Financing Mode and Firm's Investment Efficiency: Evidence from Chinese manufacturing firms

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Abstract

At present, China's firms are highly dependent on credit financing. Among the modes of credit financing, bank credit and trade credit have the most important influence on the investment behavior of firms. Based on the survey data of the World Bank to Chinese manufacturing firms, this paper studies the effect of bank credit and trade credit on the investment efficiency of firms by the Heckman model. The results show that, in general, trade credit has a significantly positive effect on firm's investment efficiency, while bank credit will reduce the efficiency of investment. From the perspective of the degree of financing constraints, the two kinds of credit financing modes have significant differences, but regardless of the degree the financing constraints, trade credit can always improve firm's investment efficiency. Further empirical research shows that trade credit can also weaken the negative effect of bank credit on the firm's investment efficiency.

Key words: investment efficiency; credit financing mode; financing constraint; bank credit; trade credit

JEL Codes: G30

1.Introduction

Under the new normal, economic growth of higher quality requires shift of investment mode from large-scale to efficiency improvement. However, the low investment efficiency of firms in China has become a problem that cannot be ignored. According to Gugler et., al. (2004) ,the investment efficiency of listed companies in China ranked in the bottom fifth. Xin et al. (2007) estimated the rate of return on the listed companies' investment and showed that cumulative return rate on investment in new 5-year was only 2.6%, far lower than the cost of capital. Among the many factors that affect the efficiency of investment, the financing mode is undoubtedly the most direct and most important. From the current perspective, investment in China is still highly dependent on credit financing. The main source of credit finance includes private credit lending, bank credit, and a wide range of various forms of trade credit. The former is mainly used to fund for firms' short-term liquidity shortage, while the latter two are mainly long-term financing for firms' fixed assets investment. In recent years, domestic and foreign scholars have begun to concern about the impact of financing modes on investment efficiency, but studies have largely ignored the characteristics behind different financing modes, and the focus of attention are concentrated on the capital markets and bank credit, so other credit financing mode such as trade credit has been ignored.

Based on the World Bank's 2012 "China Investment Climate Survey" data, this paper studied the relationship between the two financing modes-bank credit and trade credit- and firms' investment efficiency using Heckman sample selection model. This paper contributes to the current literature from four aspects: First, from the reality of firms' financing mode in China, this paper focused on two kind of credit financing mode that have the greatest impact on firms' long-term fixed assets investment. Secondly, the paper compared the different effects of bank credit and trade credit on firms' investment efficiency, and noted that trade credit played a more important role to promote investment efficiency. Thirdly, this paper considered the heterogeneity of firms' financing constraints, and studied how bank credit and trade credit affect investment efficiency of firms facing different degree of financing constraints. Fourthly, this paper also studied whether the influence of one kind of financing mode on firms' investment efficiency is affected by the other financing modes.

The remainder of the paper is organized as follows. Section 2 discusses the related theory and literature review. Section 3 discusses data and constructs econometric model. Section 4 presents the main results of the effects of bank credit and trade credit on firm's investment efficiency, including some robustness checks, and Section 5 conducts further empirical research on interaction between bank credit and trade credit. Section 6 concludes by providing a summary of the results and policy implications.

2.Literature Review

According to the theory of Modigliani and Mille(1958), on the complete capital markets, firms' financing decisions and investment decisions are separated from each other. But in reality, there are varies of frictions such as asymmetric information,

incomplete contract and agency problems on financial markets, resulting in the direct effect of financing modes of firms on their investment behavior and investment efficiency. In terms of the impact of financing modes on firm's investment efficiency, there are two kind of research ideas: Early studies are more concerned about the impact of internal financing on investment efficiency, especially the relationship between the cash flow and investment efficiency (Fazzari et al. , 1988; Kaplan and Zingales, 1997; Vogt, 1994; Lian and Cheng, 2007); in recent years, research and literature on how external financing modes affect firms' investment efficiency began to emerge (Sufi, 2009; Luo et al, 2012) .

Based on the theory of information asymmetry and the pecking order theory, using data for the US manufacturing firms, Fazzari, Hubbard and Petersen (1988) (hereinafter FHP) confirmed the positive correlation between financial constraints and investment - cash flow sensitivity, making pioneering contribution to the research concerning investment-cash flow sensitivity and investment efficiency. On this basis, a lot of empirical research supported FHP's conclusions from other perspectives such as firm size, dividend payout ratio, and firm-group relationship. However, Kaplan and Zingales (1997) (hereinafter KZ) reached the opposite conclusion using the same sample but a different methodology. They suggested that there is no monotonic causal relationship between financing constraints and investment-cash flow sensitivity. This conclusion is also supported by other research results (Cleary, 1999; Qu et al., 2011). Since then the subsequent research focused on agency problems and studied the different effect on firm's investment efficiency of agency problems and financial constraints (Vogt, 1994; Lian and Cheng, 2007; Huang and Shen, 2009).

