貿易學博士 學位論文

물류금융리스크 관리에 관한 3편 논문

Three Essays on the Risk Management of Logistics Finance

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국문초록

중국은 이미 세계에서 주요 생산국과 소비국 중의 하나가 되었다. 2016년 등록한 기업이 하루 평균 15,000개 정도로서 중국 경제의 빠른 발전에 기여했다. 또 한편으로는 중소기업의 금융문제는 갈수록 어려워지고 있다. 이와 같은 문제는 중소기업에 도덕적 리스크, 정보비대칭, 영업익스포져 등 의 요소가 존재하기 때문에 은행의 중소기업에 대한 신용평가가 높지 않기 때문이다. 게다가 대출 절차가 갈수록 복잡해지고 은행이 수익을 얻기가 어려워져 중소기업도 대출을 받기가 힘들고 투자 환경이 어려워지고 있다.

이런 상황에서 물류금융이 새로운 금융방식으로서 나타났다. 물류금융은 물류산업의 세 당사자 중소기업, 은행 및 물류기업에게 효과적인 금융플랫폼을 제공할 수 있다. 물류금융은 중소기업의 금융문제를 해결할 뿐만 아니라 은행과 물류기업에게 새로운 이윤창출 방식을 제공할 수 있을 것이다. 이에 따라 세 당사자에게 모두 이익을 가져다 줄 가능성을 가져왔다. 그러나 한편으로는 새로운 리스크도 함께 왔다.

물류금융에서 발생하는 리스크문제를 해결하기 위한 방안을 찾기 위해 이

논문은 세가지 관점에서 연구를 진행해 세 개의 에세이로 분석했다.

첫 번째, 게임이론을 바탕으로 물류금융의 신용리스크 관리를 연구한다. (Essay Ⅰ)

첫 번째 에세이에서는 먼저 은행 및 물류기업이 직면한 신용리스크를 분석한다. 다음으로 게임이론을 이용하여 은행과 중소기업 간의 관계를 분석하고, 물류기업을 도입해서 세 당사자 간의 게임적인 방식을 분석한다. 이를 통해 은행이 감독하는 확률, 중소기업의 신뢰도의 확률 및 물류기업이 계약을 이행하는 확률을 찾아 신용리스크의 이론적인 근거를 제시한다.

중소기업과 물류기업의 신용불안요소 및 위약요소를 찾는 과정에서 아래와 같은 정책을 제언했다.

1. 은행과 물류기업이 중소기업 신용관리 플랫폼을 설리하고 모든 정보를 공유한다.

2. 은행과 물류기업의 협력관계를 강화해야 한다.

3. 은행이 고객의 재무자료 데이터뱅크 시스템을 완성시키고 감독비용을 최소화 시킨다.

4. 물류기업과 중소기업의 감독관리를 강화하고 중소기업 신용불량 상황의 발생을 최소화시킨다.

두 번째, 통합신용보장방식에 있어 은행의 물류기업 리스크 평가 모델을 설정한다. (Essay Ⅱ)

두 번째 에세이에서는 먼저 통합신용보장방식에서 은행이 직면하는 리스크를 변별하고 다음으로 기업의 재무지표를 활용하여 요인분석모델을 설정한다. 물류기업 금융리스크의 주요 지표를 분석하고 물류기업의 금융리스크를 계량화 분석한다. 통합신용보장방식에서 은행의 기업 선택표준을 제공한다.

물류기업의 금융리스크는 주로 경영현황, 부채상환 능력, 수익성, 성장성 등에서 비롯된다. 이 논문은 통합신용보장방식에서 은행에게 기업의 선택표준

을 제공하며 이를 통해 은행의 물류기업에 대한 심사효율성과 신뢰성을 향상시킬 수 있다.

이 논문은 은행이 물류기업의 담보계좌(担保账户)를 설립하고 물류기업의 재무 분석 플랫폼을 구축해야 한다고 제안한다. 그리고 상장한 물류기업의 연도 보고서를 충실히 작성하고, 은행의 기업관리기관, 세무기관 간의 소통체계를 강화해야 하고 물류기업의 재무리스크 관리를 강화해야 한다. 그리고 물류기업의 거래대금에 대한 관리를 강화해야 한다.

세 번째, 통합신용보장방식에서 물류기업의 중소기업 선택방법을 연구한다. (Essay III)

세 번째 에세이에서는 먼저 물류기업이 직면한 리스크를 변별하고, AHP과 LP기법을 활용하여, 창고의 한정량과 대출한도를 제약조건으로 하는 물류기업의 중소기업에 대한 적정 대출 규모 모델을 설정한다.

그 결과 물류기업의 이윤 극대화를 보장하기 위하여 아래와 같이 몇 가지 제안을 한다.

1. 물류기업 창고의 한정량에 대한 경보시스템을 구축하고 담보물의 저장공간을 확보해야 한다.

2. 담보물에 대한 평가체계를 완성하고 물류기업 담보물가치의 적절성을 확보해야 한다.

3. 중소기업에 대한 신용평가 플랫폼을 구축하고 물류기업 대출의 안전성을 확보해야 한다.

위 내용을 전체적으로 보면 이 논문은 물류금융의 리스크 관리상에 세 가지 문제를 연구했다. 그리고 물류금융리스크의 관리에 대해 전략적인 제안을 제시했다. 이와 같이 보완된 물류금융은 중국경제를 지속적으로 발전시킬 수 있다고 예측한다.

주제어: 물류금융, 요인분석, 게임이론, AHP, LP, 리스크 관리

INTRODUCTION: General Remarks & Literature Review

1.1 Background and Objective

From the definitions of small and medium-sized enterprises (SMEs),[1] Although the definition of small and medium-sized enterprises in the world in terms of the number and size of funds is slightly different, but SMEs generally are not just small but specialized, smart, and professional, so their advantages can be fully played. Their importance on the national economy is increasing enhanced, so they can be called as "the most dynamic economic groups."

According to the statistics from State Administration for Industry and Commerce of the People's Republic of China, by the end of 2016, there are all kinds of 87.054 million market subject. There are 16.513 million holders of the new market subject for the whole year, it is increased by 11.6% over the previous year. Newly registered companies maintain rapid growth, there are 5.528 million newly registered enterprises throughout the year, 15100 a day on average.[2]

With the development of world's economic, China becomes the most important production base and potential consumption market in the world. SMEs in China face more and more opportunities to develop and also face an outstanding problem of funds shortage. In China, every day a lot of small and medium enterprises in the

1) The European definition of SME follows: "The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro."
In China, at the same time have the following two conditions of the enterprise that is small and medium enterprises: Firstly, not to raise funds. That is not public offering of shares and bonds: Secondly, the smaller enterprises, that is, in accordance with the original State Economic and Trade Commission, the State Planning Commission, the Ministry of Finance, the National Bureau of Statistics jointly issued by the four departments on the issuance of SME Standard Interim Provisions to determine the small and medium enterprises.
Source from: http://eur-lex.europa.eu/
source from: https://zh.wikipedia.org/

2) Data sources from State Adminstration for Industry & Commerce of the People's Republic of China introduce the development of the national market in 2016 to the media on Jan.18. http://www.gov.cn/xinwen/

birth, every day there are many small and medium enterprises in bankruptcy collapse. On the one hand, small and medium enterprises has brought a lot of promotion role for the Chinese economy, on the other hand, the survival conditions of small and medium enterprises is increasingly bad. One of the most important reason is the lack of small and medium sized enterprises and the bank's communication, monetary tightening in the status quo, it is difficult for the small and medium sized enterprises to obtain the necessary financial development of enterprise funding from the bank.

Some policies have been established by the People's Bank of China[3] to support the development of small and medium-sized enterprise financing, the China Banking Regulatory Commission has issued guidance to carry out small enterprise loan business; those are aimed to increase the credit to small and medium sized enterprises. Under the active support of governments at all levels, in accordance with the principle of socialization, specialization and marketization, small and medium-sized enterprise credit system and guarantee system construction have also made great progress.

But the problem of the difficulty in small and medium-sized enterprise financing has not been fundamentally solved. So developing ideas and introducing the logistics financial business into the small and medium-sized enterprise financing are realistic and feasible.

The logistics finance, which combines the logistics service and financial innovation, is an effective way to solve the financing difficulties of small and medium sized

3) On June 21, 2010, the People's Bank of China, the China Banking Regulatory Commission, the CSRC and the CIRC issued a number of opinions on further improving the work of financial services for small and medium-sized enterprises. The central idea further promoted the reform and innovation of the credit management system of small and medium-sized enterprises Small and medium-sized enterprise financial services multi-level financial organization system, broaden the characteristics of small and medium enterprises in line with the needs of diversified financing channels, and vigorously develop the SME credit enhancement system, and more initiatives to support small and medium enterprises "going out" to develop the international market to strengthen sector collaboration and monitoring and evaluation Mechanism construction. But this only from the policy on the financing of SMEs made a proposal, there is no substantive help.
source from: http://www.pbc.gov.cn/

enterprises. The logistics financial services adds new services to logistics companies, and helps the banks to pledge for financing business regulation, solve the problem of processing the collateral asses small and medium sized enterprises and asset disposal. Meanwhile, the logistics financial services transform the invent ability decided the development of the logistics finance, financing into circulating fund, that effectively relieves the lack of corporate capital liquidity problems.[4)]

With the acceleration of economic globalization, the competition of the supply chain which marking national strength and level is intensified. Along with the adjustment and the development of China's economy and gradual opening policy in China, the logistics finance not only has gradually become a necessary of China's economic development, but also is the formation of a huge market demand. As a conservative estimate, the size of China's logistics financial market is at least more than one trillion yuan. Based on the current scale of development, the development space of China's logistics financial market is still huge.

However, this new way of financing also brought new financial risks. Asymmetric information, moral hazard, operation risks, potential risks and external risks among SMEs, the logistics companies and the bank became the subject of concern during the development of logistics finance.

At present, logistics finance in China is still in a primary stage. Therefore, studying the logistics finance's operation and risk management has an important role: it could improve efficiency, reduce related costs, arrange production plan and human resource reasonably, improve the serve level of financing institution and logistics company, guarantee the financing funds security, promote the logistics finance business development.

Through discussing above problems, considering about the risk status in the development of China's logistics finance, this paper analyzes three aspects of logistics finance risk management under the unified credit guarantee mode and puts forward some policies and suggestions adapted to current development of logistics

4) Yang Juan, Chen Yu, Ren Xiaofeng. Research on the risk management of warehouse receipt pledge business.[J].logistics management.2008(2):12-13.

finance in China according to the results of the analysis.

This paper studies the three correlations in logistics financial risk management in the form of three essays.

Credit risk management is the most important problem in logistics financial risk management. Only on the basis of fully studying credit risk management can solving other practical problems in risk management.

Logistics finance has three categories: asset guarantee model, capital guarantee model and integrated model. On the basis of comprehensive comparison of various models, this paper chooses the unified credit guarantee model (which is part of the asset guarantee model) as the basis of the research, and points out the practical problems in the risk management from the angle of the bank and the logistics company respectively.

In Essay I, the paper takes the banks and logistics companies as the main body of the study.

Firstly identifies the credit risk that the bank and logistics company may occur and then uses the principle of game theory to analyze the relationship between banks and SMEs. After that further introduces the logistics companies to analyze the game among the three parties. So the probability of bank supervision, the probability of SME's integrity and the probability of the logistics company fulfilling the contract can be calculated. Through finding out the factors of dishonesty and breach of contract of SMEs and logistics companies, this paper finally puts forward the theoretical basis for the mechanism of credit risk. On the basis of finding out the factors of SME's breach of contract, this paper gives out the corresponding strategy

In Essay II, the paper takes the bank as the research subject.

After identifying the risk faced by the banks under the unified credit guarantee model, based on the financial index of the enterprise, through the establishment of the factor analysis model, the financial risk of the logistics company is quantified and analyzed, and the main indexes of the financial risk of the logistics company are found out. Through the main indicators of factor analysis can be seen, affecting the

logistics company's financial risks mainly related to the logistics company's solvency, profitability, growth capacity and operational capacity. The formula provided in this paper provides a reference for the bank screening enterprises under the unified credit guarantee mode, and effectively improves the speed and reliability of the banks to review the logistics companies.

In Essay III, the paper takes the logistics company as the research subject.

Through identifying the risk of logistics companies, followed by the use of AHP and LP combination of modeling, under the constraints of the warehouse capacity and the total amount of the credit loan, to establish a model for helping the logistics company to choose the small and medium enterprises. In the protection of logistics companies to maximize profits under the premise of the corresponding strategy.

1.2 Scope and Methodology of the Study

Logistics finance involves several aspects including logistics, financial business and so on. It needs a multidisciplinary theoretical knowledge as well as a variety of research methods to study. On basis of statistics and game theory (Essay I). with the utilization of system analysis and theoretical derivation(Essay II and Essay III), this paper studied and discussed some problems in logistics finance risk management.

1. In Essay I, first of all, identify the credit risk faced between banks and small and medium-sized enterprises, and then use the principle of game theory to analyze the relationship between banks and SMEs.

And then add logistics company to conduct a game analysis between the three parties to identify the probability of bank supervision, the probability of SME integrity and the probability of logistics companies to fulfill of the contract. To find out the factors of dishonesty and breach of contract of small and medium-sized enterprises and logistics companies, so as to put forward the theoretical basis for the mechanism of credit risk.

2. In Essay II and Essay III, This paper utilizes the method of quantitative analysis and qualitative analysis, is given priority to quantitative analysis, and takes qualitative analysis as the auxiliary pole.

3. In Essay Ⅱ, first of all, to identify the risk of bank under the unified credit model, followed by on basis of the factor analysis, through the establishment of the factor analysis model, this paper quantifies and analyzes the logistics finance risk under unified credit guarantee mode. According to the extracted public factors, single factor scores are obtained by regression method. After taking the public factor variance contribution ratio of the revised as weights and then recalculating the combination, comprehensive score for each factor of the logistics company can be concluded.

4. In Essay Ⅲ, firstly, to identify the risk of logistics company may be occur in the operational process , and then Utilizing the method of combining analytic hierarchy process (AHP) and linear programming (LP) for the study. Calculated the risk weighting by using AHP method, then constructed LP model by using those as the objective function coefficient, and the strategy that how to choose the SMEs which apply for a loan under unified credit guarantee mode can be concluded finally.

1.3 Structure and Contents

The structure of this paper is divided into three parts to complete.

In Essay Ⅰ, the paper analyzes the probability of the bank in the logistics financial credit risk management, the performance probability of the logistics company and the honesty probability of the small and medium-sized enterprises. On the basis of credit risk analysis, this paper chooses the unified credit guarantee model as the basis of the research. In this paper, according to the unified credit guarantee mode of business processes, in turn the research structure is divided into two papers and papers three.

In Essay Ⅱ, in accordance with the unified credit guarantee mode business process first step requirements, the bank to complete the credit task of the logistics company. Under the premise of identifying the risk of the bank, the factor analysis method is used to analyze the bank selection logistics company and put forward the policy suggestion of risk control for the risk faced by the bank.

In Essay Ⅲ, in accordance with the unified credit guarantee business model process

second step operational requirements, the logistics company to complete the choice of the amount of loans to SMEs. Under the premise of recognizing the risk of logistics companies, this paper analyzes the logistics companies' selection of small and medium-sized enterprises by using the integrated method of analytic hierarchy process and linear programming, and puts forward the normal suggestions of risk control for the logistics companies in the process of lending.

In this paper, through the study of paper-credit risk management (Essay I), the research on the specific business process risk management under the unified credit guarantee model (Essay II and Essay III). Through the analysis of logistics financial risk management, the practical problem has been studied, and put forward practical suggestions.

This paper consists of five parts as follows:

The first part is introduction. This chapter points out the research purpose at the beginning, then introduces the research methods and research scope of this paper, and introduces the structure and contents of each chapter and give the literature review of logistics finance in the end.

The second party is Essay I, discusses credit risk management based on game theory. Firstly, to identify the credit risk through the operational process of logistics finance, and measure the integrity probability of SMEs and the supervision probability of banks, set up a tripartite game analysis between bank, logistics company and SMEs. Finding out the factors affecting fraud and breach of the contract, this part thus puts forward the theoretical basis for the mechanism of credit risk.

The third part is Essay II, the measurement factor analysis of logistics company under unified credit guarantee mode. Firstly to identify the risk the bank may occur in the process, and then considering the financial indicators, on the basis of modeling the factor analysis to quantify and analyze the logistics finance risk under unified credit guarantee mode, finding out the main indexes of company in logistics financial risks. According to the extracted public factors, single factor scores are obtained by regression method. After taking the public factor variance contribution ratio of the revised as weights and then recalculating the combination, comprehensive score for

each factor of the logistics business enterprise can be concluded. Compared the logistics financial risks of different enterprises for the same period, this part provide some reference for the bank to the enterprises filtrating under unified credit guarantee mode.

The fourth part is Essay III, discusses logistics risk management evaluation model under unified credit guarantee mode and utilizes the method of combining AHP and LP for the study. First of all, to identify the risks logistics company may occur in the operational process, and then calculated the risk weighting by using AHP method, then constructed LP model by using those as the objective function coefficient, in the constraint of space of warehouse and the total amount of the credit amount, to maximized the total surplus value of logistics company, after calculated and illustrated the measured result, the strategy that how to choose the enterprise which apply for a loan under unified credit guarantee mode can be concluded finally.

The fifth party is the summary and conclusion. This part summarizes the conclusion and policy implication of this paper, and then puts forward prospect to research in the future.

1.4 Literature Review

Logistics finance is just limited to engage in small credit business simply at the beginning of its development. With the demand of SMEs in financing services increase, logistics finance emerges a variety of operational modes, including receivable financing, trade financing and warehouse financing chain etc. The following is a summary of the theory and operation mode of logistics finance, the related literatures of logistics finance risk management.

1.4.1 The Theoretical Study of Logistics Finance

The concept of logistics finance originated in the 2400 BC, in Mesopotamia agricultural areas, storage facilities and grading system were very common. Allen and Gregory (2004) put forward some new ideas and framework about the financing of SMEs.[5] The theoretical study of logistics finance by foreign scholars can be

5) Allen N.Berger, Gregory F.Udell.A more complete conceptual framework for SME

summarized by the following Table 1-1.

<Table 1-1> The Theoretical Study of Foreign Scholars

No.	Author	Research Contents		Published
		Definiition	Business Mode	
1	Jacqueline [6]		⊙	2000
2	Guerrisi (2001) [7]		⊙	2001
3	Rutberg [8]		⊙	2002
4	Coulter and Onumah [9]		⊙	2002
5	David [10]		⊙	2004
6	Fenmore [11]		⊙	2005
7	Ross [12]		⊙	2005
8	Leora Klapper [13]		⊙	2005
9	Allen	◆	⊙	2005
10	Gonzalo Guillen [14]	◆		2006
11	Kerle, Phillip [15]		⊙	2010
12	Kerle, Phillip [16]		⊙	2013

finance.[C].World bank conference on small and medium enterprises:overcoming growth constrainst,2004(10):14-15

6) Jacqueline (2000) discussed the experiences and lessons that need to be learned in the financing process of warehouse receipts to improve the economic benefits of warehouse receipts.
Jacqueline Bass,Katrena Henderson. Warehouse receipts: financing agricultural producers innovations in Microfinance.[J].Technical note.2000:1-9.

7) Guerrisi J. Making money move faster.[J].Supply chain management review. 2001,5(1):17-18

8) Sidney Rutberg. Financing the supply chain by piggy-backing on the massive distribution clout of United Parcel service.[J].The secured. 2002,58(6):40-4

9) Coulter J and Onumah. The role of warehouse receipt systems in enhanced commodity marketing and rural livelihoods in Africa.[J].Food policy.2002:31-37.

10) David Biederman. Logistics financiers.[J]. Supply chain management.2004(4):40-42.

11) Fenmore (2004) gave a detailed analysis of the emerging mode of operation of the order financing business.
Eric Fenmore. Making purchase-order financing work for You.[J].The secured lender. 2004,60(2):20-24

12) Ross (2005) wrote in the study that the United States as the representative of the logistics and finance research mainly research of warehouse receipt pledge model.
Julie Ritzer Ross. Supply chain solution streamlines merchandise flow.[J].Integrated solutions for retailers.2005.(10):26-28.

13) Leora Klapper (2005) analyzed the incentives and functions of SMEs in the supply chain using the inventory financing model.
Leora Klapper. The role of "reverse factoring" in supplier financing of small and medium sized enterprises [R]. World bank.2004(9):102-103

14)Gonzalo Guillen, Mariana Badell. A holistic framework for short-term supply chain

Guerrisi (2001), through the study of the development of logistics and distribution technology and the transfer of funds in the supply chain, argued that current capital flow management has not be enable to match the rapidly evolving logistics technology, especially in the field of e-commerce. Become the bottleneck of development, and thus put forward the Internet-based electronic money transfer method will be widely used in the global trade chain.

Rutberg (2002) and David B. (2004) both analyzed the case of UPS Capital. UPS Capital is one of the leaders in global supply chain management. In 1998, UPS Capital company (UPS Capital corp.) was found, providing customers with Cash On Delivery (COD), mortgages, equipment leasing, international trade financing and other financial services. The international trade financing services provided by UPS capital make the fund procurement of manufacturer or factory more flexible and the order receiving ability be greatly increased, and promote the industry comprehensive competitive ability.[17)]

UPS Capital at first leveraged an existing UPS product, for example, collect on delivery (COD.), as its core service offering. But it was not long before the traditional COD. model was improved with financial benefits designed to help accelerate and secure the flow of funds between UPS shippers and their customers. The success of these enhancements led to other financial products and services, including asset-based lending (ABL), equipment leasing, domestic and international factoring, UPS Capital-branded credit card for small businesses and employees, and electronic bill

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management integrating production and corporate financial planning.[J].Production economics. 2006(6):25-27

15) Kerle, Phillip. The necessity for supply chain finance.[J].Credit control. 2010,31(1):39-44

16) Kerle, Phillip. Forging new links? A research review of progress in the international supply chain finance market.[J].Credit control.2013,34(10):51-64

17) Illustrate the process of financial services: Assuming that Seattle's fashion companies order goods from China's fabric suppliers. UPS receives the goods delivered by Chinese enterprises and then immediately pay up to 80% of the purchase price. After the goods are delivered to the consignee in Seattle, the UPS will pay the balance to the Chinese company. This is a way for Chinese sellers to pay back more quickly and efficiently than the letter of credit, and the delivery time of the buyer in Seattle is assured.
UPS, Baidu vocabulary entry, http://baike.baidu.com/

presentment and payment, which still serve UPS customers today.

Gonzalo Guillen (2006) studied the short-term supply chain management, which combined production and corporate finance planning, and pointed out that a rational supply chain management model could affect the operation and financing of enterprises, there by increasing overall returns.

The time of domestic logistics finance theory and practice research is short. The landmark results of this stage are the presentation of the material bank (1987), the financing warehouse (2002) and the logistics bank (2004). The details of the domestic scholars can be summarized by the following Table 1-2.

