

The Influence and Adjustment of Product Market Competition and Tax Incentives on Enterprise Innovation Output

Cun Zhou^{1, a} Shiyun Zhang^{1, b} and Huimin Chen^{1, c}

¹School of Management and Economic, Chongqing University of Posts and Telecommunications, Chongqing 400065, China.

^azhoucun1995@163.com, ^bzhangsy1@cqupt.edu.cn, ^c1012845863@qq.com

Abstract

Based on the conditions of product market competition, this paper discusses the impact mechanism of tax preference on the innovation output of enterprises, and takes the listed companies of strategic emerging industries in 2009-2016 as the research sample to test the impact of tax preference on enterprise innovation. The regulatory effect of innovation output and product market competition is analyzed. The results show that, first of all, there is an inverted U-shaped relationship between tax preference and innovation output of enterprises, but the intensity of preference has not reached the inflection point of the U-shaped curve, the incentive effect is dominant and the supporting effect is obvious. Secondly, product market competition weakens the incentive effect of tax preference on innovation output. Third, the transmission effect of product market competition plays a role by influencing the R&D investment of enterprises. This study explains Schumpeter effect from another perspective and provides guidance for optimizing Chinese government subsidy policy and improving patent protection policy.

Keywords

Tax incentives; product market competence; innovation output; R&D input.

1. Introduction

What effect does the current preferential tax policy have on the technological innovation activities of enterprises? Can it effectively promote the increase of R&D investment of enterprises? This is the first question that this paper tries to answer. Product market competition and tax preferential policies are the two main forces regulating economic development and resource allocation. On the road of market-oriented reform, product market competition plays an important role in resource allocation. On the other hand, preferential tax policy is a powerful tool to intervene in economic operation, and also another important factor to promote economic development. Therefore, the conclusion drawn by considering the influence of preferential tax policies on technological innovation without market influence factors will be empty, and it is difficult to ensure the accuracy of the theory under different product market competition conditions. Therefore, when we study the impact of tax preference on the R&D investment of enterprises, we must take into account the factors of product market competition. At present, the domestic and foreign researches mostly study the impact of technology innovation from two single perspectives, and few studies the mechanism of the two. Therefore, the second question of this paper is whether the product market competition can enhance or restrain the influence of tax preference on the technological innovation of enterprises? These findings and conclusions can undoubtedly add new empirical evidence to the current research in this field.

2. Literature Review

2.1. Tax Preference and Technological Innovation of Enterprises

The section headings are in boldface capital and lowercase letters. Second level headings are typed as part of the succeeding paragraph (like the subsection heading of this paragraph). Please keep a second copy of your manuscript in your office. Tax preferential policies are the main means for the government to promote technological innovation of enterprises, but whether the implementation of tax preferential policies can effectively improve the enthusiasm of enterprises for technological research and development is still a hot topic in the current research field. There is no consensus in the current theoretical research. At present, there are two main views on this issue, one is incentive effect, the other is inhibition effect. The incentive effect thinks that preferential tax incentive can reduce the R&D cost and improve the innovation ability of enterprises, which has been studied by scholars at home and abroad.

Rao et al. (2016) found that the 10% tax credit would be a 19.8% increase in research investment expenditure, which could significantly improve the innovation ability of enterprises [2]. Jia et al. (2017) used the panel data of Listed Companies in China from 2007 to 2013 to find that the preferential tax incentive has stimulated the R&D expenditure of enterprises, and every 10% reduction in the R&D cost of enterprises can increase the R&D expenditure of enterprises by 3.97% in a short period of time. At the same time, researchers found that the tax incentive has an incentive effect on the R&D of private enterprises but has no obvious impact on state-owned enterprises [3]. Ernst et al. (2011) believed that preferential tax incentives can not only increase the enthusiasm of enterprise research and development, but also enhance the tendency of patent application [4]. Mukherjee et al. (2017) found through the study of "replacing business tax with value-added tax" restructuring that reducing corporate tax burden, easing corporate capital pressure, can improve corporate R&D investment and enhance corporate R&D capacity [5]. Improving the ability of enterprises to raise funds by themselves and easing external financing constraints can increase the ability of enterprises to resist R&D risks [6]. Domestic scholars have also done a lot of research on tax incentives for technological innovation of enterprises. Qu Wan et al. (2017) launched a questionnaire for high-tech enterprises. The policy evaluation results show that tax incentives significantly improve the R&D ability and innovation level of enterprises [7].

