



# Financial Structure, Financing Constraint and Total Factor Productivity of Enterprises

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## Abstract

The total factor productivity is the core issue of industry in China from “made in China” to “create in China”. This paper aims to study how China’s financial structure affects the total factor productivity of Chinese enterprises through the method of financing constraints. The provincial panel data from 2005 to 2015 are selected through constructing the index of total factor productivity and financing constraints. The results indicate that the development of financial market in China’s financial structure can significantly alleviate the financing constraints faced by enterprises, so as to promote the improvement of total factor productivity of enterprises.

**Keywords:** Financial structure; Financing constraint; Total factor productivity; Mesomeric effect model

## Introduction

Since 1998, the annual growth rate of China’s per capita GDP has been maintained at about 9.3%, and the economy has been in a high-speed rising trend. However, with the advent of aging population in recent years, the demographic dividend has gradually disappeared, causing that China is facing the situation of “middle income trap”, and capital and labor have been unable to make economic growth efficient. According to the frame of modern economic theory, total factor productivity is the only way to promote sustained and efficient economic growth. However, many studies at home and abroad put forward question on the contribution of total factor productivity to China’s economic growth. In domestic research, used Malmquist index method to conduct estimation on China’s total factor productivity, and it was found that China’s total factor productivity has been decreasing since 1997 [1,2]. The decline of China’s total factor productivity since 2008 is the reason for the downward trend of real GDP [3]. At the same time, the total factor productivity gap among different regions in China is gradually widening, with no convergence effect, leading to a widening gap in economic growth among the east, the middle and the west [4]. Of course, China’s total factor productivity is at the lowest level compared with other major countries in the world, so there is still a lot of

space to improve the level of total factor productivity. Therefore, in the context of the current new normal and supply-side structural reform, how to promote the improvement of China’s total factor productivity has become an urgent problem. The three aspects, sufficient R & D investment, human capital investment and system mechanism matching with technological innovation, are the important factors affecting the improvement of total factor productivity [5]. However, from the perspective of financing, the above investment activities will be subject to financing constraints due to their long cycle and difficult to observe characteristics [6]. At the same time, China is now characterized by a dual track financial system, referring that state-owned banks loan funds to state-owned and large-scale enterprises with artificially low interest rates, while commercial banks and informal financial institutions loan funds to private and small-scale enterprises with high interest rates, which makes China’s private and small-scale enterprises are facing more serious financing constraints. More than 80% of private enterprises believe that financing constraint is an important factor to restrain the development of enterprises. Previous studies have found that financing constraints have a serious inhibitory effect on the total factor productivity of enterprises. On the one hand, enterprises with large financing constraints will have a significant inhibitory

**Received date:** 25 April 2021; **Accepted date:** 30 April 2021; **Published date:** 02 May 2021

**Citation:** Ping L, Yong H, Xiuyu D (2021). Financial Structure, Financing Constraint and Total Factor Productivity of Enterprises. SunText Rev Econ Bus 2(2): 131.

**DOI:** <https://doi.org/10.51737/2766-4775.2021.031>

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effect on fixed assets, R & D and other input production of enterprises due to the availability of funds, so as to restrain the timely growth of total factor productivity [7,8]. On the other hand, enterprises with small financing constraints will have rent-seeking behaviour, and the emphasis on technological innovation is scattered. At the same time, it is easier to invest capital in the virtual economy, which generates a lot of material wealth, rather than in technological innovation, so as to have a negative effect on its own total factor productivity.

Since Goldsmith put forward the theory of financial structure in the 1960s, and after it is regarded that the essence of financial development is the change of financial structure, financial structure has become an important perspective to study the impact of financing constraints. The financial structure is based on the ratio of the trading volume of a country's stock market to the amount of bank credit. When the ratio is high, the country is "market-oriented type" and vice versa it is the "bank-oriented type" [9]. On the one hand, China's current financial system is dominated by the banking industry, and state-owned banks play a dominant role. Loans are dominated by national policies, not out of the principle of profit maximization [10]. Then, that state-owned banks were interfered by the government in the credit process. For policy purposes, a large number of funds are loaned to state-owned enterprises at low interest rates, while private enterprises and small and medium-sized enterprises are faced with high financing constraints. On the other hand, China's stock market is also characterized by high volatility, high turnover and high speculation, which makes the resource allocation function of the stock market has not been effectively played [11,12]. Through the further study, it was found that the instability of China's stock market will increase the financing cost of enterprises, which will cause that the financing constraints faced by enterprises will be intensified [13]. At the same time, the studies have pointed out that the development of financial market can reduce the information asymmetry in the market, so as to reduce the difference of internal and external financing cost and ease the financing constraints of enterprises. Above all, in the paper, it holds that the development of China's financial structure is not reasonable at this stage, and banks show strong credit discrimination to shut out the financing of private enterprises and small and medium-sized enterprises. The financial market shows high instability, which makes the function of pricing and resource allocation that should have been lost. The financial structure at this stage may make enterprises suffer from serious financing constraints, so as to further restrain the promotion of total factor productivity. This paper attempts to clarify the relationship between the development of financial structure and the financing constraints of enterprises, and how to affect the development of China's total factor productivity level through this relationship. The rest of this paper is arranged as follows: The second part is

