



# Research on the Impact of Financial Resource Mismatch on the Technological Innovation of Manufacturing Enterprises Based on Model Construction

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## Abstract

"Made in China 2025" puts forward the policy of "three steps" to complete the overall positioning of the road to manufacturing power, and enhancing the technological innovation ability of enterprises is the key to achieve this strategic goal. This paper selects the data of Chinese manufacturing enterprises and constructs a relevant model to conduct an empirical analysis on the relationship between financial resource mismatch and technological innovation of manufacturing enterprises. The results show that the mismatch of financial resources has indeed inhibited the technological innovation of manufacturing enterprises, and has become an important factor hindering the implementation of innovation development strategy. Therefore, this paper studies the influence of mismatching financial resources to technological innovation of manufacturing enterprises, so as to put forward targeted improvement suggestions for specific problems.

**Keywords-**Financial resource mismatch; Technological innovation; Manufacturing industry

## 1. Introduction

Nowadays, China's economy and society are developing at a high speed, and the expansion of the financial sector is gradually accelerating, but there are still defects such as rough development. Due to the imperfect financial structure in China, the external financing of manufacturing enterprises mainly relies on bank loans, but the information asymmetry among economic agents in China and government intervention lead to high financing costs and difficulties in financing for private manufacturing enterprises.

In this context, this hinders efficient private manufacturing enterprises to carry out R&D and innovation activities, especially some private manufacturing enterprises with high innovation efficiency and large development potential face "development bottleneck". This indicates that the inefficient allocation of financial resources in China has become an important factor hindering the implementation of innovation development strategy. Therefore, it is important to study the impact of the difference of

financial resources on the technological innovation of manufacturing enterprises.

Therefore, it is of profound theoretical and practical significance to study the impact of financial resource disparity on the technological innovation of manufacturing enterprises, so as to put forward targeted improvement suggestions for specific problems.

## 2. An Empirical Study on the Impact of Financial Resource Mismatch on technological Innovation of Manufacturing Firms

### 2.1 Variable Description

Table 1: Selection of indicators for the degree of financial resource mismatch

Variable type	Variable Description
	Technological Innovation (Inrd), for the measurement of

Explained variable	technological innovation in the academic community is mostly based on the reference of R&D, and the expenditure on research and experimental development (R&D) of manufacturing enterprises above the scale is chosen to measure the degree of technological innovation [1]
Explanatory variable	Financial resource mismatch (Fm): the cost of funds method of Shao Ting (2010) is used to measure the degree of financial mismatch of enterprises. The degree of financial mismatch in each region is measured by the difference between the cost of funds and the average cost of funds of manufacturing enterprises in each province, and the cost of funds of enterprises $r_i = \text{interest expense} / (\text{total liabilities} - \text{accounts payable})$ , $R$ represents the average cost of funds of the industry in which the enterprise is located, then the degree of financial mismatch, when the mismatch value is positive, it means that the enterprises in the region want to obtain financial resources to pay higher than the average level of. When the mismatch value is positive, it means that the enterprises in the region have to pay higher than average cost of funds, which means that the financial mismatch problem in the region is serious, and vice versa.
	Openness (Open): Generally speaking, the higher the degree of openness, the more tolerant and efficient the acceptance of advanced technologies, the higher

Control variable	the degree of awareness, and the easier it is to promote the research and development of technological innovation.
	Educational level (Edu): The higher the level of education, the more opportunities for learning and use, the more internal company resources can be integrated into the dynamic development of the market, and the more likely it is to incorporate new ideas in product and technology innovation.
	Foreign direct investment (Fdi): Foreign direct investment will be accompanied by the transfer of high technology and the introduction of highly skilled personnel, which will affect the level of technological innovation.
	Manufacturing firm size (Str): Larger firms imply more human capital and resources, mature governance, greater risk tolerance, greater commitment to technology R&D, and sufficient resources, which have a positive impact on technological innovation.

