

## *Original Paper*

# Supply Chain Finance and Financing Constraints on SMEs—An Empirical Analysis of Software Company

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### ***Abstract***

*With the perspective of small and medium-sized enterprises in China, it has trouble getting financing. Based on cash - cash flow sensitivity model, this paper figures out the existence of financial constraints on SMEs in software industry and supply chain finance's effect on it. The cash flow sensitivity of cash and supply chain finance's effectiveness are evaluated using a large sample of listed companies on the SME board from 2008 to 2018. Through empirical analysis and robustness checks, it is concluded that SMEs in software industry have financing difficulties and supply chain finance can alleviate this financial dilemma to some extent. Furthermore, the essay analyzes risk points of three different forms of supply chain finance and puts forward some suggestions about risk management for small and medium-sized enterprises, bank and third-party logistics.*

### ***Keywords***

*supply chain finance, financing constraints, small and medium-sized enterprises, cash - cash flow sensitivity, software company, risk management*

## **1. Introduction**

China's supply chain finance has developed from scratch, from simple to complex in just over a decade. The scale of China's supply chain financial market in 2015 has now exceeded 10 trillion yuan, which is expected to reach nearly 15 trillion yuan by 2020, with a huge stock market space. China's supply chain finance has been developing rapidly, and many innovations have been made for local enterprises. In the second half year of 2001, Shenzhen Development Bank, the first bank in China to start the innovation of supply chain financial products, began to pilot survival financing business in Guangzhou and Foshan branches.

Supply Chain Finance (SCF) is a professional field of commercial bank credit business in bank level, and is also a financing channel for enterprises in enterprise level, especially small and medium-sized enterprises. It is a financing mode that banks connect core enterprises with upstream and downstream enterprises to provide flexible financial products and services. Supply Chain Finance is different from the traditional bank loan in three ways, liability, interest rate and payment clauses. Compared with bank loan, supply chain finance will not add any liability entries to the balance sheet. The second feature is relatively low interest rate. According to the supply chain finance plan, suppliers who want to be paid in advance will be able to obtain funds at the interest rate related to the buyer's reputation. Therefore, interest rates are not as demanding and strict as banks. Furthermore, one of the biggest benefits of participating in the supply chain finance program is that payment terms with financial institutions can be adjusted so that buyers have enough time to pay invoices while meeting suppliers' payments. These three features make supply chain finance a better financing way for small and medium-sized enterprises compared with bank loan.

Supply chain financing has customized three business models to solve the cash flow gap of small and medium-sized enterprises (SMEs). The first mode is supply chain financing in the stage of sales, in other words, financing mode of accounts receivable. Receivables financing mode refers to the business mode that the seller transfers the undue receivables under the credit sale to the financial institutions, and the financial institutions provide financing for the seller. The receivables financing based on the supply chain is generally for the small and medium-sized enterprises in the upstream of the supply chain. The second mode is inventory financing, which is supply chain financing in operation stage. The chattel pledge business is a business in which banks issue credit loans to borrowers with the borrower's own goods as collateral. Due to the strong liquidity of raw materials, finished products and other movable properties, as well as the provisions of China's laws on the effective conditions of mortgage and pledge, financial institutions are facing great challenges in the aspects of logistics tracking, storage supervision, mortgage and pledge procedures handling, price monitoring and even realization and liquidation of movable properties, which brings huge risks to financial institutions' loans. Therefore, chattels have always been unpopular with financial institutions. Even if small and medium-sized enterprises have a lot of chattels, they cannot get loans accordingly. Based on this, the supply chain financing mode designs the chattel pledge financing mode under the supply chain. The third mode is prepayment financing mode, which represent supply chain financing in purchasing stage. In terms of product classification, prepayment financing can be understood as "financing of future inventory". From the perspective of risk control, the guarantee basis of prepayment financing is the right of customer to take delivery of goods to suppliers under prepayment, or the in-transit inventory and inventory formed through delivery, transportation and other links after the realization of the right of taking delivery. In the case of delivery right financing, such as guaranteed delivery (or confirmed warehouse), this means that the customer pays the advance payment to the upstream through bank financing, the upstream will issue the delivery note after receiving it, and the customer will pledge the

delivery note to the bank. After that, the customer will pay the bank in installments to pick up the goods in installments.

So far, China's supply chain finance has experienced three stages. The first era is also known as offline "1+n", composed of core enterprises and multiple upstream and downstream enterprises. According to the credit support of only one core enterprise, financial institutions complete the financing and credit support for multiple small and medium-sized enterprises. The second era is called "1+n" online, it moves the traditional offline supply chain finance to the online, makes the data of the core enterprise complete the docking with the financial institutions, so that the financial institutions can obtain all kinds of real business information such as storage and payment of the core enterprise and the upstream and downstream enterprises of the industrial chain at any time. The third era is referred to as online "n+n", which is based on all data e-commerce cloud services, including core enterprises and multiple upstream and downstream enterprises.

