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Has Financial Marketization Reform Promoted Innovation?

— An Empirical Test Based on Mediation Effect

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Abstract

Under the background of promoting the implementation of innovation-driven strategy in China, this paper uses the panel data of 30 provincial administrative regions in mainland China from 2000 to 2016 to measure the level of financial marketization in each region from the perspective of market-oriented credit fund allocation, and empirically examines the impact of financial marketization reform on regional enterprises' technological innovation based on the intermediary effect model. It is found that during the period of investigation, the level of financial marketization in all regions of China has increased obviously, but there are great differences among regions, and the level of financial marketization in the eastern region is higher. The improvement of the level of financial marketization is conducive to increasing R&D support within enterprises, and then promoting the improvement of innovation capability of enterprises. That is, financial marketization promotes enterprise innovation, and R & D expenditure within enterprises plays an intermediary role in this process. In exchange for different measures, this result is still robust. Therefore, we should further promote the process of market-oriented reform of the financial sector and help the implementation of the national innovation-driven strategy.

Keywords

Financial Marketization, Enterprise Innovation, Mediation Effect

1. Question

Since the reform and opening up, China has become the world's second largest economy after 40 years of rapid economic growth, but in the past, this extensive economic growth model, which relies on high energy consumption and pollu-

tion, has been unsustainable and needs to be transformed into an implicit growth model driven by innovation [1] (Yang, 2015). With the entry into the "new normal", the resource and environmental pressure that China's economy faces is highlighted. How to transform the mode of economic development and realize the high quality development of the economy has become an important issue of great concern to the party and the government. So the 18 major parties put forward the implementation of innovation-driven development strategy, putting science and technology innovation in the core position of the overall development of the country; The 19 majors of the party regard innovation as "the first motive force of development and the strategic support of building a modern economic system", and further clarify the important position of innovation in leading economic and social development. As the main force of technological innovation, the innovation ability of enterprises represents the level of innovation of the country to a certain extent, so the innovation-driven strategy needs to rely on the innovative behavior of enterprises to achieve. How to effectively improve the technological innovation ability of enterprises is particularly important.

Technological innovation is not only an important means for enterprises to enhance their core competitiveness, but also a source of power for a country's economy to achieve high quality development [2] (Pan *et al*., 2015). Innovation, as a long-term strategic choice of enterprises, may make enterprises in a favorable position of competition and bring rich return on profits, but because of characteristics of its long cycle, high risk and high investment make many enterprises prohibitive. The primary function of finance is financing support, and the financing function implies the internal functions of information processing, risk dispersion, supervision and restraint, etc. [3] (Jia *et al*., 2017). An efficient and sound financial system not only provides the source of funding needed for enterprise innovation, but also helps companies to evaluate the value of innovative projects, diversify the uncertain risks of innovative projects, and monitor and constrain the innovative behavior of business managers. Moreover, it can contribute to the successful implementation of enterprise innovation projects. However, for an emerging and transformed developing economy such as China, the establishment and improvement of the financial system is a complex process from scratch. In the process, the function of the financial market is gradually released. Financial market itself may have a supportive effect on enterprise technological innovation, but because of the imperfection of market development mechanism, the reform of marketization process within financial market lags behind, which leads to the support function of financial market to enterprise technology innovation may not be realized. Zhou and Zhao (2005) use the model of Levine and others to test the impact of financial development on China's economic growth, and it is found that the financial development alone cannot effectively explain the relationship between finance and economic growth, but after the introduction of financial market index in the model, it is found that fi-

nancial market is effective to explain economic growth [4]. This shows that it may be necessary to consider the influence of financial market factors in the process of studying financial support for economic growth, that is, the effective play of the resource allocation function of financial market needs to rely on the improvement of the level of financial market to a certain extent.

