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Analysis of the Effect of Credit Fluctuation on Capital Structure of Listed Companies

WU Kai[a],*; YANG Wen[b]

[a]Ph.D., School of Economics, Central University of Finance and Economics, Beijing, China.
[b]Discipline and Supervisory Department, Central University of Finance and Economics, Beijing, China.
*Corresponding author.

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Abstract

Based on an analysis of data from the Listed Companies in China's A share market from 2003-2015, this paper studies the influence of credit fluctuations on capital structures from the credit supply side perspective. The results show that there is a positive, significant correlation between credit fluctuations and the capital structure of listed companies. We also determined that the credit policies have affected the capital structure of listed companies. Further research shows that the differences in credit policy environment have different effects on the capital structure of listed companies. Under the stable credit policy environment, the influence of credit fluctuation on the capital structure of listed companies is positive and the coefficient of influence is larger. Under the tight or expanding monetary policy environment, the impact of credit fluctuation on the capital structure of listed companies is negative and the impact coefficient is smaller. Based on this, this paper puts forward policy recommendations to optimize the capital structure of listed companies.

Key words: Credit fluctuation; Capital structure; Credit supply side; Listed companies; China's A share; Measurement model

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INTRODUCTION

The credit supply is essentially the embodiment of the national credit policy. To a large extent, it plays the role of monetary policy transmission channel. Credit fluctuation is a market signal formed in the process of financial system operation. It not only reveals the macro economic trends, financial market risks, policy regulation and guidance, and industrial development direction, but also is a macro means of operation. It will affect the actual economic behavior, such as the financing preference and capital structure of the enterprise.

The capital structure of listed companies is the proportional relationship between the long-term debt and total assets of listed companies. This variable reflects how the listed companies obtain the long-term capital and the internal structure of the long-term capital. In the market economy environment, based on the continuous improvement of the financial market and the continuous enrichment of credit tools, the marketization of credit supply has been deepened. The influence of credit fluctuation on the capital structure of enterprises and the national economy of the country is increasing day by day. It has become an important means for the central bank to control the economy.

In this paper, we use the establishment of the banking supervision and management commission of the People's Republic of China in 2003 and the shareholding reform of state-owned commercial Banks as the starting point of the study, and we use the marketization of the interest rate in 2015 as the end point. Under the background of market-oriented reforms in the financial industry in China, this paper will study the relationship between credit supply fluctuation and enterprise capital structure.

1. LITERATURE REVIEW

In the beginning, scholars studied the capital structure of the company with the characteristics of the company

and its credit demand. Later, scholars introduced macroeconomic variables to study the impact on capital structure of the company. Now, the scholars study the capital structure of listed companies from the perspective of credit supply side.

Early scholars mainly assumed that the elastic supply of credit is infinite. On the basis of the hypothesis, they studied the relationship between the company's financial index and corporate capital structure. And they also studied the influence factors about the corporate capital structure decisions. But the conclusion is not entirely consistent. The company's capital structure choice is the combined effects of the interaction of capital demand and the supply. It is one-sided to study the capital structure solely from the perspective of capital requirements.

In previous studies, of corporate capital structures, the scholars mainly researched the infinite elasticity assumption of capital market supply, and investigated this issue from inside a company's asset structure. The research on financial risk costs, the size of a company's growth, the choice of investment strategies and non-debt tax shielding of the company's capital structure, can influence the direction of the company's capital structure choice. But the supply elasticity of capital markets is not infinite. Faukender and Petersen (2006), in the process of their research on the factors that influence the company capital structure, found that based on the information asymmetry of capital supply, when the companies made the choice of the capital structure, the managers should not only rely the company's capital demand, but also on the factors of capital supply. Research on the relationship between the capital structure of enterprises as an important source of funds and credit supply company is necessary.

At present, in the international theoretical world, the research on the relationship between capital structure and macro micro credit supply enterprise is the attention of scholars. Holmstrom and Tirole (1997) mainly studied the relationship between the company's variables (e.g., funds at the disposal of the localities, the ability of guarantee and funding constraints) and the credit supply. They found that due to its own abundant funds, strong guarantee ability, small funding constraints, the influence of the supply of bank credit is relatively small, but the capacity of a small company is relatively weak. In his study on the relationship between the American companies and credit funds supply, Leary (2008) found that firms of different sizes have varying degrees of sensitivity to changes in the ease and contraction of credit supply. This research showed that smaller firms are more significantly affected by changes in the supply of credit than larger firms. Voutsinas and Werner (2011), using the Japanese capital market as their research object, studied the relationship between Japan's capital structure and that country's corporate credit supply process. They found that the impact of credit supply shock on the capital structure of the company is derived from a company's own endowment and attribute constraints.