The main research purpose of research in this paper is to determine whether the development of supply chain finance can solve the financing difficulties of small and medium-sized enterprises and to give suggestion for these enterprises so that they can use SCF services more wisely. This paper selects information technology industry as the main research industry. It involves a qualitative semi-structured interview and empirical analysis in order to test the hypothesis. The whole analysis comes to two conclusions, the first is that financial constraints surely exist among SMEs despite the bank loans, and the second is that SCF can alleviate this kind of financial constraints to some extent. Finally, considering this two conclusions and the fact that SCF is not very popularized in China, this paper analyzes the risks of supply chain finance and strategies to deal with risks of supply chain finance in order to give suggestions for banks and enterprises about how to better provide SCF services and how to make use of this kind of service.

## 2. Literature Review

This paper relates to literatures in four aspects: financial constraints of SMEs, supply chain finance, relevant models and supply chain risks management.

### 2.1 Literature about Financial Constraints on SMEs

There are plenty of researches about financing constraints of small and medium-sized enterprises (SMEs). Thorsten et al. (2006) states the phenomenon that SMEs have limited access to external financing is common both in developing and developed countries.

### 2.2 Literature about Supply Chain Finance

Supply chain finance, also known as reverse factoring, has been originated from large and reliable enterprises' intention to alleviate the financing pressure of their supplies (Lekakos et al., 2016). Lamoureux et al. (2011) holds the view that supply chain finance has increased the competitiveness and resilience of global value chain.

### *2.3 Literature about Relevant Model*

As for the model used in this field, most research is based on investment - cash flow model proposed by Fazzari et al. (1988) and cash - cash flow sensitivity model in Almeida's (2004) essay. In the first model, sensitivity of investment to cash flow is used to measure the extent of financial constraints, which assumes firms rely on internal cash flow for investment when limited by external financing. This indicates a positive sensitivity of investment to cash flow. The basic theory contained in the second model is that the severer the financing constraints are, the more frequently companies will save cash out of cash flow, or in other words, positive cash - cash flow sensitivity.

### *2.4 Literature about Risk Management in Supply Chain Finance*

Risks of supply chain management has been thoroughly studied over the last six decades. The authors of this paper selected and analyzed articles that relate closely to the topic and help achieve the purpose of this article. Supply Tang (2006) divided risks of supply chain management into four categories, supply, demand, product, and information management after summarizing the quantitative models that applied in over two hundred journal articles. Rao and Goldsby (2009) integrated different literature into risk factor types including industrial, environmental, organizational, problem oriented, and policymakers-related factors. In Tang and Musa's paper in 2011, potential risks related to material flow, capital flow and information flow are identified and classified.

This paper is related to four main studies on financial risk assessment. Tsai (2008) simulates cash flow risks that are related to supply chain finance through the value of standard deviation of cash inflow, cash outflow and net cash flow in each period of a project horizon. In Tsai's research, suggestions for corporations which provide financing services are also given. The author proposed the best policy of asset-backed securities to finance receivables, so as to shorten the cash conversion cycle and reduce the risk of cash inflow. Liu and nagurney (2011) established a variational inequality model to investigate the effects of foreign exchange risk and competition intensity on supply chain companies participating in offshore outsourcing activities. Simulation results show that in general, the profitability and risk of risk averse enterprises are lower than that of risk neutral enterprises. There are two other studies that focuses on generic supply chain finance risks. Franca et al. (2010) has developed a programming model that involves multiple objectives with Six Sigma concepts to assess financial risk. The results show that the financial risk becomes lower with the improvement of sigma level. Lastly, Liu and Cruz (2012) looked into the influence of supply chain corporations' financial risks and economic uncertainty on value, profit and efficiency of decision-making of the whole supply chain. The contribution of this article is discovering suppliers' willingness to lower their profit margins in order to get more opportunities for business transactions from the manufacturers, who possess relatively lower financial risk and sensitivity to economic uncertainty. However, these methods have a common disadvantage of low practicability because these investigations all focus on simulation data rather than real case data.

### 3. Proposition

Compared with large companies, small and medium-sized enterprises (SMEs) in China have face challenges to obtain financing for their operations due to a relatively low credit, limited operating history and weak profitability, thus decreasing the willingness and possibility that financial institutions especially banks would lend money to them. Such financial constraints exert a negative impact on the development and growth of SMEs since it cannot afford spending and investment in the future. However, supply chain finance, which links upstream and downstream firms, banks and third-party logistics for lower costs, makes full use of the core corporations' credit advantages and provides financing convenience to SMEs. Based on the above theoretical analysis, hypothesis 1 and 2 are proposed in this paper.