### 2.2 Model Construction

The following model is constructed for the empirical study in order to analyze the impact of financial resource mismatch on technological innovation by collating and summarizing the research methods of previous scholars:[2]

$$\ln rd_{i,t} = \alpha_0 + \alpha_1 fm_{i,t} + \alpha_2 Open + \alpha_3 Edu_{i,t} + \alpha_4 \ln fdi_{i,t} + \alpha_5 Str_{i,t} + u_{i,t}$$

$$i = 1,2,3,\dots,m; t = 1,2,3,\dots,T \quad (1)$$

In the above equation, is the log of internal expenditure on research and experimental development (R&D), is the degree of financial resource mismatch, is the degree of regional openness, is the number of years of education of the labor force in each region, is the log of the amount of foreign direct investment, is the size of manufacturing firms, is a constant term, and is a random

disturbance term. The model investigates the direct effect of financial mismatch on technological innovation.

### 2.3 Data Source and Statistical Description

The data related to the mismatch of financial resources are taken from the website of the National Bureau of Statistics of China; the data of technological innovation are from the China Science and Technology Statistical Yearbook; the data required for the average education level of each province are from the China Labor Statistical Yearbook. In order to enhance the scientificity and rationality of the data, the relevant data (including foreign direct investment and total import and export) in US dollars as the original unit of denomination are converted into RMB according to the average exchange rate of the year, while to reduce the variability among the variable data, the calculation of R&D and Fdi are shown in logarithmic form, and all data have passed the smoothness test.

Before estimating the model, descriptive statistical analysis was conducted on the data of 31 provinces, as shown in the following table.

Table 2: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
lnrd	310	13.823	1.701	7.058	16.741
edu	310	8.786	1.171	4.222	12.502
open	310	0.297	0.334	0.018	1.597
lnfdi	310	14.035	2.562	0	16.932

str	310	0.396	0.139	0.061	0.751
fm	310	-2.62e-09	0.222	-0.782	0.468

The average technological innovation level lnrd of manufacturing enterprises has a maximum value of 16.741 and a minimum value of 7.058, with large differences. It indicates that the development of technological innovation is uneven and there are differences in the level of technological innovation in each province.

The lowest average years of education in each province is only 4.2 years, and the highest is 12.5 years. The minimum openness is 0.018 and the maximum enterprise size is 0.751. the maximum value of the degree of financial resource mismatch is 0.468. according to the data, there are significant regional differences in the values of the indicators among Chinese provinces.

### 2.4 Empirical Results and Analysis

#### 1) Pearson correlation coefficient test

In this paper, we choose to conduct Pearson correlation coefficient tests on technological innovation (lnrd), financial resource mismatch degree (fm), openness degree open, education level (edu), foreign direct investment (lnfdi), and manufacturing enterprise size (str) to determine the correlation between each variable.

Table 3: Pearson correlation coefficient test

	lnrd	edu	opened	lnfdi	str	fm
lnrd	1.000					
edu	0.639***	1.000				
opened	0.411***	0.554***	1.000			
lnfdi	0.572***	0.275***	0.036	1.000		
str	0.439***	0.147***	-0.0280	0.398***	1.000	
fm	-0.266***	-0.094	-0.430***	0.257***	0.271***	1.000

Note: \*, \*\*, \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively

#### 2) Multicollinearity test

A multicollinearity test is required before regression of the data.

Table4: Multicollinearity test

	VIF	1/VIF
open	1.824	.548

edu	1.62	.617
fm	1.413	.708
lnfdi	1.318	.758
str	1.241	.806
Mean VIF	1.483	.

## 3) Regression result

Table 5: Regression results of eastern, central and western regions

Variables	Eastern region	Central region	Western region
fm	10.52 (1.057)	-7.179 (-0.587)	-16.54*** (-3.469)
open	0.648*** (9.080)	0.598*** (4.878)	0.0726 (1.588)
edu	12.72*** (4.923)	2.731 (1.196)	2.514 (1.632)
lnfdi	-0.00353 (-0.294)	0.0888*** (4.437)	0.0398*** (3.164)
str	0.0308 (1.636)	-0.0572 (-1.375)	0.0407* (1.891)
R <sup>2</sup>	0.770	0.832	0.421
obs	110	80	110