The relationship between macro credit supply and micro capital structure of enterprises has been sufficiently studied in China. On the background of the non completely marketable interest rates, Tang and Liu (2005) listed companies in China as a sample. They found that the financial regulatory authorities of China on the market will lead to distortion of the interest rate of credit supply, and have a significant impact on the choice of the capital structure of listed companies. According to the exogenous attributes of credit policy, Zhao, Zhu and Wang (2008) regard it as an alternative variable of credit supply. They take the real estate industry as a sample. The impact of macro control on the capital structure of listed companies is tested. The results show that macroeconomic regulation and control affect the capital structure of listed companies through the supply and demand of credit market in two directions. If they regard the 2004 as the dividing line of macro control, the capital structure of Listed Companies in the real estate industry has changed significantly after the macro-control, which means that the company's liabilities level has improved significantly. In the study of the relationship between credit policy and corporate capital structure, Zeng and Su (2010) used the "natural experiment" approach. On the background of the credit expansion in 1998 and the credit crunch in 2004, according to the actual situation of China, they studied the sensitivity of the company's debt level to the changes in credit from three dimensions of the company size, nationalization of ownership and the ability of guarantee. In the study of the relationship between monetary policy and credit policy, Liu and Hao (2010) found that there is a significant long-term stable relationship between the required reserve requirements, total credit, interest rates and interest rates.

In summary, the current research on the impact of credit fluctuations on capital structures is still uncertain. Under the bank oriented financial system background, based on the existing research results, this paper uses the credit scale changing as a measure to further study its impact on the capital structure of listed companies in China. We also compare the results of empirical analysis to draw relevant conclusions and policy recommendations.

2. EMPIRICAL ANALYSIS OF THE IMPACT OF CREDIT FLUCTUATIONS ON CORPORATE CAPITAL STRUCTURES

2.1 Measurement Model Setting

The purpose of this paper is to examine the impact of credit scale fluctuations on the capital structure of listed companies. We chose the data of listed companies in A stock market of China, and there are some individual differences among the samples. Therefore, in the empirical

part of this section, we should control the micro and macro factors, which have an impact on the capital structure of listed companies, such as the company characteristics, industry characteristics and the macroeconomic environment. Considering the continuity of the company's operation, the capital structure of the company is adjusted on the basis of the capital structure of the previous period. Therefore, in the design process of a model, the author sets up the phase lag back of the capital structure.

In order to better examine the effect between capital structure and credit scale fluctuation of listed companies, the paper assumes that there is not the existence of adjustment costs of capital structure in the dynamic model, which the listed company can quickly adjust the company's current capital structure to the optimal capital structure after the fluctuation of the credit scale.

The model is as follows:

$$Leverage_{i,t}=\alpha+\beta_1 Leverage_{i,t-1}+\beta_2 Credit_{i,t}+\beta_3 Control_{i,t}+\varepsilon_{i,t}+\mu_t . \quad (1)$$

Among the variables included in Model 1, i is the listed companies, t is the year and $Leverage_{i,t}$ is the capital structure of the i listed companies in year t. The lag variables $Leverage_{i,t-1}$ represent the capital structures of the i listed companies in year t-1. $Credit_t$ is the credit scale fluctuation variable for period t and $Control_{i,t}$ is the control variable of i listed companies in period t. μ_t and $\varepsilon_{i,t}$ represents individual factors and the observation sample's random perturbation.

We use the Generalized Method of Moments (GMM) method to solve the endogeneity problem of our dynamic model. The differential GMM method is used to deal with the endogeneity of the dynamic model. In this method, the difference between strictly exogenous variables and the lagged items of the explanatory variables is used as a tool variable to solve the endogeneity problem. However, when the relation between the explained variable and the endogenous explanatory variable appears approximately random walk, the differential GMM method will be seriously affected by the weak instrumental variable. The results estimated by this method are likely to be biased.

In view of the weak instrumental variable problem in differential GMM, Blundell and Bond (1998) utilize the information of different equation and horizontal equation effectively. They combine the horizontal regression equation with the differential regression equation to enhance the effectiveness of the instrumental variable. This is the system GMM method. However, in the face of a few individuals, the long-term panel data, both the system GMM and the differential GMM will make the Arellano-Bond autocorrelation test lack of reliability. The long time span makes the Sargan test unreliable due to excessive production of instrumental variables, and thus biases the model in the estimation process. Therefore, the system GMM and differential GMM are generally suitable for panel data with a small time span and a large number of individual samples. In addition, due to the selection of different weight matrices, differential GMM and system GMM are divided into one step estimation and two step estimation. Compared with the one step estimation method, the GMM estimated by the two step method is less likely to be affected by heteroscedastic interference. However, under the limited sample condition, the standard deviation of the two step estimation will have a more serious downward bias, which will still have a great impact on statistical inference.

Since the sample size of this paper is large, we choose the two step GMM model to estimate the model, and examine the relationship between the credit scale variables and capital structure of the company.

2.2 Main and Control Variable Selection

2.2.1 Capital Structure

The capital structure of listed companies is the ratio of long-term debt to total assets, which reflect the relationship between the channel and the proportion of long-term capital of listed companies, so the study on short-term debt financing is not included in the capital structure. For the measurement of capital structure, this paper adopts the measure of asset liability ratio and the non-current debt ratio, that is, the proportion of non-current liabilities to total assets (Lev). To measure the capital structure of listed companies, the foreign research literature generally uses the ratio of interest bearing debt to total assets, or the ratio of interest bearing debt and the total market value. However, due to historical reasons and China's national conditions, circulating shares and non tradable shares remain in a state of coexistence for a long time. The pricing of non tradable shares remains controversial. This makes it impossible to measure the capital structure by using the ratio between interest bearing debt and the total market value of the company. Therefore, the empirical research literature in this area generally uses the ratio between interest bearing debt and total assets to measure the capital structure of listed companies. Due to the imperfection of China's securities market, the market value of listed companies fluctuates greatly. According to the practice of most scholars, this paper selects the ratio between interest bearing debt and total assets to measure the capital structure of listed companies, and uses them as explanatory variables of the model.