*Hypothesis 1: SMEs in information technology industry have financial constraints, namely positive cash-cash flow sensitivity.*

*Hypothesis 2: The development of supply chain finance can alleviate the financial constraints of SMEs in information technology industry.*

### 4. Methodology

In this essay, research is conducted by both qualitative and quantitative techniques to test two hypotheses. In terms of the qualitative approach, we use semi-structured interview to ask employees and employers from 15 typical software companies several questions concerning financial constraints and supply chain finance. When it comes to the quantitative aspect, data from 61 small and medium-sized listed companies in software industry is evaluated by means of cash - cash flow sensitivity model.

#### 4.1 Qualitative Method

As for qualitative method, semi-structured interview is applied to investigate two hypotheses. 15 typical SMEs in software industry, including YG SoftInc, DHC Software Inc and Guomai Technologies Inc, participated to this interview. We centered the inquiry on whether these corporations have face the difficulty of raising funds through traditional financing methods, their familiarity and usage of supply chain finance and what the implication of supply chain finance is. After the survey, their answers are collected and summarized in qualitative results. Detailed questions of the interview are listed in the appendix.

#### 4.2 Quantitative Method

In the literature, there are primary two models to investigate the effect of financial constraints on SMEs: investment-cash flow model (Fazzari et al., 1988) and cash - cash flow sensitivity model (Almeida, 2004). However, investment - cash model is reported to be inconsistent with the real situation (Note 1). Meanwhile, cash - cash flow sensitivity model has become more acceptable in academia and is used in this paper (Note 2).

Almeida (2004) relates financial constraints to the firm's inclination to save cash out of cash inflows, or

in other words, the cash flow sensitivity of cash. For instance, firms that lacks enough funds are more likely to hold cash for later payment while others might not suffer from this shortage. This means that financially constrained enterprises have a positive cash - cash flow sensitivity.

Therefore, the cash flow sensitivity of cash can be regarded as an effective and reasonable criterion to assess financial constraints on SMEs. In Almeida's (2004) essay, there are two models: baseline and extended model. Here, we use the extended model to verify the cash flow sensitivity of cash and the impact of supply chain finance.

In order to test hypothesis 1, the first formula of model (1) is shown below:

$$\Delta CASH_{i,t} = \alpha_0 + \alpha_1 CF_{i,t} + \alpha_2 EXPEN_{i,t} + \alpha_3 \Delta NWC_{i,t} + \alpha_4 \Delta SAD_{i,t} + \alpha_5 Control Var_{i,t} + \varepsilon_{i,t} \quad (1)$$

Variables are defined as follows:  $\Delta CASH_{i,t}$  is the difference of cash and marketable securities held by a single enterprise each year,  $CF_{i,t}$  is the cash flow from operation,  $EXPEN_{i,t}$  is the capital expenditure of the enterprise,  $SAD_{i,t}$  is the short-term debt,  $Control Var_{i,t}$  is the control item and  $\varepsilon_{i,t}$  is the error term. In this model, control item consists of SIZE, SALE and TQ (Tobin Q value). In addition, i means the  $i^{th}$  company and t represents the year. Considering economies of scale in cash management,  $\Delta CASH_{i,t}$ ,  $CF_{i,t}$ ,  $EXPEN_{i,t}$ ,  $\Delta NWC_{i,t}$  and  $\Delta SAD_{i,t}$  should be divided by  $TA_{i,t}$  (total asset). In the model (1),  $\alpha_1$  is the cash-cash flow sensitivity and it will be positive if enterprises are in shortage of capital.

In order to test hypothesis 2, this paper establishes model (2), which is the expanded form of model (1) and adds the influencing factor of supply chain finance. According to indicators adopted by Xue and Zhang (2015), this paper measures supply chain finance in three aspects: short-term loans, commercial bills, and discounted bills (Note 3). The second equation of model (2) is shown below:

$$\Delta CASH_{i,t} = \alpha_0 + \alpha_1 CF_{i,t} + \alpha_2 SCF_t + \alpha_3 SCF_t * CF_{i,t} + \alpha_4 EXPEN_{i,t} + \alpha_5 \Delta NWC_{i,t} + \alpha_6 \Delta SAD_{i,t} + \alpha_7 Control Var_{i,t} + \varepsilon_{i,t} \quad (2)$$

Among them, SCF is the indicator of supply chain finance and  $SCF \times CF$  is the interaction term of supply chain finance and operating cash flow. In model (2),  $\alpha_3$  is the coefficient of interaction term. To better understand the meaning of  $\alpha_3$ , we obtain the following equation:

$$\frac{\partial \Delta CASH_{i,t}}{\partial CF_{i,t}} = \alpha_1 + \alpha_3 SCF_t$$

From this equation, it is apparent that  $\alpha_3$  reflects the impact of current supply chain finance on corporate financing constraints. According to its meaning, this number should be negative if assumption 2 is true, that is, supply chain finance proves effective in mitigating financing constraints. Other variables have the same meaning as model (1).