As to the external financing, the existing literature mostly focused on the impact of debt financing on firm's investment efficiency. One view is that when a firm finances itself through debt financing, its owner are more inclined to invest in the projects that can increase the value of the equity but reduce that of debt, which results in over-investment or under-investment. Jensen and Meckling (1976) showed that high debt capital structure will enhance the opportunism tendency of shareholders, increasing the risk of failure greatly. So once the project fails, the loss is borne by the majority of creditors, therefor the high level of leverage may result in over-investment. Myers (1977) believed that when investment income is mainly attributable to creditors, even if the investment can increase the firm value, managers will tend to refuse investment, which will result in underinvestment. In contrast, there is still no consensus among scholars in China. The empirical analysis of Chinese listed companies by Tong and Lu (2005) showed that the scale of investment and debt proportion are significantly negative correlated. The more debt a firm bears, the less it invests, and the negative effect is affected by the risk of the investment project. Peng and Liu (2007) pointed out that debt financing can lower the effective tax rate, and the latter will inhibit firm's investment activity, and therefore, debt financing can indirectly improve the efficiency of investment. Xu and Zhou (2009) showed that the increase of a firm's leverage will significantly lower the investment efficiency of local SOEs and non-SOEs, but the impact on the central SOEs is not significant. In addition, there are also literatures focusing on more specific financing modes. Guo and Ma

(2011) studied the impact of debt financing and trade credit on investment efficiency of unlisted manufacturing firms in China. They found that firms' investment spending is constrained by debt financing, but trade credit can ease the constraints. Song and Yao (2014) believed that both bank credits and trade credit can limit firms' over-investment, and the relative importance of these two financing modes will change with the degree of financing constraints.

From the current literature, the majority of research provides analysis concerning the relationship between firm cash flow or debt financing and investment efficiency. These studies provide important inspiration for further reflection and exploration. However, there are still some deficiencies among the existing research. First, the existing literature ignores the characteristics of different financing modes, which remains to be further studied. Secondly, bank credit and capital market receive the most attention both in theory and in practice, while the role of trade credit has been ignored. Thirdly, the heterogeneity of firms' financial constraints has not been taken into consideration. In fact, compared with bank credit, trade credit may play more effective role on financing firms and improve their investment efficiency. In addition, problems about data and methodology also exist in the current literature, one of which lies in that most of the existing empirical research focus on listed companies, which will result in biased sample selection. In fact the majority of firms facing financial constraints in China are SMEs and non-listed companies. Therefore, only a sample of listed companies does not reflect the overall situation of firm's investment activities in China. In this paper, we use the World Bank "China Investment Climate Survey" data, combined with Heckman sample selection model, focusing on the relationship between the two kinds of credit financing modes and firms' investment efficiency. We hope this study can be a supplement and amendment to existing literature to some extent.

3.Data and Methodology

(1)Data

This paper uses the World Bank "China Investment Climate Survey" data. The survey used random sampling, a total of 2848 firms were surveyed, located in 25 cities, covering 19 industries.2700 private enterprises and 148 state-owned enterprises received the survey. The questionnaire contains 13 parts, covering basic information, supply and marketing, infrastructure and services, the competitive environment, the security environment, technology and innovation, financing conditions, labor conditions, and other various aspects, designed to conduct a comprehensive assessment of the investment climate. The survey provides detailed and valuable information on firm investment and financing behavior. According to the survey results, not all firms in fiscal year 2011 have carried out investment activities, and the number of firms that carried out fixed asset investment is 1442, accounting for about 50.6%. In manufacturing firms' samples, the figure is slightly higher, reaching 56.1%, implying that still nearly half of the firms did not carry out investment activities.

Since this paper focuses on financing modes and investment efficiency of manufacturing firms, we drop the service industry firms, leaving only the sample of

manufacturing firms. We also drop the missing observations, and finally get a sample of 801 observations. To reduce the effect of outliers, we winsorize the continuous variables at 1% and 99% level.

(2)Model construction and variable selection

In the sample of this paper, a total of 370 firms (about 46%) have fixed asset investment spending in fiscal year 2011, and the remaining 431 firms (about 54%) have no fixed asset investment spending. Therefore, if using OLS method to estimate the investment efficiency equation, we may face a sample selection bias. In this paper, we use Heckman sample selection model to deal with this problem. The estimation process of Heckman sample selection model consists of two steps: first, estimating the probability of firm's investment in fixed assets by Probit model, getting an inverse Mills ratio estimates.in the second step, adding the inverse Mills ratio as a control variable to the investment efficiency equation, then estimating the equation by OLS. According to Heckman (1979), we specify the model as follows:

$$investdummy_i = \alpha Z_i + \varepsilon_{1i} \quad (1)$$

$$invest_i = \beta X_i + \varepsilon_{2i} \quad (2)$$

Equation (1) is investment-determined equation, and equation (2) is the investment efficiency equation. In equation (1), $investdummy_i$ is a binary dummy variable, and a value of 1 indicates firm i's investment expenditure is positive while a value of 0 indicates no investment expenditure of firm i. $invest_i$ represents firm i's investment expenditure in fixed assets, in logarithm form. Vector Z_i and X_i consist of variables that affect firm i's investment decisions and the investment level respectively. ε_{1i} and ε_{2i} follow joint normal distribution and the variance is $\rho\sigma_\varepsilon$. If$\rho \neq 0$, then the equation (1) and equation (2) are relevant, so they must be estimated simultaneously. Otherwise, the estimated coefficients will be biased.