literature review and mechanism analysis; the third part is the model, index and data description; the fourth part is empirical test and analysis; the fifth part is the conclusion and suggestion.

## Literature Review and Mechanism Analysis

The relationship among financial structure, financing constraints and total factor productivity have been explored, and existing literature is mainly divided into the following two aspects: This paper has studied the impact of financial structure on financing constraints and the impact of financing constraints on total factor productivity of enterprises. The following is a review of the relevant literature. The impact of financial structure on financing constraints can be roughly divided into two categories: On one hand, it is considered that the irrational structure of China's banking industry leads to serious financing constraints for Chinese enterprises. The study pointed out that China's economy is in a form of "financial repression", which not only shows that the official interest rate is lower than the market interest rate, but also shows that state-owned banks are in a monopoly position. This will make it impossible for China's banking industry to form an effective competition mechanism, which will increase bank loans and reduce enterprise financing costs, so as to relief financing constraints [14,15]. At the same time, the Bank of China shows strong "ownership discrimination" and "scale discrimination" in the credit process, and private enterprises are facing more serious financing constraints compared with state-owned enterprises [16]. On the other hand, previous studies have shown that the development of financial market in financial structure can significantly alleviate the financing constraints faced by enterprises [17]. The development of a country's stock market is positively correlated with the external financing channels of small and medium sized enterprises in the test of transnational data; Further domestic research has shown that the development of China's regional financial market can improve China's financial system, so as to relieve the financing constraints faced by enterprises [18,19]. By straightening out, this paper finds that both aspects of financial structure have an impact on China's financing constraints. However, one thing that cannot be ignored is that the banks, especially the state-owned banks, play the role of government financial function in the society under China's special national conditions. The existence of this function makes the state-owned banks inevitably incline more financial resources to the state-owned enterprises, and it cannot completely change the status quo of the banking industry through the implementation of policies or other ways. Thirdly, in recent years, small and medium-sized board and growth enterprise market have opened one after another in the financial market, which provides more diversified financing paths for China's small and medium-sized enterprises. At the same time, China has been implementing a relatively loose monetary policy in recent years, and the

development of financial market plays an “intermediary” role, which is conducive to strengthening the transmission and implementation of monetary policy [19]. When China’s loose monetary policy is effectively implemented, it will lower the interest rate, which can help enterprises to reduce financing costs and ease the degree of financing constraints.

**Hypothesis 1:** China’s financial structure is one of the important factors that cause enterprises to face financing constraints. Compared with the structure of banking industry, the development of financial market can significantly relieve the financing constraints faced by Chinese enterprises. As a measure of technological progress, total factor productivity has been in stagnant state in China’s development as the world’s second largest economy, which has aroused extensive attention of scholars at home and abroad, where China’s severe financing constraints have become a key aspect to explain the lagging development of total factor productivity. As mentioned above, the financing constraints faced by enterprises are caused by the two aspects of information asymmetry and financing discrimination in China [20]. On one hand, owing to information asymmetry, banks require a lot of collateral in the process of lending, and innovation investment is often intangible assets, which cannot be taken as the collateral to get a loan from the bank, so as to make enterprises have to give up favorable investment opportunities, and restrain the growth of total factor productivity of enterprises. On the other hand, affected by financing discrimination, non-state-owned enterprises cannot obtain too much external financing. In order to ensure the sustainability of the capital chain, a large number of internal funds will be used to maintain the production and operation of the enterprise, which has a significant inhibitory effect on R & D investment and human capital accumulation, so as to hinder the development of total factor productivity. At the same time, the existing studies have confirmed that a large number of credit funds flow into inefficient state-owned enterprises, and banking credit activities do not significantly promote total factor productivity [21,22]. On the contrary, when the financing constraints of non-state-owned enterprises are relieved and financing channels are increased, the total factor productivity will be significantly increased [23,24]. Furthermore, some scholars have measured how much loss China’s financing constraints will have on total factor productivity, and have studied the loss of output efficiency in China compared with America, finding that the total factor productivity loss of Chinese industrial enterprises reached 50% in 1998-2005. Subsequently, has calculated the loss range of total factor productivity of various industries due to financing constraints as high as 20% - 70% on the basis of H-K model [25]. Above all, we find that financing constraints inhibit the development of total factor productivity of enterprises from investment intention, R & D investment, human capital and other aspects. Meanwhile, the price of capital factor is

distorted under China’s current situation, which makes capital flow into state-owned enterprises at a lower cost, which has crowding-out effect on non-state-owned enterprises, making the faced degree of financing constraints higher, and dragging down the development of its total factor productivity level.