<Table 1-2-1> The Theoretical Study of Domestic Scholars

No.	Author	Published	Research Contents
1	Chen Huai [18]	1987	The concept of"material bank"
2	Ren Wenchao [19]	1998	How to use the "material bank"
3	Luo Qi, Zhu Dao Li and Chen Boming [20]	2002	the concept of "financing warehouse"
4	Chen Xiangfeng, Shi Dailun and Zhu Daoli [21]	2005	Put forward the concept of financial logistics oriented to supply chain
5	Zou Xiaopeng and Tang Yuanqi [22]	2004	The concept of logistics finance
6	Xu Li, Luo Qian and Xiong Kanxia [23]	2005	Introduced the characteristics and functions of logistics banking business
7	Wang Yingqi [24]	2005	Introduced the application of logistics insurance
8	Zhu Hong [25]	2011	Proposed logistics finance is a concept of the combination of logistics and financial business

18) Professor Chen Huai of Renmin University of China was the first one to put forward the idea of "material bank", but because of the lack of fully understanding of the logistics concept, that concept of material banks is quite different with today. Chen Huai. The idea of material bank.[J].China industrial economics.1987:35-36.

19) Ren Wenchao. The idea and operation of material bank.[J].China logistics & purchasing. 2005(2):32-33.

20) Luo Qi, Zhu Daoli, Chen Boming had made a landmark in the business mode field of logistics finance is proposing and applying the concept of "financing warehouse". Luo Qi, Zhu Daoli, Chen Boming. A third-party logistics innovation: financing warehouse and its operation model.[J].China business and market.2002(02):11-14.

21) Chen Xiangfeng, Shi Dailun, Zhu Daoli. Research on operation mode of financing

In China, the study of logistics operation mode started from the study of warehouse receipt pledge in 1997. The details of the research contents are as follows in Table 1-2.

<Table 1-2-2> The Theoretical Study of Domestic Scholars

No.	Author	Published	Research Contents
1	Guo Zhenlin [26]	1997	Warehouse receipt pledge
2	Fang Shaokun [27]	2001	Pledge of warehouse receipt
3	Zheng Jinbo [28]	2003	Warehouse receipt pledge
4	Peng Shunzhang [29]	2003	Warehouse receipt pledge
5	Yang Shaohui [30]	2004	Warehouse receipt pledge
6	Chen Xiaoguang [31]	2005	Warehouse receipt pledge
7	Zuo Xuelian [32]	2013	The operation mode of agricultural product logistics finance
8	Qin Chang-zhi [33]	2013	Comprehensive dynamic pledge
9	Fang Weilei(2016) [34]	2016	Comprehensive dynamic pledge

warehouse .[J].Logistic and material handling.2006(1):97-99.

22) Zou Xiaoyuan, Tang Yuanqi. Analysis of logistics finance.[J].Zhejiang finance.2004(5):20-44

23) Xu Li, Luo Qian, Xiong Kanxia. Logistics Bank - a financial innovation based on logistics information platform.[J].Logistics technology.2005(06).5-7

24) Wang Yingqi. Logistics insurance and logistics financial tide early in the ascendant.[J]. China logistics & purchasing.2005(02):14-17

25)Zhu Hong. Research on innovation of modern logistics ginancial model.[J].Commercial times. 2011(26):29-30.

26) Guo zhenlin (1997) discussed the role of warehouse receipt pledge for the first time. The author thought that the warehouse receipt pledge loan provided a way for the farmers to extend the sales period of seasonal products.
Guo Zhenlin. Market bill financial innovation -warehouse receipts.[J].Hainan finance.1997(6): 17-19.

27) Fang Shaokun, Zhao Zhiyi (2001) considered that a pledge of warehouse receipt is a kind of pledge which is based on the warehouse receipt and is not same as other kind of pledge.
Fang Shaokun, Zhao Zhiyi.Study on the pledge of warehouse receipts.[J].Law and social development.2001(4):41-48.

28) Zheng Jinbo, Qi Meizhi. Warehouse receipts pledge management.[J].Railway materials management.2003(4):12-13.

29) Peng Shunzhang. Warehouse receipt financing- a new way of colored warehouse.[J]. nonferrous metals industry.2003(7):38-39.

30) Yang Shaohui. "Warehouse receipts pledge": cake bigger and bigger.[J].China storage

1.4.2 Study of Logistics Finance Risk Management

As early as the 19th century, Western classical economists put forward the concept of risk and considered it as a by-product of business activities, the operator's income was the compensation for risk in operating activities.

Risk management is the identification, assessment, and prioritization of risks (defined in ISO 31000 as the effect of uncertainty on objectives) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and /or impact of unfortunate events.[35)]

Domestic and foreign scholars start research logistics and financial risk management mainly from the warehouse receipt pledge model. The following table summarizes the specific content of Chinese and foreign scholars' risk management research.

<Table 1-3-1> Study of Logistics Finance Risk Management

No.	Author	Research Contents		Published
		Credit risk	Other risk	
1	Richard and Panos [36)]		□	1996
1	MarkD.Wenner, Francisco Proenza [37)]	★		1999
2	Juan Buchenau [38)]	★		2003
3	Robert Fries, Banu Akin [39)]	★		2004
4	Buzacot and Zhang [40)]		□	2004
5	Barsky [41)]		□	2005
6	Chu Xue Jian, Liang Honglong [42)]	★		2005
7	Ceng Wenqi [43)]	★		2006

& transport.2004(2):25-26.

31) Chen Xiaoguang. Research on warehouse receipt hypothesis on financing for logistics wnterprise.[D].Dalian Maritime university master's thesis.2006.

32) Zuo Xuelian. Construction and selection of financial operation mode of agricultural products logistics.[J].Commercial times.2012,(28):64-65.

33) Qin Chuanzhi. Analysis of the logistics financial business operation mode.[J].Economic research guide.2013(35):202-204.

34) Fang Weilei. China's logistics business model of financial operations and profit model.[J]. Storage transportation & preservation of commodities.2016(03):104-105.

35) The defination of risk management.
source from: https://en.wikipedia.org/wiki/Risk_management

36) Richard Lacroix, Panos Svarangis. Using warehouse receipts in developing and

<Table 1-3-2> Study of Logistics Finance Risk Management

No.	Author	Research Contents		Published
		Credit risk	Other risk	
8	Derek Byerlee, T.S., etc. [44]		□	2006
9	Xu Mingchuan [45]	★		2007
10	William Hoa, Tian Zheng, Hakan Yildiz and Srinivas Talluri [46]	★	□	2013
11	Olivier Lavastre, Angappa Gunasekaran and Alain Spalanzani [47]	★	□	2014
10	Kilubi Irene [48]	★		2016

transition economies.[J].Finance & development.1996(9):36-39

37) Mark.D. Wenner, Francisco Proenza. Rural finance in Latin America and the Caribbean; challenges and opportunities.[J].Strategies for micro finance in rural areas.1999(1):1-26.

38) Juan Buchenau. Innovative products and adaptations for rural finance.[D].Washington DC. 2003.

39) Robert Fries, Banu Akin. Value chains and their significance for addressing the rural finance challenge.[M].Accelerated micro enterprise advancement project 2004(12)

40) Buzacott J.A, Rachel Q. Zhang. Inventory management with asset-based financing.[J]. management science.2004(24)

41) Barsky N.P Evaluating business risks in the commercial lending decision.[J].Commercial lending review.2005,20(3):3-10

42) Chu and Liang (2005) started from the main difficulties of logistics finance credit risk prevention in China, and proposed the basic framework of"integrated" logistics financial credit risk prevention system, and put forward relevant counter measures and suggestions, but it did not in depth analysis.
Chu Xuejian, Liang Honglong. Reflections on the prevention of credit risk in the development of logistics finance.[J].Logistics technology.2005 (2):106-107.

43) Zeng (2005) had pointed that the information between the bank and the production enterprise is asymmetric, the enterprise had the internal information and was in the information superiority position, while the bank was in the information inferior position. In the case of asymmetric information, if the bank and the borrower directly carry out the pledge of warehouse receipts, due to adverse selection and moral hazard caused by information asymmetry made the pledge of warehouse receipts was difficult to carry out effectively. However, if the logistics company participated as a third party to the warehouse receipt pledge work, the situation would be greatly improved.
Zeng Wenqi. An analysis and realization of the pledged loan Business.[J].Economic management journal.2005(6):77-79.

44) Derek Byerlee. T.S. Jayne and Robert J. Myers. Managing food price risks and in

Richard and Panos (1996) pointed out that in the transition economy, the pledge of warehouse receipts could help the producers of agricultural products to finance loan, but because of the defects of institutional structure, the great risks would emerge in warehouse receipt pledge, including economic policy risks, legal risks, market price fluctuations and so on.

William Hoa, Tian Zheng, Hakan Yildiz and Srinivas Talluri (2013) reviewed and synthesized the extant literature in SCRM in the past decade in a comprehensive manner. They present and categories SCRM research appearing between 2003 and 2013. They undertake a detailed review associated with research developments in supply chain risk definitions, risk types, risk factors and risk management/mitigation strategies. They analyzed the SCRM literature in exploring potential gaps.

Olivier Lavastre, Angappa Gunasekaran and Alain Spalanzani (2014) a framework for supply chain risk management was proposed and was applied using the data collected from 164 French companies, in manufacturing sector. The literature review, the oretical framework and empirical research undertaken in this work have led to identifying critical success management for SCRM. They focused on the inter-organizational management of supply chain risk: the collaborative relationship (with industrial and supply partners) can be considered as an efficient way to make SCRM.

Foreign theoretical research is mainly represented by American scholars, they have in-depth study in the definition of the concept of physical finance from the earliest

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stability in a liberalizing market environment: Overview and policy options.[J].Food policy,2006: 275-287.

45) Xu Mingchuan. Research on the profit mode of pledge by warehouse receipts and risk transfer.[J].China business and market.2007(11):21-23.

46) William Hoa, Tian Zheng, Hakan Yildiz and Srinivas Talluri. Supply chain risk management: a literature review.[J].International journal of production research,2015,l(53):5031-5069.

47) Olivier Lavastre, Angappa Gunasekaran and Alain Spalanzani. Effect of firm characteristics, supplier relationships and techniques used on supply chainrisk management (SCRM): an empirical investigation on French industrial firms.[J]. International journal of production Research,2014,l(52):3381-3403

48) Kilubilrene, The strategies of supply chain risk management- a synthesis and classification.[J]. International journal of logistics: Research & applications.2016,19(6):604-629

warehouse receipts to logistics bank represented by UPS. Based on the actual needs of the company, through field research and scientific analysis, they proposed the specific operational processes, operational programs and implementation recommendations. Their research contents are both an extension concept and an analysis of the actual case, and analyzes the innovation affairs of logistics finance from the breadth and depth.

China's domestic research started late, but after the efforts of Chinese scholars in recent years, the concept of logistics finance and research on the operation mode have a new break through.

On the logistics financial business model research, domestic scholars from the perspective of the market gradually discussed with the third party logistics companies, banks and enterprises as the core of the logistics financial business model, but still with one or several specific qualitative description of business models, there are lack of the analysis of specific cases of the business. From the point of view of the main body of the research design, there are rarely the research on the central position of the three parties, especially the bank and the logistics company.

ESSAY I: The Credit Risk Management of Three Parties in Logistics Finance-Using Game Theory

1. Introduction

1.1 Background and Objective

Under the background of the financing difficulties of small and medium enterprises, the logistics companies looking for profit growth point and the banks to seek business innovation, logistics finance came into being. SME's financing problems, had been good improved after the emergence of logistics finance. But the new business with a new problem.

Small and medium-sized can collateral its products as a credit conditions, the pledge will be stored in the logistics company, the logistics company as a third party responsible for the supervision of collateral, the bank to provide financing funds. The emergence of logistics finance, to solve the three sides of the main problems faced by their own. Three parties not only in the logistics finance to play their own advantages in resources, but also make up for the partners of the resource disadvantage. Logistics finance can achieve the capital flow, logistics, information flow organic unity and get the multi-win situation.

In Essay I, the paper takes the banks and logistics companies as the main body of the study. The main research content of this paper is the multi-party game among the subjects in the credit risk management of logistics finance. There are three main entities in logistics finance, namely, banks, small and medium-sized enterprises and logistics companies, which play their respective roles in the business, but they are not independent, there are subtle relationships. Each subject in the decision-making will be affected by other main action, that is, there is a game between the three parties.

There are many kinds of principal-agent relationship in logistics finance, which is the agency relationship between the SMEs and the banks, the agency relationship between the banks and the logistics companies, and the agency relationship between the SMEs and the logistics companies. In the complex relationship, the risk is

accompanied by a growing revenue.

Credit risk is the most prominent risk in the many risks of logistics finance, where both banks and logistics companies will encounter the credit risk.

The reason of credit risk is due to moral hazard, incomplete information, information asymmetry, negligence of operation process and other factors, if the risk generated in the link can be effectively monitored and management measures will help the logistics of financial business more development.

1.2 Scope and Methodology of the Study

1.2.1 Scope of the Study

In Essay I, firstly, identify the credit risk faced between banks and small and medium-sized enterprises, and then use the principle of game theory to analyze the relationship between banks and SMEs.

And then add logistics company to conduct a game analysis between the three parties to identify the probability of bank supervision, the probability of SME integrity and the probability of logistics companies to fulfill of the contract. To find out the factors of fraud and breach of contract of small and medium-sized enterprises and logistics companies, so as to put forward the theoretical basis for the mechanism of credit risk.

1.2.2 Methodology of the Study

Game theory is the study of problems of conflict and cooperation among independent decision-makers. Game theory is mainly used in economics, political science, and psychology, as well as logic, computer science and biology. Game theory deals with games of strategy rather than games of chance.

Originally, it addressed zero-sum games, in which one person's gains result in losses for the other participants. Today, game theory applies to a wide range of behavioral relations, and is now an umbrella term for the science of logical decision making in

humans, animals, and computers.

According to the game participants to take action successively, can be divided into static game and dynamic game. The so-called static game refers to the participant at the same time action, even if not at the same time action, after the actors do not know the first actor to make what kind of choice; and dynamic game refers to the participants have the order, and after the actor can know the first actor what kind of choice. In dynamic games, the order of decisions are important.

According to the degree of knowledge of the characteristics of other people, the choice of space, the payment function and so on, it can be divided into complete information game and incomplete information game. Which is a complete information game refers to each of the bureaucrats in all other bureaucratic characteristics, strategic space, payment function and all other knowledge has a very accurate understanding, no prior uncertainty; the other is incomplete information game.

According to whether the cooperation between the people, can be divided into cooperative game and non-cooperative game. The difference between the two is whether there is a binding agreement between the interrelated persons. Because cooperative game is much more complex than non-cooperative game, modern game theory focuses on non-cooperative game.[49)]

<Table 2-1> Types of Non-Cooperative Game

information	static game	dynamic game
complete information	complete information static game	complete information dynamic game
incomplete information	incomplete information static game	incomplete information dynamic game

Based on the above two classification, non cooperative game can be divided into the above four types.

49) The basic theoretical theory is from the note of “Game Theory” from “Open Yale Courses”
Source from: http://open.163.com/special/gametheory/

Game theory is based on the rational human hypothesis, the difference between game and decision is: the game is proposed to guess each other's decision-making process based on the decision-making.

In the traditional economics of personal decision-making, is given a price parameter and income conditions, to maximize their personal utility, personal utility function depends only on its own choice, and not dependent on other people's choice. But the choice between people is interactive, so in the game theory focuses on the study: personal utility function is not only dependent on their own choice, and rely on the choice of others, one of the best choice is often the other parties select the function. A pair of actions that are most responsive to both sides is called a "Nash Equilibrium[50)]", which is the basis of game theory.

The research of game theory focuses on the choice of parties under the external economic conditions, and the optimal choice depends on the interaction of the game participants. In economic decision-making, we should consider the mutual reaction, interaction and mutual restraint of the parties involved.

Whether in the socioeconomic macro level, or related to the individual, economic organization of the micro level, the function of game theory is obvious. More importantly, through the study of game theory, so that we analyze the economic phenomenon and coordination of economic interests, we can learn to strategic thinking to guide our principles; in a strategic way to make our choice.

In the market economy, between enterprises, between enterprises and consumers, between enterprises and government, between government and consumers, government and taxpayer mutual influence, interdependence and mutual restraint continue to strengthen to these economies, The antagonism, dependence and restriction between the subjects are more practical significance for the research of the research premise and the starting point.

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50)"In game theory, the Nash equilibrium is a solution concept of a non-cooperative game involving two or more players in which each player is assumed to know the equilibrium strategies of the other players, and no player has anything to gain by changing only his or her own strategy borne."
Osborne, Martin J., and Ariel Rubinstein. A Course in Game Theory. Cambridge, MA: MIT, 1994. Print. source from: https://en.wikipedia.org/wiki/Nash_equilibrium

Economic game theory refers to the analysis of game theory knowledge used in the analysis of economic problems, such as the kind and structure of economic problems, to build the corresponding mathematical game model, used to describe, reflect the economic problems of participants in the strategy of motivation to find the optimal solution to the problem (in fact, the optimal solution of other stakeholder).

Because the relationship between the three parties of the business is complex and subtle, in order to maximize the pursuit of their own interests, each decision means that with the other two main game, how to minimize their own risk, need to consider what factors to decision-making, are the main focus of the business. So the paper will analyze these factors. The study of these problems has practical significance.

1.3 Structure and Contents

Essay I, discusses credit risk management based on game theory. Firstly, to identify the credit risk through the operational process of logistics finance, and measure the integrity probability of SMEs and the supervision probability of banks, set up a tripartite game analysis between bank, logistics company and SMEs. Finding out the factors affecting fraud and breach of the contract, this part thus puts forward the theoretical basis for the mechanism of credit risk.

Essay I consists of five parts as follows:

The first part is introduction. This chapter points out the research purpose at the beginning, then introduces the research methods and research scope of this paper, and introduces the structure and contents of each chapter and give the literature review in the end.

The second part is the identification of the parties involved in the operational process of logistics finance.

The third part is the two party game analysis and three game analysis among the logistics company, the SMEs and the bank.

The fourth part is the policy implication of bank and logistics company. The Last part is the summary of Essay I.

1.4 Literature Review

<Table 2-2-1> Literature Review of Game Theory

Author	Game Analysis		Research Contents
	Two parties	Three parties	
Xie, Shiyu (2002) [51]			1.The basic introduction of game theory. 2.The main part of it is staic game with complete imformation.
Prajit K.Dutta (2005) [52]			1.The basic introduction of game theory.
Wang Dan, Yu Shaoqiang (2007) [53]	✓		1.By using the method of game theory, analyzes the game problem in the shipowner's alliance, and points out that other companies will not have the power of parry as the alliance is competing with other small companies. 2.Pointed out that in the future, the shipping alliance will be controlled by several large companies.
Lu Zheng-hua, Dai Qi-li, Chen Xiu-de(2009) [54]	✓		1.Focusing on the analysis of the bank and third-party logistics companies. 2.Analysized the TPL based-financing model. 3.Suggested use this model to reduce the imformation risk.
Yang Huanhuan (2010) [55]	✓	✓	1.The game theory is used to analyze the game between the small and medium-sized enterprises and the banks, analyze the tripartite relations between the logistics companies, banks and small and medium-sized enterprises. 2.Draw the probability of the logistics companies and small and medium- and proved by empirical evidence.

51)Xie, Shiyu.Section 2: Static game of complete information. Economic game theory.[M].Fu Dan University Press:56-119

52) Prajit K.Dutta.Strategies and game: theory and practice. [M].Shanghai university of finance & economies press.2005

53)Wang Dan, Yu Shaoqiang. Shipping alliances's formation based on evolutionary game theory proceeding first international conference on transportation engineering.[C].2007:1860-1865

54)Lu Zheng-hua,Dai Qi-li,Chen Xiu-de.An analysis on logistics finance based on third

<Table 2-2-2> Literature Review of Game Theory

Author	Game Analysis		Research Contents
	Two parties	Three parties	
Liu Yangping (2010) [56]	✓	✓	1.The logistics companies and small and medium enterprises as an alliance to the game between banks. 2.Draw the probability of bank supervision and other conclusions. 3.Put forward some suggestions on the credit mechanism in logistics finance.
Cao Chongyan, Wang Wei (2010) [57]		✓	1.By using the method of game theory, this paper analyzes the game problem in logistics finance. 2.The innovation of it is to concentrate on the logistics bank.
Chen Zhengbo (2011) [58]	✓		1.Focusing on the analysis of the bank and third-party logistics companies. 2. Analysized the TPL based-financing model. 3.Suggested use this model to reduce the imformation risk.
Yang Fengmei (2012) [59]	✓		1.Focusing on the analysis of the bank and third-party logistics companies. 2.Suggested some policy implication of reduce the breach of contract.

party logistics and the financing model. 2009 International conference on e-product e-service and e-entertainment.[C].2009

55) Yang Huanhuan,The researeh of logistics finance credit risk management based on game theory.[D]. Beijing Jiaotong University.2010

56) Liu Yangping. The game model of logistics finance based on the principal-agent theory.[C].2010 International Conference on e-product, e-service and e-entertainment

57) Cao Chongyan, Wang Wei. The tripartite game of logistics banking business.[C].Proceeding of symposium on management and engineering.2010:585-589

58) Chen Zhengbo. Game theory on benefit distribution across logistics financial

<Table 2-2-3> Literature Review of Game Theory

Author	Game Analysis		Research Contents
	Two parties	Three parties	
Wang Yan, Jiang Lu (2012)[60]	✓	✓	1.The game theory is used to analyze the game between the small and medium-sized enterprises and the banks. 2.Analyzed the tripartite relations between the logistics companies, banks and small and medium-sized enterprises. 3.Draw the probability of the logistics companies and small and medium-sized enterprises and proved by empirical evidence.supervision and other conclusions. 3.Put forward some suggestions on the credit mechanism in logistics finance.
Wu Hao (2012) [61]		✓	1.The game theory is used to analyze the game between the small and medium-sized enterprises and the banks, analyze the tripartite relations between the logistics companies, banks and small and medium-sized enterprises. 2.Gave suggestion on the different side.
He Tuanying (2012)[62]		✓	1.Using game theory to analysis the relationship among three parties. 2.Gave suggestion on the different side.
He Jing, Zheng Jie (2012) [63]		✓	1.By using the method of game theory, this paper analyzes the game problem in logistics finance. 2.The innovation of it is to concentrate on aggricatural products.

system. [J].Logistics technology.2011(3):95-96

59)Yang Fengmei. Research on logistics financial default risk based on game theory.[J]. Shangdong social sciences.2012(5):129-132

60) Wang Yan, Jiang Lu. A game analysis of bank supervision decision-making in logistics finance.[J].Logistics technology.2012(12):13-14+40.