Table 1 gives a detailed description of variables in model (1) and (2).

**Table 1. Variable Description**

Variables	Description
CASH	Cash holdings, including cash and marketable securities
CF	Operating cash flow
EXPEN	Capital expenditure, includes fixed asset, intangible asset and other long-term asset
NWC	Net working capital
SAD	Short term liability
TA	Total asset
SCF	SCF:(discounted bills + short-term loans + commercial bills)/GDP
SALE	Sales revenue/total asset
SIZE	In(total asset)
TQ	Market value/total net asset

## 5. Results

This part is composed of two sections: qualitative results and quantitative results. At first, qualitative results provide a generous understanding of financial constraints and supply chain finance. Secondly, quantitative results directly reveal the relationship among different variables through concrete and accurate statistics.

### 5.1 Qualitative Results

After communicating with employers and employees from these 15 SMEs in China, it is found that almost every people assure the existence of financial difficulties in their companies while only part of software enterprises have ever used the supply chain finance to tackle such problems. This phenomenon indicates that supply chain finance is not widely accepted in China and it has great potential in capital market. Compared to supply chain finance, traditional financial approach, for example bank loan, is still the most frequently used among SMEs. For those who have already taken the advantage of supply chain finance, they illustrate the benefit of supply chain finance by persuasive arguments that supply chain finance provides easier access to raising capital than bank loans and relieves their financial constraints, thus improving the performance of SMEs. Moreover, the majority of them points out the increase of profit and sales revenue after the introduction of supply chainfinance. To sum up, it can be deduced from the response of these 15 samples that SMEs in information technology industry have financial constraints and the development of supply chain finance can alleviate their financial constraints to some extent.

### 5.2 Quantitative Results

This paper takes small and medium-sized listed companies in software industry as the research subject and selects the data from 2008 to 2018 as the sample. The relevant data are from CSMAR database, The People's Bank of China and National Bureau of Statistics of China. Before empirical analysis, data

processing excludes the samples of St / Pt and companies whose time of listing is less than 3 years, in order to ensure the stability of statistics and eliminate companies with missing and imperfect data. At last, we chose 53 software companies to make further examination. The data processing and statistical analysis of this paper are completed by Stata 12.0 and SPSS 20.0. After processing, this paper finally obtained 4576 sample observations.

### 5.2.1 Descriptive Statistics Analysis

Table 2 displays the summary of major variables in this model. From the results, the average value of  $\Delta\text{cash}$  is close to zero and its standard deviation is about 0.08, which implies the variation of cash holdings among SMEs in software industry is small. Additionally, the standard deviation of CF is 0.1677 and this means there exists fluctuation in the operating cash flow among SMEs to some extent. Other variables are in a reasonable range and this ensures the reliability and representativeness of the survey data.

**Table 2. Summary Statistics of Cash Holdings**

Variables	Mean	Min	Max	Standard deviation
$\Delta\text{CASH}$	0.0482	-0.4253	0.8268	0.0810
CF	0.0666	-0.2262	0.4748	0.1677
EXPEN	0.0577	0	0.4429	0.0634
$\Delta\text{NWC}$	-0.2507	-0.8648	0.3317	0.2022
$\Delta\text{SAD}$	0.2573	0.0178	0.7607	0.1549
SCF	1.0524	0.4265	1.8787	0.3795
SALE	0.5317	0.0647	2.1726	0.3038
SIZE	9.1672	8.0449	10.2197	0.4504
TQ	4.5660	0	53.3442	4.7907

*Source:* CSMAR database, The People's Bank of China and National Bureau of Statistics of China.

### 5.2.2 Correlation Test

Table 3 shows the results of correlation analysis. It can be concluded that most correlation coefficients between variables are relatively low but some reach to approximately 0.5. Moreover, the correlation between the  $\Delta\text{CASH}$  and the CF is positive, which can generously demonstrate the rationality of hypothesis 1 and the validity of this model.



**Table 3. Correlation Test Results**

	$\Delta$ CASH	CF	EXPEN	$\Delta$ NWC	$\Delta$ SAD	SCF	SALE	SIZE	TQ
$\Delta$ CASH	1								
CF	0.1620***	1							
EXPEN	-0.1337***	0.1611***	1						
$\Delta$ NWC	-0.4079***	0.1486***	0.2236***	1					
$\Delta$ SAD	-0.1276**	-0.0752*	-0.0027	0.3790***	1				
SCF	0.0385	-0.0015	-0.0494	0.0503	-0.0976**	1			
SALE	-0.0030	0.3122***	0.1194***	0.1909***	0.5026***	-0.1444***	1		
SIZE	-0.0595	-0.2566***	-0.2749***	0.1387***	-0.0437	0.0765*	-0.3462***	1	
TQ	0.0285	0.0494	-0.0730*	-0.0259	-0.0597	0.4537***	-0.0995**	0.0535	1

\*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10%(two-tail) test levels, respectively.