With the gradual establishment of the market economic system, China's financial sector has also implemented a series of market-oriented reform measures based on the allocation of financial resources, and constantly deepen the reform of financial marketization, such as the commercial reform of state-owned banks and the establishment of joint-stock banks [5] (Ba *et al.*, 2005). The Government's intervention in the allocation of financial resources has been gradually reduced, and the degree of marketization of Credit fund allocation has been increasing, providing stable financial support for the rapid development of China's economy [6] (Tang and Chen, 2009). So, what is the current state of China's financial marketization process? Does the promotion of financial marketization process effectively promote the technological innovation of enterprises? These problems are in urgent need of systematic theoretical analysis and empirical testing. Under this background, this paper is based on the perspective of financial market, theoretical analysis and experience to identify the role of marketization factors in the process of financial development of enterprise technological innovation, which is very important from the theoretical value and practical significance. Although the existing research has proved the influence of financial development on the technological Innovation of Enterprises [7] [8] (Huang *et al.*, 2011; Bai *et al.*, 2013). However, these studies use the GE index or the wheat index to measure financial development, and measure the level of financial development by the proportion of a country's total financial assets and GDP. Although this method is simple to operate, it focuses more on the characterization of financial scale and neglects the measurement of marketization factors in the process of financial development [9] (Tan *et al.*, 2016). In fact, the marketization process of the financial system plays an important role in the process of resource allocation in financial markets. Especially for a developing transition economy such as China, financial development includes not only the expansion of the financial system allocation scale, but also the financial deepening, that is, the improvement of the process of financial marketization. Therefore, compared to existing research, this article may contribute in the following three areas: First, in the perspective of China's financial sector marketization reform, this paper, based on the theoretical analysis of how financial market affects the technological innovation of enterprises, uses provincial panel data to test it empirically, which is an important supplement and development of the existing research. Second, investigating the impact of financial marketization process from the perspective of enterprise innovation, not only provides new empirical evidence, but also further investigates its impact mechanism, which helps us to understand transmission mechanism from the financial market to enterprise

innovation. Third, this study, combined with the reality of China's financial development, build a financial market index based on the acquisition of financial resources by non-state-owned enterprises, which can effectively investigate China's current inter-provincial level of financial market and regional heterogeneity, and build an efficient and perfect financial system to provide reference and enlightenment for the various regions.

The remainder of this study is arranged as followings: The second part is the literature review, and on this basis, we analyze the role of financial market impact on enterprise technological innovation approach; The third part constructs the financial market index from the perspective of the non-state-owned enterprises obtaining credit funds, and measures the financial market of each region; The fourth part is the construction of measurement model and empirical test; The final part is the research conclusion and policy suggestion of this paper.

2. Mechanism Analysis

Financial market refers to the cancellation or relaxation of existing decrees, rules, regulations and administrative controls restricting the financial system by the Government or the relevant financial authorities, resulting in a new financial system that is relaxed, free and more in line with the operating mechanism of the market. Its core is to make the market really play the decisive role of financial resource allocation [10] (Zhuang, 2007). Mckinnon and Shaw put forward the theory of "financial liberalization" in 1973 [11]. Their research found that the widespread financial repression in developing countries hindered their economic growth and the optimal allocation of resources because of incomplete market mechanisms. Therefore, the introduction of financial liberalization reforms in developing countries will help to promote economic growth. Since then, scholars have begun to pay attention to the important role of marketization factors in the process of financial resource allocation. It is found that the improvement of the level of financial market can help to improve the mismatch of financial resources, reduce financial repression and information asymmetry and other functions [12] [13] (Stiglitz, 2000; Huang, 2010). This can undoubtedly provide a good financial guarantee for the technological innovation of enterprises, alleviate the financing constraints and capital shortage problems faced by enterprises in the process of implementing innovative projects, and promote the improvement of enterprise innovation level.

Although the success of technological innovation can bring rich return on profits and improve the core competitiveness of enterprises, many enterprises are deterred from innovation because of the long cycle of innovation, high investment and uncertain returns and other characteristics. Therefore, the availability of adequate external financial support becomes the key to the success of innovation [14] (Xie and Fang, 2011). When enterprises are faced with higher innovation risks and financing constraints that cannot be resolved by external means, it will weaken the motivation of enterprises to carry out technological

innovation to a certain extent, so that enterprises can reduce R&D Investment [15] (Wang *et al*., 2014). An efficient, stable and sound financial system plays an important role in ensuring the successful implementation of enterprise innovation projects. Especially for a country in transition such as China, the reform of financial marketization is helpful to alleviate the problem of "financing difficulty" faced by enterprise innovation, so that enterprises can increase the investment of R&D funds and promote the improvement of their innovation ability. Specifically, financial marketization reform can alleviate the financing constraints of enterprises through the following three ways.