61) Wu Hao. The research of logistics finance credit risk management based on game theory.[D]. Chongqin normal university.2012

62) He Tuanying, Tripartite strategy selection based on non-cooperative game theory for circular logistics system of automotive industry. [C].Proceeding of 2012 24th

In the summary of the research methodology in the previous literature review, articles on credit risk in game theory have been listed. Table 2-2 will be a detailed summary of the relevant literature.

Through Table 2-2 on the game theory of the review, get the following summary:

- The scope of game theory is two-party game and tripartite game.
- The game analysis of logistics finance can be extended to the specific field of industrial logistics.
- Each author can get his own analysis from the game analysis results.

Through the analysis of the first study, Essay I attempts to study the problem:

- ▶ Try to compare the relationship between Banks and SMEs.
- ▶ Game analysis for the tripartite game, from the expected income analysis results try to get a different view of point.
- ▶ Essay II and Essay III will be in the bank, the logistics company's perspective to solve practical problems, so in the Essay I from the bank, logistics companies point of view put forward effective measures.

2. Identificaton of Logistics Financial Credit Risk

2.1 Relationship among the Three Principal Delegates

There are lots kinds of classification of logistics financial business model classified by domestic and foreign scholars. Integrating their opinions, logistics finance business mode can be divided into capital circulation mode, assets circulation mode and comprehensive mode.

Logistics finance consists of three main subjects as follows:

Chinese control and decision conference (CCDC).2012:1984-1987

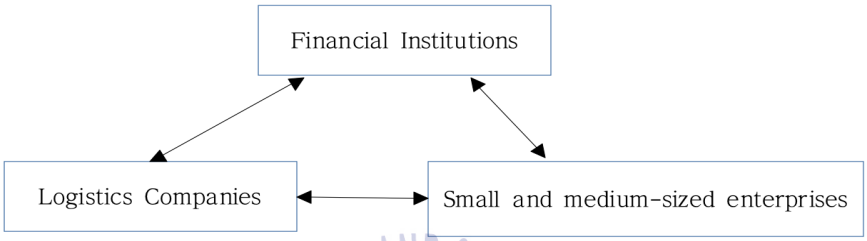
63) He Jing,Zheng Jie. Research on the Tripartite Game of Agricultural Products logistics finance credit risk management.[J].Chinese agricultural science bulletin.2014,30(8):68-74

Banks – the loan supplier; borrow money to the SME

SMEs – the loan receiver, demand for financing service

Logistics companies – provide the pledge of warehouse and supervision service

<Figure 2- 1> Relationship of Related Parties



As shown in figure 2-1, the three main operation subjects should preserve the interests of their own and cooperate with each other for mutual benefit in the logistics and financial activities.

2.2. Identification of Credit Risk

Before the quantitative analysis of logistics financial risk management, it is necessary to identify the main body of credit risk.

In the physical financial risk, the bank as a provider of funds, logistics companies as collateral regulators, logistics and financial credit is the main body.

2.2.1 The Credit Risk of Bank

The credit risk faced by banks mainly comes from two aspects:

1. From small and medium enterprises

In China, most of the small and medium enterprises are private enterprises, for their own corporate information disclosure is very cautious, banks stand in the information asymmetry of the negative point of view, it is difficult to detailed information on small and medium enterprises, bank credit risk One of the main reasons.

2. From the logistics company

Logistics companies are also the source of credit risk to the banks. Logistics companies also have two identities, the bank's agents and small and medium-sized enterprise's principal.

Although the participation of logistics companies reduce the bank directly to the SME information asymmetry problem, but the logistics companies themselves in pursuit of their own best interests, there is the possibility of collusion with SMEs, as well as the reasons for their own business level, there may be the possibility of poor supervision of collateral.

To sum up, the credit risk faced by banks comes from both the SMEs and the logistics companies. Therefore, in the Essay I, after the game analysis, mainly puts forward some suggestions on banking supervision.

2.2.2 The Credit Risk of Logistics Company

Logistics company's credit risk also comes from small and medium enterprises, on the surface, the logistics companies face credit risk is much lower than the bank. Because the logistics company in the hands of collateral as a guarantee.

However, from the previous case, because the information asymmetry, supervision is not to force, often small and medium enterprises will give the logistics company and the loan value does not match the collateral.

When the logistics company found at the time, often deceive the small and medium enterprises have disappeared without any trace, even the banks do not have small and medium enterprises information.

2.2.3 The Cause of the Credit Risk

1.Information asymmetry

Information asymmetry in logistics finance refers to the uneven distribution of information between participants.

China's scholar Xu Xuejian (2011)[64] gives a good definition in her paper.

The asymmetric situation of these two kinds of information is reflected in the actual operation of logistics finances follows: when the information of the participant exists only between one of the members, the first kind of information asymmetry is produced. When the information and logistics companies concerned with the loan customers understand, but Banks do not understand, there will be a lack of effective information matching between the Banks and loan customers. For the case of the second kind of information asymmetry, information related to the participant is not evenly distributed among the members. When the information (integrity, ability, etc.) of the logistics enterprise is allocated less in the Banks, while the loan customers are allocated more, Banks are likely does not trust the logistics companies, so the financing for loan customers will be considered again. In this way, once the process of logistics finance do not be proceed smoothly, the three participant will all get losses.

Any place where there is information asymmetry, are likely to make the information recipient make incomplete decisions, resulting in risk dangers. However, there are lots of reasons behind a problem. Therefore, when we consider the causes of logistics financial risks, we cannot simply classify that as information asymmetry. On the basis of information asymmetry, from the logistics financial business model, logistics financial participants and information asymmetry three dimensions, to specifically analyze the risk of logistics finance, that will make the risk analysis more comprehensive and thorough.

2.Moral hazard

Moral hazard[65] is a social problem. In China , there is a famous case caused by

64)Xu Xuejian defined that information asymmetry based on the financial risk of financial slow release. She believes that information asymmetry mainly includes the following two situations: When the information distribution is extreme between the participants (assuming that the total amount of information is 1, A and B are the information receiving parties, the A-party information is assigned to 1, and the B-party information is assigned to 0), the information communication is shown insufficient, or there is a lack of effective information pairing. When the distribution of information between the participants is non-extreme ($0<A<1$, $0<B<1$, and $A+B=1$), the information is hidden.
Xu Xuejian. Researches Based on the Information Asymmetry of Logistics Financial Risks Delay Release.[J].Jiangsu Business Discussion.2011(12):81-83

financing service. Jiangsu Hanshin Electric Co[66]., Ltd. is the top 50 private enterprises in Suzhou, the products are mainly freezers and air conditioners. It's annual refrigerator 500 thousand units, accounting for 16% of the national refrigerator market, sales revenue of 440 million yuan in 2004. Hanshin never owed money supplier, good reputation to win the praise of local industry, the local banking community was proud to be able to have a credit relationship with Hanshin. However, in such a company, the chairman of the board of directors takes advantage of the capital of the enterprise in the name of seven banks from the 770 million loans. However, it is unexpected that the 770 million yuan finally appeared in the stock market and then disappeared one after another; the event planners were also missed.

Wang Zexiang first open bank accounts through the Hanshin company, while his more than a dozen of subsidiaries also open a number of bank accounts, so the company's financial sector will be able to"pay" in the name of the loan and will be remitted from a bank loan to A company in the bank account, then in the same name, the money will be remitted to the B company in the bank account. Finally those money enter into the stock market. In this way, although a bank issuing loans has a regulatory responsibility for the flow of funds; it will not have the energy, nor the ability to grasp the ultimate flow of funds.

Most Chinese private entrepreneurs are able to "absolutely control" their business like Wang Zexiang, but the moral risks of private entrepreneurs and private capital they represent are becoming more and more difficult and difficult to control. Although the entrepreneur to their own capital to bear the limited liability, but in fact with the improvement of the socialization of capital, society gives private capital more and more resources. Once the moral hazard broke out, the entrepreneurs bear only limited liability, greater risk is passed on to society.

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65) In economics, moral hazard occurs when one person takes more risks because someone else bears the cost of those risks. A moral hazard may occur where the actions of one party may change to the detriment of another after a financial transaction has taken place.
source from: https://en.wikipedia.org/

66) Cnhan domestic news, A Case Study of Hanshin Electric 's Misappropriation of Huge Bank Loan, http://www.cnhan.com/gb/

"Hanshin incident" is thought-provoking and set people thinking, how to develop a financing strategy to strictly constraint the borrowing enterprises to standardize the operation and to prevent misappropriation of loans and other events, how to force banks and logistics enterprises to strengthen supervision during credit approval and post-loan management, these become the topics of scholars and logistics financial managers, these issues are important aspects of logistics and financial operations control.

From the credit risk faced by banks and logistics enterprises, the main reason is due to information asymmetry and moral hazard caused.

Banks and logistics enterprises are the main body of physical financial risk management. After we identify the credit risk, we can provide a basis for the quantitative analysis of credit risk.

3. Game analysis

3.1 Game Analysis between Banks and SMEs

In the main body of logistics finance, there are three pairs of principal-agent relationship, including as follows:

Banks- Logistics companies

Banks- SMEs

Logistics companies- SMEs

Banks are direct loan grants, and SMEs are direct beneficiaries. Therefore, the principal-agent [67]relationship between banks and SMEs is the most representative of the three relationships.

The relationship between banks and SMEs is service and be served, banks provide

67) The problem arises where the two parties have different interests and asymmetric information (the agent having more information), such that the principal cannot directly ensure that the agent is always acting in their (the principal's) best interest. Lucian Bebchuk and Jesse Fried. Pay Without Performance.[M].Harvard University Press.2004

credit services and funds, SMEs provide pledged goods and enjoy the service. The game between the two subjects is generally the adverse selection and moral hazard due to the asymmetric information.

3.1.1 Hypothesis

According to Yang Huanhuan (2008)[68] and Wu Hao (2012)[69], the hypothesis of game between the bank and SME are as follows:

(1) Participants are bank and SME. Bank has two kinds of decision as supervision or without supervision, SME has two tendencies of integrity and fraud.

(2) The probability of bank's supervision is P_1, the probability of unsupervised is $1-P_1$, the probability of integrity of SME is P_2, the probability of fraud is $1-P_2$.

(3) Other symbols are agreed as follows:

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68) Yang Huanhuan's hypotheses are as follows:
(1) Participants are banks and businesses. Banks have both supervisory and unsupervised decisions. Enterprises have both honesty and fraud. Enterprises in the loan due to choose a default or one-time repayment of loans.
(2) Assuming that the probability of bank supervision is $P1$, the probability of unsupervised is $1-P1$, the probability of firm honesty is $P2$, the probability of fraud is $1-P2$.
(3) Enterprises to obtain credit for the credit may be decorated, there is whitewash costs.
(4) Banks to reduce the credit risk, will verify the financing of enterprises, there is the cost of credit investigation, if the bank through the supervision of the financing of corporate fraud, will be rewarded by higher units, and if there is enterprises fraud behavior, and the bank is not supervised, it will be punished by higher units.
(5) Enterprise fraud will be greater than the normal income of the additional benefits, if fraud is found, will be subject to default penalties.
69) Wu Hao's hypotheses are as follows:
(1) Participants are commercial banks, small and medium enterprises.
(2) Small and medium enterprises in order to obtain loans may be their own credit situation to whitewash, there is whitewash costs; commercial banks have a certain probability of regulation, resulting in operating costs.
(3) If the commercial banks found that the small and medium enterprises breach of contract, will be subject to higher levels of leadership incentives, if there are small and medium enterprises breach of contract and commercial banks for supervision, will be subject to higher authorities punishment.
(4) SME defaults will receive additional benefits above normal returns, and penalties for compliance will be punished.

A – Principal

r – Interest on bank loans

S_1 – bank supervision costs

W_1 – bank supervision award

W_2 – bank unsupervised punishment

R – The normal return of SMEs on financing of corporate loans

W_3 – Additional income from SME's fraud

S_2 – SME's whitewash costs

S_3 – the punishment of SME breach of contract cost

3.1.2 Model Building

In the context of the above hypothesis, the information tree of the game is shown in Figure 2-3. The participant's payment matrix is shown in Table 2-3.

Figure 2-2 Information Tree between Bank and SME

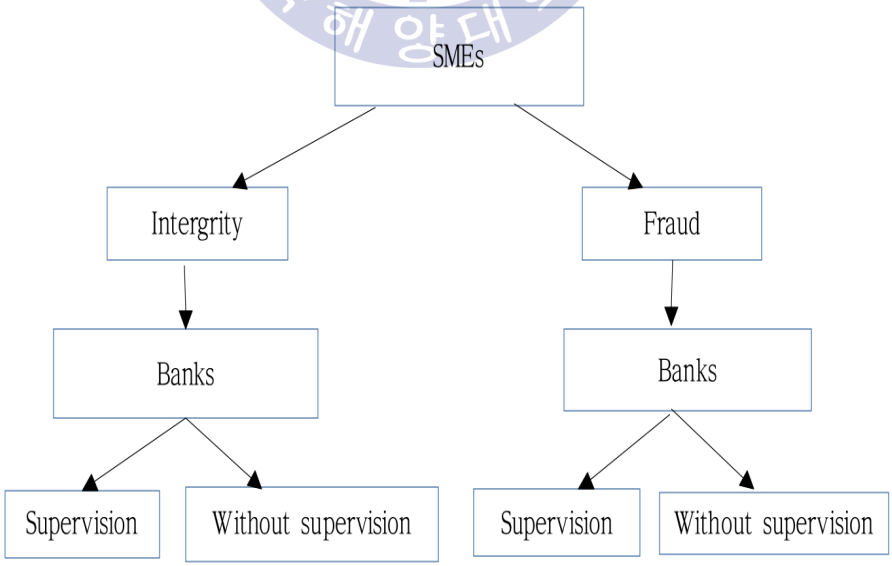


Table 2-3 The Payment Matrix of Bank and SME

		SMEs	
		P_2	$1-P_2$
SMEs	P_1	$(r-S_1,\ R)$	$(r-S_1+W_1,\ R-S_2-S_3)$
	$1-P_1$	$(r,\ R)$	$(-A-W_2,\ R+W_3-S_2)$

3.1.3 Model Solving

3.1.3.1 The Probability of Bank's Supervision P_1

From which the revenue function of SME's integrity and fraud can be obtained

$$R_1 = P_1 R + (1-P_1)R \quad 2\text{-}1$$

$$R_2 = P_1(R-S_2-S_3) + (1-P_1)(R+W_3-S_2) \quad 2\text{-}2$$

Get the result from two aspects:

1. Get the probability of bank's supervision P_1

Suppose the excepted revenue of SME's integrity and fraud is equal:

Let $R_1 = R_2$

$$P_1 = \frac{W_3 - S_2}{W_3 + S_3} \quad 2\text{-}3$$

$P_1 = \frac{W_3 - S_2}{W_3 + S_3}$ indicating that the probability of bank's supervision is related with SME's additional revenue caused by the breach of contract, whitewash costs, and penalty for breach of contract.

Table 2-4 The Excpted Revenue of SME

P_1=1, $1-P_1$=0	$R_1 = R$
Bank's revenue is $r-S_1$	$R_2 = R-S_2-S_3$
P_1=0, $1-P_1$=1	$R_1 = R$
Bank's revenue is r	$R_2 = R+W_3-S_2$

2. Suppose the probability of bank's supervision is equal to 1 or 0, the revenue

function of SME can be summaries as follows in Table 2-4.

From Table 2-4, we can see result as follow:

- If SME is integrity, the expected revenue of it is the same ($R_1 = R$), but the bank's revenue is related to supervision cost.
- On the condition that the bank is without supervision, and $W_3 > S_2$, that the additional revenue W_3 is more than whitewash cost S_2, SME will fraud.
- Indicating that the probability of bank's supervision is related with SME's additional revenue caused by the breach of contract, whitewash costs, and penalty for breach of contract.

3.1.3.2 The Probability of Integrity of SME P_2

From which the revenue function of bank's supervision or without supervision can be obtained

$$R_3 = P_2(r - S_1) + (1 - P_2)(r - S_1 + W_1) \quad 2\text{-}4$$

$$R_4 = P_2 r + (1 - P_2)(-A - W_2) \quad 2\text{-}5$$

We can get the result from two aspects:

1. Get the probability of SME's integrity P_2

Suppose the excepted revenue of bank's supervision and without supervision is equal:

Let $R_3 = R_4$

$$P_2 = 1 - \frac{S_1}{W_1 + W_2 + A + r} \quad 2\text{-}6$$

$P_2 = 1 - \frac{S_1}{W_1 + W_2 + A + r}$ indicating that the probability of SME's fraud and bank supervision costs are proportional, It also indicating the hign supervision cost is, the difficult the supervision active is. And $W_1 + W_2 + A + r$ is inversely proportional , it also indicating that the probablility of SME's fraud is relate to the principal, interest, bank supervision award and bank without supervision punishment.

2. Suppose the probability of SME's integrity is equal to 1 or 0, the revenue function of bank can be summaries as follows in Table 2-5.

From Table 2-5, we can see result as follow:

- If SME is integrity, the bank can without supervision.
- If SME is fraud, bank must supervision and can get a award from supervision, if it without supervision it will lost the principal and get a punishment.

Table 2-5 The Excepted Revenue of Bank

P_2=1, $1-P_2$=0 SME's revenue is R	$R_3 = r - S_1$
	$R_4 = r$
P_2=0, $1-P_2$=1 SME's revenue is $R + W_3 - S_2$	$R_3 = r - S_1 + W_1$
	$R_4 = -A - W_2$

3.2 Tripartite Game Model

3.2.1 Model Hypothesis

According to Cao Chongyan and Wang Wei (2010)[70], Liu Yangping (2010)[71],Yang

70) Cao Chongyan and Wang Weis hypotheses are as follows:
(1)The three parties are all rational agents. They will get the maximization of benefits in the objective conditions. The probability of banks' effective, enterprises' keeping the faith and logistics company's performance isα,β and γ.
(2)Instructions of the Actions
(effective, keep faith, perform)
Commercial bank gets profit M from the business. Because of enterprise's keeping the faith, it obtains extra rewards. There is no extra profit for logistics company.
(non effective, keep faith, perform)
If the bank's supervision is non effective, the cost is low.
(effective, keep faith, default)
Logistics company defaults but the bank is effective, it may be punished.
(non effective, keep faith, default)
The bank is non effective, so it loss. But enterprises keep faith, so the bank's payoffs is reduce its loss cost.
Logistics company's defaulting lets it get extra profit.
(effective, break faith, perform)
Although enterprises break faith, bank's supervision is non effective. So the bank has no loss. And the enterprise gets punishment. Logistics company's performing

Fengmei (2012)[72] and He Jing and Zheng Jie (2012)[73] , the hypothesis of game

gets extra rewards.
(non effective, break faith, perform)
Banks' supervision is non effective, so they loss.Enterprises gain extra profit.
(effective, break faith, default)
Because of bank's effectiveness, enterprises and logistics company both gets loss.
(non effective, break faith, default)
Enterprise gets logistics company together cheat banks. They both get extra profit.

71) Liu Yangping's hypotheses are as follows:
(1) In order to gain more benefits, logistics enterprises and SMEs form a strategic alliance.
(2) Participations are banks, logistics enterprises and SMEs alliance (hereinafter Alliance for short). Banks have two choices, that is to provide loans or not, alliance side has two trends, which is honest and fraudulent.
(3) Alliance side are likely to gloss over their credit standing to get the loan, there are cosmetic costs.
(4) Banks will be verified the alliance to reduce credit risk, there is the cost of credit investigation.
(5) Once the alliance is unable to repay the financing due to their own problems, banks will disposal the pledge goods.

72) Yang Fengmei's hypotheses are as follows:
Assuming that the total income of the logistics financial business is P, the loss is L, the supervision cost is C, the income of the financial institution to carry out the logistics financial business is I. The income of the third party logistics enterprise is V, and I+V=P.
The income function of the financial institution is: $\pi 1 = I-L$.The income function of the third party logistics enterprise is: $\pi 2=V-C$.

73) He Jing and Zheng Jie's hypotheses are as follows:
(1) Suppose there are three participants in the model: commercial banks, third-party logistics enterprises, agricultural enterprises. The three parties are to meet the "rational economic man" hypothesis, under the constraints of objective conditions will pursue their own interests to maximize.
(2) commercial banks as capital financing side. The third party logistics enterprises are responsible for assessing the daily operation status, financial status and pledge of supervised agricultural enterprises. Agricultural enterprises as a financing side, the need for commercial banks to provide financial support. However, in the tripartite participant's agricultural logistics business, there is still information asymmetry, agricultural enterprises may be associated with third-party logistics enterprises to deceive commercial banks.
(3) Assuming that there are two types of action plans for commercial banks that are regulated and not regulated. Third-party logistics enterprises also have two kinds of action programs and agricultural enterprises conspiracy to deceive commercial banks, not conspiracy. Agricultural enterprises here there are two kinds of action programs and third-party logistics enterprises collusion conspiracy.
(4) Assuming that the probability of commercial bank supervision is $P1$, the probability of unregulated is $1-P1$. Third-party logistics enterprises advocate the probability of collusion with agricultural enterprises is $P2$, the probability of

among the bank, logistics company and SME are as follows:

(1) Bank, SME and logistics company are "rational economic man"[74].

(2) The three-party game as a complete information static game.

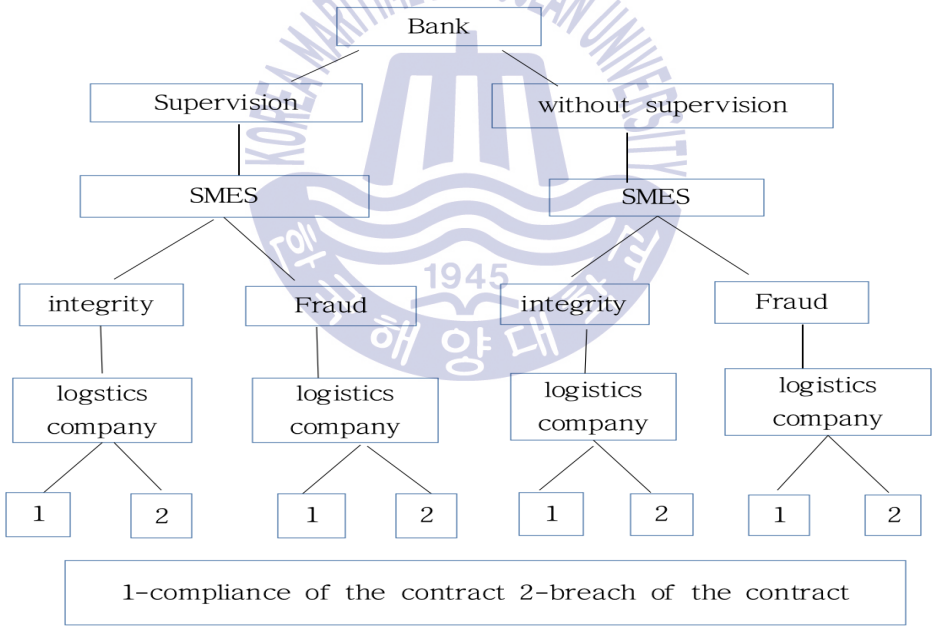
(3) The action strategy space of bank is(supervision, without supervision)

(4) The action strategy space of SME is (integrity, fraud)

(5) The action strategy space of logistics companies(compliance, breach of contract)

(6) Assuming that the probability of the bank's supervision is P_B , the probability SME's integrity is P_E and the probability of logistics company's performance is P_L.