Source: CSMAR database, The People's Bank of China and National Bureau of Statistics of China.

With the purpose of testing multicollinearity, further analysis is made. From the following table, all VIF is less than 10 and the mean VIF is 3.18. In summary, there is no severe multicollinearity among these variables.

**Table 4. VIF Results**

Variable	VIF
CF	8.76
SCF	1.77
SCF*CF	9.20
EXPEN	1.20
$\Delta$ NWC	1.42
$\Delta$ SAD	1.74
SALE	1.82
SIZE	1.40
TQ	1.32
Mean VIF	3.18

Source: CSMAR database, The People's Bank of China and National Bureau of Statistics of China.

### 5.2.3 Regression Analysis

Table 5 is the regression results of hypothesis 1 and hypothesis 2. In model (1) and model (2), the coefficient between cash and cash flow is positive at 1% significance level, which proves that the positive cash-cash flow sensitivity of enterprises does exist, and there are financing constraints for small and medium-sized software enterprises in China. Therefore, hypothesis 1 is true. With regard to the coefficient of the interaction term, it turns out to be negative, which points out that supply chain finance does alleviate the financing constraints on SMEs in software industry. In consequence,

hypothesis 2 holds. F values of two regression results are 1.96 and 1.98 respectively, which proves that the regression results are persuasive and the conclusion is relatively reliable.

**Table 5. Regression Results**

	$\Delta$ CASH	
	Model (1)	Model (2)
CF	0.9206***	1.0789***
SCF		0.0470**
SCF*CF		-0.1481
EXPEN	-0.2327**	-0.2257*
$\Delta$ NWC	-0.6592***	-0.6797***
$\Delta$ SAD	0.1195*	-0.1379*
SALE	-0.0416	-0.0253
SIZE	0.0325	0.0416*
TQ	0.0005	-0.0009
F value	1.96	1.98

\*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% (two-tail) test levels, respectively.

Source: CSMAR database, The People's Bank of China and National Bureau of Statistics of China.

#### 5.2.4 Robustness Checks

In order to ensure the integrity and accuracy of previous empirical results, this part will use the basic cash - cash flow sensitivity model in Almeida's (2004) essay to test its robustness. Specific regression results are listed in Table 6.

**Table 6. Robustness Test Results**

	CASH	
	Model (1)	Model (2)
CF	0.8905***	1.0362***
SCF		0.0430**
SCF*CF		-0.1297
NWC	-0.6513***	-0.6594***
SIZE	0.0501***	0.0521***
TQ	0.0005	-0.0008
F value	1.92	1.95

\*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% (two-tail) test levels, respectively.

Source: CSMAR database, The People's Bank of China and National Bureau of Statistics of China.

Although  $\alpha_1$  in basic model is smaller than the one in the former regression results, both are significant at 99% confidence level and this illustrates the existence of positive cash - cash flow sensitivity among SMEs in China. For the coefficient before SCF\*CF, it is also negative under robustness checks. After that, the correctness of model is thus verified and the hypothetical relationship among  $\Delta$ CASH, CF and SCF is proved sound.

Combined qualitative and quantitative results, we could draw the conclusion that SMEs in information technology industry have financial constraints and the development of supply chain finance can alleviate their financial constraints to some extent. Therefore, hypothesis 1 and 2 are correct.

## 6. Discussion

From the previous regression results, the development supply chain finance is beneficial for SMEs because it provides an alternative to raise funds. This innovative method, however, has some specific risks which we should pay attention to and offer some tactic to deal with. Therefore, this part makes a detailed summary of risks in supply chain finance for banks and enterprises and puts forward several suggestions to avoid, transfer and mitigate risks.

### 6.1 Variable Factors of Supply Chain Corporations' Financial Risk Level

The reasons why SMEs fail to obtain bank credit mainly due to low transparency of financial information, insufficient mortgaged assets and the fact that their financial indicators are difficult to meet the evaluation criteria. Compared with the traditional credit mode, the supply chain financial financing mode weakens the financial analysis and access control by replacing the static analysis of financial statements with the dynamic control of logistics and capital flow. The bank weakens the limitation of the enterprise itself and only provides credit for a single business, so as to avoid the financing obstacles existing in the disclosure of information and finance of small and medium-sized enterprises. Therefore, in the supply chain financial model, a new evaluation system need to be established to evaluate the status of supply chain companies and calculate the probability of compliance in order to judge the risks of financing business to each link of the supply chain. In the evaluation index system of supply chain financial credit, there are four main contents of investigation, applicant's qualification, counterparty's qualification, assets under financing and supply chain operation status. The whole evaluation system include 30 index.