Firstly, financial marketization reform is helpful to correct the distortion of financial resource allocation and improve the allocation efficiency of financial resources. The special situation of China's progressive reform determines that local governments have a greater ability to intervene in the allocation of financial resources, so that the allocation of financial resources presents a typical non-marketable characteristic and hinders the improvement of enterprise innovation ability [16] (Dai and Zhang, 2017). Before the reform of financial marketization, local governments have the incentive and condition to interfere with the allocation of credit resources. The pro-government behavior of commercial banks also often makes credit resources too much allocated to traditional industries that can create stable tax revenues or to innovative and inefficient state-owned enterprises, while innovative enterprises do not get good financial security. He (2008) found that China's commercial banks still exist "discriminatory" loans [17]. Their lending standards to non-state-owned enterprises are higher than those of state-owned enterprises, which will inhibit the technological innovation of non-state-owned enterprises to a certain extent. The reform of financial marketization optimizes the governance structure of banks, inhibits the government's intervention in the allocation of credit resources to a certain extent, and reduces the existence of prescriptive loans. In the process of credit resource allocation, commercial banks can allocate independently according to market principles and identify high quality enterprises and innovative projects with high innovation efficiency based on their own professional knowledge and risk control ability. Following the principle of market-oriented allocation can enable more financial resources to move from state-owned enterprises or traditional production sectors with less innovative efficiency to more innovative private enterprises or R&D and Innovation Departments. Providing a good financing environment for innovative enterprises is helpful to alleviate the external financing constraints faced by innovative enterprises and increase the availability of innovative loans, so that they can increase their capital investment in innovative projects and promote the improvement of their innovation ability.

Secondly, the reform of financial marketization can help to reduce the risk of information asymmetry between banks and enterprises, so as to provide better credit support for innovative companies. Information asymmetries between banks and businesses can increase the cost of companies getting loans from

banks. When companies need to seek credit support from banks for their R&D Innovation activities, it is difficult for banks to accurately measure the value of innovative projects in enterprises because of information asymmetry effect. So higher lending rate pricing is generally adopted to deal with the high risks faced by enterprise innovation projects, or even to refrain from lending, which will increase the cost of financing innovative enterprises and make it difficult for them to seek effective credit support. Zhou and Zhao (2005) think that if the process of financial market is accompanied by institutional development and financial innovation, such as the improvement of mortgage and guarantee system, information disclosure system, etc., the problem of information asymmetry between financial institutions and enterprises can be gradually alleviated with the advancement of financial marketization process [4]. Then the Bank and other financial institutions are more willing to lend to enterprises for technological innovation. At the same time, the improvement and improvement of the level of financial market can reduce the risk level of enterprise innovation projects with a variety of financial product portfolio, which attract more capital into the field of innovation and expand the source of financing for enterprise innovation projects.

Finally, the reform of financial marketization can enhance the degree of competition among financial institutions and help enterprises to obtain loans for R&D funds to a certain extent. Financial marketization reform cannot only promote competition among banks, but also promote competition between banks and capital markets [18] (Yan, 2015). Greater competitive pressure will prompt banks to improve their governance structure and improve the efficiency of capital allocation to provide better financing services for enterprises, especially those more innovative and efficient enterprises [16] (Dai and Zhang, 2017). As a result, competition in the financial sector can make it easier for innovative companies to access financial support.

To sum up, the financial marketization reform can alleviate the financing constraints faced by enterprise innovation by optimizing the allocation of resources, relieving information asymmetry and increasing competition, etc. Then the financial market can provide better Credit fund support, enhance the motivation and confidence of enterprises to carry out technology research and development, and then increase the internal R&D expenditure of enterprises, providing financial guarantee for the improvement of enterprise's technological innovation ability.

3. Measuring the Process of Financial Marketization in China's Regions

As far as the measurement of the process of financial marketization is concerned, most of the existing studies adopt the method of selecting the relevant index system for valuation, and then use the methods of principal component analysis or weighted average to construct the financial marketization index at the national level to reflect the level of financial marketization in a country. Laeven