**Hypothesis 2:** Financing constraints are one of the important ways to restrain the growth of China’s total factor productivity of enterprises. Compared with state-owned enterprises, the non-state-owned enterprises are more seriously affected by the reduction of total factor productivity due to the constraints of financing.

**Hypothesis 3:** The development of China’s financial market can improve the level of total factor productivity.

The possible contributions of this paper are divided into the following two parts: Throughout the existing literature, some scholars explore the impact of financial structure on financing constraints and the impact of financing constraints on total factor productivity. Firstly, in this paper, the three parts are linked to take financing constraints as an intermediate channel to explore the impact of financial structure on total factor productivity. Secondly, the existing literature tends to pay attention to the impact of financial development on financing constraints, ignoring the development of China’s financial structure, and a large number of scholars only tested how the financial development level affects the financing constraints in the process of empirical study. Only a few scholars have constructed financial structure indexes, and tested the impact of China’s financial structure on financing constraints. The micro data of listed companies are adopted in this paper to make an empirical study on how China’s financial structure affects total factor productivity through financing constraints.

## Empirical Research Framework and Index Measurement

### Econometric model

This paper aims to analyse that the unreasonable development of China’s financial structure makes Chinese enterprises face serious financing constraints, so as to influence the promotion of total factor productivity of enterprises. In order to analyse and understand the relationship of the three more intuitively, this paper takes financing constraints as intermediary variables, financial structures as explanatory variables, and total factor productivity of enterprises as the explained variables. Based on the method of, this paper establishes the following mediating effect model.

$$\ln TFP\_LP_{it} = \hat{\alpha}_0 + \hat{\alpha}_1 FS_{it} + \hat{\alpha}_2 control_{it} + \varepsilon_{0it} \quad (1)$$

$$SA_{it} = \beta_0 + \beta_1 FS_{it} + \beta_2 control_{it} + \varepsilon_{1it} \quad (2)$$

$$\ln TFP_{LP_{it}} = \theta_0 + \theta_1 FS_{0it} + \theta_2 SA_{it} + \theta_3 control_{it} + \varepsilon_{2it} \quad (3)$$

Where the set of control variables control<sub>it</sub> can be set as follows:

$$control_{it} = \lambda_1 L_{it} + \lambda_2 zzl_{it} + \lambda_3 \ln age_{it} + \lambda_4 hhi_{it} + \lambda_5 capital_{it} + \lambda_6 roe_{it} + \lambda_7 soe_{it} + \lambda_8 yendum_{it} + \lambda_9 indum_{it} \quad (4)$$

Above all, I, t represents the individual and year of the enterprise respectively, lnTFP LP represents the total factor productivity of enterprises, FS represents the current financial structure of China, SA represents the SA index, aiming the degree of financing constraints on enterprises, and SA index represents negative value. So the greater its absolute value, the greater the degree of financing constraints faced by enterprises. Control is the control variable, and zzl is the growth rate of main business, which approximately substitute for the growth of enterprises. The enterprises with better growth are less constrained by financing, and their total factor productivity level increases faster. Lnage represents the enterprise age, and about the age of enterprises, most scholars think that the old enterprises have more advantages in the financing process, and at the same time, whether new enterprises or old enterprises focus on innovation and technology investment is also one of the focuses of enterprise innovation theory. The hhi represents market competition, and the market share is used as an approximate substitute in this paper, referring to the current year's main business income of listed companies / current year's main business income of all listed companies. When the competitiveness of enterprises is strong, the degree of financing constraints is relatively small. The roe represents return on net assets, which is used to measure the efficiency of enterprises using their own capital. When the index value is higher, explaining that the level of return from investment will be higher. The capital represents the capital intensity with the usage of fixed assets / number of employees. Compared with labour-intensive enterprises, capital intensive enterprises tend to choose technology investment and innovation.

