

# Research on product market competition and corporate innovation

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**Abstract.** In the development process of enterprise modernization, the external environment of enterprises has important practical significance for the innovation development of manufacturing enterprises in China. In this paper, the relationship between product market competition and enterprise innovation is investigated using an empirical research method with a sample of A-share manufacturing companies listed in Shanghai and Shenzhen in China from 2011 to 2021. It is found that the degree of product market competition has a significant promotion effect on enterprise innovation, and the greater the degree of competition, the more significant the promotion effect. The research of this paper provides an important reference for China's manufacturing enterprises to improve their innovation ability under different competitive markets

**Keywords:** product market competition; firm innovation.

## 1. Introduction

General Secretary Xi Jinping emphasized in the report of the 20th Party Congress that we must adhere to science and technology as the first productive force and innovation as the first driving force, deeply implement the innovation-driven development strategy, open up new areas of development and new tracks, and constantly shape new momentum and advantages for development. At the same time, General Secretary Xi Jinping also stressed that "the implementation of the innovation-driven development strategy is to promote science and technology innovation as the core of the overall innovation, innovation at the core of the national development overall position." However, China's manufacturing enterprises have a low self-sufficiency rate of key technologies, a high degree of technology dependence on foreign countries, most of the advanced equipment needs to be imported, the contribution of science and technology to development is very low, the proportion of patented inventions in the world is small, China's economic development mainly relies on foreign imports of key technologies and equipment support. The conditions that support the survival of Chinese enterprises are relying on low-cost labor advantage, low price competition, and lack of capital and technology accumulation. How to promote enterprise innovation in the context of high-quality development is a key issue that needs to be solved in China, and it is crucial for China to build an "innovative country".

As an important part of the external environment of a company, product market competition is also an indispensable part of the corporate governance mechanism and plays an important role in the process of corporate innovation. There is no unified standard on the relationship between market competition and innovation in academia. Some scholars believe that product market competition has a positive effect on firms' innovation performance, and the more intense the product market competition is, the more pressure firms face from the same industry, and therefore the stronger the incentive to innovate [1]. Some other scholars believe that product market competition has a spillover effect on enterprise innovation, and there is a critical value for the impact of product market competition on enterprise innovation, and when the intensity of product market competition does not exceed the critical value that enterprises can bear, it has a significant promotion effect on enterprise innovation. However, when the intensity of product market competition exceeds the critical value that firms can afford, it will have an inhibitory effect on firm innovation [2].

Synthesizing the above analysis, this paper empirically examines the role of product market competition in enhancing the innovation process of Chinese manufacturing enterprises by using a

sample of A-share listed companies in Shanghai and Shenzhen from 2011-2021. The results of the study have important implications for promoting corporate innovation. The contribution of this paper may be that the factors that promote enterprise innovation are explored using empirical research methods in the context of China's actual situation in the era of high-quality development.

## 2. Theoretical analysis and research hypothesis

### Product market competition and corporate innovation

Product market competition as an external environment plays an indispensable role in corporate innovation. On the one hand, product market competition is a unique external corporate governance mechanism, which forces firms to increase external information disclosure in order to gain investors' attention and thus improve the transparency of corporate information[3]. Owners and potential investors can compare the information disclosed by other companies in the same industry with the actual situation of the company and exert pressure on the executives of the company to curb their short-sighted behavior, which also curbs the self-interest of executives and effectively alleviates the agency conflict between executives and shareholders. Thus, executives can only focus on the product innovation of the company. On the other hand the degree of product market competition also has a predatory effect; as the degree of product market competition increases, firms try to prevent losing competitive advantage in the same industry and thus being "predated" by competitors [4].t this time, enterprises can only increase innovation investment, enhance innovation consciousness, and develop products ahead of the average level of the same industry as soon as possible in order to seize the first opportunity in the market and gain a competitive advantage thus surviving in the fierce industry competition. Secondly, according to the market process theory, when the external market is more competitive, the original market equilibrium will be broken, which makes the product market move to a higher equilibrium[5]This is when companies spontaneously raise the importance of innovation of their products in order to seize the first opportunity in the market. Wu Yilin and Huang Shilai [6] found that the governance effect of product market competition has a significant positive effect on both exploratory and developmental innovation, and this positive effect deepens with the intensity of competition, by selecting the data of A-share listed companies in Shanghai and Shenzhen. Jaiké Song et al [7] found that the predatory effect of product market competition forces firms to continuously innovate to improve their position and avoid being eliminated from the market. It is because the dual effect of product market competition will make the executives of enterprises to ensure that their reputation will not be damaged in their limited executive career and have to strive to improve the status of enterprises in the industry, in the face of this external pressure executives will increase innovation investment. China is to open up to foreign products to improve the market competition of domestic products to stimulate local enterprises to innovate.