As for the measurement of firm's investment efficiency, there are various of methods(Vogt,1994;Stein, 2003;Lian and Cheng, 2007;Risberg,2006;Richardson,2006; Biddle, et al., 2009), and the most widely used are investment expectation model(Richardson,2006) and investment-investment opportunities sensitivity model(Biddle, et al., 2009). The former is used to measure a firm's underinvestment or overinvestment. Richardson (2006) designed a regression equation to estimate the expected level of a firm's investment, and determined whether there is underinvestment or overinvestment by the estimated residual of the model. This method needs only financial indicators that are relatively easy to obtain (especially for listed company data), so it has been widely used by scholars in China (Wei and Liu, 2007; Cheng et al., 2008; Jiang et al., 2009; Li and Xiao, 2012; Wan, 2013; Xu, 2014). However, a firm's expected investment can be influenced by many factors in addition to financial indicators used by Richardson (2006).So it may generate inevitable bias, which will lead to the estimates bias of the whole model. Investment- investment opportunities sensitivity model measures a firm's to investment efficiency through the sensitivity of investment to investment opportunities (Stein, 2003; Bushman et al, 2007; Chen et al, 2011; Jin et al., 2012; Ying and. Luo, 2012), and the investment opportunities are generally measured by the growth of a firm, whose proxy can be

Tobin Q or sales growth. Tobin's Q has been widely used due to its simple calculations (Ren, 2011; Chen et al., 2012; Li and Li, 2014), but it also has more serious flaws. At present, the speculation on China's stock market is still common, thus the market value of the firms has been overestimated or underestimated to different extent, resulting in Tobin Q's failure in accurately reflecting the growth of firms. By contrast, the growth rate of sales is more robust. So we choose investment-investment opportunities sensitivity model, using the sensitivity of investment to growth rate of sales as the measurement of a firm's investment efficiency.

This paper focuses on two kinds of credit financing, namely bank credit and trade credit. therefore, we introduce two interaction terms- *bank * growth* and *credit * growth* –in equation (2) as the key independent variables, where *growth* represents the firm's growth rate of sales, *bank* and *credit* represent bank credit and trade credit respectively. Consistent with the literature, we use a binary dummy variable to represent the bank credit, *bank* = {0, 1}, where a value of 1 indicates the firm obtained loans or lines of credit from banks or other financial institutions, and a value of 0 means the opposite; we use *credit* - the proportion of the value of total annual purchases of material inputs or services paid for after delivery- to measure trade credit.

In addition to the two interaction terms, we also retain *growth*, *bank* and *credit* as independent variables.

According to Heckman (1979), vector Z_i must contain at least one variable that is not contained in vectorX_i. Obviously, the success of research and development of new products is one of the motives for a firm to invest, so whether to invest will be largely determined by new product development. On the other hand, according to the theory of industrial organization, the competitive position of firms will also affect the investment decisions. Therefore, we set the variable *newproduct* and *competitor* included only in vector Z_i but not in the vector X_i. *newproduct* is a binary dummy variable ,with the value of 1 indicating that firm i has introduced new products or services in the last three years. *competitor* is specified to measure the number of competitors that firm i faces, ranging from 1 to 5. The greater the number, the more competitors it faces.

Apart from *competitor* and *newproduct*, the equation (1) and (2) contain the same control variables. Based on the current empirical research, we specify the following four sets of control variables.

First, we control for the basic characteristics of firms. 1. firm size dummies *small* and *medium*, *small* = {0,1}, where the value of 1 indicates firm i is a small business (less than 20 people, according to the Survey), while the value 0 indicates firm i is not a small business; *medium* = {0,1}, where the value of 1 indicates firm i is a medium business (more than 20 but less than 100 people, according to the Survey), while the value 0 indicates firm i is not medium-sized; if both *small* and *medium* takes a value of 0 , it indicates that firm i is a large business (100 people or more in size). 2. *age*, logarithm of firm age. 3. firm ownership dummy *soe*, *soe* = {0,1}, where the value of 1 indicates firm i is a state-owned enterprise, with 0 representing private firm. 4. *profit*,

logarithm of firm i's net profit. 5. group dummy variable *part*, *part* = {0,1}, where the value of 1 indicates firm i is part of a larger group, value of 0 indicates firm i is a firm on its own. 6. export dummy *export*, export = {0,1}, where the value of 1 indicates export firm, with 0 representing non-exporters.

Secondly, we control for corporate governance factors. The impact of corporate governance on firms' investment activity has been demonstrated by literature (Ren, 2011; Li et al., 2011; Gao et al., 2012; Liu et al., 2014). This paper introduces *largestowner* to measure the proportion of shares hold by the largest shareholder, *experience* to measure the manager's working experience, *femaleowner* to measure whether there are any females among the owners of the firm, *femalemanager* to measure whether the top manager is female.

Thirdly, we control for government-firm relationship. Political relations make firms gain more external financing facilities that easing their financing constraints and reduce the cost of coordination with the government, thus improving investment efficiency (Chen and Zhu, 2009). Therefore, we introduce *time* and *govcontract* to control for the relationship between government and firms. *time* is the measurement of total senior management's time spent on dealing with requirements imposed by government regulations, and *govcontract* is a binary dummy variable, govcontract = {0,1}, the value of 1 indicates that firm i has secured a government contract, while value of 0 indicates no access to government contract.