Figure 2-3 Information Tree of Tripartite Game Model



non-conspiracy is $1-P2$. Agricultural enterprises advocate with the third party logistics business collusion probability is $P3$ without collusion probability is $1-P3$.

74)In economics, homo economics, or economic man, is the concept in many economic theories portraying humans as consistently rational and narrowly self-interested agents who usually pursue their subjectively-defined ends optimally. Generally, homo economics attempts to maximize utility as a consumer and profit as a producer

3.2.2 Model Building

Based on the above assumptions of the model, the three main strategies of the triplicate game model are as shown in Table 2-6. And the information tree is shown in Figure 2-3.

Table 2-6 The Payment Matrix of Tripartite Game Model

				Bank	
				P_B	$1-P_B$
SMEs	P_E	Logistics companies	P_L	$(R,\ E,\ 0)$	$(R_1,\ E,\ 0)$
			$1-P_L$	$(R,\ E,\ -F)$	$(R_1-D,\ E,\ M)$
	$1-P_E$	Logistics companies	P_L	$(0,\ -A,\ Q)$	$(-L,\ E_1,\ Q)$
			$1-P_L$	$(0,\ -A,\ -T)$	$(-L_1,\ E_2\ M_1)$

Symbols definitions as follows:

R - additional income of bank, $R_1 > R$

E - additional reward of SME, $E_1 > E$, $E_2 > E$

F - punishment of the logistics company breach of the contract

M - additional award of the logistics company from breach of the contract and not be found, $M_1 > M$

A - SME is fraud and found by the bank, the income of SME is $-A$

T - SME is fraud and found by the bank, the income of logistics company is $-T$

Q - additional incentives from bank for not breach of the contract

D - certain loss of bank from without supervision

L - SME fraud, and the bank is without supervision, get a loss of $-L$

3.2.3 Model Solving

3.2.3.1 Probability of the Supervision of Bank P_B

(1) Set the except revenue of SME integrity and fraud are E_{11} and E_{21}, According to the tripartite game model can be drawn:

$$E_{11} = P_B[P_L \cdot E + (1-P_L) \cdot E] + (1-P_B)[P_L E + (1-P_L) \cdot E] = E \quad 2\text{-}7$$

$$E_{21} = P_L E_1 + (1-P_L)E_2 - P_B[A + P_L E_1 + (1-P_L)E_2] \quad 2\text{-}8$$

- LET $E_{11} = E_{21}$

$$P_{B1} = \frac{P_L E_1 + (1-P_L)E_2 - E}{P_L E_1 + (1-P_L)E_2 + A} \quad 2\text{-}9$$

- If the expected revenue is fixed, suppose $P_L = 0$ or $P_L = 1$

$$P_{B1} = \frac{E_2 - E}{E_2 + A} \quad (P_L = 0)$$

$$P_{B1} = \frac{E_1 - E}{E_1 + A} \quad (P_L = 1)$$

From the above formulas, based on P_{B1}, the probability of bank's supervision is decided by the probability of logistics company's compliance. And related to additional reward and punishment which the bank give to the SME.

When SME is fraud, the greater that the expected benefits $P_L E_1 + (1-P_L)E_2$ of the logistics company has got, the greater that the bank's supervision will be effective, because when the bank knows the collusion probability between the logistics company and the SME will increase, it may put more cost to monitor, the probability of supervision will increase.

On the other hand, the bank punished the SME with A, and give additional rewards E for integrity. The probability of compliance logistics company is greater, the probability of supervision will be reduced.

Because A and E are generally provided by the banks, banks always believe that

increased penalties and high incentives for the rational economic man will have a corresponding role, so ignore supervision, reduce the investment in supervision, leading to the probability of supervision to reduce.

(2) Set the expected revenue of logistics company on the compliance and breach of contract are E_{31} and E_{41}, according to the tripartite game model can be drawn:

$$E_{31} = P_B[P_E \cdot 0 + (1-P_E) \cdot Q] + (1-P_B)[P_E \cdot 0 + (1-P_E) \cdot Q] = (1-P_E) \cdot Q \quad 2\text{-}10$$

$$E_{41} = P_E M + (1-P_E) \cdot M_1 - P_B[P_E(F+M) + (1-P_E)(T+M_1)] \quad 2\text{-}11$$

- Let $E_{31} = E_{41}$

$$P_{B2} = \frac{P_E M + (1-P_E)M_1 - (1-P_E)Q}{P_E M + (1-P_E)M_1 + P_E F + (1-P_E)T} \quad 2\text{-}12$$

- If the expected revenue is fixed, suppose $P_E = 0$ or $P_E = 1$

$$P_{B1} = \frac{M_1 - Q}{M_1 - T} \quad (P_E = 0)$$

$$P_{B1} = \frac{M}{M+F} \quad (P_E = 1)$$

From the above formulas, based on P_{B2}, the probability of bank's supervision is decided by the probability of integrity of SMEs. And related to the excepted benefit M, logistics company's penalty F, SME's punishment T and additional return Q.

Based on P_{B2}, when bank supervision is invalid, the greater that the expected benefits $P_E M + (1-P_E)M_1$ of the logistics company will get, the greater the logistics company will breach the contract, bank will strengthen supervision, so the probability supervision will increase.

When the supervision is valid, the logistics company's penalty $P_E F + (1-P_E)T$ will increase, the bank thinks that the logistics company will not be easily breach of contract, and therefore will relax supervision, then the effective probability of supervision reduce.

Similarly, the greater the expected return $(1-P_E)Q$ is, the bank thinks that the logistics company will not be easily breach of contract, and therefore will relax

supervision, then the probability of supervision reduce.

3.2.3.2 The Probability of Integrity of SME P_E

(1) Set the except revenue of bank supervision or without supervision are E_{51} and E_{61}, according to the tripartite game model:

$$E_{51} = P_E[P_L \cdot R + (1-P_L)R] + (1-P_E) \cdot 0 = P_E R \quad 2\text{-}13$$

$$E_{61} = (P_L - 1)L_1 - P_L L + P_E[(1-P_L)(P_1 - D) + P_L L + R_1] \quad 2\text{-}14$$

- Let E_{51}=E_{61}

$$P_{E1} = \frac{(1-P_L)L_1 + P_L L}{(1-P_L)L_1 + P_L L + (R_1 - R) - (1-P_L)D} \quad 2\text{-}15$$

- If the expected revenue is fixed, suppose $P_L = 0$ or $P_L = 1$

$$P_{E1} = \frac{L_1}{L_1 + (R_1 - R) + D} \quad (P_L = 0)$$

$$P_{E1} = \frac{L}{L + (R_1 - R)} \quad (P_L = 1)$$

From the above formulas, based on P_{E1}, the probability of SME's integrity is decided by the probability of logistics company's compliance. And related to the additional award of bank supervision R, loss of bank without supervision L and the certain loss of D.

Based on P_{E1}, the expected loss $(1-P_L)P_1 + P_L L$ of banks under the circumstance of SME's fraud is greater, Banks will strengthen the supervision, the greater the risk of corporate finance for the choice of fraud, so the probability of integrity business will be increased.

The balance of supervision costs $R_1 - R$ between effective supervision and ineffective supervision of financial is greater, the bank will take into account the strict control of the cost control problem, the SME will think that the possibility of bank to choose a high investment supervision is small, so the probability of integrity will be reduced.

SME will also consider the factors of logistics companies in the decision-making, logistics companies alone to the Banks to bring the loss of Banks $(1-P_L)D$ is bigger, the greater the possibility of Banks to strengthen supervision, SME will take into account this, the greater the probability of integrity to keep promises.

(2) Set the expected revenue of logistics company on the compliance and breach of contract are E_{32} and E_{42}, according to the tripartite game model:

$$E_{32}=P_E \cdot 0+(1-P_E)[P_B \cdot Q+(1-P_B)Q]=(1-P_E) \cdot Q \quad 2\text{-}16$$

$$E_{42}=(1-P_B)M_1-P_BT+P_E[(1-P_B)(M-M_1)+P_B(T-F)] \quad 2\text{-}17$$

- Let $E_{32}=E_{42}$

$$P_{E2}=\frac{Q-[(1-P_B)M_1-P_BT]}{Q-[(1-P_B)M_1-P_BT]+[(1-P_B)M-P_BF]} \quad 2\text{-}18$$

- If the expected revenue is fixed, suppose $P_B=0$ or $P_B=1$

$$P_{E2}=\frac{Q-M}{Q+M} \quad (P_B=0\ )$$

$$P_{E2}=\frac{Q+T}{Q+T-F} \quad (P_L=1\ )$$

From the above formulas, based on P_{E2}, the probability of SME's integrity is decided by the probability of bank's supervision. And related to the excepted benefit M, logistics company's penalty F, SME's punishment T and additional return Q.

If the expected return $Q-[(1-P_B)M_1-P_BT]$ of the logistics company in the case of corporate confidence is greater, SME will take into account the distribution of the interests of the bank and the distribution of financial risks and other issues, the probability of integrity will increase.

If the logistics company defaults on the expected return $(1-P_B)M-P_BF$ is greater, the SME will think that the logistics company will pursue a high yield even be breach of contract, then the probability of drawing it together for the conspiracy will increase, so the probability of integrity will become smaller.

3.2.3.3 Probability of the Compliance of the Logistics Company P_L

(1) Set the except revenue of bank supervision or without supervision are E_{52} and E_{62} , according to the tripartite game model:

$$E_{52} = P_L[P_E R + (1-P_E) \cdot 0] + [(1-P_L)P_E R + (1-P_E) \cdot 0] = P_E R \quad 2\text{-}19$$

$$E_{62} = P_E(R_1 - D - (1-P_E)P_1 + P_L[P_E D + (1-P_E)(P_1 - L)] \quad 2\text{-}20$$

- Let $E_{52} = E_{62}$

$$P_{L1} = \frac{P_E D + (1-P_E)L_1 - P_E(R_1 - R)}{P_E D + (1-P_E)L_1 - (1-P_E)L} \quad 2\text{-}21$$

- If the expected revenue is fixed, suppose $P_E = 0$ or $P_E = 1$

$$P_{L1} = \frac{L_1}{L_1 - L} \quad (P_E = 0)$$

$$P_{L1} = \frac{D - (R_1 - R)}{D} \quad (P_E = 1)$$

From the above formulas, based on P_{L1}, the probability of logistics company's compliance is decided by the probability of bank's supervision. And related to the additional award of bank supervision R, loss of bank without supervision L and the certain loss of D.

Based on P_{L1}, the expected loss $P_E D + (1-P_E)L_1$ of banks caused by logistics company is greater, the logistics company to take into account the Banks will strengthen supervision, considering the benefits and risks, the probability of logistics company's compliance is increase.

The greater the difference of supervision costs $R_1 - R$ between the banks supervision and ineffectiveness, the game point of view of the logistics company and the SME is the same, the bank will consider the high cost of supervision than relax the supervision, so the probability of logistics company's compliance will reduce.

The greater the expected loss $(1-P_E)L$ is, when the SME is fraud, the logistics

company to take into account the bank will strengthen supervision, if the default risk will be great, and if the performance of the contract will get the reward from bank, so the probability of logistics company's compliance is increase.

(2) Set the except revenue of SME integrity and fraud are E_{12} and E_{22}, According to the tripartite game model can be drawn:

$$E_{12} = P_L[P_B E + (1-P_B)E] + (1-P_L)E = E \qquad 2\text{-}22$$

$$E_{22} = (1-P_B)E_2 - P_B A + P_L(1-P_B)(E_1 - E_2) \qquad 2\text{-}23$$

Let $E_{12} = E_{22}$

$$P_{L2} = \frac{P_B A + E - (1-P_B)E_2}{(1-P_B)E_1 - (1-P_B)E_2} \qquad 2\text{-}24$$

- If the expected revenue is fixed, suppose $P_B = 0$ or $P_B = 1$

$$P_{L2} = \frac{A+E}{E_1 - E_2} \quad (P_B = 0\ )$$

$$P_{L2} = \frac{A+E}{0} \quad (P_B = 1\ )\ (\text{It means the probability of bank is } P_B < 1\ )$$

Suppose $1 - P_B = x$

$$P_{L2} = \frac{(1-x)A + E - xE_2}{x(E_1 - E_2)}$$

From the above formulas, based on P_{L2}, the probability of logistics company's compliance is decided by the probability of bank's supervision. And related to additional reward and punishment which the bank give to the SME.

Based on P_{L2}, when the logistics company and the SME collusion and the bank's supervision is invalid, the greater the expected return $(1-P_B)E_2$ of the SME is, the greater the benefit that the logistics company thinks that it will be more likely to be with the conspiracy, the probability of logistics company's compliance is increase.

If the Bank raise the high penalty $P_B A + E$ on the SMEs, which will have a warning to the logistics company, the probability of logistics company's compliance is increase.

4. Policy Implication

From the results of analysis, in order to reduce the credit risk in the logistics financial business , banks and logistics companies should adopt strategies as follows:

- Banks should strengthen the dynamic risk monitoring of the logistics enterprises and the SMEs.
- Banks should reduce the information asymmetry of SMEs and logistics companies.
- Banks should fully, timely, comprehensively and effectively reflect and disclosure the risk of loss.
- Banks should establish a reliable and sound data processing system which can help it to improve the efficiency of market supervision
- Banks should make a long-term cooperation with logistics companies which can conducive to the supervision of SMEs.
- Banks put the effective incentive mechanism into the logistics financial contract.
- Banks put the design of the default penalty mechanism into the logistics financial contract.

- Logistics companies establish a credit management sharing platform with the bank.
- Logistics companies increase the method of assessing the value of the collateral.
- Logistics companies to increase the monitoring and management of small and medium enterprises.

5. Summary of Essay I

Essays I firstly identify the credit risk of bank and logistics company and then use game theory to mainly analyzes the subjective credit risk of logistics companies and banks .

Establishes the two-party game model between bank and SME. Measures and analyzes the integrity probability of the SME and the supervision probability of bank.

Establishes the tripartite game among bank, SME and logistics company, through the model builing and solving, get the probability of integrity of SME, the supervision probability of bank and the compliance probability of logistics company. so as to provide a theoretical basis for logistics finance credit risk control.

On the basis of the hypothesis of other scholar's modeling, this paper establishes the game analysis between banks and small and medium-sized enterprises, the game analysis between banks, logistics companies and small and medium-sized enterprises. In the establishment of the model to follow the other scholars of the modeling ideas, but in the model to solve ideas on the innovation.

In the game analysis of other scholars, it is only a single way to solve the equilibrium solution of the mixed strategy. This solution can understand the factors that affect the cost of bank supervision, the performance cost of logistics enterprises, the credit cost of small and medium-sized enterprises, but can not clearly show the impact of the probability of bank supervision, logistics companies and the probability of SME integrity probability of the factors.

In the process of model solving, not only the equilibrium solution of the mixed strategy is used, but also the method of solving the pure strategy is used to analyze the probability by setting the probability to 1 or 0. Through the solution of pure strategy, we can quickly analyze the probability of bank supervision, the probability of logistics company and the probability of honesty and trustworthiness of small and medium-sized enterprises. And is also a test of the equilibrium solution of the mixed strategy.

ESSAYS Ⅱ: The Risk Management of Bank Selecting Logistics Company Under Unified Credit Guarantee Mode

1.Introduction

1.1 Background and Objective

Through the analysis of Essay I, in the various modes of logistics finance, the situation of the tripartite game is very complicated. As the main body of the loan, the bank is faced with two main entities: logistics enterprises and SMEs; and there are a variety of credit risk in the business process for the bank to further carry on the logistics of financial development.

Considering all kind of financial business modes, Essay II chooses the unified credit guarantee model as the business mode of the research, and thinks that it is more suitable for the logistics finance developing in China.

Compared to the warehousing supervision in the warehouse management, the importance of logistics companies more prominent under the unified credit guarantee mode. Before the application for financing, the inspection and valuation of the pledge is carried out by the logistics companies. In the course of financing, the logistics companies shall according to the relevant supporting materials provided by the SMEs as the pledged person, to determine whether the financing and credit lines are based on the pledge of the pledged person in the warehouse. In the repayment of the loan, if the pledger is unable to repay the loan in full, the logistics company has the right to dispose of the pledge to make up for the loss caused by the default.

Unified credit guarantee mode brings great convenience, not only reflected in the logistics warehousing services, but also reflected in the enterprise financing applications. Logistics companies apply for a certain amount of credit from the bank rely on credit guarantee, and on the basis of the credit rating of the enterprises which apply for their own credit, to provide loans to them and detain the collateral

in the warehouse for the guarantee during the retention.

The unified credit guarantee mode is based on the inventory and current assets of the SMEs, which allows the financing party to apply for loans to the logistics company as collateral for the stock or liquid assets within the enterprise. Among them, the role and status of logistics companies, not only in the collateral as inventory of inventory and assessment, but also reflected in the SMEs to provide logistics and warehousing services.

In this mode of financing, for banks, without the need for material review, assessment, supervision and other work is not good at their own, as long as the logistics business credit evaluation, making their own more focused on risk assessment and lending; that improves the work efficiency and reduces the operation of the various risks. For the logistics companies, the unified credit guarantee model not only brought its profit opportunities, but also help to promote their own business integration, accelerate the further development of enterprises.

In Essay II, the paper takes the bank as the research subject.

After identifying the risk faced by the banks under the unified credit guarantee model, based on the financial index of the enterprise, through the establishment of the factor analysis model, the financial risk of the logistics company is quantified and analyzed, and the main indexes of the financial risk of the logistics company are found out. Through the main indicators of factor analysis can be seen, affecting the logistics company's financial risks mainly related to the logistics company's solvency, profitability, growth capacity and operational capacity. The formula provided in this paper provides a reference for the bank screening enterprises under the unified credit guarantee mode, and effectively improves the speed and reliability of the banks to review the logistics companies.

1.2 Scope and Methodology of Study

1.2.1 Scope of Study

In Essay II, through the operation process can clearly see that in the traditional logistics finance model, the bank is facing the risk of logistics companies and SMEs

from both sides.

In the unified credit guarantee mode, the bank only need to consider the selection of the appropriate logistics company to authorize the credit amount. In the choice of logistics companies when the banks face the information asymmetric risk will be greatly reduced.

In China, the registration of the logistics company can be inquired, and the logistics company in the unified credit guarantee business also has profit income, so the bank will face the risk of the logistics company will be able to narrow the selection.

Secondly, Essay Ⅱ uses the method of factor analysis to establish the measurement model of logistics enterprises by means of financial indicators to help banks through a simple and reliable way to select the appropriate logistics company to complete the credit task.

Essay Ⅱ quantifies and analyzes the logistics finance risk under unified credit guarantee mode. According to the extracted public factors, single factor scores are obtained by regression method. After taking the public factor variance contribution ratio of the revised as weights and then recalculating the combination, comprehensive score for each factor of the logistics company can be concluded.

1.2.2 Methodology of Study

Factor analysis[75] is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of un observed variables called factors. The definition of factor analysis is from Wikipedia as shown from formulas as follows:

Suppose we have a set of observable random variables, $x_1,\cdots,x_p$ with means $\mu_1,\cdots,\mu_p$. Suppose for some unknown constants l_{ij} and unobserved random variables F_j (called "common factors", because they influence all the observed random variables), where i∈1,⋯,p and j∈1,⋯,k, where k < p, we have

75) source from: https://en.wikipedia.org/wiki/Factor_analysis

$$x_1 - \mu i = lik F_i + \cdots + lik F_k + \epsilon i \quad 3\text{-}1$$

Here, the ε_i are unobserved stochastic error terms with zero mean and finite variance, which may not be the same for all I.

In matrix terms, we have

$$x - \mu = LF + \epsilon. \quad 3\text{-}2$$

If we have n observations, then we will have the dimensions $x_{p\times n}$, $L_{p\times k}$, and $F_{k\times n}$. Each column of x and F denote values for one particular observation, and matrix L does not very across observations.

Also we will impose the following assumption on F :

1. F and ϵ are independent.

2. $E(F) = 0$

3. $Cov(F) = I$

Any solution of the above set of equation following the constraints for F is defined as the factors, and Las the loading matrix. Suppose $Cov(x - \mu) = \Sigma$. Then note that from the conditions just imposed on F, we have

$$Cov(x - \mu) = Cov(LF + \epsilon) \quad 3\text{-}3$$

or

$$\Sigma = LCov(F)LT + Cov(\epsilon) \quad 3\text{-}4$$

or

$$\Sigma = LFT + \Psi. \quad 3\text{-}5$$

Note that for any orthogonal matrix Q, if we set $L = LQ$ and $F = Q^T F$, the criteria for being factor and factor loading still hold. Hence a set of factors and factor loadings is unique only up to transformation.

Wen Wei and Zhen Mingui (2015) [76] pointed out that there are two main methods

76) Wen Wei, Zhen Mingui. Research on Financial evaluation and risk control of China

of financial evaluation.

(1) Single index measure method. Respectively, with profitability indicators, Tobin q value, Lerner index and other indicators to evaluate the financial level.

(2) Comprehensive measurement method. The financial risk situation is evaluated from four aspects: resource allocation efficiency, technological progress degree, sales cost level and scale structure efficiency.

As the method of single-index measurement is too simplified can not fully reflect the financial situation, and the comprehensive measure is the consumer's point of view emphasizes the lack of consumer-related data support.

Factor analysis is an objective multi-index comprehensive evaluation method, which can overcome the shortcomings of the above two methods. The basic idea of factor analysis is to group the variables according to the size of the correlation so that the correlation between the variables in the same group is high. Different groups of variables have a lower correlation, and each set of variables represents a basic structure.

Factor analysis is a study of how to minimize the number of original variables into a few factor variables with minimal lack of information. And how to make factor variables have a strong interpretability of a multivariable statistical analysis method.

1.3 Structure and Contents

Essay Ⅱ, the measurement factor analysis of logistics company under unified credit guarantee mode. Firstly to identify the risk the bank may occur in the process, and then considering the financial indicators, on the basis of modeling the factor analysis to quantify and analyze the logistics finance risk under unified credit guarantee mode, finding out the main indexes of company in logistics financial risks. According to the extracted public factors, single factor scores are obtained by regression method. After taking the public factor variance contribution ratio of the revised as weights and then

's listed steel companies based on factor analysis.[J].Journal of Jiangxi university of science and technology.2015,(06):46-53.

recalculating the combination, comprehensive score for each factor of the logistics business enterprise can be concluded. Compared the logistics financial risks of different enterprises for the same period, this part provide some reference for the bank to the enterprises filtrating under unified credit guarantee mode.