(2003) measured the process of bank marketization in 13 countries and regions from six aspects: relaxing interest rate control and reducing barriers to entry [19]. If one aspect of the reform is carried out in a certain year, the value is assigned to 1, otherwise 0, and then the market index of each year is obtained by summing up the six aspects. Domestic scholar Huang divides each index into five levels and gives different weights by using eight indicators: marketization degree of interest rate, maintenance degree of credit autonomy, degree of freedom of access to institutions, degree of diversification of property rights of commercial financial institutions, degree of freedom of business scope, degree of free flow of capital, degree of marketization of social financing and degree of indirection of financial regulation. Measure the degree of financial marketization in China. Zhou and Zhao (2005) used principal component analysis (PCA) based on the study of Jin (2001) to measure China's financial marketization process by selecting nine indicators, such as interest rate and exchange rate marketization degree, to construct a financial marketization index [4]. They found that since the reform and opening-up, except for the stagnation of the financial marketization reform in 1987-1991, the process of financial marketization has been stable for the rest of the time. Other scholars also use similar index settings to construct a financial market evaluation index system to examine the process of China's financial market [10] [20] (Liu and Shen, 2002; Zhuang, 2007). However, this measurement method depends on the implementation of a specific market-oriented reform policy. It is mainly used to measure the process of financial marketization at the national level. It is difficult to obtain the data of the process of financial marketization at the provincial level. It is difficult to examine the heterogeneity of the process of financial marketization between provinces. It is also very subjective to select and assign the constituent indicators according to different scholars. To objectively measure the level of financial marketization among different regions of a country.

For the measurement of the process of financial marketization at the provincial level, the existing research extensively uses the financial marketization index constructed by Fan *et al.* (2011), which reflects the level of financial marketization in China's gradual reform process from the two levels of competition in the financial industry and marketization of credit fund allocation [21]. Unfortunately, the statistical caliber of the index changed in 2009, and its financial market index after 2009 has not been fully published, which cannot meet the needs of this study. Because the banking sector plays a dominant role in China's financial system and the development of capital market is relatively short, this study mainly focuses on the banking sector when measuring the regional financial market, without considering the stock market and bond market for the time being. Drawing on the research of Aziz and Duenwald (2002), Zhang and Jin (2005), we use the marketization of bank credit fund allocation to measure the level of financial marketization in different regions [22] [23]. The reason is that the financial system is still in a gradual process of transformation for such a

"new economy plus transition" as China. The operation of the financial system is subject to interference from all sides. As a result, financial resources are not fully allocated in accordance with the principle of marketization, which affects the efficiency of capital allocation [24] (Li, etc., 2013). Especially after fiscal decentralization, local governments will intervene and control financial resources directly or indirectly under the pressure of tax competition and promotion. Due to the soft budget constraints of the state sector and the close connection with local governments, there are a large number of policy-oriented loans in China's banking sector, which results in many inefficient state-owned enterprises being able to obtain bank loans at lower interest rates, while the more efficient non-state-owned enterprises are difficult to obtain bank credit funds to expand production scale or carry out R&D and innovation activities. The phenomenon of "ownership discrimination" in bank loans not only leads to the low efficiency of financial resources allocation, but also affects the improvement of the overall innovation ability of Chinese enterprises. With the deepening of financial market reform, local governments' intervention in financial resource allocation will gradually decrease. Market price signals will guide bank credit resources to non-state-owned enterprises with higher efficiency in order to obtain higher income levels. Based on the above considerations, we use the proportion of loans allocated by banks to non-state-owned enterprises in GDP to measure the marketization level of bank credit funds allocation.

Specifically, we use the proportion of non-state sector bank loans to GDP to express the level of financial marketization in different regions. Since the loan data allocated by banks to non-state-owned enterprises cannot be obtained, we use Aziz and Duenwald (2002), Li (2007) and Li (2013) as reference to divide the whole credit into two parts: state-owned enterprises and non-state-owned enterprises. Then, according to the close relationship between the bank credit obtained by state-owned enterprises and the output of state-owned enterprises, we use the fixed effect of "disability". The first-order autocorrelation of difference structure is used to estimate the credit proportion of non-state-owned enterprises indirectly. The formula for calculating bank credit is as follows:

$$Fin_{it} = \alpha + \beta Soe_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = \rho \varepsilon_{i,t-1} + \delta_{it} \quad (2)$$

Among them, the explanatory variable *Fin* is the proportion of regional bank credit to GDP, and the explanatory variable *Soe* is the proportion of regional state-owned enterprise output value to regional industrial output value. βSoe indicates that bank loans obtained by state-owned enterprises account for the proportion of total credit. The proportion of bank loans obtained by non-state-owned enterprises can be composed of three parts: the remaining constant term α, the regional dummy variable μ_i and the stochastic interference term ε_{it}. Formula (2) is a first-order autoregressive process of random interference term, which is used to adjust the sequence correlation of random interference term. The data used are from China Statistical Yearbook, China Financial

Statistical Yearbook and Statistics Yearbook of provinces and municipalities. The data range is 2000-2016.