**Table 7. Evaluation Index and Its Description**

Grade I Index	Grade II Index	Grade III Index	Index Description
Applicant's qualification	Enterprise Quality	Leaders' Quality- C <sub>1</sub>	Years of managers working in the industry
		Employees' Quality- C <sub>2</sub>	Professional technology and professional ethics
		Managers' Quality- C <sub>3</sub>	Management system, industrial structure and internal supervision
		Quality of financial disclosure- C <sub>4</sub>	Audit of financial statements and information

			disclosure
	Operation Quality	Business turnover capacity- C <sub>5</sub>	Sales Revenue/(Average prepayment balance+Average balance receivable+Average inventory balance)
	Profitability	Sales profit margin- C <sub>6</sub>	Sales Profit/Sales Revenue
		Net industrial yield- C <sub>7</sub>	After tax profit/[(Beginning balance of net assets + Ending balance of net assets)/2]
	Debt paying ability	Current ratio- C <sub>8</sub>	Current assets-Current liability
		Quick ratio- C <sub>9</sub>	(Current assets-inventory)/Current liability
		Asset liability ratio- C <sub>10</sub>	Total liability/Total asset
		The ratio of cash flow to current liabilities- C <sub>11</sub>	Cash flow of business operation capability/Current liability
		Interest protection- C <sub>12</sub>	Profit before tax/Interest expense
	Development Potential	Growth rate of sales revenue- C <sub>13</sub>	(Sales Revenue this year- Sales Revenue last year)/ Sales Revenue last year
		Net profit growth rate- C <sub>14</sub>	(Net profit this year- Net profit last year)/ Net profit last year
		Growth rate of total assets- C <sub>15</sub>	(Asset this year- Asset last year)/ Asset last year
Counterparty's qualification	Credit Rating	Credit Rating- C <sub>16</sub>	/
	Industry Characteristic	Industry Status- C <sub>17</sub>	Characteristics of industry concentration, monopoly and cycle
	Profitability	Sales profit margin- C <sub>18</sub>	Sales Profit/Sales Revenue
	Debt paying ability	Quick ratio- C <sub>19</sub>	(Current assets-inventory)/Current liability
Assets under financing	Hostage Characteristic	Price stability- C <sub>20</sub>	Last quarter volatility
		Liquidity- C <sub>21</sub>	Ability to convert hostage into cash
		Vulnerability of hostage- C <sub>22</sub>	Whether to use and save the natural property of the substance
	Receivables Characteristic	Account age and account period- C <sub>23</sub>	80% of accounts receivable's period
		Return record- C <sub>24</sub>	Whether there is a buyer's return
		Bad debt rate of receiver- C <sub>25</sub>	Uncollectible ratio at maturity
Supply chain operation status	Industry Status	Industry growth rate- C <sub>26</sub>	Judge the industry average level
		Industry environment- C <sub>27</sub>	Political, social, economic and technological environment
	Degree of Corporation	Years of trading- C <sub>28</sub>	/
		Transaction limit- C <sub>29</sub>	Industry average times
	Previous Performance	Default rate- C <sub>30</sub>	Number of defaults/Total number of transactions

## 6.2 Risks of Supply Chain Finance

When commercial banks provide credit service, risks of supply chain finance (SCF) need to be fully considered. For small and medium-sized enterprises, it is also important for them to realize the risk points so that they can regulate themselves better.

Risks for commercial banks are crucial to be analyzed, for it can help banks provide financing service better and help enterprises to complete their system. In the receivable financing mode, there are three main risk points, quality of account receivable, operation status of financing enterprises and credit status of financing enterprises. In inventory mode, banks need to watch out for regulatory risk, collateral security and value recognition risk. In prepayment financing mode, credit status and supervision ability of TPL enterprises are the main risks for banks to consider.

Risks of supply chain finance for enterprises can be classified into endogenous risk and exogenous risk. When supply chain financial business is embedded in the enterprise's business, involving receivables financing mode, inventory financing mode and prepayment financing mode, it can cause certain endogenous risks in the operation or financial situation. This report will mainly focus on endogenous risks which can be solved or reduced.

Endogenous risks mainly come from the operation process where enterprises transfer funding risks to themselves in different modes. It involves two kinds of companies in the supply chain, companies who provide financing services and companies who require them. These risks can be analyzed in two aspects, management and finance.

Inefficient management of enterprises that need financing will lead to operational risk and cause losses to all enterprises in the supply chain. In the aspect of management, risks can occur among low supply chain correlation, small and medium-sized enterprises' poor credit status, fake supply chain trading background and ineffective supply chain management.