Essay Ⅱ consists of six parts as follows:

The first part is introduction. This chapter points out the research purpose at the beginning, then introduces the research methods and research scope of this paper, and introduces the structure and contents of each chapter and give the literature review in the end.

The second part is from the operational process of identification of the risk that bank may occur.

The third part is the establishment of the index system. Under the screening of the comprehensive evaluation index of the enterprise, the index system of the factor analysis is established according to the reference data of other scholars in the literature review.

The fourth part is the model analysis, through the factor analysis method, obtained in the unified credit guarantee mode, the bank selects the logistics company's model foundation.

The fifth part is the policy implication of Essay Ⅱ.

The last part is the summary of Essay Ⅱ.

1.4 Literature Review

In the summary of the research methodology in the previous literature review, papers of factor analysis have been listed. Table 3-1 will be a detailed summary of the relevant literature and also to summarize the financial indicators of the comprehensive performance of the enterprise, to provide a theoretical basis for the third chapter to confirm the indicators.

<Table 3-1-1> A Literature Review of Essay Ⅱ

Author	Factor Analysis	Financial Evaluation	Research Contents
Ranlun, Li Jinlin (2005)[77]	✓	✓	The author uses the method of factor analysis to select 13 financial indexes for some listed companies in China's small and medium-sized enterprises in 2013 to establish the index system to evaluate the performance of enterprises.
Shan Nannan (2007) [78]	✓		The author elaborated the establishment process of the logistics financial risk evaluation index system, and made the reliability analysis of the risk evaluation index system.
Li Weihong(2010) [79]	✓	✓	The author use AHP, factor analysis to research for if the financial report can be help to avoid the credit risk management the bank may occur. On the basis of it, give some useful suggestion to the bank.
Yang Lei, Zhang Yizhen(2010) [80]	✓		The two authors published two papers of the factor analysis of the risk management problems in the logistics operation of agricultural products. They pointed out the cause of the risk management of agricultural products. They set up a risk evaluation index system of agricultural products.
Lin Haiming (2012) [81]	✓		The author discusses the problems in factor analysis and puts forward some suggestions on the issues that should be paid attention to in factor analysis.
Wang wei (2013) [82]	✓	✓	The author selected 13 financial indicators of Haier's corporate performance evaluation from 2011 to 2013 for factor analysis for the financial evaluation. To provide a theoretical basis for research for the financial evaluation of SMEs.

77) Ran Lun,Li Jinlin. Application of economic factor analysis method in comprehensive performance evaluation of listed companies in small and medium-sized Enterprises.[J].Mathematical Statistics and Management.2005,(01):75-80+115.

78)Shan (2007) elaborated the establishment process of the logistics financial risk evaluation index system, and made the reliability analysis of the risk evaluation index system.
Shan Nannan. A study on the Logistics Finance.[D].Dalian maritime university.2007.

<Table 3-1-2> A Literature Review of Essay Ⅱ

Author	Factor Analysis	Financial Evaluation	Research Contents
Qu Xiaojuan, Zhang Zhen (2014) 83)	✓		The author used factor analysis to study the risk management problems in the logistics operation of agricultural products. The risk factors in the financial operation of agricultural products were analyzed from the factor analysis, then the author pointed out the influence of ten factors from internal management and external risk on the financial operation of agricultural products logistics.
Yang Janzhen, Zhen Biya, Yang Lifan (2014) 84)	✓		This paper use factor analysis to set up a application evaluation index of the process of cross-border e-commerce. And also design a questionnaire of it.
Wu Tian (2016) 85)	✓	✓	In the paper, the author takes the SME as the research object, select the first warning of the company's financial data for the first 3 years and Combined with the financial characteristics of small plates. Use logistics factor analysis to establish a financial warning model.
Wen Wei, Zhen Mingui (2015)	✓	✓	The author chooses 43 listed companies in China's steel companies as the research object in 2013. Through the 11 financial indicators, the factor analysis method is used to get the index system of the enterprise financial evaluation, and some strategies and suggestions are put forward.

79)Li Wenying. Application of AHP analysis in risk management of engineer projects.[J]. Journal of Beijing university of chemical technology.2009(65):45-46+66.

80)Yang Lei,Zhang Yizhen. The system construction of agricultural products logistics financial system based on factor analysis.[J].Journal of Guangdong agricultural sciences.2010(4):251-253.

81)Lin Haiming. Analysis of some common problems in factor analysis applications.[J]. Statistics and Decision.2012,(15):65-69.

82)Wang wei. Application of economic factor analysis method in Haier Group's financial performance evaluation.[J].Journal of Shandong agricultural university2013,(01):111-116.

83) Qu Xiaojuan, Zhang Zhen. Risk management of financial business in agricultural produce logistics:A factor analysis perspective.[J].Logistics technology.

2. Risk Identification of Banks

2.1. Operational Process of Unified Guarantee Credit Mode

Unified credit guarantee mode is an innovative logistics and financial mode, which is based on logistics enterprises.

The operation process[86] is as follows:

- Banks according to the logistics' business credit situation, business scale, business operation status and other aspects of comprehensive consideration, signed the "Bank Cooperation Agreement" and "Mortgage Agreement" to the logistics company.
- Logistics companies mortgage a certain asset to the banks.
- Banks will awarded the logistics companies a certain amount of credit funds.
- Logistics company had got the unified credit guarantee, it can examine the status of the owner of the SMEs, and signed a "mortgage agreement" with the owner of SMEs.
- The owner of SMEs to provide certain goods or commercial order mortgage, a certain amount of financial support will give the owner of the SMEs.

The development of logistics financial business under the unified credit mode has good prospects and the possibility of the actual operation, so this study selects the object of risk management related problems under unified credit mode for research.

However, at present, the overall legal environment of China's unified credit guarantee mode is not perfect, and there will be some problems when logistics

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2014,(05):163-165.

84)Yang Janzhen, Zhen Biya,Yang Lifan. Research on evaluation index system of cross-border e- commerce based on factor analysis.[J].Financial and economic.2014,(09):94-102.

85)Wu Tian. Applied reasearch about logistics model on risk waring of financial SMEs on factor analysis.[D]. Huangdong Jiaotong university.2016

86)Dong Xinlin. Analysis on the mechanism of logistics financial risk based on unified guarantee model.[J]Economist.2012(12):239-240

companies and banks implement the unified credit mode. Before discussing the measurement factor analysis of how banks choose logistics companies, we need to analyze the risks that banks may be encountered in the current unified credit mode, and then discuss how to choose a different logistics companies to credit.

2.2 Risks to the Bank Unified Guarantee Credit Mode

In China, as a result of a unified credit guarantee appears for a short time, in the banks of the work process, the banks credit index system is not perfect, the accuracy of credit calculation can not be guaranteed. The exact verification of the credit amount is the key link of credit management, and it is necessary to have a scientific risk analysis method to accurately approve the credit amount.

Poor management risk

The unified financial guarantee mode of the logistics financial simplifies banks of the loan work process and improve the efficiency of the loan. In the current work process, the staff of most banks only focus on the management of the highest credit, and there is a problem of granting credit but not managing. Many practitioners believe that after calculating the maximum credit limit of the recipient in accordance with the relevant methods, the credit management is over, they rely on loan review to control the risk when crediting. This misunderstanding an ideological tendencies, making the bank credit management is sometimes a mere formality, restricting the effectiveness of credit.

Not strictly approval decision risk

Some banks did not conduct a full investigation and study in the assessment of the economic strength of enterprises, credit status, balance sheet, product market sales, business management level and efficiency when check the corresponding qualification of the enterprise, resulting in unreasonable loans, then a huge bad debts will be formed over time.

Banks sometimes simplify procedures and review hasty for the increasing the amount of loans and performance, and then provide loan even to those who fail to meet credit requirement, the “Hanshin incident” listed in Essay I in this paper is a

good example.

Legal environmental risk

At present, the development of China's logistics and finance is still in the initial stage, there is no specific laws and regulations on the logistics company and the entire supply chain business operations to standardize the integration of operation, which makes the logistics and financial business can not follow, there may be the use of legal loopholes in the interests of the problem.

As a bridge between banks and SMEs, logistics companies on the one hand may provide false data to the bank for winning the customers, deliberately deceive bank loan, on the other hand, due to poor management, logistics companies lose their ability to repay repayment, causing the bank to suffer losses.

3. Index Establishment

3.1 Bank Assessment Contents

Unified credit guarantee mode for banks, the focus of study should be the logistics companies, the comprehensive strength of logistics companies including basic quality, solvency, profitability, innovation ability, growth potential and credit records. These six elements reflect the operation ability and credit status of the logistics companies scientifically and comprehensively.

1. The basic quality of enterprises

The basic quality of the enterprise is the internal condition which affects the enterprise credit condition, the higher enterprise quality can guarantee the enterprise to develop the new product, the new service unceasingly, enhances the market share, obtains the bigger economic efficiency. For the logistics companies, the basic quality of the enterprise is mainly reflected in the scale of the enterprise, the quality of the leader, the quality of the staff and the management level.

2. Solvency

The solvency of the enterprise is the most important performance of the enterprise

credit condition, and also the most important index of the enterprise credit evaluation. The solvency of enterprises not only reflects the level of business risk, but also reflects the ability of enterprises to use the debt to engage in business activities. The main indicators of corporate solvency include: asset liability ratio, current ratio, quick ratio and so on.

3. Profitability

Corporate profitability is the basis of corporate credit, only if the enterprise profit, that is possible to repay the debt on schedule. Profitability refers to the ability of enterprises to obtain benefits in the process of operation, which is the embodiment of the level of management and operating performance. Profitability is the basis for the survival of the enterprise, the measure of the profitability of a number of indicators, including: primary earnings per share, sales net profit margin, gross profit margin, return on assets and return on net assets, etc..

4.Innovation ability

With the rapid development of science and technology, the technological innovation ability of enterprises plays an important role in the formation of competitive advantage, especially for the technology-based. Evaluation of enterprise innovation capability indicators are: the proportion of new product sales revenue, the proportion of technical personnel, new technical equipment rate, R&D input intensity, etc..

5. Growth potential

Growth potential is to promote the continuous progress of enterprises, and the ability of improving the credit situation, only with the great growth potential, the enterprise could ensure the continuity of profitability, its credit situation will be good.

The main indicators if the evaluation of the enterprise's own growth ability are as follows: net profit growth, sales revenue growth rate, capital accumulation rate, enterprise development planning, etc..

6. Credit record

Credit record is the past performance of the enterprise, not only reflects the

solvency of the enterprise, but also objectively reflects the company's willingness to pay.

In the process of analyzing the six elements, we find that the basic quality of enterprise and innovation ability is the link which is difficult to grasp, there is no real data as a support.

Therefore in the research process, we mainly consider the use of solvency, profitability, growth potential, credit records and other aspects as a risk measure factor analysis source.

3.2 Establishment of Financial Index System

In this paper, in order to avoid the business process is too complicated, as well as the authenticity and reliability of the data, this paper will focus on data collection to the annual financial report of enterprises, taking into account the scale of enterprises and indicators of data representation and availability, this paper chooses related financial indicators which can reflect the logistics company and forms an index system of logistics companies financial risk.

There are many indicators that can be chosen in the financial analysis report. Choosing the appropriate indicators to establish the index system is the necessary step before factor analysis.

The following Table 3-2 is the detailed description of the relevant index system mentioned in the literature review. According to the establishment of Wen Wei and Zhen Mingui (2015), Li Weihong (2010, Wang wei (2013), Ran Lun and Li Jinlin (2005) and Sunwei (2012), through the basis of these indicators, this paper will establish its own analysis index system for factor analysis.

From Table 3-3, we can classify the financial indicators of the enterprise performance appraisal and select the relevant data from the annual report of the logistics companies to form the index system of the financial risk of the logistics company.

Table 3-2 Literature Review of Selecting Evaluation Index System

The type of evaluation index		Item	Author's Selection
Analysis of solvency	Short-term solvency	Current ratio	Wen Wei, Zhen Mingui (2015) Li Weihong (2010) Wang wei(2013) Ranlun, Li Jinlin(2005) Sunwei(2012)
		Quick ratio	Wen Wei, Zhen Mingui (2015) Li Weihong (2010) Wang wei(2013) Ranlun, Li Jinlin(2005) Sunwei(2012)
	Analysis of long - term solvency	Debt asset ratio	Wen Wei, Zhen Mingui (2015) Li Weihong (2010) Wang wei(2013) Ranlun, Li Jinlin(2005) Sunwei(2012)
		Equity ratio	Wang wei(2013) Ranlun, Li Jinlin(2005)
Analysis of operational capacity		Receivable Turnover Ratio	Sunwei(2012)[87] Ranlun, Li Jinlin(2005) Li Weihong (2010) Wang wei(2013)
		Inventory turnover ratio	Sunwei(2012) Ranlun, Li Jinlin(2005) Li Weihong (2010) Wang wei(2013)
		Total Assets Turnover ratio	Sunwei(2012) Ranlun, Li Jinlin(2005) Li Weihong (2010)
Profitability Analysis		ROE	Sunwei(2012) Ranlun, Li Jinlin(2005) Li Weihong (2010) Wen Wei, Zhen Mingui (2015)
		ROA	Sunwei(2012)
		Primary Earnings Per Share	Wen Ranlun, Li Jinlin(2005) Wen Wei, Zhen Mingui (2015)
Growth ability analysis		Operating income growth rate	Sunwei(2012) Ranlun, Li Jinlin(2005) Li Weihong (2010)
		Owner's Equity Growth Ratio	Sunwei(2012)

87)Sun Wei.A study on the performance evaluation system of enterprise based on strategies.[D].Capital university of economics.2012

Table 3-3 Enterprise Comprehensive Evaluation Index System

The type of evaluation index		Item
Analysis of solvency	Short-term solvency	Current ratio
		Quick ratio
	Analysis of long - term solvency	Debt asset ratio
		Equity ratio
Analysis of operational capacity		Receivable Turnover Ratio
		Inventory turnover ratio
		Total Assets Turnover ratio
Profitability Analysis		ROE
		Primary Earnings Per Share
Growth ability analysis		Operating income growth rate

3.3 Explanation of Data Indicators

In order to explain the significance of this article, we will analyze and sort out the contents of the selected indicators in this paper. According to the analysis of the index connotation, the selection basis of the selected indicators is pointed out.

(1) Current ratio[88] (CR)

The current ratio is a liquidity ratio that measures whether or not a firm has enough resources to meet its short-term obligations. It compares a firm's current assets to its current liabilities, and is expressed as follows:

(2) Quick ratio[89] (QR)

Which is the current assets in the current assets can immediately realize that part of the assets, such as cash, securities, accounts receivable and prepayment.

Both the current ratio and quick ratio are used to indicate the liquidity of the firm, namely the value of the short-term debt repayment ability of the firm. The former reference value is 2 and the latter is 1. It should be noted, however, that firms with high current ratios are not necessarily able to repay short-term debt because in the flow of assets, although the cash, securities, accounts receivable liquidity is very

88)Current ratio. http://baike.baidu.com
89)Quickratio. http://baike.baidu.com

strong, but if the inventory, deferred expenses, etc. are also part of the current assets of the project, its realization time will be longer, especially the inventory is likely to occur backlog, poor sales, residual, cold back, etc., and its liquidity of the funds is poor. The quick ratio can avoid this situation, because the quick assets refers to the flow of assets is easy to realize that part of the assets.

(3) Debt Asset ratio[90]

The debt asset ratio is the percentage of the total liabilities at the end of the period divided by the total amount of the assets, that is, the ratio of the total liabilities to the total assets. Assets and liabilities are reflected in the proportion of the total assets is borrowed to raise funds, but also can measure the degree of protection of the interests of creditors in the liquidation.

Debt asset ratio reflects the proportion of capital provided by the creditor to the total capital, also known as the debt-to-business ratio. This indicator is a comprehensive indicator of the level of corporate debt. It is also a measure of the ability of companies to use the funds of the creditors to carry out business activities, and reflects the degree of security of creditors to issue loans. If the debt asset ratio reaches 100% or more, the company has no net assets or insolvency.

(4) Equity ratio[91]

The equity ratio is a financial ratio indicating the relative proportion of equity used to finance a company's assets and refers to the joint-stock enterprises of the total liabilities and the total amount of. Equity ratio is an indicator to assess the rationality of the financial structure.

The equity ratio is a good indicator of the level of leverage used by a company. The equity ratio measures the proportion of the total assets that are financed by stockholders, as opposed to creditors. A low equity ratio will produce good results for stockholders as long as the company earns a rate of return on assets that is greater than the interest rate paid to creditors. It is generally considered that this ratio is1:

90) Debt asset ratio. http://baike.baidu.com
91) Equity ratio. http://baike.baidu.com

1, that is, 100% or less, it should be solvency, but it should be combined with the specific circumstances of the enterprise to be analyzed.

(5) Receivable turnover ratio[92)]

Accounts receivable have a pivotal position in current assets. If the company's accounts receivable can be the timely recovery, it's capital efficiency can be greatly improved. The turnover rate of accounts receivable is the ratio of turnover rate of accounts receivable. It indicates the average number of corporate accounts receivable to cash in a given period. The higher the turnover rate of accounts receivable, the faster the recovery. On the contrary, indicating that excessive working capital sluggish accounts receivable, affecting the normal cash flow and solvency.

(6) Inventory turnover ratio[93)]

The inventory turnover ratio is the ratio of the cost of goods sold to the average inventory balance for a certain period of time. It is used to reflect the turnover rate of inventory, that is, measure whether inventory liquidity and inventory funds are reasonable or not. It is necessary to improve the efficiency of the use of funds and enhance the short-term solvency of the enterprises while ensuring the continuity of production and operation. Inventory turnover ratio is one of the most important indicators of business operation analysis, and is widely used in enterprise management decision. Inventory turnover ratio can not only be used to measure the efficiency of inventory operations in all aspects of production and operation, but also to evaluate the business performance of enterprises, reflecting the performance of enterprises.

Inventory turnover ratio is a supplementary explanation of the turnover rate of current assets. Through the calculation and analysis of inventory turnover ratio, it is possible to measure the turnover rate of inventory assets in a certain period of time. It is a measure that reflects the efficiency of purchasing, producing and selling enterprises. The higher the inventory turnover ratio, the stronger the liquidity of the enterprise's inventory assets, the faster the inventory turnover and inventory on the inventory.

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92)Receivable turnover ratio. http://baike.baidu.com/
93)Inventory turnover ratio. http://baike.baidu.com/

(7) Total assets turnover rate[94)]

The total asset turnover rate is the ratio of the net amount of business income to the total assets of a firm in a given period.

The total asset turnover rate is an important indicator for comprehensively evaluating the quality of operation and efficiency of all the assets of the enterprise. The greater the turnover rate, indicating that the faster the total asset turnover, reflecting the stronger sales capacity. Enterprises can be through the small profits but quick turnover approach to accelerate the turnover of assets, resulting in an increase in the absolute amount of profits. Total asset turnover rate reflects the overall business capacity of the enterprise, in general, the more the number of revolutions of assets or the smaller number of days of turnover, indicating that the faster the turnover, the greater the operational capacity.

(8) Return on equity (ROE) [95)]

Return on net assets is the percentage of net profit and average shareholder's equity, which is the percentage ratio of the company's after-tax profit divided by the net assets. This indicator reflects the level of earnings of the shareholders' equity to measure the efficiency of the company's use of its own capital. The higher the indicator value, the higher the return on investment. The indicator reflects the ability of its own capital to receive net income. In general, an increase in debt will lead to an increase in the return on net assets.

(9) Primary earnings per share[96)]

Basic earnings per share means that the enterprise should calculate the earnings per share in accordance with the current net profit of the ordinary shareholders, divided by the weighted average of the issued ordinary shares. If the enterprise has a consolidated financial statement, the enterprise shall calculate and present the earnings per share on the basis of the consolidated financial statements.

(10) Operating income growth rate[97)]

94) Total assets turnover rate. http://baike.baidu.com
95) Return on net assets. http://baike.baidu.com
96)Primary earnings per share. http://baike.baidu.com

The growth rate of operating income is the ratio of the increase in operating income of the enterprise to the total operating income of the previous year, which reflects the increase and decrease of the operating income of the enterprise. Operating income growth rate is a measure of business conditions and market share and an important symbol of predicting business development trend. Increasing operating income is the basis for the survival of enterprises and the conditions for development. If the indicator is greater than 0, indicating that the company's operating income has increased, the higher the index value, indicating that the faster the growth rate, the better the corporate market prospects; if the indicator is less than 0, then there is product or service is not marketable, low quality and high price, so the market share is shrinking.

Through the above analysis of ten indicators, we can conclude that the ten indicators cover the company's profitability, solvency, growth capacity, operational capacity of the important content. The factor analysis model on the basis of those is true and reliable.