The estimated results are as shown in Table 1. The coefficients of β and ρ are 0.8462 and 0.7355, and both of them are significant at 1% significance level, which shows that our model is reasonable. The credit allocated by banks to the non-state sector can be obtained by subtracting the part explained by the proportion of output of state-owned enterprises from all bank credit in the regression model. Based on this, the level of financial marketization in different regions of China from 2000 to 2016 can be calculated.

After obtaining the basic data of the index of "marketization of bank credit allocation", we also convert it into the score of financial market index according to Wang's method (2017)[1] [25]. Table 2 reports the actual scores of financial market index in some years of 30 regions in China. The data used are from the

Table 1. Estimates of the credit proportion of non-state-owned enterprises.

	coefficient	T value
Investment in fixed assets of state-owned enterprises/ Investment in fixed assets in the whole society	0.8462	3.05
ρ(ar)	0.7355	
R-sq	0.7251	
Obs	510	

Table 2. Financial Marketization Index of China from 2000 to 2016.

	2000	2016	Mean		2000	2016	Mean
Beijing	10.00	11.30	9.96	Henan	1.11	3.33	1.89
Tianjin	3.13	6.96	4.76	Hubei	0.76	3.62	2.14
Hebei	0.00	4.61	1.82	Hunan	0.13	2.58	1.27
Shanxi	4.04	6.33	3.26	Guangdong	3.61	5.58	3.88
Inner Mongolia	1.27	2.76	1.11	Guangxi	0.74	4.00	2.08
Liaoning	2.58	7.58	4.03	Hainan	3.46	8.40	4.44
Jilin	4.32	4.36	2.88	Chongqing	3.43	5.85	4.17
Heilongjiang	1.67	4.15	1.53	Sichuan	2.23	4.65	3.04
Shanghai	5.43	9.45	7.52	Guizhou	1.86	5.89	3.26
Jiangsu	0.69	4.75	2.97	Yunnan	1.50	5.38	3.57
Zhejiang	2.07	7.35	5.30	Shaanxi	3.03	3.81	2.69
Anhui	0.75	4.78	2.43	Gansu	2.14	8.71	3.25
Fujian	0.64	5.11	2.59	Qinghai	3.14	8.56	4.23
Jiangxi	1.16	4.49	2.06	Ningxia	3.84	7.31	4.92
Shandong	0.77	3.52	2.25	Xinjiang	2.01	5.27	2.51

[1]Specific transformation methods can be found in "China's Provincial Marketization Index Report (2016)", compiled by Wang *et al.* (2017), which will not be repeated here.

China Marketization Index published by Wang Xiaolu *et al.* in 2011 and 2017. The average value of Beijing's financial marketization index is the highest from 2000 to 2016, reaching 9.96, while that of Inner Mongolia's is the lowest, only 1.11, reflecting the great difference in the process of financial marketization in different regions of China. By comparing the data of 2000 and 2016, we can find that the financial marketization index in 2016 is higher than that in 2000, which indicates that the degree of financial marketization in each region is gradually improving, which is also consistent with the reality of deepening financial system and marketization reform in recent years.

4. Empirical Test

1) Establishment of econometric model

Mediating effect model is mainly used to measure the indirect influence of explanatory variables on the explanatory variables through mediating variables (Cai and Xu, 2017) [26]. When considering the influence of independent variable X on dependent variable Y, if X affects Y by influencing variable Z, variable Z is called intermediate variable. The equation is expressed as follows:

$$Y = \alpha X + e_1 \tag{3}$$

$$Z = \beta X + e_2 \tag{4}$$

$$Y = \alpha' X + \gamma Z + e_3 \tag{5}$$

Among them, alpha represents the total effect of X on Y, Z is a mediating variable, indicating the direct effect of X on Y, and the effect of X on Y through Z.

