

Empirical Study on Effect of Credit Constraints on Productivity of Firms in Growth Enterprise Market of China

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Abstract This paper investigates the effects that credit constraints have on firms' productivity. The FGLS and OLS estimations are employed as our analysis tool. Then we use the unbalanced panel data of SMEs and innovation-oriented firms listed in the board of Growth Enterprise Market of China from 2001 to 2016 as the validation. In our analysis, the ownership of firm is also taken into consideration. The empirical results show that credit constraints don't have significant influence on productivity, while the effect actually exists when considering ownership.

Keywords: credit constraints, firm productivity, growth enterprise market, FGLS method, ownership

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1. Introduction

Firms need reliable and sufficient funding to develop and thrive, no matter external or internal. The existing literature points out that financial frictions like credit constraints have a negative effect on the capital allocation, which is responsible for great productivity differentials among countries [1].

When it comes to firm level, credit constraints still play an important role of shaping productivity. Firms facing credit constraint often have problems in creating sufficient cash flow, which brings a lot of inevitable follow-ups, like discouraging technology improvement, inducing factor hoarding and incurring higher cost.

Chinese Second-board Market, also known as growth enterprise market (GEM), contains mainly Small and Medium Firms (SMEs) and innovation-oriented industries. Those firms are high-investment because of their great potentials and also high-risk because of their instability. For sustainable development, those firms need stable funds.

In this paper, we use the Second-board Market as our ideal laboratory to figure out the direct effect that credit constraints have on firms' productivity, especially for SMEs and innovation-oriented industries. Our work differs from existing literatures in many aspects. First, our research focuses on Chinese SMEs and innovation-oriented firms which facing much more difficulties in financing compared to traditional industries. Second, we focus on external credit constraints, and further decompose it based on different sources: state-owned banks, non-state owned banks and other financial institutions. Finally, we examine

whether there is a different effect to credit constraints on different firm ownerships.

The reminder of this paper structured as follows: Section 2 focuses on related literature. Section 3 explains the empirical model. Section 4 shows the whole empirical analysis and results. Section 5 discusses our findings and conclusions.

2. Literature Review

There has been heated debate in literature over the link between financial development and economic growth. King and Levine [17] presented the conclusion that financial system can promote economic growth validated by the data on 80 countries over 1960-1989. The following researches stick with the concept. Recently, Naeem et al [18] indicated financial sector development (FSD) has a positive effect on economic growth based on the dataset from GCC countries among a long time period 1975-2012. Rubi Ahmad et al [15] revealed the same results as Naeem using data from selected developing economies in Africa. The same evidence is supported by Jose L.Ruiz [19] and A. Bara [15].

Many empirical studies have investigated the link between financial development and economic growth at the micro-level. And mostly, they choose the relationship between credit constraints and productivity of firms as the cut-in point. Xiang and Wei [14] found out the liquidity constraints have specific negative effect on private firms' productivity using 1998-2008 firm-level data in China. The following paper, Manaresi and Pierri's research [7] showed that credit contraction account for a quarter of the

observed decline in Italian total factor productivity growth quantitatively. While, Roberts, and Fielding [10] came up with a contrary finding that the external financing can obstruct the growth of firms based on low-income country data. In line with Regasa et al, Wang and Zhao [12] found that financing constraints on the productivity will produce positive influence, while relaxation of constraints will reduce the production efficiency.

The Chinese Second-board Market is built to help firms like SMEs and innovation-oriented firms, whose request for external finance is usually refused by banks which caused by common features. They can offer many investment opportunities, but they can also bring great risk. There are plenty literatures spot on Second-board Market. Qun and Zhai [9] revealed that credit constraints have negative influence on Hi-tech firms' R&D investment and sustainable growth. And Tong and Yao [11] validated the same result using evidence from SMEs. On the contrary, Lu [6] pointed out that credit constraints aren't the main factor influencing the R&D investment based on the Chinese Second-board Market data from 2011 to 2013. Hu and Zhang [4] found out the development of financial intermediary and GEM could not ease firms' financing constraints.

So far, existing literatures either discuss about the connection between the credit constraints and firm's productivity among traditional industries, or research the effect of credit constraints based on SMEs and innovation-oriented enterprises but focus on other aspects of firm performance. In our paper, we directly study the relationship between the credit constraints and SMEs and innovation-oriented enterprises' productivity, funding sources and firm ownership are also taken into consideration.

3. Model

Enlightened by Nickell [8], our empirical model directly puts the financial constraints into the production function and some transformations are made to ensure the effectiveness of the model in our analysis. The regression model is constructed as follows.

$$L_{\text{productivity}it} = \beta_0 + \beta_1 L_{\text{bankloan}it} + \beta_2 L_{\text{turnover}it} + \beta_3 L_{\text{roe}it} + \beta_4 L_{\text{quick}it} + \mu_{it} \quad (1)$$

In the developed model, $L_{\text{productivity}it}$ depicts the firm i 's productivity of year t , with $L_{\text{bankloan}it}$, $L_{\text{turnover}it}$, $L_{\text{roe}it}$ and $L_{\text{quick}it}$ stands for the i th firm's bank loan, turnover ratio, return on equity and acid-test ratio. μ_{it} describes the stochastic error.