First of all, high correlation of supply chain system is essential. The more complete a supply chain system is, the higher integration degree is. When the capital flow forms a closed loop in the supply chain business, the enterprise can control the risk by tracking and managing each link. This kind of tracking management requires a high degree of relevance among all links of the supply chain, such as purchase, production, sales, storage and distribution. However, Radke and Tseng (2012) has mentioned that once the relevance of the enterprise is low, the gap in the financing link causes uncontrollable risks, which then will cause losses to the supply chain financial business participating in the enterprise operation.

Secondly, good credit condition is the precondition for the normal operation of supply chain financial business. The credit status of an enterprise reflects its willingness and ability to pay debts to some extent. Small and medium-sized enterprises usually have poor credit status compared with large-scale enterprises. In addition, China's incomplete credit system leads to low cost of violations, resulting in delay of debt repayment or difficulty to recover. Olson and Wu (2011) have explained how this can increase risks of supply chain.

Thirdly, in the background of supply chain trade financing, some enterprises obtain financing loans by providing false business documents and goods certificates, while the funds are transferred to other speculative or investment businesses, resulting in huge capital losses in the financial businesses provided by enterprises.

Lastly, through their professional management ability, supply chain enterprises promote the close cooperation and coordination of the main parts of each link, they also put forward higher requirements for the professional level of supply chain enterprises at the same time. From the perspective of supply chain management, the effective integrated management of each link of supply chain is the basic premise for the normal operation of supply chain financial business. Once there is a problem of management mechanism in the process of enterprise operation, it may cause the risk of supply chain out of control, which will have a certain impact on supply chain management. From the perspective of supply chain operation, the normal operation of the supply chain business is determined by the operation of the upstream and downstream enterprises in the supply chain. Once the operation of an enterprise deteriorates, causing the incoherence of business flow, logistics and information flow, triggering the fracture of capital flow, the financial business chain of supply chain will consequently collapse.

Companies who provide financing services need to bear considerable financing risks. In the aspect of finance, there are three main sources of risks, asset liquidity risks, debt financing risks and cash flow risks. Firstly, enterprises provide financing services for small and medium-sized enterprises in the chain through the mode of credit sale and advance payment, resulting in large-scale advance payment and accounts receivable. The early expenditure and delayed recovery of capital can reduce the capital efficiency of enterprises and easily cause the periodical operation capital pressure of enterprises. When large-scale prepayments and receivables have problems, or will have liquidity problems, it is not conducive to the business development of the enterprise. Secondly, debt financing risks also occur because enterprises need more external funds, and maintain the development of financial business through debt financing rolling while providing financing services. Referring to Poojari et al. (2008), in the specific process, enterprises rely on their own good credit status and the overall supply chain as the potential guarantee basis to obtain loans from banks and other institutions, and then lend funds to other small and medium-sized enterprises to obtain capital arbitrage through the supply chain trade business or financial business. Therefore, the debt burden of supply chain enterprises is quite heavy. With the continuous expansion of business scale, the leverage level continues to increase, which may limit the subsequent refinancing business. High leverage and heavy debt business model will increase the exposure of supply chain financial risks. Lastly, large scale outflow of enterprise capital is not conducive to the accumulation of liquidity. Due to the poor coverage of operating cash flow to corporate debt, the capital of corporate operation and debt repayment depends on external financing, which causes great financing pressure. Once the external financing channels are blocked, supply chain enterprises will face the risk of capital rupture.

**Table 8. The Summary of Risks in Supply Chain Finance**

Party	Risks	
Commercial Bank	Receivable financing mode	Quality of account receivable, Operation status of financing enterprises Credit status of financing enterprises
	Inventory mode	Regulatory risk, collateral security and value recognition risk
	Prepayment financing mode	Credit status and supervision ability of TPL enterprise
Enterprises	Endogenous risk	Management and finance
	Exogenous risk	

### *6.3 Strategies to Deal with Risks of Supply Chain Finance*

Solutions of supply chain finance risks can be analyzed in the following three modes. In the receivables financing mode, considering one of the sources of risks is small and medium-sized enterprises' poor credit status, enterprises should establish good cooperative relationship with core enterprises to obtain credit guarantee of core enterprises and strengthen the management of accounts receivable. Meanwhile, banks and other financial institutions should take measures to deal with the market risk of goods under accounts receivable. Additionally, strengthening the supervision of customer credit pledge goods, improving the internal operation management standards, and preventing operational risks are also solutions for ineffective management. Specifically, the logistics enterprises should constantly improve the level of warehouse management and warehouse management information, formulate a sound risk control plan for handling the warehousing and delivery of quality goods, and strengthen the supervision ability of quality goods. According to different service modes, logistics enterprises and banks should formulate strict operation specifications and supervision procedures to eliminate risks caused by internal management loopholes and irregularities.