At last, we control for regional fixed effects. firms located in 25 cities have been surveyed, so we introduce 24 binary dummy variables to control for the impact of local factors on firms investment behavior.

In summary, the econometric model in this paper can be further written as follows:

$$investdummy_i = \alpha X_i + \theta_1 competitor_i + \theta_2 newproduct_i + \varepsilon_{1i} \quad (3)$$

$$invest_i = \beta_1 growth_i * bank_i + \beta_2 growth_i * credit_i + \beta_3 growth_i + \beta_4 bank_i + \beta_5 credit_i + \gamma X_i + \varepsilon_{2i} \quad (4)$$

(3)Statistical description

Table 1 shows mean, variance and extreme value of the variables. Overall, more than half of the firms have investment in fix assets, and the average value of investment expenditure is about 4.346. The growth rate of sales gets an average of 43.5%, but with serious polarization. A small number of the firms gain a negative sales growth, while that figure of the fastest growing firms doubles 8,000 times, so we winsorize continuous variables including growth, and conduct robustness tests. As to the financing, firms gaining access to bank credits account for about 41.5% , the average trade credit firms obtain is about 61.32%.

As shown in Table 2, there is a significant difference in sales growth and financing modes between firms have investment expenditure and those who have no investment expenditure. For the firms that have investment expenditure, the volatility of the sales growth is greater than those who have no investment expenditure. On the financing modes, the probability of obtaining bank credit for firms that have

investment expenditure is higher than those who have no investment expenditure, but trade credits obtained by the former is less than the latter.

4.Main Results

(1)Baseline Regression

We estimate equation (3) and (4) with the method of Heckman(1979). Table 3 shows the estimation results. Column (i) shows the results with the first and the fourth set of control variables, column (ii) with the first, the third and the fourth set of control variables, column (iii) with the first, the second and the fourth set of control variables, and column (iv)with all control variables.

From table 3, all the four estimated inverse Mills ratio- λ- are significant, thus the null hypothesis that "equation (3) and (4) are independent of each other," should be refused. That means Heckman two-stage estimation method is necessary here to correct the sample selection bias. Compared each column with each other, we find no significant difference in the magnitude and significance of the coefficient of *growth*bank* and *growth*credit*, indicating a much lighter of multicollinearity and robustness of the model. Further analysis below is based on the results of column (iv).

The results show that the impact of different financing modes on firm's investment efficiency is different. The coefficient of *growth*bank* is significantly negative, indicating that bank credit may reduce firm's investment efficiency. While the coefficient of *growth*credit* is significantly positive, indicating that the trade credit can improve firm's investment efficiency. These results suggest that firms gaining access to bank credit do not use it effectively. In the current bank-dominated financial system of China, the primary role played by bank credit is funding for businesses as "large lenders" (Hu et al (2008); Shen et al (2013); Zhang, et al (2015)), while its supervision function has been weakened. Information asymmetry between banks and firms also increases the difficulty of supervision on the use of funds. In contrast, trade credit is based primarily on the "relationship" accumulated in long-term economic dealings between borrowers and lenders, which can reduce the information asymmetry, making it easier for the lender to monitor the behavior of borrowers effectively. Petersen and Rajan (1997) pointed out that this information advantage of relationship lenders is difficult to obtain for banks. Therefore, if inefficient investment behavior exists after obtaining funds, it will easily be known by the lender, thus affecting subsequent financing and the subsequent cooperation, so the borrower in this case will urge itself to improve investment efficiency.

As to the control variables, the coefficient of *soe* in the first step is not significant, but significantly positive in the second step, indicating that there is no difference in investment decision between state-owned enterprises and private enterprises, but once deciding to invest, the investment expenditure of SOEs is significantly higher than private enterprises. From the perspective of firm size, the coefficients of *small* are significantly negative both in the first and in the second step. At the meantime, the coefficient of *medium* is not significant in the first step, while it is significantly negative in the second step, indicating that compared with large firms, the probability of small firms to invest is smaller, and the investment expenditure of small and

medium-sized firms is also less than large firms.

(2)Robustness test

We first conduct the robustness test with a sub-sample. Here we extract the sample of private firms, and the estimation results are shown in column (i) of Table 4. We find that the coefficient of *growth*bank* is significantly negative, while that of *growth*credit* is significantly positive, which is consistent with the results of full sample estimation, thus confirming the conclusion that bank credit will reduce firm's investment efficiency while trade credit can improve it. The results for control variables are also highly consistent with our baseline model.

In our sample, there are some firms whose sales growth is negative, which may have some impact on our estimation results, so we exclude these observations. The estimation results are shown in column (ii) of table 4.

As is shown in column (ii) of table 4, both the magnitude and the significance of key independent variables are unchanged, the coefficient of the *growth*bank* is still significantly negative, and the coefficient of *growth*credit* remains significantly positive, consistent with the baseline model.