Gao et al. (2016) tested the incentive effect of tax preference by two ways of R&D input and patent output and found that the incentive effect of tax preference has no significant impact on patent output [8]. McKenzie et al. (2010) analyzed the impact of tax preference on R&D investment of enterprises, and found that the short-term impact of tax preference on R&D investment of enterprises is small, and it is difficult to have an impact on innovation decision-making of enterprises [9].

Through the above literature review, it is found that there are two main points of view in the current research on the research of tax preference on technological innovation of enterprises. One is to hold the view of incentive effect, which holds that tax preference can help enterprises reduce the pressure of research and development funds, promote innovation investment of enterprises, and improve innovation performance of enterprises. Compared with government subsidies, tax preference can be more effective and continuously help enterprises to carry out sustainable innovation. Another view is that tax preference will not promote enterprise innovation, or even have a negative impact on enterprise innovation. In recent years, some scholars think that the tax preference is full of uncertainty in the process of enterprise incentive, which is affected by many uncertain factors. Scholars began to consider how tax incentives affect enterprise innovation in different situations. Generally speaking, the incentive effect of tax preference on technological innovation of enterprises has not been unanimously accepted by academia. We can find that the reason for different research conclusions may be that there

are differences in research objects and methods in the past, and in a complex market situation, different national conditions and environments will affect the impact of tax preferences on technological innovation activities of enterprises.

2.2. Product Market Competition Affects Tax Incentives and Innovation

"Schumpeter effect" holds that the fiercer the product market competition, the less the enterprise will conduct R&D innovation [12]. Based on the micro data of communication equipment manufacturing industry, Huang Xunjiang found that in the segment industry, product market competition has a negative impact on innovation performance [13]. Zhang Chunpeng found based on A-share manufacturing industry data that product market competition inhibited innovation investment of low-tech enterprises and increased financial level of enterprises [14]. Lu Xiaomeng based on the industrial enterprise database, using the fixed effect model, found that the product market competition led to the increase of the external financing cost and the unknown risk of the enterprise, and the enterprise would choose to reserve a large amount of cash, rather than invest the cash in the innovation projects with no return in the short term [15,16]. Zhang Yongkui found that product market competition inhibited the positive relationship between academic independent directors and enterprise R&D Investment [17]. Another part of scholars believe that product market competition will promote enterprise research and development, the higher the competitive position of product market, the higher the innovation profit will be obtained than the companies that are in the same pace, and the companies will escape the threat of competition through innovation to avoid being eliminated by the market. Scherer pointed out earlier that monopoly will lead to organizational inertia, while competition will bring stronger innovation impetus to enterprises [18]. Based on the data of China's industrial enterprises, domestic scholars have reached similar conclusions, that is, competition has a significant role in promoting technological innovation [19, 20]. In the follow-up study, it is found that "Schumpeter effect" and "competition escape effect" can exist at the same time, and there is not a simple linear relationship between product market competition and enterprise technological innovation [21]. Based on the data of Chinese industrial enterprises, domestic scholars found that excessive competition will weaken the profitability of enterprises and reduce the technological innovation ability of enterprises [22]. According to the research on the government's policy-making to support the technological innovation of enterprises, it is just because of the significant externalities of innovation interaction that only the product market competition allocates resources, which easily leads to market failure, and the desire of enterprises to carry out technological research and development is not strong. Therefore, governments of all countries spare no effort to formulate policies to encourage enterprises to carry out technological research and development and innovation [23, 24], so as to promote innovation ability the ascension of [25]. In a market-oriented environment, the capital transferred by the government to enterprises will not be a bowl of water. For promotion or other interests, the government will give more "care" to some enterprises, which will affect the market order, further reduce the innovation vitality of enterprises, make the rent-seeking prevailing, and cause the waste of national resources. Therefore, under the condition of product market competition, how to effectively use tax incentives to promote enterprise innovation is also the focus of academic research.

