B	.440	.587	1.104	-.910	11.342
S.E	.189	.271	.395	.398	.4592
Wals	5.437	4.697	7.828	5.228	6.101
df	1	1	1	1	1
Sig.					

The expression of regression probability in model structure analysis is:

$$\ln\frac{P}{1-P}=11.342+0.44F1+0.587F3+1.104F4-0.910F7 \tag{10}$$

According to the actual situation of our country, the values in the formula are divided into the critical value and beyond the critical value, but they are infinitely close to the value 1. The credit and punctuality of enterprise financing are better, and the risk in the financial supply chain evaluation results is smaller. However, when the value of P is close to 0, the risk of credit evaluation results in the supply chain of the enterprise is greater.

The structural detection model is used to calculate and forecast the estimated value P of the enterprise by using the basic comparison of the contracted punctuality of the sample in recent years, and obtain the basic status of the enterprise's credit. The basic situation of the test sample is shown in Table 4.

Table 4: Contract punctuality results of test samples

	1	2	3	4	5
F1	-3.420	-3.634	1.339	-0.489	-2.648
F2	23.677	20.193	22.158	26.309	21.121
F3	-8.322	-7.309	-11.999	-7.738	-5.955
F4	7.234	5.204	3.746	3.057	5.175
F5	-3.412	-1.413	2.165	-0.708	-0.695

3. Result Analysis and Discussion

An enterprise was established in 2000, the time listed on the Shenzhen Stock Exchange was in 2005. The company's total stock cost was 493.75 million yuan, and the company's main operating position (hereinafter referred to as B) is the distribution of accessories for high-end models, which gives the domestic car manufacturers spare parts supply. The annual turnover is nearly 35% growth rate. Due to the economic downturn in recent years, the growth rate decreased slightly. Table 5 shows the company's business data indicators.

Table 5: Indicator data of the business capital of the company

Assets income	Selling rate	Asset liability ratio	Current ratio	Quick ratio	Asset turnover
10.9%	6.5%	44.9%	1.406	1.012	1.18

B companies in the country have a number of production bases, which serves as a supplier of mainstream automotive brands in the country. FAW-Volkswagen is also one of its major customers. In the process of cooperation, FAW Volkswagen and B companies annual growth rate is about 4% of the car, the growth rate is about 0.77, B companies asset size can be ranked in the domestic top 10 at the end of the year, which shows that the enterprise's parts and components of the supply chain are relatively mature, it is closely related to upstream enterprises. The risk of bad debts within a given time limit is controlled within 1% in B companies, and the same industry rank can be controlled in the top 50.

From the global market economy trend, China's auto industry is still the fastest growing country in the global market. According to the basic operation status of B Company and the development situation in recent years, the financial risk credit evaluation of supply chain was carried out. MILP's structural

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analysis results were combined to qualitatively analyze the values and summaries of the indicators in the credit risk assessment process. Table 6 is the statistical results of B's financial and financial results, which facilitate the exclusion of factors other than financial factors.

Table 6: Other company indicators

Enterprise scale	Leadership quality	Management level	Sales profit	Asset ranking
7	7	10	3.4%	10

The credit risk assessment of Company B was carried out by the previous model expression and the structural analysis structure of MILP. The results are as follows:

$$P = \frac{1}{1+e^{-[11.3+2+0.44\times(-6.1802)+0.597\times(-4.8694)+1.104\times5.6678-0.910\times9.946]}} = 0.95$$

It can be seen from the results of the solution that the credit risk assessment model MILLP of financial supply chain is reasonable and can calculate the probability of credit compliance of an enterprise and can evaluate the credit operation index of the enterprise. From the solution data, the risk assessment model of supply chain finance in B companies is of great help for the company's compliance rate. The structure of the typical MILLP structural analysis shows that the financial risk of the supply chain is relatively small, and commercial and financial operations can rest assured that the enterprise carries out financial capital chain services. In fact, the enterprise's financial asset evaluation index is ideal. Combined with the specific financial situation, it can be found that the operation of the enterprise is in good condition, and the possibility of bankruptcy reorganization is very small under the condition of major application problems, the credit situation is good, the model structure is in good condition.