Table 3-4 Index System of Logistics Finance Risk Management

Type of index	Name of index
Profitability index	Earnings per share (EPS)
	Return on equity(ROE)
Debt paying ability index	Current ratio(CR)
	Quick Ratio(QR)
	Equity ratio
	Asset-liability ratio
Growth ability index	Operating income growth rate
Operational ability index	Inventory turnover ratio
	Receivables turnover ratio
	Total asset turnover

97)Operating income growth rate. http://baike.baidu.com

Table 3-5-1 Logistics Financial Risk Measurement Data 1

Company name	EPS	ROE	Operating income growth rate	CR	Debt Asset ratio
Chongqing road &bridge Co., Ltd.	0.27	7.23	-4.35	11.82	50.79
Hubei Chutian Expressway Limited by Share Ltd	0.22	7.59	1.05	0.7	53.22
Da qin Railway Co., Ltd.	0.35	7.59	-21.82	1	25.13
Fujian Expressway Development Co., Ltd	0.2	6.47	-2.91	0.72	32.95
Jiangxi Ganyue Expressway Co., Ltd	0.39	6.65	-6.97	1.12	51.93
Guangshen Railway Co., Ltd.	0.15	3.89	11.89	1.81	10.82
Hunan Investment Co., Ltd	0.12	3.87	14.77	2.19	32.95
Jinlin Provincial Expressway Group Co., Ltd	0.13	5.9	39.98	1.78	58.08
Heilongjiang Transportation Development Company Ltd.	0.2	6.9	-1.08	1.73	27.17
Jiangsu Expressway Company Limited	0.48	11.27	-5.86	0.6	39.21
Shangdong Hi-speed Group Co., Ltd	0.51	10.14	-1.41	2.57	47.12
Sichuan Expressway Company Limited	0.34	7.73	4.24	1.81	59.53
China Railway Tielong Lostics Co., Ltd.	0.15	3.89	-3.94	3.05	30.05
Guangxi Wuzhou Communications Co., Ltd	0.24	6.44	-48.73	1.5	71.71
Ningxia Western Venture Industrial Co., Ltd.	-0.05	-1.6	14.46	0.83	26.06
Xiandai Investment Co., Ltd	0.53	7.26	35.55	0.96	65.53
Guangdong Transportation Development Company Ltd.	0.43	9.9	5.63	1.43	47.49
Shenzhen Expressway Company Limited	0.43	7.53	30.41	1.97	52.47
Henan Zhongyuan Expressway Co., Ltd	0.16	5.26	-21.22	0.35	75.5
Aucksun Limited	0.21	10.82	19.77	1.89	46.35
Freetrade Science &Technology	0.03	1.79	-7.95	2.17	1.91
Jiangsu Feiliks International Logistics Co., Ltd.	0.17	5.96	7.95	2.1	33.18
Hengtong Logistics Co., Ltd.	0.37	7.19	-5.05	1.28	28.83
CTS Global Logistics Co., Ltd.	0.25	6.12	-9.61	2.43	9.62
Shenzhen Huapengfei Supply Chain Co., Ltd.	0.23	3.89	-16.35	3.09	13.64
C&D Corporation	0.46	6.57	1.03	1.52	79.62
Shanghai Jiaoyun Co., Ltd.	0.24	5.46	-0.31	1.91	42.14
New Trade International Co., Ltd.	0.57	5.2	-4.63	2.69	38.29

Data Source: Shanghai Stock Exchange[98)]

98) Shanghai stock exchange. http://www.sse.com.cn

Table 3-5-2 Logistics Financial Risk Measurement Data 1

Company name	EPS	ROE	Operating income growth rate	CR	Debt Asset ratio
Shenzhen PROLTO Supply Chain Management Co., Ltd.	0.42	13.7	17.24	1.06	94.37
STO Express Co., Ltd.	0.02	0.71	2.77	1.34	50.67
Tianshun Supply Chain Co., Ltd.	0.39	6.18	1.64	3.02	32.39
Sinotrans Limited	0.79	9.78	12.72	3.52	75.62
Jiangsu Wanlin Modern Logistics Co., Ltd.	0.17	3.19	3.32	1.51	51.16
Xiamei Xiangyu Group Co., Ltd.	0.32	5.82	80.72	1.07	74.57
Xinlin Logistics	0.08	2.05	61.87	1.9	28.13
Shenzhen Eternal Asia Supply Chain Co., Ltd.	0.21	8.5	39.07	1.14	80.22
Inform Equipment Group Co., Ltd.	0.58	7.46	16.81	4.73	19.1
YTO Express Co., Ltd.	0.43	12.44	43.53	2.83	23.16
Y.U.D.Yangze River Investment Industry Co.,Ltd.	0.41	13.42	-37.2	1.56	54.05
Changjiu Group Co., Ltd.	0.63	13.36	9.5	1.94	39.11
CMST Development Co., Ltd.	0.2	4.77	-23.63	2.72	51.24
Beibu Gulf Port Co., Ltd.	0.41	6.21	-6.49	0.93	40.56
Bohai Ferry Company Ltd.	0.47	7.54	-3.47	0.72	20.79
Chongqin Gangjiu Company Limited	0.09	1.1	-21.98	1.25	41.4
Dalian Port (PDA) CompanyLimited	0.03	1.97	50.76	1.47	41.92
Hainan Strait Shipping Co., Ltd.	0.32	5.67	6.28	10.23	6.92
Jinzhou Port Co., Ltd.	0.02	0.68	23.27	1.12	51.76
Nanjing Port Co., Ltd.	0.09	3.08	19.61	2.43	33.23
Ningbo Zhoushan Port Co., Ltd.	0.14	5.47	-3.81	0.73	37.38
Ningbo Marine Company Ltd.	0.05	2.04	3.92	0.29	48.86
Rizhao Port Co., Ltd.	0.07	2.23	-2.8	0.6	40.61
Xiamen Port Holding Group Co.	0.23	4.28	17.27	1.63	40.54
Shanghai International Port (Group) Co., Ltd.	0.17	6.61	2.22	0.71	42.8
Shenzhen Chiwan Wharg Holding Limited	0.66	9.27	2	0.72	17.97
Tangshan Port Group Co., Ltd.	0.24	8.71	31.71	1.27	30.95
Tianjin Port Holdings Co., Ltd.	0.6	6.63	-25.08	1.56	40.07
Wanjiang Logistics Company Ltd.	0.11	5.01	-18.39	0.88	45.6
Yingkou Port Liability Co., Ltd	0.05	3.44	-7.79	1.97	32.89
China Merchants Energy Shipping Co., Ltd.	0.33	11.43	-1.81	3.18	43.91
China Shipping Container Lines Co., Ltd.(Shanghai)	-0.05	-4.56	-55.26	0.71	87.91
Zhuhai Port Holding Group Co., Ltd.	0.11	3.23	-13.93	0.74	49.63
Guangzhou-Baiyun International Airport	0.92	9.94	8.06	1.24	36.28
China Eastern Airlines	0.49	13.28	4.79	0.25	73.91
Hannan Airlines	0.27	6.08	15.73	1.45	59.81
China southern Airlines	0.66	14.53	1.52	0.22	70.8
Xiamen Airport Group	1.09	10.05	5.77	1.79	18.23
Shanghai Airport Authority	1.09	0.75	10.8	6.23	16.32
Shenzhen Airport Group	0.2	3.89	0.12	1.55	15.41
Air China	0.27	10.77	3.72	0.31	67.42

Data Source: Shanghai Stock Exchange

Table 3-6-1 Logistics Financial Risk Measurement Data 2

Company name	QR	Equity Ratio	Inventory turnover ratio	Receivable Turnover Ratio	Total Assets Turnover
Chongqing road &bridge Co., Ltd.	9.78	1.03	0.08	7.79	0.03
Hubei Chutian Expressway Limited by Share Ltd	0.68	1.14	143.93	20.3	0.1
Da qin Railway Co., Ltd.	0.9	0.34	15.42	11.04	0.27
Fujian Expressway Development Co., Ltd	0.72	0.99	48.84	5.86	0.1
Jiangxi Ganyue Expressway Co., Ltd	0.88	1.2	2.93	16.11	0.1
Guangshen Railway Co., Ltd.	1.7	0.12	36.53	5.11	0.4
Hunan Investment Co., Ltd	0.82	0.49	0.08	4.24	0.07
Jinlin Provincial Expressway Group Co., Ltd	1.77	1.58	201.6	37.04	0.08
Heilongjiang Transportation Development Company Ltd.	0.49	0.38	0.1	75.16	0.08
Jiangsu Expressway Company Limited	0.12	0.67	0.79	64.74	0.17
Shangdong Hi-speed Group Co., Ltd	1.51	0.91	0.15	1636.36	0.1
Sichuan Expressway Company Limited	1.03	1.55	1.55	16.28	0.15
China Railway Tielong Lostics Co., Ltd.	0.56	0.43	1.78	63.94	0.65
Guangxi Wuzhou Communications Co., Ltd	0.57	2.65	0.1	8.42	0.07
Ningxia Western Venture Industrial Co., Ltd.	0.74	0.33	8.65	3.11	0.18
Xiandai Investment Co., Ltd	0.56	1.89	14.15	28.82	0.33
Guangdong Transportation Development Company Ltd.	1.43	0.96	873.35	39.96	0.15
Shenzhen Expressway Company Limited	1.46	1.33	2.3	6.3	0.1
Henan Zhongyuan Expressway Co., Ltd	0.2	3.09	0.8	36.44	0.06
Aucksun Limited	1.13	1.23	4.28	4.07	0.51
Freetrade Science &Technology	1.95	0.63	4.46	21.77	0.15
Jiangsu Feiliks International Logistics Co., Ltd.	1.71	0.6	55.65	5.88	0.98
Hengtong Logistics Co., Ltd.	0.8	0.44	115.15	23.87	1.58
CTS Global Logistics Co., Ltd.	2.14	0.4	40.3	5.01	1.29
Shenzhen Huapengfei Supply Chain Co., Ltd.	2.76	0.16	6.04	2.26	0.2
C&D Corporation	0.34	5.39	1.24	36.7	0.74
Shanghai Jiaoyun Co., Ltd.	1.21	0.82	5.41	8.31	0.83
New Trade International Co., Ltd.	2.43	0.62	1.99	0.93	0.26
Shenzhen PROLTO Supply Chain Management Co., Ltd.	0.92	16.77	40.49	4.6	0.1
STO Express Co., Ltd.	0.85	1.07	2.82	5.58	0.7
Tianshun Supply Chain Co., Ltd.	2.47	0.48	42.69	2.85	0.68
Sinotrans Limited	3.23	0.19	788.36	5.44	0.41

Data source: Shanghai Stock Exchange

Table 3-6-2 Logistics Financial Risk Measurement Data 2

Company name	QR	Equity Ratio	Inventory turnover ratio	Receivable Turnover Ratio	Total Assets Turnover
Jiangsu Wanlin Modern Logistics Co., Ltd.	1.33	1.05	79.3	5.82	0.08
Xiamei Xiangyu Group Co., Ltd.	0.28	4.02	9.37	40.68	2.6
Xinlin Logistics	1.35	0.4	3.69	2.17	0.32
Shenzhen Eternal Asia Supply Chain Co., Ltd.	0.76	5.73	5.59	5.45	1.17
Inform Equipment Group Co., Ltd.	2.84	0.24	1.93	2.75	0.36
YTO Express Co., Ltd.	1.9	0.3	66.86	142.3	1.94
Y.U.D. Yangze River Investment Industry Co.,Ltd.	1	1.53	3.96	2.2	0.46
Changjiu Group Co., Ltd.	1.93	0.67	4396.62	3.64	1.02
CMST Development Co., Ltd.	1.18	1.08	2.57	12.39	0.57
Beibu Gulf Port Co., Ltd.	0.76	0.8	15.78	5.7	0.17
Bohai Ferry Company Ltd.	0.66	0.27	22.93	41.43	0.23
Chongqin Gangjiu Company Limited	0.73	0.93	4.75	8.29	0.16
Dalian Port (PDA) Company Limited	1.17	0.78	11.72	15.8	0.32
Hainan Strait Shipping Co., Ltd.	9.63	0.07	29.92	22.37	0.23
Jinzhou Port Co., Ltd.	0.79	1.1	10.26	14.62	0.17
Nanjing Port Co., Ltd.	2.34	0.52	34.21	15.01	0.13
Ningbo Zhoushan Port Co., Ltd.	0.5	0.63	38.77	7	0.24
Ningbo Marine Company Ltd.	0.26	1.13	28.54	38.92	0.14
Rizhao Port Co., Ltd.	0.57	0.76	26.21	5.49	0.17
Xiamen Port Holding Group Co.	1.13	0.75	18.62	9.86	1.15
Shanghai International Port (Group) Co., Ltd.	0.57	0.84	4.29	11.27	0.21
Shenzhen Chiwan Wharg Holding Limited	0.69	0.26	42.7	82.67	0.71
Tangshan Port Group Co., Ltd.	1.13	0.49	9.27	9.13	0.29
Tianjin Port Holdings Co., Ltd.	1.39	0.88	41.01	9.16	0.27
Wanjiang Logistics Company Ltd.	0.67	0.99	11.3	11.13	0.39
Yingkou Port Liability Co., Ltd	1.92	0.53	25.44	6.82	0.16
China Merchants Energy Shipping Co., Ltd.	2.95	1.03	7.93	6.18	0.13
China Shipping Container Lines Co., Ltd.(Shanghai)	0.57	6.97	13.83	9.7	0.14
Zhuhai Port Holding Group Co., Ltd.	0.65	1.1	17.66	5.91	0.24
Guangzhou-Baiyun International Airport	1.21	0.58	38.91	8.32	0.31
China Eastern Airlines	0.13	3	27.64	36.44	0.38
Hannan Airlines	1.37	1.64	771.85	52.63	0.22
China southern Airlines	0.15	3.08	41.26	4.12	0.46
Xiamen Airport Group	0.69	0.24	2573.13	6.05	0.28
Shanghai Airport Authority	6.21	0.2	146.85	6	0.2
Shenzhen Airport Group	1.55	0.18	344.46	6.7	0.18
Air China	0.23	2.3	35.28	7.79	0.39

Data source: Shanghai Stock Exchange

4. Factor Analysis

4.1 Data collect

As shown in Table 3-4, in the process of index selection, considering the enterprise scale and the typical and availability of index data, this paper selects relevant financial index to set up the index system of logistics finance risk.

As shown in Table 3-5 and Table 3-6, this paper selects 69 logistics business of listed companies annual report in 2016 for data analysis.

In Table 3-5 and Table 3-6, due to the arrange and relationship with logistics finance risk are different. we need to modify the original data. We can through mathematical transformation to turn two kinds of indexes into positive data. By mathematical transformation formula is:

(1) Positive formula :

$$y_{ij} = (x_{ij} - \min x_i) / (\max x_i - \min x_i) \quad 3\text{-}6$$

(2) Interval formula

$$y_{ij} = |x_{ij} - \overline{x_i}| / (\max x_i - \min x_i) \quad 3\text{-}7$$

y_{ij} means that No.j company's No.i index has been transformed

x_{ij} means the original data of No.j company's No.i index

$\max x_i$ means the maximum data of No.j index in all listed companies

$\min x_i$ means the minimum data of No.j index in all listed companies.

$\overline{x_i}$ means the average value of the No.j index.

Through transform, all the data have been transformed to positive data. All data has been limited within 0 to 1.

4.2 Model Building

From the above-mentioned theory, we have hypothesis as follows:

1. F and ϵ are independent.

2. $E(F) = 0$

3. $Cov(F) = I$ (to make sure that the factor are un correlated.

The financial data of the listed companies in 2016 were used as samples, and SPSS 23.0 software was used to analyze the sample data.

As shown in Table 3-7, the inspection probability of Bartlett spherical is 0.000, so refused to correlation matrix for the null hypothesis of unit matrix, that demonstrated this model has factor structure.

Table 3-7 KMO and Bartlett's Test

Bartlett's Test of Sphericity	Approx. Chi-Square	252.626
	df	45
	Sig.	.000
a. Based on correlations		

Table 3-8 is the initial solution of the factor analysis, showing the common variance data for all variables. The "Initial" column is the common variance of the variables under the initial solution of the factor analysis. It shows that if all the eigenvalues (10) are extracted by the principal component analysis method, the null variance of the original variable can be explained, and the common variance of the variable is 1 (the original variable is normalized variance is 1). The"Extraction" column is the common variance when extracting the eigenvalue by the specified extraction condition (five factors extracted in this example). It can be seen that the common variance of all variables is high and the loss of information for each variable is less. So the overall effect of factor analysis extraction is ideal.

Table 3-8 Communalities

	Initial	Extraction
EPS	1.000	.765
Operating income growth rate	1.000	.727
ROE	1.000	.703
CR	1.000	.963
Debt Asset Ratio	1.000	.801
QR	1.000	.964
Equity Ratio	1.000	.809
Inventory Turnover Ratio	1.000	.657
Receivable Turnover Ratio	1.000	.878
Total Assets Turnover	1.000	.683
Extraction Method: Principal Component Analysis.		

4.3 Model Solving

By SPSS 23.0 we can select public factors. Factor loading matrix using the variance of the solution to rotate, after rotate we can get variance contribution rates of each variance.

As shown in Table 3-9, the first five public factor variance contribution rates are 20.060% ,18.504%, 16.361%, 13.975 and 12.537%. The cumulative contribution rate is 79.511%. From the point of the cumulative contribution rate, these five common factors reflect most information of logistics enterprise financial risk.

Table 3-9 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.115	21.148	21.148	2.115	21.148	21.148	2.006	20.060	20.060
2	2.025	20.246	41.394	2.025	20.246	41.394	1.850	18.504	38.564
3	1.567	15.666	57.059	1.567	15.666	57.059	1.636	16.361	54.925
4	1.221	12.206	69.265	1.221	12.206	69.265	1.397	13.975	68.900
5	1.025	10.246	79.511	1.025	10.246	79.511	1.061	10.612	79.511
6	.653	6.529	86.041						
7	.609	6.088	92.128						
8	.453	4.530	96.659						
9	.282	2.819	99.477						
10	.052	.523	100.000						

Extraction Method: Principal Component Analysis.

Given after rotated component matrix, as shown in Table 3-10, we can analysis the correlation degree between each index and public factor. Five common factors respectively from different aspects reflect the characteristics of the logistics financial risks.

After the variance of the variance method, CR, QR, EPS and debt asset ratio are

the four variables in the first factor has a higher load, the first factor to explain the main factor of these four variables, whose significance represents the enterprise's profitability and debt paying ability.

The ratio of EPS, ROE, inventory turnover ratio and total assets turnover are higher in the second factor. The second factor mainly explains the four variables, which represent the enterprise's profitability and operational ability.

Table 3-10 Rotated Component Matrix

	Component				
	1	2	3	4	5
EPS	.169	.847	.090	.024	.100
Operating income growth rate	-.001	.002	-.026	.852	.031
ROE	-.015	.785	.111	.127	.243
CR	.979	.018	.030	-.061	-.001
Debt Asset Ratio	.130	.044	.878	.059	-.092
QR	.977	.007	.053	-.068	-.045
Equity Ratio	-.047	.032	.898	.014	.021
Inventory Turnover Ratio	-.173	.700	-.140	.006	-.342
Receivable Turnover Ratio	-.055	.094	-.080	-.035	.927
Total Assets Turnover	-.115	.120	.098	.801	-.067
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a]					
a. Rotation converged in 5 iterations.					

The third factor load big quantity from debt asset ratio, equity ratio and ROE. This means it reflects the enterprise's debt-paying ability and profitability.

The fourth factor reflects big in operating income growth rate, total assets turnover and ROE. It reflects the enterprise's ability in growth and debt- paying and profit.

The fifth factor has a highly load in receivable turnover ratio and ROE. It represents the enterprise's operational ability and profitability.

Above analysis shows that for a logistics company, the logistics financial risk mainly includes of debt-paying ability, profitability growth ability and operational ability. Therefore, we can judge the logistics finance risk from these five aspects.

Table 3-11 is the factor score coefficient matrix, which is based on the regression algorithm to calculate the coefficient of the function of the coefficient, according to the table, can be the following factor score function:

Table 3-11 Component Score Coefficient Matrix

	Component				
	1	2	3	4	5
EPS	.075	.458	.013	-.044	.048
Operating income growth rate	-.010	.407	.040	.026	.189
ROE	.074	-.074	-.068	.640	.053
CR	.495	.003	-.040	.034	.011
Debt Asset Ratio	.015	-.012	.534	-.006	-.054
QR	.492	-.001	-.026	.027	-.030
Equity Ratio	-.080	-.021	.565	-.052	.051
Inventory Turnover Ratio	-.092	.420	-.119	-.072	-.378
Receivable Turnover Ratio	-.014	.000	-.014	-.007	.872
Total Assets Turnover	.000	-.001	.012	.571	-.046

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Component Scores.

$$F_1 = 0.75x_1 - 0.010x_2 + 0.074x_3 + 0.495x_4 + 0.015x_5 + 0.492x_6 - 0.080x_7 - 0.092x_8 - 0.14x_9 + 0.00x_{10}$$

3-8

$$F_2 = 0.458x_1 + 0.407x_2 - 0.074x_3 + 0.003x_4 - 0.012x_5 - 0.001x_6 - 0.021x_7 + 0.420x_8 + 0.00x_9 - 0.001x$$

3-9

$$F_3 = 0.013x_1 + 0.040x_2 - 0.068x_3 - 0.040x_4 + 0.534x_5 - 0.026x_6 + 0.565x_7 - 0.119x_8 - 0.014x_9 + 0.012x_{10}$$

3-10

$$F_4 = -0.044x_1 + 0.026x_2 + 0.64x_3 + 0.034x_4 - 0.006x_5 + 0.027x_6 - 0.052x_7 - 0.072x_8 - 0.007x_9 + 0.571x_{10}$$

3-11

$$F_5 = 0.48x_1 + 0.189x_2 + 0.053x_3 + 0.011x_4 - 0.054x_5 - 0.030x_6 + 0.051x_7 - 0.378x_8 + 0.872x_9 - 0.46x_{10}$$

3-12

Table 3-12 shows the covariance matrix of five factors. The correlation coefficient between the two factors is zero, indicating that there is no correlation between the five factors after factor analysis and extraction, and the design goal of factor analysis is realized. It also shows that it is obtained by orthogonal rotation method.

Table 3-12 Component Score Covariance Matrix

Component	1	2	3	4	5
1	1.000	.000	.000	.000	.000
2	.000	1.000	.000	.000	.000
3	.000	.000	1.000	.000	.000
4	.000	.000	.000	1.000	.000
5	.000	.000	.000	.000	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Component Scores.

And then use each public factor's revised variance contribution rate as a weighting factor to calculate its linear combination. The formula as follows:

$$F = \sum_{i=1}^{5} C_i F_i \qquad 3\text{-}13$$

C_i means each public factor's variance contribution rate

F_i means each public factor's factor score.

Using formula 3-13 to carry out the logistics finance risk factors for each logistics company.

4.4 Model Comprehensive Evaluation

According to the above analysis results of 69 logistics companies in 2016 annual report data, for the results of logistics risk management of the comprehensive evaluation . It will provide favorable help to the commercial banks to carry out a unified credit guarantee mode of unified credit behavior.

Firstly, the weight is determined according to the variance contribution rate of the five factors. Since the five factors largely reflect most of the original variable

information, the cumulative contribution rate of 79.511%, then use the factor variance contribution rate as a comprehensive evaluation of the weight, in accordance with the respective variance contribution rate, the five factors weighted addition as a comprehensive evaluation score, the formula is:

$$F = 0.20060F_1 + 0.18504F_2 + 0.16361F_3 + 0.13975F_4 + 0.10612F_5 \quad 3\text{-}14$$

Secondly, using the raw data be transformed in each of the 69 logistics companies in Tables 3-5 and 3-6, theoretically the score of the logistics risk factor for each logistics company can be calculated.

Finally, the size of the logistics management risk of the logistics company is determined by the size of the comprehensive evaluation score value.

5. Policy Implication

This paper takes the bank as the research subject, and explores the data model of the bank selection logistics company under the unified credit guarantee mode.

Through the analysis of the previous scholars' papers, this paper chooses the factor analysis method as the foundation of the model.

Through the method of factor analysis, this paper establishes the formula of calculating the weight of each factor under the unified credit guarantee mode, and helps the banks to choose the less risky logistics companies through the formula. At the same time, this paper puts forward the following conclusions and policy implication on the current situation of banks and logistics companies.

1. Banks to establish a sound logistics company assessment system, and connect with the stock exchange analysis system to share the annual report. This system will help banks to grasp the most reliable and the latest logistics company financial data.

2. Banks and business management departments to connect the inquiry system to help banks confirm the true identity of the logistics company whether there is fraud.

3. Bank and the tax department's query system for information sharing, to keep abreast of the logistics company's capital changes.

4. Person in charge of the logistics company's credit guarantee account.

5. To train high-quality financial analysis staff, proficient in enterprise financial data analysis, to help banks analysis the variety of data quickly.

6. Summary of Essay Ⅱ

Essay Ⅱ discusses the scope of the logistics company by selecting the financial index as the basis for determining the financial risk of the logistics. Based on the financial analysis of the financial indicators, this paper establishes the measurement index of the logistics financial risk.