After the literature review, most of the literature mainly focuses on the impact of tax incentives on R&D investment of enterprises, while the research of considering innovation output is not sufficient. Secondly, whether the specific negative or positive impact of tax incentives on enterprise innovation has not reached a consensus conclusion. In addition, there are few literatures to discuss the mechanism of the impact of product market competition and tax incentives on technological innovation. In the process of influencing enterprise innovation, how

product market competition and tax incentives interact with each other is rarely discussed by scholars.

3. Theoretical Analysis and Research Hypothesis

3.1. Main Effect Hypothesis

Innovation is a long-term activity. Its positive externalities and uncertain risks will seriously affect the innovation enthusiasm of enterprises. Government subsidies and tax preferences are considered as one of the powerful means to improve the innovation enthusiasm of enterprises. The government needs to increase its support for enterprises and investment in R&D platform construction to strengthen its support for R&D activities. To some extent, tax preference directly alleviates the dilemma of R&D funds in the form of cash, which has an impact on enterprise innovation.

Through literature review, it is found that the impact of tax incentives on technological innovation of enterprises has a controversial role in promoting and inhibiting. The promotion function thinks that the tax preference obtained by the enterprise can enhance the enthusiasm of enterprise innovation and effectively encourage the enterprise to carry out technology research and development. But the inhibitory effect is that tax preference will inhibit the innovation of enterprises. The conclusion that the tax preference is contrary to the enterprise output is that the relationship between the tax preference and the enterprise innovation is not simple linear. The tax preference will promote the enterprise's R&D innovation in the initial stage but will produce the crowding out effect on the enterprise's R&D innovation after exceeding the critical value. To sum up, this paper holds that tax preference has double effects on technological innovation of enterprises. Incentive effect and crowding out effect exist at the same time. If incentive effect is dominant, tax preference can promote enterprise innovation, otherwise, crowding out effect. The final effect of tax preference is related to the intensity. The intensity of tax preference is not the higher the better, it should be in a reasonable range. Previous studies have also found that tax preference is not a simple linear relationship with enterprise innovation. Based on this, this paper puts forward the research hypothesis:

Hypothesis 1: the relationship between tax preference and innovation output is non-linear, which shows that when the degree of tax preference is low, it is positively correlated with innovation output; when the degree of tax preference is high, it is negatively correlated with innovation output.

3.2. Regulation Effect of Product Market Competition

Product market competition plays an important role in resource allocation, which has an important impact on the implementation effect of government fiscal and tax incentive policies and the path of technological innovation for enterprises. Therefore, the conclusion that considering the effect of government's fiscal and tax incentive policies on enterprise innovation is undoubtedly empty and can't deal with the complex market conditions. In this paper, the index of product market competition is selected to study whether the market competition environment plays a regulatory role in the relationship model of "government financial and tax incentives - enterprise innovation" and whether there is a substitution effect between product market competition and government financial and tax incentives. This paper expects that the product of product market competition and government subsidies will have an important impact on the innovation output of enterprises.

The government financial and tax incentives promote the technological innovation of enterprises. Its means is to help enterprises overcome the externality of innovation and smooth the R&D risk of enterprises by transferring funds, so as to promote enterprises to actively carry out R&D innovation. From the literature of product market competition and enterprise

technology innovation, the core of "Schumpeter effect" and "competition escape effect" is to influence the enterprise's innovation decision-making behavior through the expected profit. As government subsidies and tax preferences can affect the expected profits of enterprises, it is obvious that the effect of fiscal and tax incentive policies will be affected by "Schumpeter effect" and "competition escape effect". In view of the controversy of "Schumpeter effect" and "competition escape effect" in academic circles, this paper holds that these two effects will change with the change of market competition, which is also the theoretical source of the "inverted U" view on the relationship between market competition and innovation. In the early stage of industrial development, the overall level of competition in the industry is relatively low, and the profits obtained by innovation can make enterprises obtain excess profits, showing "competition escape effect". In the later stage of industrial development, innovation revenue will decrease, and enterprises will reduce R&D investment, showing "Schumpeter effect". Government subsidies and tax preferences directly affect the profits of enterprises. To some extent, the profit pressure of listed enterprises can be alleviated. Enterprises choose projects with long R&D cycle, high R&D investment and high R&D risk to enhance the innovation willingness of enterprises, which will inevitably weaken. The efficiency of transformation from government subsidies and tax preferences to innovation output will also decrease, so from the perspective of innovation achievements. The market competition of products is bound to be substituted by government subsidies and tax preferences.