5.Further empirical research

The empirical results above show that access to bank credit reduces firm's investment efficiency, which conflicts with existing findings by other scholars (Ying and Luo, 2012; Song and Yao, 2014). The current literature suggests that bank credit has different effects on firms facing different degree of financing constraints. In order to further clarify the financing modes (especially bank credit) on firm's investment efficiency, we divide the sample into two–firms facing strong financing constraints form the one, and firms facing weak financing constraints form the other. We define firms facing strong financing constraints as the ones who do not apply for line of credit or loan due to high interest rates and so an or whose recent line of credit or loan has not been approved, and define firms facing weak financing constraints as the ones who have no need for a loan or whose recent line of credit or loan has been approved. Here, two methods–Heckman and OLS–are used to estimate the baseline model. The regression results are shown in Table 5.

As can be seen from Table 5, access to bank credit can significantly improve the investment efficiency of firms facing strong financing constraints, and this is also true for trade credit. These results suggest that when firms face strong financing constraints, access to credit–either bank credit or trade credit–can significantly improve the efficiency of investment, which also confirms the conclusions of Ying and Luo(2012) and Song and Yao(2014). As for firms facing weak financing constraints, the results are consistent with the baseline regression, that is, access to bank credit decrease firm's investment efficiency while the more trade credit available, the higher the investment efficiency. This shows that when firms face financing weak constraints, the promotion of investment efficiency must rely more on trade credit.

In the above, we compare the effects of bank credit and trade credit on firm's

investment efficiency, and the results show that these two kinds of financing play different roles. Overall, banks credit has a significant negative impact on firm's investment efficiency while trade credit has a significant positive impact. The next question is, whether the effect of one financing mode on firm's investment efficiency will change with the other. That is, on the one hand, whether the negative effect of bank credit will be affected by trade credit; on the other hand, whether the positive effect of trade credit will be affected by bank credit.

To investigate the questions above, we introduce an interaction term of three variables, so that the equation (4) can be extended into the following form.

$$invest_i = \beta_0 + \beta_1 growth_i * bank_i * credit_i + \beta_2 growth_i * bank_i + \beta_3 growth_i + \beta_4 bank_i + \beta_5 credit_i + \gamma X + \varepsilon_i \quad (5)$$

$$invest_i = \beta_0 + \beta_1 growth_i * bank_i * credit_i + \beta_2 growth_i * credit_i + \beta_3 growth_i + \beta_4 bank_i + \beta_5 credit_i + \gamma X + \varepsilon_i \quad (6)$$

Specifically, we build equation (5) to examine whether the negative effect of bank credit will be affected by trade credit and build equation (6) to examine whether the positive effect of trade credit will be affected by bank credit.

In order to tackle the problem of sample selection bias, we still use the Heckman two-step method to estimate equation (5) and equation (6). The first step is regression of equation (3), to give an estimation of the inverse Mills ratios. Then the second step is regression of equation (5) and equation (6) with the estimated inverse Mills ratio as an additional control variable.

Column (i) and column (ii) of table 6 show the estimated results of equation (5) and equation (6) respectively. From column (i) we find that, the coefficient of $growth_i * bank_i *$ credit$_i$ is significantly positive, indicating that with the increase in trade credit, the negative effect of bank credit on firm's investment efficiency will be weakened. Meanwhile, the results in column (ii) show that the coefficient of $growth_i * bank_i *$ credit$_i$ is not significant, indicating that the positive effect of trade credit on firm's investment efficiency will not be influenced by whether it gain access to bank credit or not.

To test the robustness of model (5) and (6), once again we drop the SOE observations and get the sub-sample of private enterprises. The regression results based on this sub-sample show no significant difference with the full sample regression. the regression results are not listed due to space limitation.

6.Conclusion

In this paper, we investigate the effects of bank credit and trade credit on firm's investment efficiency using Heckman sample selection model, based on the World Bank "China Investment Climate Survey" data. We have come to the following conclusions from the empirical results. First, on the whole, different financing modes have different effects on firm's investment efficiency. Trade credit can improve firm's investment efficiency, while bank credit may reduce it. Secondly, it should be emphasized that the impact of different financing modes on investment efficiency is

related to the degree to which firms face financing constraints. Specifically, both bank credit and trade credit can improve the investment efficiency of who face strong financing constraints, and bank credit has a negative but trade credit has a positive effect on firm’s investment efficiency facing weak financing constraints, which is consistent with the baseline regression results. The reason may be that when a firm faces strong financing constraints, both bank credit and trade credit can alleviate it, thereby improving the efficiency of investment. And when facing weak financing constraints, banks may not be able to supervise the using of funds so that reduce firm’s investment efficiency. While as for trade credit, information asymmetry between borrowers and lenders is not as serious as that in the situation of bank credit, and the “relationship” urges the firm promote investment efficiency of itself. Thirdly, further research in this paper suggest that trade credit can weaken the negative effect of bank credit on firm’s investment efficiency.

Conclusions of this paper have important policy implications. First, when firms face strong financial constraints, policy makers should aim to enable them to be funded through a variety of financing modes to ease the financing constraint, thereby increasing the efficiency of investment. Secondly, bank credit improves the investment efficiency of firms facing strong financing constraints, but reduces the investment efficiency of those who facing weak financing constraints, suggesting that "big lender" role of banks in China is concentrated on lending rather than supervision, so the banking sector reform in the future should focus both on lending and on supervision. Finally, trade credit plays an important role on improving firm’s investment efficiency, therefore the government should guide firms to take advantage of trade credit financing, and provide a guarantee for the effective use of trade credit for firms facing narrow financing channels.