Based on the analysis of the above-mentioned mechanism, this paper argues that the process of financial marketization can improve the output level of technological innovation by easing the financial constraints of enterprises and increasing the R & D expenditure within enterprises. Therefore, this paper constructs the following regression model by referring to the Hayes' intermediary effect test method.

$$innovation_{it} = \eta_0 + \alpha_1 market_{it} + \sum_{j=2}^{6} \alpha_j control_{it} + \eta_i + \varepsilon_{it} \tag{6}$$

$$RD_{it} = \tau_0 + \beta_1 market_{it} + \sum_{j=2}^{6} \beta_j control_{it} + \tau_i + \varsigma_{it} \tag{7}$$

$$innovation_{it} = \xi_0 + \gamma_1 market_{it} + \theta RD_{it} + \sum_{j=2}^{6} \gamma_j control_{it} + \xi_i + \upsilon_{it} \tag{8}$$

Among them, *innovation* is the output of technological innovation, *market* is the index of financial marketization and *control* is the control variable. We will introduce it in detail later. Formula (6) shows the overall impact of financial market on enterprise technological innovation, and R & D expenditure is the intermediary variable. Firstly, the benchmark regression of Equation (6) is used to test whether financial marketization has a significant impact on technological innovation of enterprises. If $\alpha_1 > 0$, it shows that financial marketization can

promote technological innovation of enterprises. Secondly, the Equation (7) is estimated to test whether the relationship between financial marketization and R & D expenditure RD is significant. Finally, Finally, we estimate the Equation (8) by regression. When α_1, $\beta_1 > 0$ and $0 < \gamma_1 < \alpha_1$, it shows that the above-mentioned positive mediation effect exists, and vice versa, the negative mediation effect exists.

2) Selection of indicators and demonstration of numbers

Interpreted variables: technological innovation. Referring to most existing studies, this paper still uses patent data to characterize the level of technological innovation output of enterprises (Bai and Jiang, 2015) [27]. Patent data includes patent application amount and patent authorization amount. In the benchmark regression part, we use patent application amount as the interpreted variable, and in the robustness test part, we use patent authorization amount as the interpreted variable.

Explanatory variables: financial marketization. Using the financial market index calculated above.

Control variables. Referring to the existing research, we put the following control variables which may affect the technological innovation of enterprises into the regression model: a) R & D capital investment, referring to Hu *et al.* (2005), Wu (2006) and others' research, this paper uses the method of perpetual inventory to calculate it, the specific method is no longer described. [28] [29] The data used are from China Statistical Yearbook and provincial and municipal Statistical Yearbook. The data range is 2000-2016. b) R & D personnel investment is measured by full-time equivalence of R & D personnel. The data used are from China Science and Technology Statistical Yearbook, which covers the period 2000-2016. c) Regional education level, drawing on the research of Bao (2008) and Zhu (2011), is measured by the average number of years of education of the population over 6 years old in each region. The data used are from China Statistical Yearbook, which covers the period 2000-2016. d) The level of economic development is expressed by the logarithm of regional GDP. The data used are from China Statistical Yearbook, which covers the period 2000-2016. e) The degree of opening to the outside world is expressed by the proportion of the total import and export volume of the region to GDP. The data used are from China Statistical Yearbook and provincial and municipal Statistical Yearbook. The data range is 2000-2016. f) Infrastructure level. It is expressed by the proportion of the total regional postal and telecommunication services to GDP. The data used are from China Statistical Yearbook and provincial and municipal Statistical Yearbook. The data range is 2000-2016.

3) Analysis of benchmark results

In order to investigate the impact of financial market reform on technological innovation of enterprises, based on the balanced panel data of 30 provincial administrative regions in China from 2000 to 2016, we use mixed OLS, fixed-effect FE and random-effect RE models to regression. The estimated results are shown in **Table 3**. Among them, column (1) is classified as mixed OLS regression,

column (2) and column (3) are fixed effect and random effect regression, respectively. In order to select the appropriate regression model for analysis, this paper carries out the corresponding model setting test. The results of F test strongly reject the original hypothesis that there is no individual fixed effect, indicating that fixed effect regression is superior to mixed OLS regression; LM test strongly rejects the original hypothesis that there is no individual random effect, indicating that random effect regression is superior to mixed OLS regression; Hausman test strongly rejects the original hypothesis, indicating that fixed effect model is superior to random effect model. Therefore, the fixed effect model has higher estimation efficiency and robustness. This paper uses the regression results of the fixed effect model to analyze.

As shown in the regression results of the fixed effect in Table 3, the impact coefficient of financial marketization on technological innovation of enterprises is significantly positive at the level of 1%, indicating that the improvement of financial marketization level can promote enterprise innovation. As mentioned

Table 3. Benchmark model estimation results.