Based on the above analysis, this paper proposes the following assumptions:

Hypothesis 2: product market competition will weaken the relationship between tax preference and innovation output. When tax preference innovation output is positive correlation, product market competition weakens the positive correlation; when tax preference innovation output is negative correlation, product market competition inhibits the negative correlation.

4. Research Design

4.1. Research Samples and Data Sources

The development of strategic emerging industries is of great strategic significance to the country, and it is also the main incentive object of the government's tax preference. Therefore, this paper selects A-share listed companies of China's strategic emerging industries from 2009 to 2016 as the research sample and selects 1238 sample stocks according to the comprehensive index of China's strategic emerging industries, and finally obtains 4010 effective samples.

4.2. Variable Definition and Measurement

Innovation output (LnPA): for enterprise innovation output, patent is not the best observation index, but in view of data availability, patent is the best measurement index that can be collected and utilized at present. This paper uses the natural logarithm of patent application plus one as the main explanatory variable.

Innovation input (RDI): in order to consider the impact of business income, this paper uses the ratio of total R&D investment and main business income as the proxy variable to measure innovation input.

Tax preference (Tax): mainly referring to the practice of Xia Qinghua[26], according to the actual income tax rate of the enterprise as an alternative variable to measure the degree of tax preference, for the convenience of research, this paper uses the opposite number of the ratio of income tax expense to EBIT for reverse calculation. The larger the value, the higher the degree of tax preference.

Product market competition (PMC): referring to previous studies [22], based on the hypothesis that the more fierce the product market competition is, the higher the sales cost is, this paper

uses the ratio of sales cost and operating revenue as the proxy variable of product market competition.

As for the control variables that affect the technological innovation behavior of enterprises, referring to the existing literature, this paper selects the enterprise scale, profitability, growth ability, asset liability ratio, cash flow ratio, corporate governance efficiency, enterprise age, equity nature and capital intensity as the control variables.

Table 1. Definition of main variables

Variable name	Symbol	Definition
Innovation output	LnPA	Ln (patent applications in the year)
Innovation input	RDI	annual R&D input / main business income
Tax preference	Tax	- (income tax expense / EBIT)
Product market competition	PMC	sales expense / operating revenue
Enterprise scale	Insize	ln (total assets at the beginning of the period)
Profitability	ROA	net profit / total assets
Growth	Gro	operating revenue / last year's operating revenue-1
Asset liability ratio	Lev	Lev total liabilities / total assets
Cash flow ratio	cflat	operating cash flow / total assets
Age of enterprise	age	the span from the year of establishment to the year of data observation
Capital density	cap	fixed assets / total assets
State	State	Whether state is state-owned
Industry	ind	industry dummy variable
Year	year	virtual variable

5. Empirical Analysis

5.1. Descriptive Statistics and Correlation Analysis

Table 2 reports the descriptive statistical results of the main variables, in which innovation output is dominated by patent applications, and the minimum and maximum values of LnPA are 0.693 and 6.603, respectively, with an average of 3.231 and a median of 3.178, indicating that there are significant differences in innovation output among different enterprises, and there are few patent applications and no substantive innovation in some enterprises. Innovation investment is measured by the ratio of R&D investment to main business income. The maximum value is 0.249, the minimum value is close to 0, and the average value and median value are 0.059 and 0.044 respectively, which shows that there are great differences in innovation investment of enterprises. In terms of tax preference, it is mainly measured by the opposite number, the minimum value is -0.513, the maximum value is -0.001, and the average and median values are -0.146 and -0.145, respectively, reflecting that there are differences in enterprises' access to government tax preference.