### Index description

On the measurement of financing constraints, the mainstream methods are mainly divided into three categories: KZ index, WW index, SA index. When selecting indicators, KZ index and WW index all adopt endogenous financial variables related to financing constraints, such as cash flow. To prevent endogeneity, used the KZ index to divide the degree of financing constraints by financial statements, and at the same time, the SA index is constructed by using only two variables of enterprise size and enterprise age:  $-0.737 * Size + 0.043 * Size^2 - 0.04 * Age$ . Therefore, after this paper selects SA index and takes its absolute value, SA is an index to measure the degree of financing constraints of enterprise. On the measurement of total factor

productivity, the existing literature mainly uses OP and LP methods. Semi parametric regression model to establish continuous production mode parameters to take the investment amount as the proxy variable of productivity, and the robust productivity can be obtained by controlling the deviation. The intermediate inputs of enterprises as proxy variables based on OP method, to avoid the problem of data truncation, which can more accurately reflect the changes of total factor productivity of enterprises. This paper chooses the LP method to measure the total factor productivity of enterprises. The indexes needed for LP method mainly include Yit, Kit, Lit and Mit. The Yit represents income, which is represented by the main business income of the enterprise in this paper; The Kit represents capital investment, and the average original value of fixed assets is used to measure in this paper; The Lit represents labor input, and this paper uses the number of employees to measure; The Mit represents the investment in intermediate products of enterprises, and this paper uses the method of for reference, and measures it by the cash outflow of purchasing products and services; the Iit represents investment amount, and this paper uses for the definition of capital, and uses the construction of fixed assets and other cash payments to measure. Among them, Yit can be obtained after the consumer price index deflated, Kit can be obtained the fixed asset investment price index deflated, and Mit and Iit can be obtained by the regional GDP index deflated. About the financial structure, the relative composition of financial market and bank is used to express in the paper. On the definition of financial market, some scholars point out that it mainly refers to the stock market (Allen and Gale, 2000; Levine, 2005). Therefore, the total market value of the stock market is approximately substituted for the financial market, and the total amount of bank credit is substituted for the bank.

$$FS = \frac{credit}{Tbankasset} \quad (5)$$

### Data sources

This paper uses the panel data of 30 regions in Chinese mainland for 2005-2015 years to conduct an empirical analysis. Among them, the total regional production index, consumer price index and fixed asset investment price index are all derived from the annual data of provinces of the National Bureau of Statistics of China. The total assets of the bank come from the "Financial Operation Report" of all provinces in China. The total market value of stock market, main business income of listed enterprises, original value of fixed assets, total assets and other micro data of enterprises in each province are all from Wind database. Meanwhile, the financial enterprises, ST and \*ST enterprises, and roe and growth rate abnormal enterprises are eliminated (Table 1,2).

*Table 1: Statistical description of related variables.*

Variable	Number of samples	Mean	Standard deviation	Minimum	Max
LnTFP_LP	19257	7.745	1.045	1.898	12.469
FS	19275	3.488	2.529	0.090	16.821
SA	19257	2.979	0.518	0.0005	5.047
L1	19257	7.559	1.312	1.946	13.223
zsl	19257	13.167	24.261	-49.917	100
lnage	19257	2.610	0.386	0	4.174
hhi	19257	0.0008	0.016	0	2.077
roe	19257	8.029	10.226	-49.967	49.978
capital	19257	77.559	564.138	0	33810.97

*Table 2: Correlation coefficient among variables.*

	LnTFP_LP	FS	SA	L1	zsl	lnage	hhi	roe	capital
LnTFP_LP	1.0000								
FS	-0.1073	1.0000							
SA	-0.6871	0.0580	1.0000						
L1	0.5318	-0.0088	-0.6293	1.0000					
zsl	0.1209	-0.0163	-0.0572	0.0146	1.0000				
lnage	0.0583	-0.1556	0.2999	-0.0035	-0.1484	1.0000			
hhi	0.1091	0.0101	-0.1282	0.1009	0.0144	-0.0547	1.0000		
capital	0.0472	-0.0329	-0.0850	-0.1352	-0.0138	0.0064	0.0040	1.0000	
roe	0.2508	-0.0959	-0.1408	0.0909	0.3120	-0.0526	0.0173	-0.0005	1.0000

### Benchmark Estimation Results and Analysis

This part is based on the mesmeric effect model to conduct empirical test on the influence of financial structure for total factor productivity of enterprises. In this paper, OLS and GMM regression method were used to regress the model, and the regression results are shown in Table 3. Meanwhile, according to the procedure of, the detection has been conducted in the paper, finding that coefficient  $\beta_1$  is significant at 1% level and explaining that it is reasonable to use financing constraints as intermediary variables [26]. This paper uses the panel data of 30 regions from 2005 to 2015, and uses OLS and GMM methods to test the mesomeric effect of model (1), model (2) and model (3), whose results show that the effect of FS on LnTFP\_LP in model (1), and the coefficients of FS to SA in model (2) are significant at 1%, indicating that the mesomeric variable selected in this paper is reasonable and the mesomeric effect is significant. In model (3), FS to LnTFP\_LP coefficient still passing the 1% significance test, explaining that this paper is partial mesomeric

effect. Financial structure not only affects the total factor productivity of enterprises through financing constraints, and unreasonable financial structure will also reduce the attraction of China's foreign direct investment, so as to restrain the improvement of total factor productivity of Chinese enterprises (Table 3).