Based on the data of 69 sample logistics companies, factor analysis can be used to find out that the size of logistics financial risk is mainly from solvency, profitability, growth ability and operational ability through the extraction of public factors and correlation analysis.

In these indicators, the contribution rate of liquidity ratio, asset-liability ratio and earnings per share is larger. Equation 3-13 can be used as a bank to examine the corporate screening reference of the logistics company in the unified credit guarantee mode.

At the same time, it simplifies the business process of banks to choose logistics risk, and can promote the further development and improvement of logistics and financial business.

Most of the academic papers, the general use of analytic hierarchy process to calculate the risks faced by an enterprise. For banks, it is a time-consuming thing to do if each financing project is to be done using tedious analytic hierarchy process.

In this paper, being studied the model of logistics financial business, and find that in the unified credit guarantee mode, the bank only needs to complete the credit task, and do not need to participate in the logistics financial supervision tasks. Under this business mode, the basic need of bank is to consider the risk from logistics companies to complete the financing project, so as to avoid the risk from the small and medium enterprises.

After identifying the risks encountered by the bank, this paper adopts the other scholars' model foundation and uses the factor analysis method to analyze the financial data of the logistics company. On the basis of fully studying the indexes of other scholars' modeling, this paper chooses some indexes which have obvious influence on the profitability, solvency, growth ability and management ability as the basis of the index system. The paper puts forward a new reference system for the bank selection logistics company under the unified credit guarantee mode.

ESSAY Ⅲ : The Risk Management of Logistics Company Selecting SME Under Unified Credit Guarantee Mode

1. Introduction

1.1 Background and Objective

In the development of logistics finance, the financing difficulties of small and medium-sized enterprises have been greatly improved. But the risk management of the logistics financial business model is different.

According to the current credit management system in China is not perfect and the information asymmetry between banks and small and medium enterprises is still exist, change the bank's regulatory functions into the logistics company's work, will be the most effective mode in China.

In the unified credit guarantee mode, the bank's supervisory function is reduced, and the bank basically completes the work of the fund provider.

Logistics companies how to choose the appropriate small and medium enterprises to carry out the specific amount of the operation of the amount of money is the problem to be solved in Essay Ⅲ, logistics companies is the main research body, the paper expected through modeling analysis to help logistics companies to better avoid the process of lending Risk, and helping the logistics company to maximize profits. On the basis of theoretical research, the paper puts forward some policy suggestions on the risks faced by logistics companies in the process of lending.

1.2 Scope and Methodology of the Study

1.2.1 Scope of the Study

In Essay Ⅰ, this paper discussed the relationship between the banks, logistics companies, SMEs in the logistics finance credit risk management. In Essay Ⅱ, under the credit guarantee mode, this paper analyzed the way to help banks to choose the logistics companies.

On the basis of the conclusions had got, there left a problem to be resolved. That is, logistics companies in the access to banks under the unified credit, the provision of pledged loans faced by the choice of those enterprises and how much to give the amount to SMEs.

In the unified credit guarantee mode, when the logistics company to obtain bank credit, the bank will no longer guarantee the amount of collateral related to supervision, do not need to consider the amount of credit within the credit line.

As the logistics company in which to obtain their own economic interests, willing to bear the risk of credit, the credit risk faced by banks in part by the logistics company to undertake, so after identifying the logistics company's risk, how to deal with the risks encountered by logistics companies, and to help logistics enterprises to maximize the benefits, Is Essay III to be studied.

In Essay III, firstly, to identify the risk of logisitcis company may be occur in the operational process , and then Utilizing the method of combining analytic hierarchy process (AHP) and linear programming (LP) for the study. Calculated the risk weighting by using AHP method, then constructed LP model by using those as the objective function coefficient, and the strategy that how to choose the SMEs which apply for a loan under unified credit guarantee mode can be concluded finally.

1.2.2 Methodology of the Study

Analytic Hierarchy Process (AHP)[99] first proposed by the United States University of Pittsburgh professor T.L.Saaty in the 1970s. This is a good way to combine qualitative and quantitative analysis with a systematic, hierarchical analysis of the problem.

AHP breaks down a complex problem into multiple constituent factors and further breaks down these factors in a dominant relationship. In the following order:

- Target level (highest)

99)The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. https://en.wikipedia.org/

- Criteria layer (middle layer)
- Indicator layer (lowest level)

AHP determines the relative importance of each phoneme in the hierarchy by comparing the two methods, and then evaluates the subject comprehensively to determine the general order of the relative importance of each factor. AHP will stratify our thinking process, compare the relevant factors one by one, and test whether the comparison results are reasonable, so as to provide a more convincing basis for the analysis of decision-making. The proposed method not only provides a practical decision-making method for dealing with such problems, but also provides a more vague problem of processing, how to establish a comprehensive analysis of the mechanism and causal relationship through scientific analysis Mathematical model of the model.

The idea of analytic hierarchy process is to break down a complex and vague problem into various constituent factors and group these factors into a dominant relationship to form an orderly hierarchical structure. Construct a judgment by comparing the weights between the two factors Matrix, and then comprehensive human judgment to determine the relative importance of decision-making factors in the overall order. [100]

Linear programming (LP) is a mathematical method to achieve the best outcome (such as maximum profit or lowest cost) in a mathematical model whose requirements are represented by linear relationships. [101]

Linear programming can be widely used in business and economics. Linear programming is an important division in operational research. It is a way to assist people in scientific management. In economic management, transportation, agricultural production and other activities, to improve the economic effect is the people's requirements. The procedure for using the AHP[102] can be summarized as

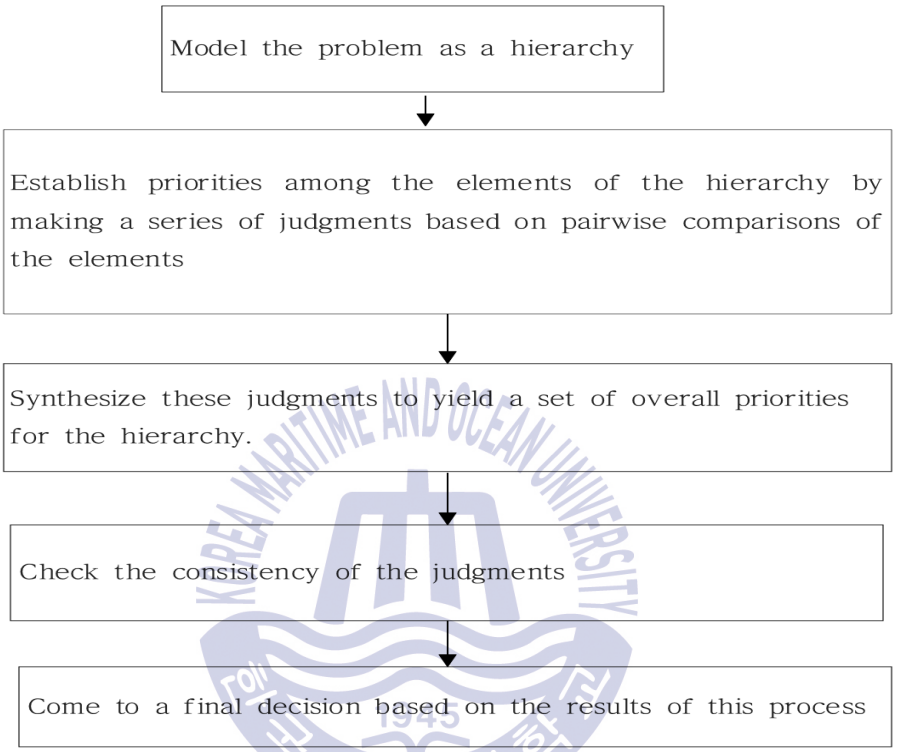
100) Yi Junli, Pang Yan. Based on the financial risk of agricultural products logistics evaluation.[J].Enterprise economy.2012(12):124-128.

101) Linear programming is a special case of mathematical programming (mathematical optimization). https://en.wikipedia.org/wiki/Linear_programming

102) Pang Yan, Xia Yangkun. Risk evaluation of furniture logistics finance of third

shown in Figure 4-1.

Figure 4-1 The procedure for AHP



To improve economic efficiency generally through two methods: first, technical improvements: second, the improvement of production organization and plan, that is reasonable arrangements for human and material resources.

Linear programming is under certain conditions, reasonable arrangements for human resources and other resources, so that the economic results to achieve the best. In general, the problem of the maximum or minimum value of the linear objective function under the linear constraint condition is called the linear programming problem.

Linear programs are problems that can be expressed in canonical form[103] as :

party logistics enterprise.[J].Journal of central south university of forestry & technology.2015 (12):117-132+122

103) In most fields, a canonical form specifies a unique representation for every object,

$$\text{maximaize} \quad c^T X$$

$$\text{subject to} \quad Ax \leq b$$

$$\text{and} \quad x \geq 0 \qquad \text{4-1}$$

x represents the vector of variables (to be determined)

c and b are vectors of (known) coefficients

A is a (known) matrix of coefficients

$(.)^T$ is the matrix transpose

$c^T X$ is the objective function represents for the maximized or minimized

Logistics financial business as a complex system, to determine its evaluation indicators, it is necessary from a different point of view, according to the specific circumstances, the classification of various indicators and comprehensive, in accordance with the principles of scientific indicators to determine the evaluation index system.

Analytic Hierarchy Process (AHP) is a simple tool for evaluating multiple objects under multi-objective and multi-criteria conditions. In the process of logistics, the choice of logistics financial operation can be understood as multi-objective decision-making problem, AHP is to solve the multi-objective decision-making problem, the use of AHP makes the whole process can be quantified, so that the process can reduce the subjectivity, Choose the right combination of logistics services.

In the decision-making of AHP, the main body can be divided into the following steps: analyzing the problem, determining the relationship between the various factors in the system, establishing the hierarchical model of the system; constructing the judgment matrix of the two pairs; calculating the relative weight In the sorting; calculate the elements of the system on the basis of the total weight of the synthesis, and the total sort.

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while a normal form simply specifies its form, without the requirement of uniqueness.
https://en.wikipedia.org/wiki/Linear_programming

The LP method can determine the size of the credit line based on the SMEs, but the flaw of LP is that the weight of each factor is equal.

To solve this problem, this paper attempts to combine AHP method with LP method, use AHP method to calculate the risk weight of small and medium enterprises, and then use the LP method to calculate the logistics company's credit line for small and medium enterprises.

1.3 Structure and Contents

Essay III, discusses logistics risk management evaluation model under unified credit guarantee mode and utilizes the method of combining AHP and LP for the study. First of all, to identify the risks logistics company may occur in the operational process, and then calculated the risk weighting by using AHP method, then constructed LP model by using those as the objective function coefficient, in the constraint of space of warehouse and the total amount of the credit, to maximize the total surplus value of logistics company, after calculated and illustrated the measured result, the strategy that how to choose the enterprise which apply for a loan under unified credit guarantee mode can be concluded finally.

Essay III consists of five parts as follows:

The first part is introduction. This chapter points out the research purpose at the beginning, then introduces the research methods and research scope of this paper, and introduces the structure and contents of each chapter and give the literature review in the end.

The second part is the identification of logistics company may occur from SME in the operational process.

The third part is model building and model solving, through the combined using the AHP and LP, find out a useful way to help logistics company to maximize its profit and avoid of some risks.

The fourth part is the implication of Essay III.

The Last part is the summary of Essay III.

Table 4-1-1 Literature Review of Essay Ⅲ

Author	Published	Methodology of the study	Research Result
Qin Hongbo, Wang Hongqi [104]	2009	AHP	Determining the Weight of Evaluation Index by Analytic Hierarchy Process The fuzzy comprehensive evaluation of the performance of credit management to evaluate, with a view to the establishment of a more feasible credit management performance evaluation system
Li Wenying [105]	2009	AHP	The author introduces the concept, principle and characteristics of AHP in detail. Through the construction and construction of the Panama Canal, the paper points out the significance of the application of the analytic hierarchy process (AHP) in the risk management of the project and the problems that should be paid attention to.
Wang Yong, Chen Yun, Xu Peng[106]	2010	AHP LP	Using AHP and LP to research the way to help 3PL to select the enterprises who want loan from it.
Lili[107]	2010	AHP LP	Under unified credit mode, using AHP and LP together to established a way to set up a model to select the suitable enterprise.

104)Qin Hongbo, Wang Hongqi. Bank credit risk management based on AHP method the construction of performance evaluation model.[J].Financial theory and practice.2009(1):12-14.

105)Li Wenying. Application of AHP analysis in risk management of engineer projects.[J]. Journal of Beijing university of chemical technology.2009(65):45-46+66.

106) Wang Yong, Chen yun, Xu Peng. Research on the choice of small and medium-sized enterprises based on unified credit mode financing.[J]. Technology economic.2010(2):124-129

107)Lili. On selection of small and medium enterprises by TPL under unified credit model.[J].Industrial engineering journal.2010(8):48-52

1.4 Literature Review

This paper summarizes the literatures related to logistics finance and risk management by AHP and the application of LP method in economic management. It is briefly summarized in the literature review of the research methods in general introduction. In Essay Ⅲ, scholars' specific research results is to be included as shown in Table 4-1.

Table 4-1-2 Literature Review of Essay Ⅲ

Author	Published	Methodology of the study	Research Result
Bao Yaodong[108]	2010	AHP	In view of the problem of logistics financial risk, through the use of analytic hierarchy process, to a certain extent, reduce the subjectivity of decision-making issues, making the entire evaluation process can be selected to enhance the choice of scientific.
Zhao Na[109]	2010	LP	Using the research method of LP, analyzes the investment model and production planning model in economic management
Gen Dezhi[110]	2011	LP	The basic model of LP is introduced, and the LP calculation model is discussed.
Tang Jiamian[111]	2011	LP	Discussed and studies the meaning of the linear programming problem in real life. Introduced the background, characteristics and practical application of linear programming problems.

108)Bao Yaodong, Zhang Wuxi. Research on logistics financial risk based on AHP and

Table 4-1-3 Literature Review of Essay Ⅲ

Author	Published	Methodology of the study	Research Result
Dou Lianchi [112)]	2012	AHP	Constructed a hierarchical evaluation index system of enterprise financial indicators from the five aspects of value creation ability, profitability, development ability, operation ability and solvency, and explains the specific examples.
Yi Junli,Pang Yan	2012	AHP	Constructed the index system of financial risk evaluation of typical agricultural products logistics Using AHP to quantitatively analyze the risk factors of agricultural product logistics finance. Put forward the risk prevention strategy in agricultural product logistics financial operation.
Dong Xinlin[113)]	2014	AHP LP	Established a model by using AHP and LP together to choose a suitable enterprise to use the credit from banks under unified credit mode
Lin Guojin[114)]	2015	AHP	Through the analytic hierarchy process, it provides a model reference for the financial risk assessment of the enterprise and puts forward some suggestions on the controllability of the financial risk
Pang Yan, Xia Yang kun	2015	AHP, Fuzzing-AHP	Set up the financial risk evaluation index system of 3PL furniture logistics by Fuzzing-AHP.

its prevention.[J].China logistics & procurement.2010(5):68-69.

109)Zhao Na, Huang ruifang. Application of LP in economy management.[J]. Jounral of Jiyuan vocational and technical college.2010(3):65

110)Gen Dezhi. Research on algorithm of linear programming.[J].Software.2011(6):48-49

111)Tang Jiamian, Zhou Jinwei. The application of linear programming in economic life.[J].Time of commercial.2011(9):10-11

112) Dou Lianchi. Construction and analysis of enterprise financial index evaluation system based on value creation based on analytic hierarchy process-taking an oil

Through the literature Review of AHP and LP, summarized as follows:

☞ AHP and LP made a different way to be used in risk management.

☞ AHP for a single enterprise evaluation can play a very good effect, through the assessment of the various indicators of the enterprise system can help establish a screening for an enterprise. It can help logistics companied to complete the credit risk assessment of SMEs. But can not complete the allocation of credit lines.

☞ The LP model can help companies determine the problem of maximizing profit under the linear equation. The advantage of LP is that it is simple and easy to calculate. The disadvantage is that it can not complete a single assessment of risk management.

☞ The comprehensive utilization of AHP and LP can help the logistics companies to complete the distribution of bank credit lines in the unified credit guarantee mode and help the logistics enterprises get enough profit in this business.

In this paper, based on the research methods used in the literature, the use of literature in the two ways of combining research methods is suitable for logistics company to complete the benefits of maximizing and reducing the risk of the possibility.

2. Risk Identification of Logistics Company

The essence of logistics finance is: to reduce transaction costs and risks, banks to use logistics company to provide logistics information and logistics supervision, according to the logistics supply chain and financial activities.

Under unified credit guarantee mode, according to the size of the warehouse, operating performance, operating status and so on to granted a certain amount to the logistics company. The logistics company can directly use these credit lines to provide

company as an example.[J].Accounting research. 2012(8)136-138.

113) Dong Xinlin, Cao Xuesong, Zhen Wenjin. Research on logistics financial risk evaluation model based on unified credit guarantee Model.[J].Economist.2014(8):66-67

114) Lin Guojin. The application of analytic hierarchy process in enterprise's financial risk assessment.[J].China management information.2015(1):5-7.

flexible pledged loan business to the relevant enterprises. The banks are not directly involved in the specific operation of the pledged loan project.

On behalf of the banks and the SMEs, logistics companies signed the pledge loan contract and the warehousing management service agreement to provide the pledge financing to the SMEs. Under this situation, summaries the viewpoint of Chu Xue Jian (2005), Tang Shaoyi (2005),Chen Jiao [115](2010), Dong Xinlin(2014), logistics companies may occur risks as follows:

2.1 Credit Risk from SME

SME's assets and credit problems arising from the two major problems caused by the loss of logistics companies. SME's operating capacity should be the most significance condition that the logistics company to select customers at first. Because the logistics company to a large extent played a role in the guarantee, when the customer can not repay on time, while the pledge to sell, after the auction is not enough to repay the principal and interest of bank loans, the logistics company will bear joint and several liability.

At the same time, the SME's credit situation is also very important. As mentioned in Essay I, credit risk is the greatest risk in logistics finance. Logistics company, is provide service of small and medium-sized enterprises, it faces the credit crisis than the bank in the unified credit guarantee mode.

In China, SME credit management in addition to the administration and the tax system can be found in the registration of enterprise information, the other information can not easily been appeared. It remains information asymmetry. The SME credit management is an unresolved problem.

2.2 Risks from Mortgage

Evaluate risk

Due to the logistics company's assessment system and the technical imperfections brought about by the risk. The valuation of the value of the collateral is an

115) Chen Jiao. Logistics financial risk prevention and control strategy of third party logistics enterprises.[J]. Joural of Huan industry polytechnic.2010(6):54-56

important element, so the risk of the assessment is worthy of attention. The completeness of the valuation system of the collateral value of the logistics company and the scientific nature of the assessment method will directly affect the accuracy of the valuation of the pledge.

Collateral risk

When the small and medium enterprises due to poor management or other reasons can not return the bank's loan market, collateral must be auction. The risk of collateral is derived from the risk that the collateral can not be sold as expected, mainly in terms of the legitimacy of the pledge, the stability of the price, the ability to realize and the quality.

2.3 Risks of Internal

Manage risk

Logistics companies involved in the process of logistics and financial services because of the management of the imperfect risks. Logistics and financial services related to goods supervision or credit guarantee and other aspects of the content. Therefore, participation in logistics and financial services for the logistics company's internal staff training is very important, employees do not understand the operating process, will give the logistics company unnecessary losses.

Regulatory risk

Logistics companies assume important regulatory tasks, in the operating process, in strict accordance with the warehouse receipts or bill of lading import and export processes, reduce the risk of the emergence.

2.4 Risks from External

China's current logistics and financial business to carry out the better, but the relative legal system is not perfect, there is no matching warehouse receipts laws and regulatory laws, logistics companies as intermediaries need to pay attention to the law is not sound caused controversy.

3. Model Building and Solving

3.1 AHP Analysis

3.1.1 Analytic Hierarchy Chart of SME's Risk Assessment

SME's risk assessment can be from the solvency of the material, the enterprise's marketing ability, the enterprise's financial situation. Based on the research of Bao Yaodong (2010)[116], Wang Yong (2010)[117], Yi Junli (2012)[118] and Pang Yan (2015)[119],

116) The financial and financial risk assessment hierarchy chart of Bao Yaodong includes the following contents:

(1) The risk of collateral	(2) The financial situation of enterprises	(3) Corporate credit capacity
1)The market price of the pledge	1)Solvency	1)Business ability
2)The status of the pledge	2)Profitability	2)Operator credit status
3)The quality of the goods	3)Credit ability	3)Customer integrity

117) Wang Yong's logistics financial risk assessment hierarchy chart includes the following:

(1) The risk of collateral	(2) The financial situation of enterprises	(3) Enterprise marketing ability
1) The market price of the pledge	1) Solvency	1) Main business growth
2) The ability to evaluate the pledge	2) Profitability	2) Market share
3) The quality of the goods	3) Cash flow analysis	3) Advertising costs

118) Yi Junli's logistics financial risk assessment hierarchy chart includes the following:

(1) The risk of collateral	(2) Business situation	(3) Outside the enterprise situation
1) The price of the collateral market price fluctuations	1) The integrity of the enterprise	1) Laws and regulations
2) The choice of the variety of collateral	2) The legitimacy of the goods	2) Industry environment
3) Valuation of goods	3) The future development of enterprises	3) Macro environment

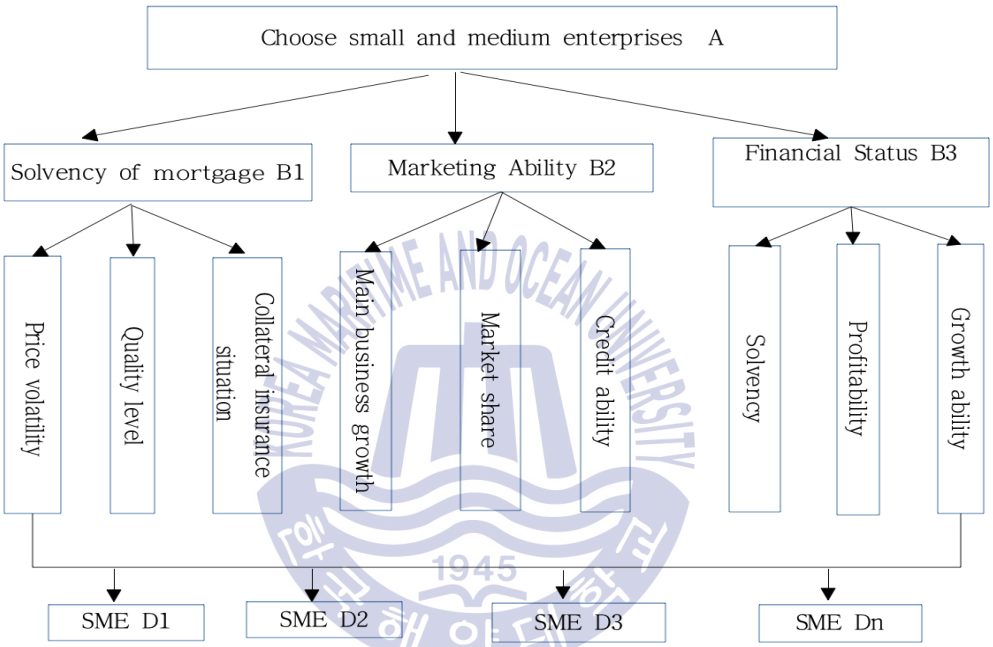
119) Pang Yan's logistics financial risk assessment hierarchy chart includes the following:

(1) The risk of collateral	(2) Business situation	(3) Outside the enterprise situation
1) The market price of the pledge	1) The integrity of the enterprise	1) Laws and regulations
2) The choice of the variety of collateral	2) The financial situation of the enterprise	2) Industry environment
3) Valuation of goods	3) The future development of enterprises	3) Macro environment
4) The insurance situation of the pledge	4) The future development of goods	

the risk assessment hierarchy of SMEs is shown in Figure 4-2

As a pledge as a guarantee, so the customer credit rating, solvency of the study is relatively simple. In the examination of the credit amount of SMEs focused on the enterprise's market sales ability.