2.2.2 Credit Fluctuation Variables

According to the theoretical analysis and hypothesis, this paper defines the credit fluctuation variables. This paper will choose credit growth rate as a variable to describe credit fluctuation. Specifically, this paper will use the total size of the credit growth rate (To_credit), short-term

credit growth rate (St_credit) and long-term credit growth rate (Lt_credit) as a description of our credit fluctuation variables, to examine the relationship between capital structure and credit scale fluctuations between companies.

2.2.3 Other Control Variables

According to the experience of empirical research, the other control variables of this paper will be selected from many angles, such as company, industry and macro economy. At the company level, the paper will choose the size of the company (Scale), profitability (Profit), non-debt tax shields (Ntds), flow rate (Flow_ra), the level of Holdings (Control) as control variables of firm characteristics. On the industry level, according to the classification standard of Wind database, this paper uses dummy variables to control the 24 industries involved in the sample data. At the macroeconomic level, this paper focuses on the influence of macroeconomic situation on the explanatory variables, so this paper will select the natural logarithm of GDP (lnGDP) and the macroeconomic climate index (Mac_index) as a characterization of China variables to measure the economic situation under control. See Table 1 for details.

Table 1
Lists and Implications of Empirical Model Selection Variables

Variable name	Description	Variable definitions and meanings
Capital structure	Lev	The product of the ratio of assets to liabilities and non-current liabilities
Asset liability ratio	Ast_deb_ra	Total liabilities divided by total assets.
Non-current debt ratio	Uldeb_ra	Non-current liabilities divided by total liabilities.
Credit scale growth rate	To_credit	The credit scale at the end of this term minus the credit scale at the end of the last term, then divided by the credit scale at the end of the term. It can measure the easing extent of credit.
Growth rate of short-term loans	St_ credit	The short term credit size at the end of this period minus the short term credit at the end of the last term, then divided by the short term credit scale at the end of the term. It can measure the easing extent of the short-term credit.
Medium and long-term loan growth rate	Lt_ credit	The long-term credit scale at the end of this period minus the long-term credit scale at the end of the last term, then divided by the long-term credit scale at the end of this term. It can measure the easing degree of long-term credit.
Deposit spread	SL_is	The benchmark interest rate for the 3-5 years of loan minus the benchmark interest rate for the 3 years terms deposit.
Required reserve ratio	RR_ratio	Required reserve ratio
Company size	Scale	Total assets scale
Profitability	Profit	Return on assets
Non-debt tax shield	Ndts	Pre-tax profit minus the quotient of tax expense and corresponding tax rate, divided by the total assets.
Current ratio	Flow_ra	The current assets divided by the current liabilities.
Holding level	Control	Ownership concentration
Industry characteristics	Wind	According to the wind classification, they fall into 24 Categories
Macroeconomy	lnGDP	Natural logarithm of GDP
Economic climate index	Mac_index	Macroscopic consistent composite index

2.3 Data Processing and Descriptive Statistics

In 2003, the People's Republic of China Banking Regulatory Commission was established. In the same year, the state-owned commercial banks began the shareholding system reform. The People's Bank of China began to formulate the credit expected control target at the beginning of each year. We use 2003 as the starting point for our analysis. The full market rate at the end of 2015 is the end point of our study's time span. Therefore, this paper will set the time span of the study from 2003 to 2015. This paper selects the quarterly data of listed companies of A shares in Shanghai and Shenzhen two cities as the research object, and makes the following screening: a) in the sample period, excluding the debt ratio of less than 0 or more than 1 of listed companies; b) in the sample period, excluding the listed companies with missing observation data; c) excluding ST and ST* listed companies; d) excluding listed companies in the financial sector. In this paper, a balanced panel data with 2828 items is obtained. The data of capital structure and control variables come from the data of Listed Companies in Wind database. Credit related data from the annual data statistics released by the people's Bank of China website. The macro economic data comes from the data statistics of China Railway network.

Table 2 shows descriptive statistics of regression model variables. The average asset liability ratio of China's listed companies is 46.3%. In the process of measuring

the average financial leverage of the company, the asset liability ratio used by Tong (2004) is 47.1%. Two data are basically consistent. But, the asset liability ratio of Listed Companies in developed countries is 53.8%-73.2% in the same period. In contrast, the asset liability ratio of China's listed companies is relatively low. Companies prefer to raise capital through equity financing channels, while debt financing has a lower preference, which is similar to the conclusions drawn in the previous chapters.