Table 2. Descriptive Statistics

Variable	Mean	Sd	Min	P50	Max
LnPA	3.231	1.366	0.693	3.178	6.603
RDI	0.059	0.049	0.001	0.044	0.249
TAX	-0.146	0.105	-0.513	-0.145	-0.001
PMC	0.077	0.080	0.001	0.049	0.370
LnSize	21.687	1.131	19.729	21.553	24.967
Lroa	0.049	0.047	-0.079	0.045	0.179
Lgro	0.227	0.449	-0.493	0.149	2.885
Llev	0.371	0.202	0.047	0.357	0.820
Cflat	0.038	0.065	-0.120	0.036	0.198
Age	14.927	5.218	4	15	29
Cap	0.188	0.135	0.009	0.158	0.557

5.2. Regression Analysis

Linear model and the inverted u-shaped model analysis and comparison, the linear model 1, the preferential tax a linear relationship with the enterprise innovation output performance is significant positive correlation ($\alpha_1 = 0.0845$, $p < 0.01$), the model 3, the quadratic curve is characterized by preferential tax item a regression coefficient didn't pass the significance test ($\alpha_1 = 0.0086$, $p > 0.05$), and the second time a significantly negative regression coefficient ($\alpha_2 = 0.1092$, $p < 0.01$), the general opening down inverted u-shaped relationship. Two points can be deduced from this finding: first, there is an interval between the positive incentive effect of tax incentives enjoyed by strategic emerging industries on innovation output. Within this interval, tax incentives are significantly positively correlated with innovation output; beyond this interval, tax incentives are negatively correlated with innovation output. The regression coefficient of the square item of tax preference in model 3 and model 4 is significantly negative ($\beta_4 = -0.1092$, $p < 0.01$; $\beta_4 = -0.0620$, $p < 0.1$) can be supported, which also supports the research hypothesis 1 in this paper. Second, the relationship between Tax incentives for strategic emerging enterprises and enterprise innovation output generally presents a positive correlation. This conclusion can be seen from model 1 and model 2 that the regression coefficient of Tax is significantly positive (positive $\beta_1 = 0.0845$, $p < 0.01$). Equation $\beta_1 = 0.1101$, $p < 0.01$) was verified. The above conclusions indicate that the degree of tax preference is non-linear with enterprise innovation, and the research hypothesis that too high degree of tax preference will inhibit enterprise innovation output is supported by empirical evidence. However, the government tax incentives enjoyed by strategic emerging enterprises in the study sample range play a positive role in innovation output.

Model 2 and model 4 examine the moderating effect of product market competition on tax incentives and innovation output. It was found that in linear model 2, product market competition had an inhibitory effect on innovation output ($\beta_2 = -0.0697$, $p < 0.05$), which further tested previous results [30] and the above. In linear model 2, the regression coefficient of the interaction term "PMC×Tax" is significant ($\beta_3 = -0.0579$, $p < 0.05$), indicating that product market competition has a significant negative regulating effect on the relationship between Tax preference and innovation output, and product market competition has a substitution effect on Tax preference. In nonlinear model 4, the regression coefficient of the product term "PMC×Tax" is significant ($\beta_3 = -0.1158$, $p < 0.05$), and the regression coefficient of the interaction term "PMC×Tax²" is significant ($\beta_5 = 0.0588$, $p < 0.1$).

This indicates that in the inverted u-shaped relationship between tax incentives and innovation output, the inverted u-shaped curve will become more and more gentle with the increasing

degree of product market competition, which further indicates that the regulating effect of product market competition is relatively obvious. This supports the research hypothesis 2 in this paper. In the control variable. In addition to the decreasing significance of the relationship between profitability and innovation output, the relationship between enterprise size, asset-liability ratio, capital intensity and enterprise age and innovation output has been tested for robustness. The specific regression results are shown in table 3.

Table 3. Regression results

	Liner model		Nonlinear model	
	model1	model2	model3	model4
InSize	0.5303*** (31.46)	0.5284*** (31.20)	0.5284*** (31.38)	0.5226*** (31.11)
Roa	0.0511** (2.51)	0.0567*** (2.76)	0.0349* (1.68)	0.0391* (1.85)
Gro	-0.0009 (-0.06)	0.0015 (-0.11)	-0.0026 (-0.18)	-0.0025 (-0.17)
Lev	0.0893*** (4.86)	0.0856*** (4.64)	0.0898*** (4.89)	0.0860*** (4.67)
Cflat	-0.0028 (-0.17)	-0.0016 (-0.10)	-0.0020 (-0.12)	-0.0011 (-0.06)
Age	-0.0899*** (-6.27)	-0.0883*** (-6.16)	-0.0878*** (-6.13)	-0.0873*** (-6.08)
Cap	-0.0437*** (-2.91)	-0.0465*** (-3.09)	-0.0438 (-2.92)	-0.0471*** (-3.13)
Tax	0.0845*** (6.28)	0.1101*** (5.90)	-0.0086 (-0.29)	0.0527* (1.28)
Tax2			-0.1092*** (-3.60)	-0.0620* (1.48)
PMC		-0.0697** (-2.59)		-0.0840** (-2.56)
PMC×Tax		-0.0579** (-1.98)		-0.1158** (-1.99)
PMC×Tax2				0.0588* (1.37)
_Cons	-0.2748*** (4.83)	-0.2783*** (-4.89)	-0.2707*** (-4.76)	-0.2722*** (-4.79)
Wald chi2	1857.70***	1867.80***	1876.67***	1886.63***
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	4010	4010	4010	4010