In inventory financing mode, two sources of risks, low supply chain correlation and ineffective supply chain management need to be taken into account. According to Mak and Shen (2012), enterprises could select a professional third-party logistics regulator to participate. And the management of core enterprises to small and medium-sized enterprises need to be strengthened. Moreover, it is essential to establish a flexible and fast market commodity information collection and feedback system to avoid product market risks (Kull & Talluri, 2008). In the era of buyer's market, the quality of products, the speed of renewal, and the disclosure of positive and negative information have a direct impact on the realization value and sales of pledged goods. Therefore, logistics enterprises and banks should choose the right collateral according to the market bank, and set a reasonable pledge rate. Generally speaking, the products with good sales trend, high market share, strong strength and high popularity are selected as the pledged goods, and the monitoring mechanism of sales situation and price change trend is

established for them, so as to obtain real information in time, avoid the evaluation distortion of pledged goods caused by information asymmetry, and control market risk.

In the prepayment financing mode, banks and other financial institutions should establish a complete set of management mechanism of prepayment pledge to prevent fake supply chain trading background provided by small and medium-sized enterprises. Core enterprises must take corresponding strategies to deal with the risks brought by buyback to enterprise management. Logistics enterprises and banks should share information, fully cooperate and strengthen credit management of customers. Logistics enterprises should give full play to their advantages in mastering the first-hand information of customers and pledged goods. Meanwhile, banks could use their credit assessment and risk control methods to establish a customer data collection system and credit investigation and verification system to conduct all-round credit management for customers and form an interactive supervision and control mechanism.

In conclusion, only when banks and all the enterprises on the supply chain interact well, a virtuous circle can be formed.

## 7. Conclusion

Reviewing the supply chain finance' development from offline "1+n" to online "n+n" in China, this essay compares bank loans with supply chain finance in liability, interest rate and payment clauses. As for small and medium-sized enterprises, traditional financing methods cannot satisfy their demand for raising funds and financial constraints are common among these companies. Therefore, the purpose of our research is to explore whether supply chain finance can relieve SMEs' financing burden and offer guidance about risk management along supply chain.

Using cash - cash flow sensitivity model, this essay links SME's financial constraints to its intention to save money for potential spending and investment. For companies that are financially constrained, cash holdings including cash and marketable securities will increase if there is abundant cash flow, which means positive cash flow sensitivity of cash. Subsequently, we hypothesize that SMEs in information technology industry have financial constraints, namely positive cash-cash flow sensitivity and the development of supply chain finance can alleviate their financial constraints. To test two hypotheses, cash-cash flow sensitivities and supply chain finance's impact are examined through qualitative and quantitative method and the data is from publicly traded software companies between 2008 and 2018.

From qualitative results, most software companies have limited access to capital and traditional financing methods might be costly. Under this circumstance, supply chain finance partly resolves their problems. Meanwhile, quantitative assessment which involves descriptive statistics analysis, correlation test, regression and robustness checks prove the positive cash - cash flow sensitivity for SMEs and supply chain finance's mitigating effect on financial restraints. To sum up, both qualitative and quantitative investigations are able to confirm hypothesis' validity.

Although supply chain finance benefits SMEs' operation in empirical results, there contains certain



level of risk which requires awareness and attention. Subsequently, we provide strategies to deal with risks after evaluating specific uncertainty in receivable financing mode, inventory mode and prepayment financing mode.

The major innovation of our research is using both qualitative and quantitative methods in empirical analysis and concentrating on SMEs in software industry which face relatively severe financial constraints but lacks evident academic support. Since there are only 61 listed SMEs in software industry, relatively small number of sample is the major research limitation.

We hope future researchers could measure the quantitative impact of supply chain finance on SMEs' performance, for example sales and profit and then it could be a thorough and comprehensive guidance for SMEs.

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## Notes

Note 1. Fazzari et al. (1988) assume that a financial constrained company has less money left for investment, which indicates the stronger investment - cash flow sensitivity. In 1997, however, Kaplan and Zingales test this model and find it is contrary with reality.

Note 2. Almeida (2004) evaluates corporations' financial constraints in the perspective of cash-holdings.

Note 3. Xue and Zhang (2015) use short-term loans, commercial bills, and discounted bills to reflect the development of supply chain management.

## Appendix

### Semi-structure Interview Questions:

1. Does your company face difficulties of raising fund?
2. Under financial constraints, which method do your company uses most frequently?
3. Have your company ever heard of or used supply chain finance?
4. What is the frequency of supply chain finance used by your company?
5. Which one is more accessible, supply chain finance or bank loan and why?
6. Can supply chain finance satisfy the demand for capital in enterprises' daily operation?
7. After using supply chain finance, what are major changes happening to your company?
8. After using supply chain finance, dose your company's profit increase?
9. After using supply chain finance, does your company's sales revenue increase?