	(1) OLS	(2) FE	(3) RE
market	0.0165	0.0304***	0.0204**
	(0.0104)	(0.00791)	(0.00824)
ln*K*	0.474***	0.122	0.421***
	(0.0671)	(0.0824)	(0.0750)
ln*L*	0.520***	0.183**	0.277***
	(0.0747)	(0.0765)	(0.0748)
Inf	−3.776***	−5.356***	−5.307***
	(1.157)	(0.768)	(0.822)
Eco	0.599***	1.183***	0.680***
	(0.0744)	(0.128)	(0.106)
Hum	−1.875***	1.382***	0.570
	(0.329)	(0.419)	(0.416)
Open	0.0307	0.274**	0.182*
	(0.0764)	(0.128)	(0.108)
Cons	−4.652***	−8.754***	−7.291***
	(0.597)	(0.660)	(0.654)
Time effect	No	Yes	Yes
Regional effect	No	Yes	Yes
Hausman	/	0.0000	0.0000
R-square	0.9170	0.9241	0.0183
Observations	510	510	510

Note: *, ** and *** indicate the significant level of 10%, 5% and 1% respectively. The figures in parentheses are corresponding standard errors (bilateral).

above, with the deepening of financial market reform, the financial sector can provide more stable credit fund support for enterprise innovation to alleviate the "financing constraints" faced by enterprises. Meanwhile, the functions of information processing and supervision constraints implied in the financing function can help enterprises identify the value of innovation projects, restrain the innovative behavior of enterprise managers and increase enterprises. R & D expenditure has a positive impact on the improvement of technological innovation capability of enterprises.

The above fixed-effect model tests the direct impact of financial marketization on enterprise innovation, but it can not identify its impact path. In order to identify whether financial marketization can promote innovation level by increasing R & D expenditure, this paper continues to use intermediary effect model to test it. The estimated results are shown in Table 4, and both models (6) and (7) are regressed using fixed effects. For ease of comparison, the estimated results of model (8) are also shown in Table 4. Among them, the results of model

Table 4. Mediation effect test results.

	(1)	(2)	(3)
market	0.0302***	0.00106***	0.0304***
	(0.00792)	(0.00041)	(0.00791)
ln*K*	/	/	0.122
			(0.0824)
ln*L*	0.253***	0.567***	0.183**
	(0.0607)	(0.0338)	(0.0765)
Inf	−5.249***	0.875**	−5.356***
	(0.766)	(0.426)	(0.768)
Eco	1.327***	1.175***	1.183***
	(0.0831)	(0.0462)	(0.128)
Hum	1.484***	0.835***	1.382***
	(0.413)	(0.230)	(0.419)
Open	0.271**	−0.0253	0.274**
	(0.128)	(0.0714)	(0.128)
Cons	−9.380***	−5.120***	−8.754***
	(0.509)	(0.283)	(0.660)
Time effect	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes
Hausman	0.0000	0.0000	0.0000
R-square	0.924	0.972	0.9241
Observations	510	510	510

Note: *, ** and *** indicate the significant level of 10%, 5% and 1% respectively. The figures in parentheses are corresponding standard errors (bilateral).

(6), model (2), model (7) and model (8) are listed in (1) and (3).

Table 4 reports the regression results of intermediary effect. The study shows that the intermediary effect of financial marketization on technological innovation output is significant. The second column shows that the influence coefficient of financial marketization on R & D expenditure is significantly positive at the level of 1%. It shows that the improvement of financial marketization level has a positive effect on R & D expenditure within enterprises, and can lead to the improvement of innovation ability of enterprises. It means that there is an intermediary effect of internal R & D expenditure in the impact of financial marketization on enterprise innovation. R & D expenditure is indeed an important means of financial market reform to enhance the innovation capability of enterprises. The reason is that the financial market reform weakens the ability of local governments to intervene in the allocation of bank credit resources, and the level of autonomous management of banks will be improved accordingly. According to market price signals, enterprises with higher innovation efficiency will be provided with credit support, thus alleviating the "financing constraints" dilemma faced by innovative enterprises. R & D investment is the key to the success of innovation. Because R & D innovation activities have a long cycle, high risk, and require huge capital investment in the early stage, enterprises need to have stable cash flow to support them. When enterprises can obtain stable credit support from banks, they will enhance their motivation and enthusiasm for R & D innovation, thus increasing R & D expenditure, ensuring the smooth development of R & D activities, and promoting the improvement of innovation capability of enterprises.