Based on this, this paper proposes the following hypotheses:

H1: Product market competition and firm innovation show a positive correlation, i.e., the promotion of product market competition on firm innovation.

## 3. Study design

### 3.1 Sample selection and data sources

The initial research sample of this paper is the A-share manufacturing listed companies in Shanghai and Shenzhen in China between 2011 and 2021, and all the sample data are obtained from the Guotaian database. In order to avoid possible adverse effects of interfering factors on the empirical results, the sample is treated as follows: (1) Excluding the sample companies of financial and insurance category, ST and PT. (2) Excluding companies that do not disclose their corporate innovation investment. (3) Excluding the data with missing relevant financial variables. (4) The continuous variables were subjected to the upper and lower 1% tail reduction. After screening, the

final number of observations is 16945. The processing software used in this paper is Stata16 and Excel.

### 3.2 Description of variables

#### 3.2.1 Explanatory variables

The explanatory variable in this paper is corporate innovation (Rd), because this paper is more inclined to analyze the input process of corporate innovation activities, therefore, the ratio of R&D investment to current operating income is used to measure corporate innovation, and the larger the value of this indicator, the greater the corporate innovation investment.

#### 3.2.2 Explanatory variables

Product market competition (Pcm)

For the degree of product market competition is currently measured by two main indices, which are Herfindahl index and Lerner index. In this paper, referring to the study of Yu Desheng [1] mainly adopts the Lerner index to measure the monopoly position of enterprises in the market, and the formula of Lerner index is (price - marginal cost)/price. Because marginal cost measurement itself is difficult so this paper uses profit margin instead, where  $Pcm = (\text{operating revenue} - \text{operating costs} - \text{selling expenses} - \text{administrative expenses}) / \text{operating revenue}$  [1]. The value of Pcm varies between 0 and 1. The smaller the value of Pcm, the smaller the market power in the industry and the greater the competition faced by the enterprise. the larger the value of Pcm, the smaller the competition faced by the enterprise.

#### 3.2.3 Control variables

Since the relationship between excess cash holdings and corporate innovation can be affected by many factors, this paper refers to [8] Yu Yike et al. and Zhang Huili [9] in the selection of control variables to select corporate return on assets (Roa), Tobin's q, firm size, total asset turnover ratio, firm's years on the market, and equity concentration as control variables. Detailed variable definitions and calculations are shown in Table 1.

Table 1 Variable definitions

Variable Name	Variable Code	Variable definition and calculation method
Corporate Innovation	Rd	R&D investment / current operating income
Product Market Competition	Pcm	Lerner index, $pcm = (\text{operating revenue} - \text{operating costs} - \text{selling expenses} - \text{administrative expenses}) / \text{operating revenue}$
Enterprise size	Lnsiz	Natural logarithm of the company's total assets at the end of the year
Number of years the company has been listed	Age	Age of listing, the natural logarithm of the year of observation minus the year of company establishment plus 1
Return on Assets	Roa	Return on assets = net profit / total assets * 100%
Tobin's q	TobinQ	Market value of the company/total assets
Total Asset Turnover Ratio	Turn	Operating income/total assets
Concentration of equity	First	Shareholding ratio of the first largest shareholder
Annual dummy variables	Year	The value is 1 when the company is in the year, otherwise it is 0

### 3.3 Model construction

To verify the relationship between hypothesized product market competition and firm innovation, model (1) is constructed in this paper as follows:

$$Rd_{i,t} = \alpha_0 + \alpha_1 Pcm_{i,t} + \alpha_2 Controls_{i,t} + \sum Year + \varepsilon_{i,t}$$

In addition,  $\alpha_0$  in model (1) represents the constant term of the model;  $\alpha_1$  represents the regression coefficient of the corresponding variable;  $\alpha_2$  represents the regression coefficient of the control variables; Controls represents a series of control variables listed in the previous section;  $\epsilon$  is the random disturbance term of the model. In addition, Year is added as a dummy variable to control the effect of year factor in this paper.