Note: \*\*\*, \* \*and \* represent that it is significant at the level of 1%, 5%, and 10% respectively, and t value is in brackets.

According to the mesomeric effect model, model (1), model (2) and model (3) are sorted out:

$$\ln TFP\_LP = (\theta_0 + \theta_2 \beta_0) + (\theta_1 + \theta_2 \beta_1) FS + \varepsilon_{4i} \quad (6)$$

Finally, it can be obtained by calculation that the results of OLS and GMM by the influence of FS on LnTFP\_LP through financing constraints are -0.029 and -0.251, respectively. In the following, we will systematically analyze the regression results of GMM.

### The influence of financial structure on total factor productivity of enterprise

The regression coefficient of FS for lnTFP\_LP is -0.0432, which has passed the 1% significance level test, indicating that China's current financial structure is not reasonable, and the unreasonable development of the production rate has restrained the growth of the total factor productivity of the enterprise. Roughly, when the financial structure increases by 1 unit, the total factor productivity of an enterprise decreases by about 4%. The financial structure is

measured by the ratio of bank credit to the market value of the stock market, referring that the development of banking industry will further worsen the total factor productivity at this stage. On the contrary, the development of financial market can effectively alleviate the inhibition of the total factor productivity of enterprises. This result confirms the hypothesis 3 in this paper.

**Table 3:** Estimation results of the model of mesomeric effect.

Variable	OLS	OLS	OLS	GMM	GMM	GMM
	lnTFP_LP (1)	SA (2)	lnTFP_LP (3)	lnTFP_LP (1)	SA (2)	lnTFP_LP (3)
FS	-0.0294*** (-11.46)	0.0100*** (9.33)	-0.0151*** (-7.26)	-0.0432*** (-10.26)	0.0160*** (8.79)	-0.2301*** (-6.80)
SA			-1.3986*** (-99.76)			-1.3293*** (-70.57)
L1	0.4240*** (94.17)	-0.2494*** (-132.98)	0.0744*** (14.74)	0.4187*** (48.16)	-0.2654*** (-73.61)	0.0744*** (9.66)
zsl	0.0032*** (14.09)	-0.0001 (-1.41)	0.0031*** (16.74)	0.0032*** (10.72)	-0.0001*** (-1.51)	0.0030*** (12.30)
lnage	0.0322*** (2.07)	0.5316*** (81.79)	0.7788*** (53.22)	0.0816*** (3.95)	0.6000*** (57.78)	0.8683*** (42.76)
hhi	1.5263*** (4.34)	-0.9267*** (-6.41)	0.2155 (0.76)	55.7109*** (3.96)	-17.6403*** (-5.72)	11.0494*** (3.77)
capital	0.0002*** (23.43)	-0.0001*** (-32.49)	0.00004*** (6.07)	0.0002*** (4.80)	-0.0001*** (-5.32)	0.0001** (2.94)
roe	0.0183*** (33.53)	-0.0027*** (-12.26)	0.0144*** (32.39)	0.0188*** (24.50)	-0.0032*** (-11.17)	0.0147*** (22.54)
soe4	0.2383*** (15.29)	-0.0912*** (-14.07)	0.1144*** (9.03)	0.1864*** (10.55)	-0.0649*** (-7.87)	0.1071*** (7.77)
yeadam	yes	yes	yes	yes	yes	yes
indum	yes	yes	yes	yes	yes	yes
Hansen test (p)				0.84	0.16	0.50

There are two main reasons for the above results: First, the financial services provided by banks and financial markets are not the same. The comparative advantage of banks is that they can effectively reduce financial frictions and transaction costs when dealing with a series of "standardized" financing with short-term, low-risk and large amount of collateral; Financial markets are more effective in designing new, long-term and high-risk projects (Allen and Gale, 1999). The general characteristics of projects at the forefront of technology are huge investment (mostly invested in intangible assets, such as patented technology and human capital), long recovery cycle and high risk, so the development of the banking industry cannot provide good financial services for such projects, and the financial market can meet the needs of such

projects. Secondly, banks and financial markets pay interest in different ways. If financing is through banks, the principal and interest must be paid on time. Once the project has problems, such as the broken asset chain, it will be difficult for the enterprise to repay the principal and interest, which will make enterprises enter into great crisis of liquidation and bankruptcy [27]. On the contrary, if the enterprise is financing through the financial market, and when the project encounters problems, it may be reflected in the decrease of stock price or dividend in the short-term, which will not lead enterprises facing the crisis of liquidation and bankruptcy directly, and make enterprises have enough time to adjust. Therefore, the financing mode of regular repayment of principal and interest by banks will inhibit the enthusiasm of enterprises to invest in technology research and

development, and the financial market has a certain role in promoting the enthusiasm of technology R & D investment.