Figure 4-2 Analytic Hierarchy Chart of SME's Risk Assessment



After determining the hierarchical structure of the risk assessment of SMEs, and then according to T.L.Saaty quartile method, the establishment of two judgments matrix, respectively, in the judgment matrix were sorted and consistent test on the basis of each request for loans risk combination of SMEs. If the weight is greater, it indicates that the logistics company is facing less risk.

3.1.2 Hypothesis

Based on the research of Wang Yong (2010)[120] and Dong Xinlin (2014)[121], model

120) Wang Yong's analytic hierarchy process model is assumed as follows:
By the end of 2005, a domestic logistics company for more than 500 customers to provide financial financing business. By the end of 2009, the logistics company for the pledge of credit balance of 20 million yuan, the remaining 15,000 square meters

hypothesis as follows:

- A logistics company to carry out a unified credit model of the loan business.
- The pledge loan credit balance of 40 million, the remaining 20,000 square meters of the storehouse, the pledge rate of 80%, the loan period of 6 months.
- The company to carry out this business to be paid to the bank interest rate of 6% interest rate, the company to give loans to small and medium enterprises as an integer.
- At this time there are four companies to apply for a pledge loan to the logistics company, four loan business sample data as shown in Table 4-2.

Table 4-2 Specific Conditions of Financing Enterprises

No.	Interest rate (%)	Mortgage Unit Value Space (square meters / ten thousand yuan)	Evaluation of Pledged Value (Ten Thousand Yuan)
E1	8	4	1300
E2	9	6	900
E3	11	5	700
E4	10	7	1100

3.1.3 Model Analysis

(1) Single-level ordering

According to the banks of the four companies to the results of the survey to list the matrix, find the weight of the matrix, and consistency test.

Where A is the target layer, B is the criterion layer (where B1 is the solvency of

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of inventory area, the pledge rate of 70%, the loan period of 3 months. The company to carry out this business to be paid to the bank interest rate of 7% interest rate, the company to give loans to small and medium enterprises as an integer.

121) Dong Xinglin's analytic hierarchy process model is assumed as follows:

A logistics company opened lending business to four small and medium enterprises. The credit balance for pledged loans is 15 million yuan, the remaining 15,000 square meters of inventory area, the pledge rate of 70%, The company to carry out this business to be paid to the bank interest rate of 6% interest rate, the company to give loans to small and medium enterprises as an integer.

the collateral, B2 is the marketing ability, B3 is the financial condition), and D is the program layer.

1) On the judgment matrix A-B

From the data of the judgment matrix in Table 4-3, we can get the weights w_1 =0.557, w_2=0.320, w_3=0.123. With the help of Table 4-4, upon examination, CR_1 =0.017<0.1, to meet the requirements of consistency.

Table 4-3 Judgment Matrix A-B

A	B1	B2	B3
B1	1.00	2.00	4.00
B2	1/2	1.00	3.00
B3	1/4	1/3	1.00

Table 4-4 Consistency Index Table-RI

N-order	RI	N-order	RI
1	0	16	1.5943
2	0	17	1.6064
3	0.52	18	1.6133
4	0.89	19	1.6207
5	1.12	20	1.6292
6	1.26	21	1.6385
7	1.36	22	1.6403
8	1.41	23	1.6462
9	1.46	24	1.6497
10	1.49	25	1.6556
11	1.52	26	1.6587
12	1.54	27	1.6631
13	1.56	28	1.667
14	1.58	29	1.6693
15	1.59	30	1.6724

2) On the judgment matrix B1-D

From the data of the judgment matrix in Table 4-5, we can get the weights w_1 =0.096, w_2=0.277, w_3=0.161, w_3=0.466. With the help of Table 4-4, upon examination, CR_2=0.0098<0.1, to meet the requirements of consistency.

3) On the judgment matrix B2-D

From the data of the judgment matrix in Table 4-6, we can get the weights w_1 =0.482, w_2=0.088, w_3=0.158, w_4=0.272. With the help of Table 4-4, upon examination, CR_3=0.0054<0.1, to meet the requirements of consistency.

Table 4-5 Judgment Matrix B1-D

B1	D1	D2	D3	D4
D1	1.00	0.33	0.50	0.25
D2	3.00	1.00	2.00	0.50
D3	2.00	0.50	1.00	0.33
D4	4.00	2.00	3.00	1.00

Table 4-6 Judgment Matrix B2-D

B2	D1	D2	D3	D4
D1	1.00	5.00	3.00	2.00
D2	0.20	1.00	0.50	0.33
D3	0.33	2.00	1.00	0.50
D4	0.50	3.00	2.00	1.00

4) On the judgment matrix B3-D

From the data of the judgment matrix in Table 4-7, we can get the weights w_1 =0.490, w_2=0.306, w_3=0.126, w_4=0.079. With the help of Table 4-4, upon examination, CR_4=0.0174<0.1, to meet the requirements of consistency.

Table 4-7 Judgment Matrix B3-D

B3	D1	D2	D3	D4
D1	1.00	2.00	4.00	5.00
D2	0.50	1.00	3.00	4.00
D3	0.25	0.33	1.00	2.00
D4	0.20	0.25	0.50	1.00

(2) Level total-ordering

Based on each single-level sorted weight data, you can now get the risk combination weight data in Table 4-8.

Table 4-8 Risk Combination Weight

B layer	B1	B2	B3	D Layer Hierarchical Ordering of the Total Weight
D layer	0.557	0.32	0.123	
D1	0.096	0.482	0.49	0.268
D2	0.277	0.088	0.306	0.220
D3	0.161	0.158	0.126	0.156
D4	0.466	0.272	0.078	0.356

According to the risk combination weight of each SME who applies for a loan, it is concluded that the greater the weight value, the smaller the risk to the logistics company.

3.2 LP Analysis

3.2.1 The Establishment of Objective Function

After the risk combination weight w_i of each SME is obtained by AHP method, the linear programming model is constructed as the coefficient of objective function.

When the logistics company allocates the quota to the SMEs, the SMEs give the interest of the logistics company r_l, at the same time, logistics company must gives interest r_b to the bank for the rate as they agreed before. So in the unified credit guarantee mode, the logistics company will receive a extra income r_d. Then it can be easily got a formula :

$$r_d = r_l - r_b \qquad 4\text{-}2$$

From the basic formula 4-1, we can get the objective function formula of the surplus value of the logistics company as follows:

$$\max M = \sum_{i=1}^{n} w_i (r_d y_i) \qquad 4\text{-}3$$

$r_d y_i$ represents the interest income obtained from the N0.I small and medium-sized

enterprise

$w_i(r_d y_i)$ represents the surplus value obtained from the No.I small and medium-sized enterprise

M (Total surplus value) represents the total surplus value obtained by the logistics company

3.2.2 Restrictions

The above formula 4-3 must subject to the restrictions as follows:

(1) The total amount of the loan can not exceed the balance of the total credit of the logistics company .

$$\sum_{i=1}^{n} y \leq C$$

C represents for the balance of the total credit of the logistics company

(2) Warehouse capacity constraints

The total volume of mortgage can not exceed the remaining capacity of the warehouse.

$$\sum_{i=1}^{n} Y_i \leq S$$

S represents for the total strage space of logistics company

Y_i represents for the collateral value of the mortgage when the No.i small and medium-sized enterprise give collateral to the logistics company

(3) Credit constraints of small and medium-sized enterprises

In accordance with a certain rate of pledge to convert the value of collateral, the logistics company will give the small and medium-sized enterprise a loan not exceed the pledge multiplied by the total value of the pledge rate.

$$y_i \leq b_i v_i$$

b_i represents for the pledge rate

v_i represents for the value of the collateral

(4) $x_i \geq 0$

3.2.3 Model Calculating

Using the formulas and constraints given in 2.2.1 and 2.2.2, the risk weights for each SME are substituted into formula 5-3.

The following calculation model can be obtained.

$$\max M = 0.268 \times 0.02 \times 0.5 \times y_1 + 0.220 \times 0.03 \times 0.5 \times y_2 + 0.156 \times 0.05 \times 0.5 \times y_3 + 0.356 \times 0.04 \times 0.5 \times y_4$$

$$st.$$

$$y_1 + y_2 + y_3 + y \leq 4000$$

$$y_1 \leq 1300 \times 0.8; \quad y_2 \leq 900 \times 0.8$$

$$y_3 \leq 700 \times 0.8; \quad y_4 \leq 1100 \times 0.8$$

$$\frac{y_1}{0.8} \times 4 + \frac{y_2}{0.8} \times 6 + \frac{y_3}{0.8} \times 5 + \frac{y_4}{0.8} \times 7 \leq 20000$$

$$y_i \geq 0, \text{ and } y_i \bigcap \geq r$$

$$i = 1, 2, 3, 4$$

Use Lingo 11.0, set up a program as follows:

```
model:

max=0.00268*y1+0.003340*y2+0.0039*y3+0.0071*y4;

y1+y2+y3+y4<=4000;

y1<=1040;       y2<=720;

y3<=560;        y4<=880;

5*y1+7.5*y2+6.25*y3+8.75*y4<=20000;

@gin(y1);       @gin(y2);

@gin(y3);       @gin(y4);

end
```

Run the above procedure to get the following results :

Table 4-9 Results of the Lingo11.0

Global optimal solution found.			
Objective value:	12.82240		
Objective bound:	12.82240		
In feasibilities:	0.000000		
Extended solver steps:	0		
Total solver iterations:	0		
	Variable	Value	Reduced Cost
	y_1	1040.000	-0.2680000E-02
	y_2	480.0000	-0.3340000E-02
	y_3	560.0000	-0.3900000E-02
	y_4	880.0000	-0.7100000E-02

It can receive the final result as follows:

$y_1 = 1040$; $y_2 = 480$

$y_3 = 560$; $y_4 = 880$

The last amount of loan available is as follows:

E1 is 10.4 million yuan; E2 is 4.8 million yuan.

E3 is 5.6 million yuan; E4 is 8.8 million yuan.

4. Policy Implication

Under unified credit guarantee mode, the logistics company can get a interest balance between bank interest rates and the loan interest rate. It is an important part of logistics company's business.

In this paper, the analytic hierarchy process and linear programming are used together. First, use AHP to calculate the risk weight, and then use it as an objective function to construct the LP model of loan amount.

From the results of analysis, in order to reduce the outside and inside risk in the logistics financial business, logistics companies should adopt strategies as follows:

- The logistics company establishes the credit management platform of the small and medium-sized enterprises and shares the information with the bank to ensure that the customer's credit is monitored at any time.
- Logistics companies to establish a sound assessment of the pledge system, through the system can make accurate judgments for the market price and the value of goods.
- Logistics companies to cultivate a high level of operational personnel which can reduce operational risk.
- Logistics companies to establish a sound warehouse receipt system to ensure the legitimacy of warehouse receipts.
- Logistics companies to establish the capacity of the warehouse early warning mechanism to ensure that the warehouse has enough collateral storage space.

5. Summary of Essay Ⅲ

In the actual business process, a single factor analysis or AHP analysis method, can only determine the risk of a single enterprise loan, and can not be a reasonable allocation of loans to the same time apply for small and medium enterprises.

On the basis of other scholars 'research, Essay Ⅲ analyzes the components of the hierarchical analysis structure of other scholars' judgment of financial risk of small and medium-sized enterprises, and summarizes some factors, and lists the new hierarchical structure diagram.

Essay Ⅲ analyzes the main research results of each article, and concludes with the integrated research method of AHP and LP to solve the problem of unified credit guarantee mode, AHP method and the LP method are used together to establish the model of logistics enterprises to select small and medium-sized enterprises according to the warehouse capacity and the total amount of loans under the consideration of risk control.

From the conclusion had been got, the size of the mortgage risk of the loan enterprise and the size of the loan interest rate which the loan company committed to give to the logistics company is not the only standard for the logistics company to

select. In the actual choice of small and medium enterprises, should take into account the interest rate and risk weight on the logistics enterprises to obtain the impact of the residual value of the collateral.

Of course, the model provided in this article only considers the situation of single profit, and simplifies the discussion of many costs. So in the final practical choice, the need for logistics enterprises according to the actual situation to make the most rational choice.

Summary and Conclusion

1.1 Summary of Research

In China, the logistics financial service as the product of the combination of logistics industry and the financial industry has a very broad prospects in China. As the SMEs are allowed to use their own warehouse receipts, finished goods, accounts receivable and other resources to mortgage, pledge for obtaining loans in logistics financial service, that provides favorable conditions for SMEs financing services and cash flow, and also provides a new source of profits for the logistics companies and Banks even when in the case of market saturation.

However, logistics finance is a new way of financing, the development time is short in China, so there are a lot of factors need to be studied in the law, operation process, business model, personnel quality, information systems, risk management and so on.

In this paper, the author has selected part of the risk management for studying. In the course of the study, it is sure that the unified credit guarantee model in the Chinese market can be carried out healthily. This paper discusses the credit risk management in the logistics financial risk management from the view of game theory, and provides a theoretical basis for financing institution with how to select the appropriate logistics companies to credit, and also this paper discusses how the logistics companies allocate the loan amount of SMEs. By solving these problems, the financing costs and the risk of financing can be reduced; the operational efficiency of banks and logistics companies can be improved; and the development of China's logistics industry will be promoted healthily and rapidly.

This paper takes the unified credit guarantee model of logistics finance as the research object, and makes a comprehensive and systematic study of the above key problems through the basic theory of statistics and game theory.

Essay I

Credit risk restricts the development of China's logistics and financial business, effective control and prevention of credit risk will provide a strong guarantee to

crack the financing bottleneck of China's SMEs and the healthy development of the national economy.

In Essay I, firstly idtentify the credit risk of bank and logistics company and then use game theory to mainly analyzes the subjective credit risk of logistics companies and banks .

Establishes the two-party game model between bank and SME. Measures and analyzes the integrity probability of the SME and the supervision probability of bank.

Establishes the tripartite game among bank, SME and logistics company, through the model building and solving, get the probability of integrity of SME, the supervision probability of bank and the compliance probability of logistics company. so as to provide a theoretical basis for logistics finance credit risk control.

On the basis of the hypothesis of other scholars' modeling, this paper establishes the game analysis between banks and small and medium-sized enterprises, the game analysis between banks, logistics companies and small and medium-sized enterprises. In the establishment of the model to follow the other scholars of the modeling ideas, but in the model to solve ideas on the innovation.

In the game analysis of other scholars, it is only a single way to solve the equilibrium solution of the mixed strategy. This solution can understand the factors that affect the cost of bank supervision, the performance cost of logistics enterprises, the credit cost of small and medium-sized enterprises, but can not clearly show the impact of the probability of bank supervision, logistics companies and the probability of SME integrity probability of the factors.

In the process of model solving, not only the equilibrium solution of the mixed strategy is used, but also the method of solving the pure strategy is used to analyze the probability by setting the probability to 1 or 0. Through the solution of pure strategy, we can quickly analyze the probability of bank supervision, the probability of logistics company and the probability of honesty and trustworthiness of small and medium-sized enterprises. And is also a test of the equilibrium solution of the mixed strategy.

Essay Ⅱ

Under unified credit guarantee mode, the banks authorize the amount of credit to the logistics company according to the business size, operating performance and the credit level, then the logistics company pledges loans and processes the final settlement based on the demands and conditions of the customers. When carrying on the logistics financial business under unified credit guarantee mode, it is very important for banks to measure the risk of logistics companies.

Under unified financial guarantee model, for banks, the focus of the inspection is the logistics company. The comprehensive strength of logistics companies includes the basic quality of enterprises, solvency, profitability, innovation, growth potential and credit records. These six elements reflect the business capacity and credit status of their own scientifically and comprehensively.

At the same time, it simplifies the business process of banks to choose logistics risk, and can promote the further development and improvement of logistics and financial business.

Most of the academic papers, the general use of analytic hierarchy process to calculate the risks faced by an enterprise. For banks, it is a time-consuming thing to do if each financing project is to be done using tedious analytic hierarchy process.

In this paper, being studied the model of logistics financial business, and find that in the unified credit guarantee mode, the bank only needs to complete the credit task, and do not need to participate in the logistics financial supervision tasks. Under this business mode, the basic need of bank is to consider the risk from logistics companies to complete the financing project, so as to avoid the risk from the small and medium enterprises.

After identifying the risks encountered by the bank, this paper adopts the other scholars' model foundation and uses the factor analysis method to analyze the financial data of the logistics company. On the basis of fully studying the indexes of other scholars' modeling, this paper chooses some indexes which have obvious influence on the profitability, solvency, growth ability and management ability as the

basis of the index system. The paper puts forward a new reference system for the bank selection logistics company under the unified credit guarantee mode.

Essay Ⅲ

The bank gives a certain amount of credit to the logistics companies based on their capacity and credit status scale, and they signed a credit agreement and bear unlimited liability. After obtaining the loan, logistics companies carry on negotiation with SMEs applied for pledged loans. SMEs keep the pledge in the logistics warehouse, and the logistics company according to the status of the pledge and the SME credit rating, operation, finance and other conditions to give the corresponding credit line.

In this model, logistics companies carry on negotiation with SMEs directly, and has the right to decide which SMEs to choose and how much credit will be.

There are many options for the current selection, such as Analytic Hierarchy Process (AHP), Linear Programming (LP), and so on. Based on the combination of AHP and LP, the risk weight is calculated by AHP method, and the LP model is constructed as the coefficient of objective function. Calculate the measurement results and make a description, so as to obtain a unified credit guarantee mode, how to choose to apply for a loan business strategy.

1.2 Conclusion of Research

Essay Ⅰ

In Essay I, through the analysis of the game between the two main body of the traditional credit business and the tripartite game of the three main body of logistics financial business, it can be found that the credit risk of the banks in the logistics finance can be reduced from the following aspects:

- Banks should strengthen the dynamic risk monitoring of the logistics enterprises and the SMEs.
- Banks should reduce the information asymmetry of SMEs and logistics companies.
- Banks should fully, timely, comprehensively and effectively reflect and disclosure

the risk of loss.

- Banks should reduce the cost of supervision.
- Banks should establish a reliable and sound data processing system which can help it to improve the efficiency of market supervision
- Banks should make a long-term cooperation with logistics companies which can conducive to the supervision of SMEs.
- Put the effective incentive mechanism into the logistics financial contract.
- Put the design of the default penalty mechanism into the logistics financial.
- Logistics companies establish a credit management sharing platform with the bank.
- Logistics companies increase the method of assessing the value of the collateral.
- Logistics companies to increase the monitoring and management of small and medium enterprises.

The development of logistics financial risk, and the prevention and control of credit risk, are inseparable from the joint efforts of government departments and the main bodies participating in logistics finance logistics. Government departments need to regulate the market order, improve the legal environment, builds credit risk prevention system.

Banks need to strengthen the customer's credit review, build enterprise credit information database, establish a long-term strategic cooperative relationship with logistics enterprises, improve the reward and punishment mechanism, timely introduce credit rating agencies, and choose the customers scientifically and objectively.

Logistics companies need to establish a scientific credit risk index system and evaluation system. As the bridge between banks and SMEs to establish a trust relationship among the three parts,

SMEs need to correctly select the cooperative logistics companies, comply with the provisions of the contract, perform the contract on time, and keep good credit.

Essay Ⅱ

This paper takes the bank as the research subject, and explores the data model of the bank selection logistics company under the unified credit guarantee mode.

Through the analysis of the previous scholars' papers, this paper chooses the factor analysis method as the foundation of the model.

Through the method of factor analysis, this paper establishes the formula of calculating the weight of each factor under the unified credit guarantee mode, and helps the banks to choose the less risky logistics companies through the formula. At the same time, this paper puts forward the following conclusions and policy implication on the current situation of banks and logistics companies.

- Banks to establish a sound logistics company assessment system, and connect with the stock exchange analysis system to share the annual report. This system will help banks to grasp the most reliable and the latest logistics company financial data.
- Banks and business management departments to connect the inquiry system to help banks confirm the true identity of the logistics company whether there is fraud.
- Bank and the tax department's query system for information sharing, to keep abreast of the logistics company's capital changes.
- Person in charge of the logistics company's credit guarantee account.
- To train high-quality financial analysis staff, proficient in enterprise financial data analysis, to help banks analysis the variety of data quickly.

Essay Ⅲ

Under unified credit guarantee mode, the logistics company can get a interest balance between bank interest rates and the loan interest rate. It is an important part of logistics company's business.

In this paper, the analytic hierarchy process and linear programming are used together. First, use AHP to calculate the risk weight, and then use it as an objective

function to construct the LP model of loan amount.

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- Logistics companies to cultivate a high level of operational personnel which can reduce operational risk.
- Logistics companies to establish a sound warehouse receipt system to ensure the legitimacy of warehouse receipts.
- Logistics companies to establish the capacity of the warehouse early warning mechanism to ensure that the warehouse has enough collateral storage space.

1.3 Research prospects in the future

This paper is a preliminary study and discussion on some problems in logistics financial risk management, and the author's level is limited, and there are still many shortcomings, believing that the research will get more and more attention. The need for further work in the future includes:

(1) This paper study the risk management problem under the credit guarantee mode. Different financing modes have different business management processes, operational norms and risk points. SMEs in different industries will also have different financing schemes, and relative operational and management issues need to be studied in depth. This paper only utilizes the principal-agent theory to study the information asymmetry between the various subjects of logistics finance. The research of moral hazard is the next research point.

(2) The logistics and financial business also involves business risk, legal risk,

operational risk, industry risk, system risk and so on, and establishing a rigorous quantitative early warning model and the processing mechanism will be the future research direction.

(3) The prediction of the pledge of SMEs involves a lot of contents, such as the pledge time of the pledge and the way of pledging. These forecasts are related to the profit of the parties to the loan and need to be considered in the future.

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