## 4. Empirical Results and Analysis

### 4.1 Regression analysis

Table 2 Descriptive statistics of the variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Rd	16945	4.613	3.56	0.07	21.48
Pcm	16945	0.138	0.104	-0.113	0.489
TobinQ	16945	2.081	1.227	0.882	7.998
Turn	16945	0.628	0.34	0.136	2.132
Roa	16945	0.052	0.048	-0.099	0.205
Lnisze	16945	22.02	1.163	20.025	25.595
First	16945	33.942	14.004	9.08	71.62
Age	16945	2.833	0.345	1.74	3.482

Descriptive Statistics Table 2 reports the descriptive statistics of the variables. It can be seen that the mean value of enterprise innovation (ratio of R&D investment to current operating income) is 4.613 indicating that the innovation intensity of manufacturing enterprises in China is still weak, with a minimum value of 0.07 and a maximum value of 21.48, which shows that there is a great difference in the innovation capability between different enterprises in the same industry, which needs to be further strengthened. For product market competition, the minimum and maximum values are -0.114 and 0.489 respectively, which also indicates that there is a great difference in the degree of product market competition, i.e., there is a significant difference in the high and low market position of enterprises.

## 4.2 Regression analysis

Table 3 Regression results of product market competition and firm innovation

Variables	Rd
Pcm	-2.585*** (-3.62)
TobinQ	0.051** (2.00)
Turn	-2.130*** (-13.25)
Roa	-3.592*** (-3.97)
Lnsiz	-0.156 (-1.56)
First	0.004 (0.75)
Age	-0.396 (-0.86)
Year	Yes
Constant	9.994*** (4.22)
Observations	16,945
R-squared	0.113
Number of name	2,658
adj_R2	0.120
F	23.37

In this paper, considering the variability of panel data performance in the random regression model and fixed effects model, the panel regression with two-way fixed effects model is used based on the Hausman test results, and further considering the possible effect of heteroskedasticity on the estimation results, this paper also uses clustering robust standard errors. Table 3 reports the panel regression results for product market competition and firm innovation. The second column indicates the relationship between product market competition and firm innovation, where the regression coefficient of product market competition is -2.585 and significant at the 1% level. Because the higher value of pcm indicates the lower level of competition, which in turn can indicate that product market competition has a significant promotion effect on firm innovation. When the product market is highly competitive, companies will increase their innovation investment to consolidate or even improve their position in the industry in order to prevent the risk of being predated. Since China's market economy system is not yet sound and competition within the industry is weak, the impact of product market competition on enterprise innovation will be more significant.

## 5. Conclusions and Recommendations

### 5.1 Conclusions of the study

This paper explores the relationship between product market competition and enterprise innovation based on the background of high-quality development with the sample of A-share manufacturing companies listed in Shanghai and Shenzhen from 2011 to 2021, and draws the following conclusions: product market competition has a positive role in promoting enterprise innovation, and the more intense the product market competition, the higher the transparency of enterprises, and enterprises must continuously improve their position in the industry in order to better obtain investors' favor. The more competitive the product market is, the higher the transparency of the company, and the better the company can gain the favor of investors, the more

the company must improve its position in the industry, and increasing the investment in innovation is undoubtedly the most basic way for manufacturing companies. The positive effects of the governance effect and the predatory effect of product market competition are dominant. In terms of the governance effect, the more competitive the product market is, the better the external governance mechanism of the company, which can inhibit the short-sighted and self-interested behavior of executives and thus increase the investment in corporate innovation. In terms of the predation effect, the more competitive the product market is, the more the company will take the initiative to increase its innovation investment in order to prevent being "predated" by other companies in the same industry.

## 5.2 Countermeasures and Suggestions

Based on the findings of this paper, the following suggestions are put forward: from the manufacturing enterprise level, in the face of the fierce industry net whole thing, enterprises should tilt their resources in enterprise innovation, so as to ensure the normal development of enterprises. From the national level, the country should accelerate the improvement of market economy rules, create a good atmosphere of product market competition for enterprises, and promote the output of China's manufacturing enterprises in terms of innovation.

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