Note: \*, \*\*, \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively

By region, the impact of the degree of financial mismatch on manufacturing enterprises' technological innovation in the eastern region is not significant, which is because the eastern region is economically developed, geographically superior, and has absolute advantages in financial resources, technological resources and environmental resources. The analysis of the data in the eastern region reveals that the degree of financial resource mismatch in the eastern region is mostly negative, that is, the cost of using funds in the eastern region is lower than the average level, and the financing cost for manufacturing enterprises in the eastern region to take business development and innovation investment is low, so there will be positive results. The level of education is positive and significant, indicating that the eastern region attracts innovative talents to gather and promote innovation due to its economic and educational advantages.

The degree of financial resource mismatch in the central region has a negative effect on the technological innovation of manufacturing enterprises, but the effect is insignificant because although there is a financial mismatch in the central region, the deviation of the cost of using capital is not significant. The effect of foreign direct investment on the technological innovation of manufacturing enterprises in the central region is positive, which indicates that the introduction of foreign investment helps the technological innovation of manufacturing enterprises in the central region. The education level is positive but insignificant. This indicates that in the central region, there is still a need to actively introduce innovative talents and bring into play

the great driving force of talents for technological innovation.

For the western region, the coefficient of financial resource mismatch is -16.54 and significant, indicating that there is a serious financial resource mismatch in the western region, which affects the improvement of the technological innovation level of manufacturing enterprises in the western region. This is mainly due to the high cost of using capital caused by the non-issuance of economy and poor financial environment in the western region, which inhibits the motivation of technological innovation and squeezes out the resources for conducting technological innovation.

Due to the backwardness of educational resources and economic development level in the western region, and the low number of R&D personnel, it plays a weak role in the improvement of technological innovation level of enterprises. The size of manufacturing enterprises has a significant role in promoting technological innovation, because the cluster effect can be exerted in the western region, which has a significant effect on promoting the improvement of enterprises' innovation output. The coefficient of foreign direct investment is positive, indicating that foreign investment can also significantly improve the improvement of technological innovation level of manufacturing enterprises in western region.

## 3. ROBUSTNESS TEST

## 3.1 Model construction

To ensure the validity of the empirical results, robustness tests were carried out. Meza (2019) points out through further research that the higher the proportion of state-owned capital in the paid-in capital of manufacturing enterprises, the lower the cost of capital use. Such ownership discrimination will cause a large number of high-quality financial resources to be inclined to have state-owned background, and the phenomenon of ownership orientation rather than efficiency orientation in resource allocation will occur. That is, the existence of ownership discrimination, as a replacement variable.<sup>[3]</sup>

$$\ln rd_{i,t} = \alpha_0 + \alpha_1 Own + \alpha_2 Open + \alpha_3 Edu_{i,t} + \alpha_4 \ln fdi_{i,t} + \alpha_5 Str_{i,t} + u_{i,t} ,$$

$$i = 1,2,3 \dots m; t = 1,2,3, \dots T \quad (2)$$

## 3.2 Regression result

Table 6: Regression result

Variables	Nation wide	Central region	Eastern region	Western region
own	-12.77** (-2.939)	2.119 (0.311)	-9.342 (-0.690)	-12.94*** (-3.290)
open	0.422***	0.635***	0.595***	0.0754

	(10.05)	(8.861)	(5.087)	(1.878)
edu	11.43***	13.00***	2.764	2.917*
	(7.743)	(4.981)	(1.213)	(1.878)
lnfdi	0.0349***	-0.00641	0.0896***	0.0372***
	(4.053)	(-0.0536)	(4.555)	(2.937)
str	0.0207	0.0283	0.0579	0.0434**
	(1.391)	(1.485)	(1.402)	(2.013)
R <sup>2</sup>	0.644	0.767	0.833	0.414
obs	300	110	80	110

Note: \*, \*\*, \*\*\* indicate significant at the 10%, 5%, and 1% levels, respectively

At the national level, the ownership discrimination coefficient is -12.77, which is very significant, indicating that the higher the ownership discrimination of regional credit resources on manufacturing enterprises, the stronger the inhibition effect on the improvement of technological innovation of manufacturing enterprises. In the regions with high credit ownership discrimination, the degree of inhibition on the technological innovation output of manufacturing enterprises is higher than that in the regions with low ownership discrimination. From the perspective of economic significance, commercial banks tend to lend to state-owned enterprises due to their own operating characteristics, thus inhibiting the technological innovation output of manufacturing enterprises.