4. Robustness Test

In the above benchmark regression, patent application volume is used as an explanatory variable to measure the level of technological innovation of enterprises. The regression results show that the process of financial marketization can provide technological innovation capability of enterprises by increasing internal R & D expenditure. In order to estimate the robustness of the results, the patent grant amount is further used as the interpreted variable to estimate the robustness of the results. Comparing with the amount of patent applications, patent authorization screens out some patent applications that do not meet the patent application standards, so it represents a higher "quality" of technological innovation. The estimated results of robustness test are shown in Table 5. After replacing the original dependent variable patent application amount with patent authorization amount, the regression results are basically consistent with the above. The impact of financial market index on patent authorization amount is still significantly positive at the level of 1%, and financial market can improve the level of patent authorization by promoting the R & D expenditure of enterprises, which to some extent shows that the conclusions of this paper are robust.

Table 5. Robustness test.

	(1)	(2)	(3)
market	0.0529***	0.00106***	0.0569***
	(0.00766)	(0.00041)	(0.00760)
ln*K*	/	/	0.0243
			(0.0799)
ln*L*	0.379***	0.567***	0.365***
	(0.0586)	(0.0338)	(0.0742)
Inf	−6.375***	0.875**	−6.396***
	(0.741)	(0.426)	(0.745)
Eco	1.224***	1.175***	1.195***
	(0.0804)	(0.0462)	(0.124)
Hum	0.499	0.835***	0.478
	(0.400)	(0.230)	(0.406)
Open	0.144	−0.0253	0.145
	(0.124)	(0.0714)	(0.124)
Cons	−8.203***	−5.120***	−8.079***
	(0.492)	(0.283)	(0.640)
Time effect	Yes	Yes	Yes
Regional effect	Yes	Yes	Yes
Hausman	0.0000	0.0000	0.0000
R-square	0.925	0.972	0.925
Observations	510	510	510

Note: *, ** and *** indicate the significant level of 10%, 5% and 1% respectively. The figures in parentheses are corresponding standard errors (bilateral).

5. Conclusions and Policy Implications

How to optimize the allocation of financial resources and provide good financial support for enterprise innovation is an important issue in the process of deepening the reform of supply-side structure, transforming the mode of economic development and building an innovative country in China. Based on this, this paper uses the panel data of 30 provincial administrative regions in mainland China from 2000 to 2016, refers to the measurement method of Zhang Jun and Jin (2005), uses the credit proportion of non-state-owned enterprises in all bank loans to measure the level of financial marketization in each region, and empirically examines whether the market-oriented reform of financial sector has played a role in promoting enterprise innovation since 2000. Based on the intermediary effect model, this paper examines the intermediary role of R & D expenditure in the process of financial marketization affecting enterprise innovation capability. The main findings are as follows: 1) During the investigation period, the level of financial marketization in all regions of China showed a certain

upward trend, and the rate of increase accelerated after 2008, which is also consistent with the fact that China has been deepening the market-oriented reform of the financial sector in recent years. 2) The level of financial marketization in the eastern region is generally higher than that in the central and western regions. Because of the influence of history and geography, the economic development of our country presents the economic ladder pattern of eastern, central and western regions. The economic development level and market completeness of eastern regions are obviously higher than those of central and western regions. The financial sector in the eastern region started early and developed rapidly, and gradually formed a relatively perfect financial system, so the level of marketization is relatively high. 3) Financial marketization can significantly improve the output level of technological innovation, and R & D expenditure plays a mediating role between them. That is to say, the improvement of financial marketization level can increase R & D expenditure of enterprises, and then promote the improvement of innovation ability of enterprises.

The enlightenment of these conclusions is that under the background of China's economy entering a new normal, the traditional factor driving force has gradually weakened, so how to cultivate a new sustainable economic growth motive is particularly important. Innovation is not only an important means for enterprises to enhance their core competitiveness, but also an important driving force to improve the quality of national economic development. Based on this, the Party and the government put forward the implementation of innovation-driven strategy in order to cultivate new impetus for China's economic growth, transformation and upgrading. Therefore, we should unswervingly deepen the market-oriented reform of the financial sector, reduce the direct intervention of government administrative forces in the allocation of financial resources, promote the rapid improvement of the level of financial market in various regions, provide good financial support for enterprise innovation, and accelerate the process of building an innovative country in China.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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