Table 2
Descriptive Statistics of Selected Variables

Variance	Mean	Variance	Minimum	Maximum
Ast_deb_ra	0.463	0.182	0.009	0.999
Uldeb _ ra	0.519	0.295	0.005	0.999
To_credit	0.042	0.028	0.009	0.447
St_ credit	0.036	0.026	-0.017	0.339
Lt_ credit	0.050	0.038	0.020	0.538
SL_is	0.028	0.003	0.023	0.033
RR_ratio	0.155	0.0537	0.06	0.215
Scale	12.319	1.479	1.632	21.531
Profit	4.848	64.691	-7,988.846	7,590.962
Ndts	0.032	0.067	-0.684	0.555
Flow_ra	0.261	20.880	-60.957	4,010.502
Control	24.757	22.417	0.000	125.160
lnGDP	12.179	0.768	10.177	13.443
Mac_index	99.700	2.893	93.920	104.377

The total scale of China's credit has shown a rapid growth from 2003 to 2015. In the situation of rapid growth, the growth of medium and long-term credit and short-term credit is slightly different. In the descriptive statistical table of variables, the annual average growth rate of RMB credit is 4.2%, the average annual growth rate of medium and long-term credit is 5%, and the annual average growth rate of short-term credit is 3.6%. The growth of short-term credit is relatively slow. The annual average deposit reserve ratio is 15.5%, and the average annual interest rate of deposit and loan spreads is 2.8%. This is the same as the information conveyed by the credit scale growth index. Low statutory reserve ratio and high deposit and loan spread show that China's credit policy remained relatively loose during the period from 2003 to 2015. China's credit environment is relatively relaxed, there is no sign of the credit crunch and the situation. On the basis of expansionary policies, the executive authorities of China's monetary policy just fine tune the policy appropriately.

From the perspective of industry differences, there is a big difference in the debt level of Companies in different industries. Some companies have a higher debt ratio, and the debt ratio is close to 100%. Some companies have a lower debt ratio, and their asset liability ratio is close to 0.9%. There is almost no demand for financing through debt channels in companies with low debt ratios.

From the corporate level, the trade-off theory suggests that different firms will make different optimal capital structure decisions according to their own characteristics. In the descriptive statistics of variables, the standard deviation of the corporate characteristic control variables shows that there is a large individual difference in the company characteristic control variables at the corporate level. This shows that it is necessary to make fixed effects on enterprises in empirical regression.

3. EMPIRICAL ANALYSIS

In the process of empirical test of Equation (1), we can use either fixed effect model to estimate or random effect model. However, due to the fact that the characteristic variables of different companies are not completely exogenous, the fixed effect model is chosen to estimate. The results of Hausman test on the model show that it is appropriate to estimate the Formula (1) with fixed effect model. Therefore, the fixed regression model is used to estimate and analyze the regression model in this paper.

Table 3 shows the impact of credit fluctuation on the capital structure of listed companies. Under the control of industry fixed effect, the coefficient of total credit growth and the capital structure of listed companies are positive, but not significant. This is the case in Equation (1). In order to overcome the interaction between enterprises, Equation (2) increase the control of fixed effects of enterprises on the basis of Equation (1). We find that the coefficient of total credit growth rate is still positive, and the coefficient in Equation (1) rises to 31.2%, and is significant at the 1% level. This shows that the variables describing the characteristics of the company are not completely exogenous, and there are certain regularities in different listed companies. This needs to use fixed effect model to estimate. Based on the panel data model, Equation (3) increases the control variables of corporate characteristics, such as firm size, profitability, non debt tax shield, liquidity ratio and holding level. In addition, Equation (3) increases the natural logarithm of GDP and the macroeconomic index. After re-estimation, we find that the coefficient of total credit growth rate is still positive, but the coefficient in Equation (2) is reduced to 10.5%, and it is significant at the 1% level. Furthermore, Equation (4) increases the control of the fixed effect of the enterprise, and finds that the coefficient of the growth rate of the total scale of credit is positive, and the coefficient in Equation (3) is reduced to 9.6%, and is significant at the 1% level.

When we use the system GMM method to estimate the model, we can overcome the endogeneity problem as much as possible. The results are shown in Equation (5). You can find the coefficient of the total size of the credit growth rate is still positive, and is significant at the 1% level. However, after removing the possible endogeneity effect, the coefficient of total credit growth rate is 5.5%, which is smaller than the coefficient in Equation (4). This is mainly due to the reverse causality between the capital structure of listed companies and the growth rate of the total scale of credit. The capital structure of listed

companies will affect the financial decisions of enterprises, such as the financing arrangements of enterprises. The debt financing of listed companies through the medium and long term credit improves the capital structure of the company and increases the pressure of debt repayment. In the process of repayment of debt, the company may passively increase short-term credit to compensate for the cash flow gap in the process of repayment of debt. This promotes the growth of the total scale of credit, and forms the reverse causality between the capital structure of listed companies and the growth rate of total credit.

The empirical results in Table 3 transfer some information about the relationship between capital structure and corporate control variables. We found the relationship between the capital structure of listed companies and some control variables are positively correlated, such as firm size, liquidity ratio, holding degree, and the relationship between the capital structure of listed companies and some control variables are negatively related, such as profitability, non debt tax shield. When Equation (3) added some company level and macro level control variables, such as firm size, profitability, non debt tax shield, liquidity ratio, the level of holdings, the natural logarithm of GDP and economic boom index, the coefficient will be the total size of the credit growth rate has declined greatly. It shows that the control variables have positive influence on the capital structure of listed companies. These positive effects offset the positive impact of the overall growth rate of credit loan on the capital structure of Listed Companies in Equation (2). This makes the total size of the credit growth rate coefficient in Equation (3) has decreased greatly.