By region, the coefficient of ownership discrimination in eastern China is 2.119 and not significant. This shows that in the eastern region, financial institutions are less vulnerable to the restrictions of different enterprise ownership when allocating credit resources. This is mainly because of the strong market competitiveness of non-state-owned manufacturing enterprises in eastern China. Commercial Banks in the credit agreement with non-state manufacturing enterprises, due to the higher reimbursement ability and credit enterprise itself, ignore ownership restrictions, to provide loans to the strength of the party, at this time for the eastern region of manufacturing enterprise technological innovation, though still has certain inhibitory effect, but it is not obvious.

The coefficient of ownership discrimination in central China is -9.342, which is still not significant. It shows that ownership discrimination has no significant moderating effect on technological innovation of manufacturing enterprises in central China. Ownership discrimination coefficient is 12.94, in the western region of China shows that the western region of non-state manufacturing enterprise financial resources will be less and you will be able to access that contributed to the areas of credit system of ownership discrimination, of the western region the improvement of technology innovation of manufacturing enterprises have obvious inhibitory effect,

and compared with the eastern region that inhibit innovation to improve the role of the more obvious.

The results of robustness test show that the coefficient and significance of each basic explanatory variable in the model do not change much, indicating that the above conclusion is reliable.

#### 4. CONCLUSION

The coefficient of misallocation of financial resources is negative, but not significant, indicating that the misallocation of financial resources does hinder the improvement of technological innovation of manufacturing enterprises. Similarly, the misallocation of financial resources will intensify the discrimination of ownership, thus limiting the technological innovation level of enterprises.

Foreign direct investment is significantly positive, indicating that foreign direct investment has a significant impact on technological innovation, which indicates that in the process of promoting the opening up, China has achieved initial results in technological innovation of enterprises by developing market for technology and attracting foreign investment. Foreign capital investment and technology investment can help technological progress and promote enterprises' independent innovation ability.

The coefficient of education level is positive, indicating that the higher the education level is, the higher the technological innovation level is. This is because employees are important carriers of contributions to technological innovation. The openness rate is significantly positive, indicating that the higher the degree of openness, the higher the level of technological innovation.

The scale coefficient of manufacturing enterprises is significantly positive, which has a positive impact on the regional technological innovation level, indicating that the larger the scale of manufacturing enterprises is, the stronger the financial strength is, and it is easier to attract innovative talents and capital to carry out technological innovation.

The mismatch of financial resources is widespread in China, which is embodied in the disconnection between huge financial resources and the real economy, and the deviation from the pareto optimal state of financial resources allocation. State-owned manufacturing enterprises have easy access to financial resources, while private manufacturing enterprises are in a difficult situation of financing.<sup>[4]</sup>

## 5. POLICY SUGGESTIONS

### 5.1 *Less government intervention*

The government's frequent intervention in the distribution of bank financial resources leads to strong political color in China's commercial bank credit, resulting in the mismatch of financial resources. In order to reasonably allocate financial resources in accordance with the efficiency, it is necessary to reduce the government's intervention degree in the allocation of financial resources. Specific suggestions are as follows: First, improve the level of financial legal system, speed up the marketization of financial system reform process, it can enhance the independence of commercial Banks in the financial resource configuration, Banks can by the enterprise's productivity and profitability and return on capital objectively reflect the enterprise market competitiveness of financial indicators to determine the allocation of credit resources, to a certain extent. This can also reduce the government's intervention role in the allocation of bank credit resources. Second, remove the umbrella for inefficient state-owned manufacturing companies. Many state-owned manufacturing enterprises are in a state of inefficient or ineffective production. However, due to the protection of the government, they can still obtain production funds from banks at low cost through government intervention to maintain their operations. This is not only a waste of financial resources, but also an unfair distribution of resources. The government's protection for these inefficient manufacturing enterprises should be removed, and these enterprises should be urged to find problems from their own development and get out of the dilemma of low efficiency.<sup>[5]</sup>