### **The influence of financial structure on financial constraints**

The coefficient of FS to SA is 0.0160 and passes the 1% significance level test, indicating that China's financial structure has a positive effect on SA index at present. While the larger the SA index, the greater the degree of financing constraints faced by enterprises, indicating that China's current financial structure is one of the important factors for Chinese enterprises to face financial constraints. When the financial structure increases by one unit, the financing constraint index increases by about 1.6%. At the same time, at this stage, the development of banking industry will make the financing constraints faced by enterprises more serious, and the development of financial market can effectively alleviate the financing constraints faced by enterprises. This result confirms the hypothesis 1. The reasons for the above are as follows. On the one hand, since 1978, the allocation of China's financial resources has changed from financial allocation to bank loans, and the state and state-owned commercial banks have completed this measure by signing financial contracts. In this particular historical context, China's state-owned banks show a unique "paternalism" to lend a lot of money to state-owned enterprises, and these lending decisions are often made for political purposes, which is not determined by the principle of efficiency maximization, leading to the uneven distribution of financial resources in China, so as to cause the occurrence of financing constraints of other non-state-owned enterprises. Other commercial banks show the tendency of "mortgage guarantee first", and most of the acceptable collateral are fixed assets such as houses and land. For small and medium-sized enterprises, the amount of fixed assets that can be mortgaged is small, and there are almost no assets that meet the requirements of banks and can be used for loan mortgage, so it is difficult to finance from banks through formal channels [28]. On the other hand, the financial market has the characteristics of direct financing and diversified ways, which can overcome the barriers of natural entry and institutional entry in asset transfer, and ensure the liquidity of assets in the process of transfer. Meanwhile, the stock price conveys the information about the enterprise value in the financial market, and the lender will decide the amount and period of funds granted to the enterprise according to the stock price. There is no need to issue loans to enterprises through hard indexes such as collateral.

### **The impact of financial structure on total factor productivity through financing constraints**

Finally, we calculate FS to  $\ln TFP_{LP}$  by means of the mesomeric effect model, and the mesomeric effect coefficient of is -0.251, and the results show that China's irrational financial structure has seriously inhibited the development of total factor productivity of enterprises through financing constraints at this stage. The influence of development of banking and financial market on total factor productivity is the same as the above paper without too much detail. The reasons for the above results is that on one hand, China is in the period of transition economy, and there is a serious financial repression in the financial departments, referring to the serious control of interest rate and exchange rate. In the case of small interest rate change, banks will be responsible for high-risk loans to high-tech industries, without achieving the corresponding risk premium subsidy, which will make banks lose the enthusiasm for its loans, and incline to lend funds to labour or capital intensive enterprises with low risk. On the other hand, enterprises' investment in high-tech means great uncertainty, high proportion of specific equipment, intangible assets and high sunk cost. It is difficult for banks to evaluate the value of such projects and supervise enterprises accordingly. Therefore, the financing constraints of banks for innovative technology projects are more serious than other projects. When the enterprises cannot borrow enough funds from the bank to invest, they have to give up the development of technological innovation projects, so as to influence the promotion of total factor productivity of enterprises. On the contrary, on one hand, the function of financial market is not only financing, but also pricing. When the technological innovation project of an enterprise is successful, the market share and operating revenue of the enterprise will rise correspondingly, which can be reflected in the rise of the stock price, referring that borrowers can get the risk premium of high-risk projects through the financial market. Therefore, the financial market can increase the enthusiasm of borrowers for such projects. On the other hand, when the enterprises directly conduct financing in the financial market, the necessary condition is that enterprises must disclose information regularly. Such initiatives enable investors to monitor the current projects of the enterprise. When investors have good expectations for the project, it will lend money to enterprises. Meanwhile, the risk sharing mechanism of the financial market makes the financial market and the borrowers share the risk. Even if the enterprise's profitability declines in the short term and causes the stock price fluctuation, the borrowers will not rush to liquidate the enterprise. Therefore, when enterprises invest in high and new technology, they cannot only obtain sustainable sources of funds, but also will not fall into financial crisis due to the rupture of capital chain. In conclusion, the development of China's financial market can significantly alleviate the financing problems faced by enterprises in the development of high-tech, which can improve the enterprises' enthusiasm for technology

investment and innovation, and promote the improvement of the total factor productivity of Chinese enterprises at the same time.