Table 3
Empirical Test of Credit Structure on the Capital Structure of Listed Companies

Variance	(1) FE	(2) FE	(3) FE	(4) FE	(5) S-GMM
lag_lev					0.001
					(0.001)
To_credit	0.124	0.312***	0.105***	0.096***	0.055***
	(0.114)	(0.107)	(0.022)	(0.015)	(0.010)
LnScale			0.027***	0.036***	0.025***
			(0.000)	(0.000)	(0.002)
Profit			-0.000***	-0.000***	-0.000*
			(0.000)	(0.000)	(0.000)
Ndts			-0.002***	-0.001***	-0.001***
			(0.000)	(0.000)	(0.000)
Flow_ra			0.000	0.000*	0.000
			(0.000)	(0.000)	(0.000)
Control			0.000***	0.000***	0.000
			(0.000)	(0.000)	(0.000)
lnGDP			0.000***	0.000***	0.000*
			(0.000)	(0.000)	(0.000)
Mac_index			0.000***	0.000*	0.000*
			(0.000)	(0.000)	(0.000)
Constant	0.106***	0.004	-0.161***	-0.306***	-0.177***
	(0.026)	(0.335)	(0.005)	(0.032)	(0.024)
Observations	91,165	91,165	76,387	76,387	55,443
R-squared	0.003	0.002	0.363	0.363	--
Industry fixed effects	Y	Y	Y	Y	Y
Firm fixed effects	N	Y	N	Y	Y
AR(1)Test					0.000
Sargan-test					673.569 [0.122]

Note.

(1) The data in brackets are the standard deviations generated in the regression process. ***, ** and * indicate, respectively, that the marked regression coefficients are significant levels at 0.01, 0.05 and 0.1.

(2) In the Arellano-Bond first order sequence correlation test, AR (1) reports the p value and Sargan reports the statistical value.

(3) The fixed effect (FE) is a fixed effect model and S-GMM (SYS GMM) is a generalized moment estimation model.

(4) The control variables are not included in the first equation and the second equation. The first equation only controls the fixed effect of the industry, and the second equation controls both the fixed effect of the industry and the fixed effect of the firm.

(5) The third equation joins the enterprise scale (Scale), profitability (Profit), non-debt tax shields (Ndts), flow rate (Flow_ra), the level of Holdings (Control) and the other control variables only on the industry fixed effects to control. The fourth equation is still the control of enterprises increase in fixed effects based on the third equation.

(6) In order to solve the possible endogenous effects of variables, the fifth equation adopted the systematic GMM method to estimate model.

To sum up, in Table 3, we use the growth rate of credit scale as an alternative variable of credit fluctuation. No matter what regression model is used, the empirical results show that the credit growth is positively related to the capital structure of listed companies, and the impact coefficient is about 5.5%-31.2%. However, the conclusion of the study and conclusions of other scholars are different. Su and Zeng (2009), Min and Shen (2011) believe that the impact of changes in the overall size of credit and the company's capital structure is uncertain. For this reason, this article will further explore the possible reasons for the following chapters, which will be mainly based on the perspective of the term structure of credit.

4. ROBUSTNESS TESTS

In the test of the previous section, we choose the growth rate of credit scale as the proxy variable of credit change. However, as everyone knows, deposit reserve rate and the interest spreads of deposit and loan can also reflect the changes in the credit. Therefore, the robustness test will use the deposit reserve rate and the interest spreads of deposit and loan as the proxy variable of the credit change to make a robust test.

As shown in Table 4, a robust test of the relationship between the volatility of credit scale and capital structure is reported. Equations (1), (2), (3) show that when the interest spreads of deposit and loan is used as an

Table 4
Robustness Test of the Impact of Credit Size Volatility on Capital Structures

Variance	(1) FE	(2) FE	(3) S-GMM	(4) FE	(5) FE	(6) S-GMM
lag_ lev			0.315***			0.260***
			(0.011)			(0.010)
SL_is	1.249***	1.070***	1.148***			
	(0.044)	(0.025)	(0.020)			
RR_ratio				-1.064***	-0.392***	-0.440***
				(0.016)	(0.012)	(0.028)
LnScale	0.043***	0.029***	0.030***	0.045***	0.039***	0.055***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.004)
Profit	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ndts	-0.000***	-0.000***	-0.002***	-0.001***	-0.000***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flow_ra	-0.001***	-0.000***	-0.000*	-0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Control	-0.000***	0.000***	-0.001***	0.001***	0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lnGDP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mac_index	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.211***	-0.268***	0.027	-0.086***	-0.312***	-0.246***
	(0.009)	(0.055)	(0.045)	(0.009)	(0.054)	(0.054)
Observations	84,375	84,375	62,491	84,375	84,375	62,491
R-squared	0.187	0.748	--	0.228	0.751	--
Industry fixed effect	Y	Y	Y	Y	Y	Y
Firm fixed effects	N	Y	Y	N	Y	Y
AR(1)Test			0.000			0.000
Sargan-test			614.168 [0.212]			523.578 [0.171]

Note.