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Table1-Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
investdummy	0.5381	0.4989	0	1
invest	4.3455	1.7416	-5.2983	11.6082
growth	0.4350	1.3738	-0.4000	11.5000
bank	0.4145	0.4929	0	1
credit	61.3234	29.9431	0	100
small	0.2846	0.4515	0	1
medium	0.4082	0.4918	0	1
age	2.6807	0.3897	1.0986	4.4659
soe	0.0150	0.1216	0	1
profit	15.4844	1.9496	8.8818	22.9458
part	0.1111	0.3145	0	1
export	0.3508	0.4775	0	1
largestowner	0.8386	0.2233	0.2	1
experience	2.7924	0.4554	0.6931	3.8501
femaleowner	0.5452	0.4983	0	1
femalemanager	0.0774	0.2674	0	1
time	1.0799	2.1026	0	30
govcontract	0.1124	0.3160	0	1
newproduct	0.4632	0.4990	0	1
competitor	4.6317	0.9235	1	5
Obs.		801		

Table2-Summary Statistics of subsamples

	Firms have investment in fix assets				Firms have no investment in fix assets			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
investdummy	1	0	1	1	0	0	0	0
invest	4.345	1.742	-5.298	11.608	——	——	——	——
growth	20.699	418.785	-0.843	8694.652	1.107	11.381	-0.667	165.667
internal	15.871	1.966	9.903	22.946	15.034	1.833	8.882	21.696
bank	0.483	0.500	0	1	0.335	0.473	0	1
credit	58.167	29.424	0	100	65.000	30.162	0	100
soe	0.012	0.107	0	1	0.019	0.136	0	1
small	0.206	0.405	0	1	0.376	0.485	0	1
medium	0.434	0.496	0	1	0.378	0.486	0	1
age	2.703	0.398	1.099	4.466	2.655	0.378	1.792	4.043
part	0.137	0.344	0	1	0.081	0.273	0	1
export	0.441	0.497	0	1	0.246	0.431	0	1
largestowner	0.819	0.226	0.200	1	0.861	0.218	0.200	1
experience	2.844	0.450	1.386	3.850	2.733	0.455	0.693	3.714
femaleowner	0.575	0.495	0	1	0.508	0.501	0	1
femalemanager	0.081	0.273	0	1	0.073	0.260	0	1
time	1.334	2.164	0	20	0.784	1.991	0	30
govcontract	0.146	0.354	0	1	0.073	0.260	0	1
newproduct	0.587	0.493	0	1	0.319	0.467	0	1
competitor	4.575	0.983	1	5.000	4.697	0.846	1	5
Obs.	431				370			

Table3- The Effects of Bank Credit and Trade Credit on Firm's Investment Efficiency.

Variable	i		ii		iii		iv	
	First step	Second step	First step	Second step	First step	Second step	First step	Second step
*growth*bank*		-0.230*		-0.238*		-0.226*		-0.233*
		(0.136)		(0.136)		(0.136)		(0.136)
*growth*credit*		0.003**		0.003**		0.003**		0.003**
		(0.002)		(0.002)		(0.002)		(0.002)
constant	-0.227	-0.276	-0.227	-0.335	-0.227	0.309	-0.227	0.251
	(1.191)	1.315	(1.191)	(1.302)	(1.191)	(1.378)	(1.191)	(1.361)
growth	0.040	-0.117	0.040	-0.101	0.040	-0.125	0.040	-0.111
	(0.038)	(0.171)	(0.038)	(0.171)	(0.038)	(0.171)	(0.038)	(0.171)
bank	0.449***	0.264	0.449***	0.278	0.449***	0.232	0.449***	0.244
	(0.119)	(0.177)	(0.119)	(0.176)	(0.119)	(0.182)	(0.119)	(0.181)
credit	-0.005***	-0.001	-0.005***	-0.001	-0.005***	0.000	-0.005***	0.000
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
soe	-0.364	1.183*	-0.364	1.110*	-0.364	1.208*	-0.364	1.136*
	(0.406)	(0.639)	(0.406)	(0.639)	(0.406)	(0.644)	(0.406)	(0.643)
small	-0.287*	-0.486**	-0.287*	-0.507**	-0.287*	-0.441**	-0.287*	-0.464**
	(0.157)	(0.213)	(0.157)	(0.213)	(0.157)	(0.219)	(0.157)	(0.218)
medium	0.095	-0.340**	0.095	-0.336**	0.095	-0.333**	0.095	-0.329**
	(0.132)	(0.157)	(0.132)	(0.155)	(0.132)	(0.161)	(0.132)	(0.159)
age	-0.075	-0.302*	-0.075	-0.302*	-0.075	-0.228	-0.075	-0.226
	(0.146)	(0.169)	(0.146)	(0.167)	(0.146)	(0.189)	(0.146)	(0.187)
profit	0.058	0.339***	0.058	0.343***	0.058	0.329***	0.058	0.332***
	(0.037)	(0.045)	(0.037)	(0.045)	(0.037)	(0.047)	(0.037)	(0.047)
part	-0.155	0.161	-0.155	0.153	-0.155	0.156	-0.155	0.148
	(0.168)	(0.194)	(0.168)	(0.192)	(0.168)	(0.200)	(0.168)	(0.198)
export	0.362***	0.184	0.362***	0.189	0.362***	0.166	0.362***	0.170
	(0.117)	(0.150)	(0.117)	(0.149)	(0.117)	(0.154)	(0.117)	(0.152)
largestowner	-0.396		-0.396		-0.396	0.043	-0.396	0.038
	(0.251)		(0.251)		(0.251)	(0.326)	(0.251)	(0.322)
experience	0.158		0.158		0.158	-0.213	0.158	-0.216
	(0.132)		(0.132)		(0.132)	(0.177)	(0.132)	(0.175)
femaleowner	-0.010		-0.010		-0.010	0.061	-0.010	0.060
	(0.114)		(0.114)		(0.114)	(0.154)	(0.114)	(0.152)
femalemanager	0.270		0.270		0.270	-0.637**	0.270	-0.625**
	(0.206)		(0.206)		(0.206)	(0.256)	(0.206)	(0.254)
time	0.132		0.132	0.033	0.132		0.132	0.031
	(0.025)		(0.025)	(0.032)	(0.025)		(0.025)	(0.032)
govcontract	0.022		0.022	-0.071	0.022		0.022	-0.037
	(0.177)		(0.177)	(0.189)	(0.177)		(0.177)	(0.195)
newproduct	0.686***		0.686***		0.686***		0.686***	
	(0.114)		(0.114)		(0.114)		(0.114)	
competitor	-0.174***		-0.174***		-0.174***		-0.174***	
	(0.062)		(0.062)		(0.062)		(0.062)	
λ		-0.780**		-0.711**		-0.992***		-0.918***
		(0.310)		(0.320)		(0.333)		(0.342)
City Fix Effect	YES		YES		YES		YES	
Obs.	801		801		801		801	

Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table4-Robustness Tests.

Variable	i		ii	
	First step	Second step	First step	Second step
*growth*bank*		-0.238*		-0.258*
		(0.136)		(0.141)
*growth*credit*		0.003**		0.004*
		(0.002)		(0.002)
constant	-0.336	0.391	-0.575	0.784
	(1.195)	(1.377)	(1.238)	(1.380)
growth	0.039	-0.107	0.035	-0.178
	(0.038)	(0.171)	(0.046)	(0.188)
bank	0.437***	0.230	0.473***	0.158
	(0.121)	(0.183)	(0.128)	(0.190)
credit	-0.005***	-0.001	-0.006***	0.000
	(0.002)	(0.003)	(0.002)	(0.003)
small	-0.279*	-0.495**	-0.182	-0.538**
	(0.158)	(0.220)	(0.167)	(0.223)
medium	0.110	-0.354**	0.156	-0.386**
	(0.134)	(0.161)	(0.139)	(0.165)
age	-0.068	-0.245	-0.029	-0.283
	(0.149)	(0.191)	(0.153)	(0.189)
soe			-0.349	1.128*
			(0.407)	(0.629)
profit	0.062*	0.327***	0.066*	0.316***
	(0.037)	(0.047)	(0.039)	(0.049)
part	-0.124	0.124	-0.135	0.161
	(0.172)	(0.201)	(0.177)	(0.207)
export	0.346***	0.159	0.360***	0.207
	(0.118)	(0.154)	(0.124)	(0.156)
largestowner	-0.393	0.028	-0.492*	-0.059
	(0.256)	(0.326)	(0.268)	(0.340)
experience	0.150	-0.204	0.172	-0.217
	(0.134)	(0.176)	(0.141)	(0.180)
femaleowner	0.000	0.055	0.042	-0.040
	(0.115)	(0.154)	(0.119)	(0.156)
femalemanager	0.306	-0.653**	0.268	-0.660**
	(0.210)	(0.258)	(0.224)	(0.265)
time	0.035	0.035	0.025	0.055
	(0.026)	(0.033)	(0.027)	(0.033)
govcontract	0.001	0.006	0.003	-0.002
	(0.180)	(0.198)	(0.184)	(0.199)
newproduct	0.674***		0.759***	
	(0.115)		(0.120)	
competitor	-0.163***		-0.170**	
	(0.063)		(0.068)	
λ		-0.945***		-1.020***
		(0.353)		(0.328)
City Fix Effect	YES		YES	
Obs.	789		736	

Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table5-Subsample Regression: strong financing constraints and weak financing constraints.