### Result analysis on regression analysis of other variables

As can be seen from columns 6 and 7 of Tab. 3, the coefficient of enterprise size to financing constraint index and total factor productivity is -0.2654 and 0.0744 respectively, which all pass the 1% significance test, which are consistent with the results of most scholars, showing that when the scale of enterprises increases, the financing constraints will decrease, and total factor productivity level increases. The coefficient of enterprise age to total factor productivity is 0.8683, and passes the 1% significance test, showing that the longer the enterprise lasts, the lower the degree of financing constraints, and the total factor productivity rises accordingly. Market competition, growth rate of business income and roe are negatively correlated with financing constraint index, and the total factor productivity level is positively correlated, passing the 1% significance test, and proving that the improvement of enterprise performance can significantly alleviate the financing constraints faced by enterprises, which is also in line with the common sense of enterprises in the financial market financing or bank financing. Meanwhile, when the market competitiveness of enterprises is strong, the income is rising and the profitability is increasing, enterprises can first rely on internal financing to solve the capital problem, so as to improve the total factor productivity level of enterprises. The *soe4* is represented as state-owned enterprise in dummy variable, whose coefficient of financing constraints is negative, and the coefficient of total factor productivity is positive, passing the 1% significance test, showing that China's state-owned enterprises have increased, while financing constraints have declined, and reflecting that the degree of financial constraints of Chinese state-owned enterprises is less than that of non-state-owned enterprises, so as to prove the hypothesis 2. The possible reasons are as follows: The increase of state-owned enterprises can significantly improve China's total factor productivity. A large amount of capital flows to state-owned enterprises at a lower cost, making them far superior to non-state-owned enterprises in terms of human capital accumulation and investment in fixed assets. Although the efficiency of technological innovation is lower than that of non-state-owned enterprises, it has an absolute advantage in technological progress [30]. Although the capital intensity of enterprises has passed the 1% significance test on financing constraint index and total factor productivity, its influence value is almost 0. The possible reason is that the development of total factor productivity depends on a large number of intangible assets, and intangible assets are difficult to measure, and cannot use fixed assets / number of employees to fully explain that the total factor productivity of enterprises with more capital must be higher than that of labor-intensive industries [31,32].

### Heterogeneity Test

No matter from the distribution of industry or the development of financial market, there are significant differences among the eastern, central and western regions of China. In order to analyze whether the impact of financial structure on total factor productivity of enterprises through financing constraints varies with different regions, this paper further tests the heterogeneity of samples, and uses GMM to test the mesomeric effect of model (1), model (2) and model (3), so as to further conduct robustness check on it through 2SLS regression test. First, we can see the influence of FS1, FS2, FS3 in column 1 of Tab. 4 on of *lnTFP\_LP* were -0.0140, -0.0624 and -0.0662 respectively, all passing the 1% significance test, referring that the financial structure in eastern China has the least inhibition on total factor productivity of enterprises, the central region takes the second place, and the western region has the highest degree of inhibition on the level of total factor productivity. This result is also in line with the current situation in China, and the development degree of capital market and the rationalization degree of financial structure in the eastern region are better than those in the central and western regions. The influence of FS1, fs2 and FS3 in the second column on SA index were 0.0110, 0.0263 and 0.0179 respectively, all passing the 1% significance test, referring that the influence of financial structure on financing constraints in eastern China is less than that in central and western China, which is reasonable. Compared with the western region, the impact of unreasonable financial structure on the financing constraints of enterprises in the central region is more serious, and the possible reason lies in China's western development plan. The state intends to support enterprises in the western region, with different degrees of preference in terms of subsidies and fiscal policies. Under the influence of such policies, enterprises in the western region are less constrained by financing, which affects the empirical results. The influence of FS1, FS2, FS3 and SA in the third column on *lnTFP\_LP* were -0.0013, -0.0300, -0.0426, -1.3164, respectively. Except for FS1, the other variables have passed the 1% significance test. However, FS1 fails to pass the significance test, which indicates that the impact of financial structure on total factor productivity of enterprises in eastern China through financing constraints is a complete mesomeric effect, referring that the eastern region only restrains the improvement of total factor productivity through financing constraints. The possible reason is that most of the overseas direct investment in eastern China is in the developed areas of eastern China, and this channel will improve the level of total factor productivity in eastern China (Table 4).