(1) The data in brackets are the standard deviations generated in the regression process. ***, ** and * indicate, respectively, that the marked regression coefficients are significant levels at 0.01, 0.05 and 0.1.

(2) In the Arellano-Bond first order sequence correlation test, AR (1) reports the p value and Sargan reports the statistical value.

(3) The fixed effect (FE) is a fixed effect model and S-GMM (SYS GMM) is a generalized moment estimation model.

(4) In the control of the industry fixed effects, the first and fourth equation respectively estimate the relationship between the capital structure of listed companies and the interest spreads of deposit and loan, and the relationship between the capital structure of listed companies and the deposit reserve rate. In the control of industry fixed effects and firm fixed effects, the second and fifth equation respectively estimate the relationship between the capital structure of listed companies and the interest spreads of deposit and loan, and the relationship between the capital structure of listed companies and the deposit reserve rate.

(5) In order to solve the possible endogenous effects of variables, the third equation and the sixth equation adopted the systematic GMM method to estimate the model.

alternative variable of credit volatility, the capital structure of listed company and the interest spreads of deposit and loan is positively related, and the impact coefficient is between 1.070-1.249. Equations (4), (5), (6) show that when the reserve requirement rate is used as an alternative variable of credit volatility, the capital structure of listed companies has a negative correlation with the deposit reserve rate, and the impact coefficient is between 0.392-1.064. These results are consistent with the theoretical expectations. In the last section, when the total scale growth rate of credit is used as the proxy variable of credit changes, the empirical test results are consistent with the conclusions drawn from the robustness test in this section.

As the intermediary industry of credit market, the profit source of banking industry mainly comes from the interest margin of deposit and loan. With the increase of spreads between deposits and loans, the enthusiasm of banks to develop credit business is higher. But if the spread between deposits and loans shrinks, the profitability of the banking sector will shrink. It can be seen that commercial banks as independent entities of interest, in the face of the financing needs of enterprises, the decision to increase or reduce the scale of credit depends on the operation and profitability of commercial banks. The bank's deposit and loan spreads have positive effects on the supply of credit scale of commercial banks. That is to say, the amplification of deposit loan spreads will increase the credit supply of banks, and it is easier for listed companies to realize debt financing through loan channels. Therefore, there is a positive correlation between changes in the interest spreads of deposit and loan and the capital structure of listed company.

On the basis of the traditional IS-LM model, Bernanke and Blinder (1998) combine credit channels and monetary channels, and build the CC-LM model. The CC curve represents the credit market in the model, the LM curve represents the money market. In this model, the monetary policy changes will cause the shift in the CC curve and LM curve. The model shows that the central bank can use the deposit reserve ratio and other monetary policy tools to control the monetary base. The central bank can realize the impact of credit scale through credit channels, so as to achieve the government's macroeconomic regulation and control objectives. When the central bank needs to tighten monetary policy, the central bank may increase the statutory deposit reserve rate. When the statutory deposit reserve ratio is raised, according to the ratio of statutory reserve requirements issued by the central bank, commercial banks must retain more cash as legal reserve requirements. So the quantity of loanable funds lending will decrease. The statutory deposit reserve ratio and the capital structure of the company showed a reverse relationship.

In Table 4, Equation (1) shows that the coefficient of the interest spreads of deposit and loan is positively related to the capital structure of listed companies, and is significant at the 1% level. In order to overcome the interaction between enterprises, Equation (2) increases the control of fixed effects of enterprises on the basis of Equation (1). We find that the coefficient of the interest spreads of deposit and loan is still positive. However, the coefficient in Equation (2) is reduced to 1.070 compared with Equation (1), and the result is still significant at 1% level. This shows that, when checking the relationship between the capital structure of listed companies and the interest spreads of deposit and loan, the characteristic variables of different enterprises still exist some incomplete exogenous. In order to overcome the endogeneity problem, we use the system GMM method to model re-estimation. The result of Equation (3) shows that the coefficient of the interest spreads of deposit and loan is still positive, and is significant at the 1% level. After removal of the endogenous effect, the coefficient is 1.148. Similarly, the reserve ratio of Equation (4) is negatively related to the capital structure of listed companies. The coefficient of the deposit reserve ratio of 1.064, and is significant at the 1% level. On the basis of Equation (4), the control of fixed effect is added. In Equation (4), the coefficient of deposit reserve rate is still negative, but only drops to 0.392, and is still significant at the 1% level. When the system GMM method was used to re-estimate the model, we removed the possible endogeneity effect. The result of Equation (6) shows that the coefficient of the deposit reserve ratio is 1.148, and is still negative.

In the analysis of Table 4, we use the deposit reserve ratio and the interest spreads of deposit and loan as the proxy variable to test the robustness of the credit change. In the previous section, we examine the total growth rate of credit as a proxy variable for credit change. These two conclusions are consistent with the direction of influence and significance. Under the current economic environment in China, the change tendency of credit changes and capital structure of listed companies has the same direction, so the empirical results in this section are robust.