Taking a certain enterprise as an example, the typical MILLP structural analysis model was measured, and the stability of the financial credit risk assessment model was obtained. The stability of the technology can be accurately predicted based on the importance of the variable, which can avoid the uncertain impact of financial products. Analytical information provides bias reporting for supply chain management evaluation and determines the future direction of supply chain finance management.

4. Conclusions

Supply chain finance is a new and convenient way of financing for small and medium-sized enterprises in financial supply. By reading a lot of literature, in this paper, supply chain financial risk assessment was deeply understood, more mature credit risk assessment methods were discussed, the supply chain financial model and the corresponding credit test points were analyzed. The research work focused on the optimization of international supply chain finance risk assessment model prediction methods. Based on the typical model of MILLP structure, the structure model of financial statement analysis was designed. In this paper, a more convenient supply chain model was used to describe the adaptability of the model, and the optimal operation of the financial impact of a company was analyzed. The superiority of the model was obtained. On the basis of the capital chain of the controllable enterprises, the next stage of the MILP structural analysis model was planned, so as to find an optimization model to solve the supply chain design and operation.

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References

[1] Su Y, Lu N. Supply Chain Finance Credit Risk Evaluation Method Based on Self-Adaption Weight[J]. Journal of Computer & Communications, 2015, 03(7):13-21.
[2] Shi J, Guo J, Wang S, et al. Credit Risk Evaluation of Online Supply Chain Finance Based on Third-party B2B E-commerce Platform: an Exploratory Research Based on China's Practice[J]. International Journal of u- and e- Service, Science and Technology, 2015, 8.

ISSN 2616-5902 Vol. 4, Issue 1: 55-60, DOI: 10.25236/AJBM.2022.040110

[3] Zhang L, Hu H, Zhang D. A credit risk assessment model based on SVM for small and medium enterprises in supply chain finance[J]. Financial Innovation, 2015, 1(1):14.

[4] Su Y, Lu N. Simulation of Game Model for Supply Chain Finance Credit Risk Based on Multi-Agent[J]. Open Journal of Social Sciences, 2015, 03(1):31-36.

[5] Hartono B, Paramita D. On individual risk preference measurement: models adaption and evaluation for an Indonesia context[J]. International Journal of Applied Decision Sciences, 2015, 8(4):376.

[6] Zhang C L. Risk assessment of supply chain finance with intuitionistic fuzzy information[J]. 2016, 31(3):1967-1975.

[7] He Y, Xu Z, Gu J. An approach to group decision making with hesitant information and its application in credit risk evaluation of enterprises[J]. Applied Soft Computing, 2016, 43:159-169.

[8] Bi X, Dong X, Liu Y T. Supply Chain Finance Credit Risk Evaluation Based on Trapezoid Fuzzy Number[J]. 2013:1467-1475.

[9] Qiao L S H, Lin Z H. The Evaluation Study of Supply Chain Financial Risk Based on the BP Neural Network[J]. Applied Mechanics & Materials, 2013, 401-403:2306-2309.

[10] Li L J, Si M T. The Financial Risk Assessment of Manufacturing Firms under the Supply Chain Environment[J]. Applied Mechanics & Materials, 2013, 433-435:2367-2372.

[11] Zhou X F, Lv H, Xu S W. Evaluation of Electronic Products OEM Industry Supply Chain Risk Based on Fuzzy Influence Diagram[J]. Applied Mechanics & Materials, 2013, 380-384:2498-2501.

[12] Jokinen R, Pettersson F, Saxén H. An MILP model for optimization of a small-scale LNG supply chain along a coastline[J]. Applied Energy, 2015, 138(C):423-431.

[13] Yan H L, Shu-Xiang L I, Polytechnic H I. Research on Finance Model of Agricultural Supply Chain Under the New Rural Construction Environment[J]. Journal of Hunan Industry Polytechnic, 2014, 124(2):565-571.

[14] More D, Basu P. Challenges of supply chain finance: A detailed study and a hierarchical model based on the experiences of an Indian firm[J]. Business Process Management Journal, 2013, 19(4):624-647(24).

[15] Wang Y, Ma Y, Zhan Y. The Research on Supply Chain Finance Model with Supplier-led[J]. International Journal of Advancements in Computing Technology, 2013, 5(8):566-576.