Finally, we bring the data of columns 1, 2 and 3 into the model (6) for calculation to achieve that the results show that the financial structure of the eastern, central and western regions of China has an impact on total factor productivity of -0.015, -

0.0646, - 0.0661 respectively through financing constraints. The final result shows that the financing channel in eastern China has the least inhibition on total factor productivity of enterprises, the central region takes the second place, and the western region is

the most serious. For other variables, the results are roughly consistent with the above analysis, which will not be repeated here.

**Table 4:** Heterogeneity test of financial structure's impact on total factor productivity of enterprises through financing constraints.

Variable	GMM	GMM	GMM	2SLS	2SLS	2SLS
	lnTFP_LP (1)	SA (2)	lnTFP_LP (3)	lnTFP_LP (1)	SA (2)	lnTFP_LP (3)
FS1	-0.0140** (-2.87)	0.0110*** (5.31)	-0.0013 (-0.34)	-0.0141** (-2.94)	0.0110*** (5.23)	-0.0014 (-0.37)
FS2	-0.0624*** (-11.23)	0.0263*** (10.95)	-0.0300*** (-6.66)	-0.0626*** (-11.35)	0.0262*** (10.77)	-0.0302*** (-6.71)
FS3	-0.0662*** (-14.33)	0.0179*** (8.90)	-0.0426*** (-11.38)	-0.06663*** (-14.43)	0.0178*** (8.75)	-0.0427*** (-11.38)
SA			-1.3164*** (-69.76)			-1.3163*** (-81.05)
L1	0.4211*** (48.61)	-0.2664*** (-73.89)	0.0789*** (10.24)	0.4214*** (76.55)	-0.2665*** (-110.91)	0.0791*** (12.85)
zzl	0.0033*** (10.99)	-0.0002 (-1.66)	0.0030*** (12.56)	0.0033*** (11.95)	-0.0001 (-1.64)	0.0031*** (13.80)
lnage	0.0841*** (4.09)	0.6012*** (58.13)	0.8641*** (42.60)	0.0831*** (4.09)	0.6009*** (66.93)	0.8633*** (45.08)
hhi	57.0552*** (3.95)	-17.4120*** (-5.68)	11.0278*** (3.80)	54.8348*** (17.21)	-17.3734*** (-16.88)	11.0180*** (4.16)
capital	0.0002*** (4.84)	-0.0001*** (-5.35)	0.00005*** (3.02)	0.0002*** (21.05)	-0.0001*** (-30.48)	0.00005*** (5.20)
roe	0.0184*** (23.96)	-0.0031*** (-10.80)	0.0144*** (22.20)	0.0184*** (28.87)	-0.0031*** (-11.23)	0.0144*** (27.66)
soe4	0.2137*** (12.03)	-0.0699*** (-8.43)	0.1277*** (9.41)	0.2134*** (12.33)	-0.0694*** (-9.10)	0.1277*** (9.05)
yea dum	yes	yes	yes	yes	yes	yes
indum	yes	yes	yes	yes	yes	yes
Hansen test (p)	0.11	0.12	0.37			
Sargan (P)				0.12	0.13	0.39

## Conclusions and Suggestions

From the perspective of financing constraints, this paper analyses the impact of China's financial structure on the development of total factor productivity under the mesomeric effect model. Then the panel data of 30 provinces in China from 2005 to 2015 are selected to use the fixed effect method to empirically test the influence of financial structure on the level of total factor

productivity. The empirical results prove the hypothesis of this paper, indicating that China's financial structure needs to be optimized, and the good development of financial market can slow down the financing constraints faced by Chinese enterprises, especially non-state-owned enterprises, so as to ease the constraints on China's total factor productivity due to financing constraints. Although China is still a bank-oriented financial system, this paper holds that the financial market plays an

indispensable role in the industrial upgrading and economic transformation of Chinese enterprises. At present, China's GDP growth is slowing down, and simple rough machining and imitating the technology of developed countries can no longer meet the conditions for China's sustained and rapid economic growth, so Chinese enterprises will inevitably change from "rough processing" and "technology imitation" to "technological innovation". Therefore, China should speed up the development and reform of the financial market, establish a diversified financial market, and support the development of financing platforms such as gem and small and medium-sized board to provide corresponding financial services for high-quality high-tech industries, and ease the financing difficulties of enterprises, which will lead the total factor productivity level in a state of slow development. Of course, China's relevant departments should also strengthen supervision over the financial market, introduce corresponding laws, maintain a good order and environment for the operation of the financial market, and reduce the occurrence of speculation. Of course, when we construct the financial structure, only the stock market is taken as a financial market to test the empirical analysis, and there is no relevant test and analysis on the bond market, which is also the deficiency of this paper and the important direction of future research.

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