variable	strong financing constraints			weak financing constraints		
	Heckman		OLS	Heckman		OLS
	First step	Second step		First step	Second step	
*growth*bank*		1.087*	1.578***		-0.326*	-0.062
		(0.591)	(0.113)		(0.173)	(0.122)
*growth*credit*		0.019*	0.003**		0.010***	0.004**
		(0.010)	(0.001)		(0.002)	(0.002)
constant	-6.110	0.422	-0.099	5.434	1.353	0.848
	(1.959)	(1.552)	(0.326)	(1.402)	(1.604)	(2.162)
growth	0.134	0.128	-0.063	0.029	-0.565**	-0.269*
	(0.320)	(0.505)	(0.080)	(0.042)	(0.226)	(0.149)
bank	0.521*	0.258	-0.194***	0.411***	0.339	0.828***
	(0.279)	(0.241)	(0.044)	(0.155)	(0.257)	(0.249)
credit	-0.007*	-0.004	-0.001	-0.005**	-0.005	-0.013***
	(0.004)	(0.004)	(0.001)	(0.002)	(0.004)	(0.004)
small	-0.346	-0.859***	0.005	-0.336*	-0.502	-0.705**
	(0.306)	(0.268)	(0.046)	(0.204)	(0.307)	(0.318)
medium	0.196	-0.384*	0.053	-0.025	-0.331	-0.304
	(0.272)	(0.200)	(0.041)	(0.167)	(0.214)	(0.254)
age	0.033	-0.151	0.027	-0.220	-0.271	-0.393
	(0.342)	(0.278)	(0.052)	(0.176)	(0.237)	(0.270)
soe			-0.088	0.219	1.082	1.109
			(0.120)	(0.543)	(0.747)	(0.830)
profit	0.034	0.207***	0.020*	0.061	0.274***	0.273***
	(0.081)	(0.073)	(0.012)	(0.045)	(0.061)	(0.068)
part	0.249	0.108	0.030	-0.098	-0.005	-0.155
	(0.402)	(0.257)	(0.058)	(0.205)	(0.260)	(0.311)
export	0.864***	0.322	-0.004	0.132	0.270	0.424*
	(0.233)	(0.237)	(0.035)	(0.149)	(0.201)	(0.234)
largestowner	-0.032	-0.488	-0.007	-0.713**	-0.036	-1.205**
	(0.479)	(0.366)	(0.071)	(0.334)	(0.447)	(0.510)
experience	0.085	0.183	-0.081*	0.268	-0.188	0.376
	(0.284)	(0.231)	(0.042)	(0.167)	(0.245)	(0.258)
femaleowner	0.050	0.089	0.015	-0.015	0.162	0.111
	(0.210)	(0.173)	(0.032)	(0.142)	(0.220)	(0.241)
femalemanager	0.379	-0.012	-0.040	0.135	-0.417	-0.186
	(0.531)	(0.375)	(0.073)	(0.241)	(0.330)	(0.363)
time	0.006	-0.007	-0.009	0.038	0.026	0.073*
	(0.095)	(0.087)	(0.014)	(0.028)	(0.039)	(0.043)
govcontract	-0.344	0.002	0.023	0.280	-0.171	0.539
	(0.382)	(0.261)	(0.056)	(0.233)	(0.264)	(0.329)
newproduct	0.644***			0.706***		
	(0.231)			(0.149)		
competitor	-0.281**			-0.159**		
	(0.126)			(0.078)		
λ		0.151			-0.808	
		(0.392)			(0.500)	
City Fix Effect	YES		YES	YES		YES
Obs.	286			495		

Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table6-Interaction between Bank Credit and Trade Credit.

Variable	i		ii	
	First step	Second step	First step	Second step
*growth*bank*credit*		0.005***		-0.001
		(0.002)		(0.002)
*growth*bank*		-0.528***		
		(0.171)		
*growth*credit*				0.005**
				(0.002)
constant	-0.227	0.110	-0.227	0.427
	(1.191)	(1.349)	(1.191)	(1.370)
growth	0.040	0.108	0.040	-0.327***
	(0.038)	(0.129)	(0.038)	(0.116)
bank	0.449***	0.255	0.449***	0.175
	(0.119)	(0.180)	(0.119)	(0.179)
credit	-0.005***	0.000	-0.005***	-0.001
	(0.002)	(0.003)	(0.002)	(0.003)
small	-0.287*	-0.446**	-0.287*	-0.471**
	(0.157)	(0.217)	(0.157)	(0.220)
medium	0.095	-0.321**	0.095	-0.345**
	(0.132)	(0.158)	(0.132)	(0.160)
age	-0.075	-0.231	-0.075	-0.233
	(0.146)	(0.186)	(0.146)	(0.188)
soe	-0.364	1.114*	-0.364	1.182*
	(0.406)	(0.641)	(0.406)	(0.647)
profit	0.058	0.335***	0.058	0.329***
	(0.037)	(0.047)	(0.037)	(0.047)
part	-0.155	0.142	-0.155	0.146
	(0.168)	(0.197)	(0.168)	(0.200)
export	0.362***	0.179	0.362***	0.166
	(0.117)	(0.151)	(0.117)	(0.153)
largestowner	-0.396	0.034	-0.396	0.048
	(0.251)	(0.321)	(0.251)	(0.325)
experience	0.158	-0.209	0.158	-0.216
	(0.132)	(0.174)	(0.132)	(0.176)
femaleowner	-0.010	0.037	-0.010	0.068
	(0.114)	(0.152)	(0.114)	(0.154)
femalemanager	0.270	-0.595**	0.270	-0.639**
	(0.206)	(0.253)	(0.206)	(0.256)
time	0.132	0.031	0.132	0.030
	(0.025)	(0.032)	(0.025)	(0.033)
govcontract	0.022	-0.014	0.022	-0.035
	(0.177)	(0.194)	(0.177)	(0.198)
newproduct	0.686***		0.686***	
	(0.114)		(0.114)	
competitor	-0.174***		-0.174***	
	(0.062)		(0.062)	
λ		-0.907***		-0.964***
		(0.339)		(0.343)
City Fix Effect	YES		YES	
Obs.	801		801	

Standard errors are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.