### 5.2 *Leverage the role of foreign investment*

The establishment of a more perfect financial mechanism is the only way to eliminate financial mismatch. In addition, we can also take advantage of market opportunities to actively attract foreign investors to invest in Our country and learn and introduce advanced foreign technology. In order to adapt to the pace of economic globalization, we should change our goals and not just focus on research. We should pay more attention to the introduction of foreign advanced technology and the role of foreign investment. At the same time, we should pay attention to the introduction of technology and capital in accordance with local conditions, due to the different level of economic development and innovation capacity of the eastern and western regions of China, in the introduction of technology and capital, relevant departments need to formulate policies according to the actual situation of the region. For the regions with high technological innovation level, the gap between these regions and foreign advanced technology is not obvious due to the early injection of foreign investment and their

own high level of economic development. At this time, the effect of foreign direct investment on alleviating the mismatch of financial resources and promoting the improvement of innovation level is not significant. In this region, in the introduction of foreign investment and technology, should focus on cultivating high-quality manufacturing enterprises using foreign investment and foreign technology research and development of independent innovation ability, improve local manufacturing core technology innovation of enterprises in the international market competitiveness, attract more and more advanced technology focus on regional technology innovation level, Thus driving the overall promotion of regional technological innovation level.

However, in the regions with relatively weak economic development and technological innovation level, we should be good at developing and utilizing the geographical characteristics and advantages of the region to promote the economic development of enterprises, attract foreign investment into the region, open up new financing channels for manufacturing enterprises to invest in innovation, and obtain investment funds for innovation. At the same time, we should make use of the industrial cluster effect to increase the influence and attraction of the region, expand the scale of foreign direct investment as much as possible, and promote the overall improvement of the technological innovation level of the region. In order for foreign investment and technology introduction to better promote enterprise innovation and social and economic development, it is necessary to strengthen the protection of intellectual property rights, improve relevant systems, and provide a clean and secure atmosphere for enterprise innovation.

### 5.3 *Improve the credit environment for private enterprise*

For private manufacturing enterprises lacks a strong credit guarantee in credit activities, can build social credibility of the government credit guarantee institutions, fiscal spending by the government and the state-owned assets supervision and administration commission established special funds set aside special services to private manufacturing enterprises credit credit guarantee institutions, and commercial Banks to establish credit link port directly. When applying for loans from commercial banks, private manufacturing enterprises can apply for credit guarantee from government credit guarantee institutions in advance, which is equivalent to guaranteeing their credit financing with government credit and capital. This not only Narrows the gap with state-owned manufacturing enterprises in financing status, but also strengthens the confidence of banks to sign credit agreements with private manufacturing enterprises and reduces the rejection psychology of banks. In addition, civil society capital can be guided to inject into credit

guarantee agencies to spread the risk of the government as a guarantor.<sup>[6]</sup>

#### 5.4 Guide and support backward area

Due to the historical and geographical factors in western China, the technological innovation ability of manufacturing enterprises is always lagging behind, especially in education and attracting talents. The independent innovation capability of manufacturing enterprises in western China has been lagging behind for a long time. It is necessary to increase policy support, financial support and technical support for technological innovation in the western region, and encourage the eastern and central regions to drive technological innovation growth of manufacturing enterprises in the western region. Due to the lack of education level and resources in western China, it is difficult to cultivate high-quality innovative talents. Or the environment is not good, difficult to attract talent, difficult to take root. Improve the level of regional education and educational resources. At the same time, we must integrate the existing labor market and allocate human capital reasonably.

At the same time, we will improve the incentive mechanism for talent allocation, strengthen the disclosure of talent demand information, focus on solving the problem of brain drain and talent shortage, and enable scientific and technological innovative talents to play a greater role in China's economic construction.

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