6. Conclusion

This paper discusses the influence of government fiscal and tax incentives on technological innovation of enterprises at different levels of product market competition from the mutual

relationship and interaction mechanism among product market competition, government fiscal and tax incentives and enterprise innovation output. Based on the data of a-share listed companies in China's strategic emerging industries from 2009 to 2016, the research hypothesis was verified, and the following conclusions were obtained:

(1) the degree of tax incentives has A non-linear impact on the technology R&D activities of listed companies in China's strategic emerging industries a-shares and has A non-linear impact on the R&D input and innovation output of enterprises. This non-linear effect is embodied in the "inverted u-shape", that is, when the level of tax incentives is low, tax incentives can promote enterprises' R&D and innovation activities, but when the level of tax incentives reaches a high level and exceeds the threshold value, tax incentives will inhibit enterprises' investment in R&D activities, thus affecting innovation output. In the sample range, the government tax incentives enjoyed by strategic emerging enterprises in the sample range of this study play a positive role in innovation output, but the marginal utility decreases with the increase of tax incentives.

(2) product market competition negatively moderates the relationship between tax incentives and enterprise technological innovation. Specifically, in the linear relationship between tax incentives and innovation output, or the first half of the "inverted u-shaped" curve, product market competition weakens this favorable positive correlation; In the second half of the inverted u-shaped curve, where tax incentives are negatively correlated with innovation output, product market competition suppresses this unfavorable negative correlation. This shows that product market competition has two sides, which can not only form substitution effect with certain level of tax incentives, but also adjust the problem of insufficient innovation enthusiasm caused by "excessive support". The effect of tax incentives on enterprise innovation is closely related to product market competition. From another perspective, tax incentives can alleviate the lack of innovation of enterprises in the fierce market competition. At this time, tax incentives can be regarded as an effective means of deployment.

Acknowledgments

We would like to thank the anonymous reviewers for their valuable suggestions. Financial supports from Chongqing Social Science Found (Project#2018YBGL079) and Chongqing Scientific Research Innovation Foundation for Graduate Students (Project# CYS18255) are also acknowledged.

References

- [1] liu shangxi, fan yixia. Building an innovation-friendly tax system based on the concept of innovative development [J]. Tax research, 2016, (10): 3-8.
- [2] Rao, Nirupama. Do tax credits stimulate R&D spending? The effect of The R&D tax credit in its first decade[J]. Journal of Public Economics, 2016, 140:1-12.
- [3] Junxue Jia, Guangrong Ma. Do R&D tax incentives work? Firm-level evidence from China[J]. China Economic Review, 2017, 46
- [4] Christof Ernst, Christoph Spengel. Taxation, R&D tax incentives and patent application in Europe[J]. Zew Discussion Papers, 2011,
- [5] Abhiroop Mukherjee, Manpreet Singh, Alminas Žaldokas. Do corporate taxes hinder innovation? [J]. Journal of Financial Economics, 2017, 124: pags. 195-221.
- [6] Tor Jakob Klette, Jarle M ø en, Zvi Griliches. Do Subsidies to ltd. R&D Reduce Market Failures? Research Policy,1999, 29(4-5): 471-495.