3.1. Dependent Variable

In our model, the productivity is represented by two proxy variables: total-factor productivity (**tfp_lp**), which usually used to measure the economy's long-term technological change; net profit per employee (**L_productivity**), the one explains the firms' production foundations.

For details, the total-factor productivity (TFP) is calculated by the LP method proposed by Levinsohn and

Petrin [4], in our case, net profit, employee number and total asset are used for the computation.

And we employ profits per employee to calculate **L_productivity**, which provides a dynamic measure of finance growth, average output of labor, and the level of profitability within a corporation.

3.2. Explanatory Variables

In our study, we choose bank loan (**L_bankloan**) as the representative of credit constraint, because small and medium enterprises and innovation-oriented firms get their external funding mainly from banks. Therefore the amount of debt a firm has borrowed becomes our research proxy for credit constraints.

Next, we select total capital turnover rate (**L_turnover**) to evaluate firm's efficiency. Demonstrated by Bodie, Kane, and Marcus [2], asset turnover is a financial ratio that measures the efficiency of how a company use its own assets in generating sales income.

The return on equity (**L_roe**) is chosen as a measure of the profitability of a business in relation to the book value of shareholder equity. In existing papers (Woolridge and Gray [13]), ROE is usually used as a measure of how well a company uses investments to generate earnings growth.

At last, the quick ratio, the ratio between liquid assets and current liabilities, is chosen to measure the ability of a company to use its quick assets to extinguish or retire its current liabilities. Generally, the higher the ratio, the greater the company's liquidity, as Gallagher [3] discussed. Liquidity is one of the most important index to evaluate firm performances, so we put **L_quick** into the model.

A summary of the variables is presented in Table 1.

Table 1. Description of Variables.

Variable	Description
L_productivity	log (net profit /employee)
tfp_lp	total-factor productivity by LP method
L_bankloan	log (bank loan)
L_turnover	log (total capital turnover)
L_roe	log (return on equity)
L_quick	log (quick ratio)

4. Experiments and Results

The data used in this study is collected from the CSMAR database. The database is broadly used in empirical researches of Chinese economy. The dataset covers 2401 observations of 379 small and median enterprises (SMEs) and innovation-oriented firms from 2001 to 2016 in Chinese Second-Board Market. It contains detailed firm-level information of listed SMEs and innovation-oriented firms including employment, location and financial statements like balance sheet, income statement and cash flow statement.

Because of the dataset we used is unbalanced panel data, we apply Feasible Generalized Least Squares estimation method (FGLS) with a heteroscedastic error term, and fixed effect Ordinary Least Squares (OLS) method is used as a robustness check.

The basic regression results are presented in Table 2.

As the Table 2 displays, there is no significant relationship between bank loan and firm's productivity. The result supports that credit constraints have no significant influence on the productivity of SMEs and innovation-oriented firms. We can learn that the establishment of Second-Board Market may help SMEs and innovation-oriented firms get access to external funding more easily. At the same time, we can find in the table that return on equity and quick ratio have a positive influence on firm's productivity, which is in line with the common sense.

As is known to all, the 2008 Financial Crisis caused great negative effect worldwide. Therefore, we take the 2008 financial crisis as the key time point to perform the descriptive analysis to describe the change of funding source before and after.

The obtained results are shown in Table 3. The analysis states that loans mainly come from state-owned commercial banks before crisis, while majority of loans comes from other financial institutions after crisis. It shows that after crisis, state-owned banks decreased lending to SMEs and innovation-oriented firms, shows a much stricter credit constraint. Also, the scale of lending granted by financial institutions after crisis rose up about 200 times compared with commercial banks. It can be shown that though SMEs and innovation-oriented firms do suffer from serve credit constraints, these firms survived and thrived by

active participation of financial institutions for liquidity support.

Then, we examine whether the effect of credit constraints on various firm ownership is different. With the purpose, we adopt ownership to distinguish the two kinds of firms, which equals one if the firm is state-owned, otherwise equals zero. The altered model is presented below.

$$L_{\text{productivity}_{it}} = \beta_0 + \beta_1 L_{\text{bankloan}_{it}} + \beta_2 L_{\text{turnover}_{it}} + \beta_3 L_{\text{roe}_{it}} + \beta_4 L_{\text{quick}_{it}} + \beta_5 \text{ownership}_{it} \quad (2)$$

In the Table 4, the effect of ownership is significant under FGLS regression analysis, which depicts that discrimination of ownership does exist when it comes to innovation-oriented firms. And credit constraints show a negative effect.