5. FURTHER STUDY ON THE RELATIONSHIP BETWEEN CREDIT FLUCTUATIONS AND CAPITAL STRUCTURES

Although the regression coefficient of the total credit growth rate is in line with the positive expectations, the impact is limited and declining. This paper argues that the previous scholars have concluded that the relationship between credit and corporate capital structure is uncertain, because the effect of policy environment is ignored.

In 2004, under the situation of overheated economy, the country introduced the credit tightening policy and

related measures to avoid the inflation risk and inhibit the overall rise of prices. The State Council, in the report of the People's Republic of China government work, points out that we should appropriately control the scale of credit, expand the issuing scale of corporate bonds, and gradually increase the proportion of direct financing of enterprises. It was not until 2006 that China's credit control went out of the contraction channel and entered the expansion channel. In 2008, in order to cope with the world financial crisis, the central government implemented an active monetary policy to speed up the scale of credit. It was not until 2011 that the central government turned from expansionary credit policy to moderately stable credit policy. Therefore, this paper divides the period from 2003 to 2015 into 3 periods: 2003-2006 years are credit control tightening period, 2007-2010 years are credit control expansion period, and 2011-2015 years are credit control stable period. After controlling the fixed effect and fixed effect of firms respectively, we obtain the effect of credit fluctuation on the capital structure of listed companies under time heterogeneity in Table 5. We can find that the relationship between capital structure and credit fluctuation in China's listed companies is not immutable and unchanging, and the relationship between the two will show different relations in different periods.

Table 5
Empirical Results of the Impact of Credit Volatility on the Capital Structure of Listed Companies Under Policy Heterogeneity

Variance	(1) 2003-2006	(2) 2003-2006	(3) 2007-2010	(4) 2007-2010	(5) 2011-2015	(6) 2011-2015
To_credit	-0.485***	-0.250***	-0.054	-0.048**	1.499***	0.438***
	(0.131)	(0.058)	(0.045)	(0.022)	(0.128)	(0.063)
LnScale	0.023***	0.130***	0.020***	0.019***	0.051***	0.039***
	(0.002)	(0.006)	(0.001)	(0.002)	(0.001)	(0.001)
Profit	-0.001***	-0.001***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ndts	0.002***	0.000	0.003***	0.001***	0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Flow_ra	-0.038***	-0.015***	-0.047***	-0.022***	-0.001***	-0.000***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Control	-0.002***	-0.000	-0.001***	-0.000	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
lnGDP	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mac_index	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.118***	-1.029***	0.148***	0.267	-0.421***	-0.396***
	(0.027)	(0.071)	(0.015)	(1,523.184)	(0.013)	(0.061)
Observations	9,893	9,893	22,637	22,637	44,958	44,958
R-squared	0.354	0.892	0.385	0.862	0.274	0.866
Industry fixed effects	Y	Y	Y	Y	Y	Y
Firm fixed effects	N	Y	N	Y	N	Y

Note.

(1) The data in brackets are the standard deviations generated in the regression process. ***, ** and * indicate, respectively, that the marked regression coefficients are significant levels at 0.01, 0.05 and 0.1.

(2) In the control of the industry fixed effects, the first, the third and the fifth equation respectively estimate the relationship between the credit fluctuation in different periods and the capital structure of the listed companies. In the control of industry fixed effects and firm fixed effects, the second, the fourth and the sixth equation respectively estimate the relationship between the capital structure of listed companies and credit fluctuation in different periods.

In the case of only controlling the fixed effect of the industry, such as Equation (1), there is a negative correlation between the credit fluctuation and the capital structure of Listed Companies in the 2003-2006 years, and the coefficient is -0.485. In the case of controlling the fixed effect and fixed effect of enterprises, such as Equation (2), there is still a negative correlation between the credit fluctuation and the capital structure of listed companies, the coefficient is -0.250. The results of the two empirical tests are significant at the 1% level. The negative correlation between credit fluctuation and the capital structure of Listed Companies in this period is mainly due to the contraction of credit scale during this period. This raises the cost of debt financing of listed companies. But at the same time, it also indirectly raises the cost of equity financing. Therefore, in the case of tight credit scale, the listed companies do not necessarily choose equity financing channels to finance, because the financing costs of the channels also rise.

Many companies listed on A shares are state-owned enterprises. When the credit scale is tight and the lending

threshold is raised, the unlisted companies are more difficult to reach the bank lending threshold. At this point, the banking industry is more willing to lend money to the large-scale listed companies with the background of state-owned enterprises, so as to ensure the safety of funds and profit stability. And from the point of view of listed companies, due to the imperfect capital market, bank loans compared to equity financing channels is still a lower cost source of funds. Due to the lending preference of the banking industry, the listed companies tend to make debt financing through bank credit and improve the capital structure of the company when they make capital structure decisions. Therefore, the change of capital structure of Listed Companies in the period has negative correlation with the fluctuation of credit scale.