- [7] Qu wan, feng haihong, hou qinjiang. Research on innovative policy evaluation methods and application: a case study of tax incentives for high-tech enterprises [J]. Scientific research management, 2017, 38(01): 1-11.
- [8] Gao Lei, Leo l. Yang, Joseph h. Zhang. Corporate patents, R&D success, and tax avoidance[J]. Review of Quantitative Finance & Accounting, 2016, 47(4): 1063-1096.
- [9] Kenneth j. Mckenzie, Natalia Serzhun. Taxation and R&D: An Investigation of the Push and Pull Effects[J]. Canadian Public Policy, 2010, 36(3): 307-324.
- [10] zhang junrui, Chen yixin, wang fangjun. Research on the impact of preferential income tax policies on enterprise innovation efficiency [J]. Scientific research management, 2016, 37(03): 93-100.
- [11] chu deyin, ji fan, Yang shan. Fiscal subsidies, tax incentives and patent output of strategic emerging industries [J]. Tax research, 2017, (04): 99-104.
- [12] Joseph Alois Schumpeter. Capitalism, Socialism, and Democracy[J]. Political Studies, 1942, 27(4): 594-602.
- [13] huang xunjiang. Does competition promote innovation? -- a four-dimensional analysis based on China's communication equipment manufacturing industry [J]. Production-economy review, 2017, 8(02): 108-121.
- [14] zhang chungeng, xu yanyong. Market competition: "roadblock" or "booster" -- evidence of "shifting from reality to reality" in technology-heterogeneous enterprises [J]. Financial science, 2019, (08): 1-13.
- [15] Lu xiaomeng, hou xiaohua, Yin zhichao. Product market competition, uncertainty and corporate savings rate -- empirical evidence from the database of Chinese industrial enterprises [J]. Shanghai finance, 2018, (06): 11-22+10.
- [16] David Haushalter, Sandy Klasa, William f. Maxwell. The influence of product market dynamics on a firm's cash holdings and hedging behavior[J]. Journal of Financial Economics, 2007, 84(3): 797-825.
- [17] zhang yongkui, lai shaojuan, du xingqiang. Academic independent director, product market competition and company innovation input [J]. Economic management, 2019, 41(10): 123-142.
- [18] Scherer. Market Structure and the Employment of Scientists and Engineers[J]. American Economic Review, 1967, 57(3): 524-531.
- [19] li wei. The relationship between technological innovation and market structure in industrial evolution -- a Chinese interpretation of schumpeter's hypothesis [J]. Science research management, 2009, 30(06): 39-47.
- [20] jian ze, duan yongrui. Enterprise heterogeneity, competition and convergence of total factor productivity [J]. Management world, 2012, (08): 15-29.
- [21] Michael Polder, Erik Veldhuizen. Innovation and Competition in the Netherlands: Testing the Inverted -u for Industries and Firms[J]. Journal of Industry Competition & Trade, 2012, 12(1): 67-91.
- [22] nie huihua, tan songtao, wang yufeng. Innovation, enterprise scale and market competition: panel data analysis based on Chinese enterprises [J]. World economy, 2008, (07): 57-66.
- [23] Emre Ozcelik, Erol Taymaz. R&D support programs in developing countries: The Turkish experience[J]. Research Policy, 2008, 37(2): 258-275.
- [24] Birgit Aschhoff. The Effect of Subsidies on R&D Investment and Success: Do Subsidy The History and The Size Matter [J]. Journal of Social Science Electronic Publishing, 2009.

- [25] Cesar Alonso - Borrego, Jose i. Galan - Zazo, Francisco Javier Forcadell, etc. Assessing the effect of public subsidies on firm R&D investment: A survey [J]. *Journal of Economic Surveys*, 2013, 28 (1) : 36-67.
- [26] xia qinghua, huang jian. Market competition, government resource allocation and enterprise innovation input -- evidence of China's high-tech enterprises [J]. *Economic management*, 2019, 41(08): 5-20.
- [27] Chen qiang. *Advanced econometrics and application of Stata (2nd edition)* [M]. Beijing: higher education press, 2014.
- [28] lian yujun, su zhi, ding zhiguo. Cash-flow sensitivity test for financing constraint hypothesis? [J]. *Statistical research* (10): 94-101.
- [29] Chen limin, liu jingya, zhang shilei. The influence of imitation isomorphism on the relationship between internationalization and performance of enterprises -- an empirical study based on the legitimacy of institutional theory [J]. *China industrial economy*, 2016, (9): 127-143.
- [30] kang zhiyong; Tang xueliang. Can you have your cake and eat it too?