Therefore, to demonstrate the effect more clearly, we classify all firms into two groups namely state-owned and non-state-owned firms, and perform the regression respectively.

As seen in the Table 5 and Table 6, credit constraints have a significant negative effect on non-state-owned firms' productivity, while make no difference to state-owned firms. It indicates the existence of serve proprietorship discrimination in China, state-owned firms can get funds more easily compared with non-state-owned ones due to their close relations with the government.

Table 2. Regression Results

Variables	OLS		FGLS	
	tfp_lp	L_productivity	tfp_lp	L_productivity
L_bankloan	-0.214 (0.196)	-0.0360 (0.0285)	-0.0765 (0.0938)	-0.00710 (0.0113)
L_turnover	0.584 (0.412)	-0.157** (0.0741)	-0.239 (0.240)	-0.295*** (0.0391)
L_roe	4.655*** (0.568)	0.591*** (0.0767)	5.657*** (0.151)	0.663*** (0.0258)
L_quick	0.665 (0.471)	0.341*** (0.0661)	1.282*** (0.199)	0.437*** (0.0218)
constant	-0.843 (15.04)	9.866*** (1.560)	-17.34*** (4.816)	7.890*** (0.676)

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Robust standard errors in parentheses.

Table 3. Mean of loan from different source (unit: ten thousand)

Source of loan	before 2008	from 2008 to 2016
The four state-owned banks	56.5	21.6
Other banks	31.5	41.9
Financial institutions	0	10819.4

Table 4. Regression Results (with ownership)

Variables	OLS		FGLS	
	tfp_lp	L_productivity	tfp_lp	L_productivity
L_bankloan	-0.425* (0.247)	-0.0390 (0.0340)	-0.388** (0.172)	-0.0376** (0.0157)
L_turnover	0.105 (0.395)	-0.182*** (0.0602)	-0.582** (0.263)	-0.287*** (0.0468)
L_roe	4.372*** (0.715)	0.474*** (0.0843)	4.840*** (0.279)	0.439*** (0.0389)
L_quick	0.490 (0.660)	0.219** (0.0886)	0.843** (0.344)	0.315*** (0.0367)
ownership	2.265 (2.878)	-0.412 (0.322)	0.0332 (0.919)	-0.443*** (0.156)
constant	1.442 (16.95)	8.789*** (2.139)	3.022 (7.367)	7.640*** (1.072)

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Robust standard errors in parentheses.

Table 5. Regression Results (with State-owned Firms)

Variables	OLS		FGLS	
	tfp_lp	L_productivity	tfp_lp	L_productivity
L_bankloan	-0.326 (0.685)	-0.0856 (0.113)	-0.0998 (0.466)	-0.0674 (0.0912)
L_turnover	-0.733** (0.347)	-0.240*** (0.0704)	-0.656* (0.339)	-0.205*** (0.0650)
L_roe	2.737* (1.598)	0.489*** (0.165)	2.410*** (0.582)	0.534*** (0.120)
L_quick	0.0291 (2.901)	0.605* (0.358)	1.505 (1.127)	0.684** (0.275)
constant	-13.97 (72.85)	14.51* (8.111)	33.26 (23.02)	13.55** (5.425)

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Robust standard errors in parentheses.

Table 6. Regression Results (with Non-state-owned Firms)

Variables	OLS		FGLS	
	tfp_lp	L_productivity	tfp_lp	L_productivity
L_bankloan	-0.0191 (0.0121)	-0.0427 (0.0364)	-0.0199** (0.00816)	-0.0397** (0.0185)
L_turnover	0.0506 (0.0469)	-0.197 (0.184)	-0.00590 (0.0201)	-0.285*** (0.0723)
L_roe	0.197*** (0.0402)	0.489*** (0.121)	0.246*** (0.0126)	0.483*** (0.0399)
L_quick	0.00101 (0.0283)	0.0717 (0.0780)	0.0253 (0.0165)	0.236*** (0.0422)
constant	1.540** (0.621)	4.561** (1.967)	0 (0)	6.723*** (1.093)

Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Robust standard errors in parentheses.

5. Conclusions

In our work, we try to figure out the effect of credit constraints on firm's productivity validated by the data from Chinese growth enterprise market. Two econometric techniques OLS and FGLS are applied in our experiment.

Through the experiment, we obtain some meaningful results. Based on the results from our experiments, credit constraints do not exert significant influence on the productivity of SMEs and innovation-oriented firms. The analysis of funding sources shows an interesting switch, the main funding source comes from bank before 2008 while it's replaced by financial institutions after the financial crisis. Besides, there is an obvious difference between effects on state-owned and non-state-owned firms, where a significant negative effect is shown on non-state-owned firms when facing credit constraints.

From our analysis, the SMEs and innovation-oriented firms are still suffering from the credit constraints even with the help of growth enterprise market. Firms still cannot get funds from banks easily. There is still a long way to go.

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