In the control of the industry fixed effects, such as Equation (3), in the 2007-2010 years, there is a negative correlation between the credit fluctuation and the capital structure of listed companies, the coefficient is -0.054, and is not significant. In the control of the industry fixed effects and firm fixed effects case, as shown in Equation (4), the relationship between the capital structure of listed companies and credit volatility is still negative, and the coefficient is -0.048, significant level of 5%. The negative correlation between the credit fluctuation and the capital structure of Listed Companies in this period is due to the prosperity of the equity financing market in this period. But the debt financing market is not developed enough and not perfect enough. With the expansion of credit scale, the cost reduction of listed companies through debt financing is not equal to the decline of equity financing costs. The credit fluctuation caused by the financial crisis in this period is aggravating, which makes the theoretical model of credit fluctuation and capital structure of listed companies fail. Therefore, the relationship between credit fluctuation and the capital structure of listed companies is not significant when the fixed effect is not controlled in this stage.

In the case of only controlling the fixed effect of the industry, such as Equation (5), there was a positive correlation between the credit fluctuation and the capital structure of Listed Companies in the 2011-2015 years, and the coefficient was 1.499. In the case of controlling the fixed effect and fixed effect of enterprises, such as Equation (6), there is still a positive correlation between the fluctuation of credit and the capital structure of listed companies, the coefficient is 0.438. The results of the two empirical tests are significant level of 1%. With the maturity of China's debt financing market, the proportion of debt financing of listed companies continues to rise. The listed companies do not rely too much on the equity financing market in the financing decision. Therefore, there is a positive correlation between credit fluctuation and capital structure of Listed Companies in this period.

CONCLUSION

On the basis of controlling all kinds of corporate variables and macroeconomic variables, this paper studies the impact of credit fluctuation on capital structure by using the data of Listed Companies in China's A share market from 2003 to 2015. In the research process, the fixed effect method and the system GMM regression method were adopted to carry on the regression analysis of the model. The results show that there is a positive, significant correlation between credit fluctuations and the capital structure of listed companies. Then we also have further research on the relationship between credit fluctuations and the capital structure of listed companies. The results show that the different credit policy environment has different effects on the capital structure of listed companies. Under the stable credit policy environment, the influence of credit fluctuation on the capital structure of listed companies is positive and the coefficient of influence is larger. Under the tight or expanding monetary policy environment, the impact of credit fluctuation on the capital structure of listed companies is negative and the impact coefficient is smaller.

POLICY RECOMMENDATIONS

As an important factor affecting the financing environment, the credit policy is related to the financing decisions and capital structure of listed companies. China is in a period of strategic opportunities, and relevant authorities should make good use of macro credit policy and make good use of the policy tools that influence the capital structure of micro enterprises. Make the credit policy play a good impact on the capital structure of listed companies, and promote the continuous optimization of the capital structure of listed companies.

Firstly, we recommend that first, China should continue to deepen the market-oriented interest rate reforms, improve the pricing and transmission mechanism of the interest rate of deposit and loan, and optimize the interest rate structure of commercial banks. Interest rate is the objective embodiment of capital price. Interest rate policy affects money supply and corporate financing, and it is an important policy measure of market economy regulation. In the process of market allocation of resources, interest rate should play a basic role in regulating. Reasonable interest rate policy will make the flow of funds more reasonable and more efficient. Therefore, in the pricing of deposit and loan interest rates, financial institutions should be given more operational space. The existing transmission mechanism of interest rate policy should be further optimized and improved.

Secondly, the central bank should reduce the frequency of deposit reserve policy, and keep the difference of deposit reserve adjustment. When the deposit reserve rate

is adjusted, the scale of the credit will change with the total amount of available funds. This change will affect the level of the company's current liabilities, and ultimately lead to the corresponding adjustment of the company's capital structure. Although the adjustment of the reserve requirement has significant effect on the credit market, the negative impact of the policy tool on the market may be too much. Therefore, it is suggested that the central bank should gradually reduce the use of the deposit reserve rate adjustment means, and even should gradually stop the means. Because the domestic financial market of China is immature and imperfect, the government has limited operational tools for macro-control. Therefore, in the foreseeable future, the deposit reserve ratio will continue to be an important regulatory policy. However, the central bank should make appropriate use to reduce the cost of capital structure adjustment, and make the credit policy more effective in regulating the credit market. The existing statutory deposit reserve system should be further optimized so as to make it more targeted to the structural problems of the credit market.

Thirdly, the relevant authorities should further improve the capital constraint mechanism of prudential supervision, and improve the multi-level capital adequacy supervision system. The authorities should improve the countercyclical capital buffer mechanism, reduce credit market volatility, introduce leverage regulation, and strengthen the capital supervision system. China's Banking Regulatory Commission (CBRC) has effectively reduced the systemic risks of banks by establishing the capital restraint mechanism of prudential supervision. In 2004, the CBRC promulgated the measures for the management of capital adequacy ratio of commercial banks. In the aspect of raising capital for commercial banks, the supervision of the banking regulatory bureau is becoming more and more standardized, and a more perfect capital restraint mechanism has been established. In the allocation of bank resources, the CBRC should guide banks to allocate credit resources more reasonably by means of countercyclical capital requirements. Commercial banks obtain a large amount of capital through the capital market, and the capital adequacy ratio has been significantly improved. CBRC should establish a more perfect supervision system. CBRC also needs to guide the improvement of bank risk measurement tools, so that the risk management ability of commercial banks will be strengthened.

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