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Tax Preference and Firm Innovation Performance

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ABSTRACT: *This paper selects 2012-2019 A-share listed companies as samples to study the impact of tax preference on enterprise innovation performance, and further explores the impact of financing constraints on the relationship between the two. The results show that the more tax incentives a firm enjoys, the better its innovation performance will be. From the perspective of innovation output structure, compared with invention patents, tax incentives have a significant incentive effect on utility models and design. Further research finds that the relationship between tax incentives and innovation performance is moderated by firm financing constraints. Finally, this paper puts forward the existing problems in China's current innovation tax incentive policies, and then puts forward suggestions on the incentive policy system needed for the construction of an innovation-oriented country, which has certain reference significance for enterprises and policy makers.*
KEY WORD*: Tax Incentives, Innovation Performance, Financing Constraints*

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I. INTRODUCTION

The arrival of the economic "new normal" poses new challenges to the national economic and social development, and mass innovation has become the basic orientation for China to build an innovation-oriented country. As the main body of the innovation system, the R&D and innovation of enterprises plays a pivotal role in the healthy operation of the national innovation system: statistics show that enterprises have become the main participants of social innovation activities in terms of the output value of new products, the number of patent applications and authorization and other innovative outputs.

The technological innovation of enterprises cannot be separated from the support of the government. Guo Xiaodan (2011) believes that government support can not only solve the funding gap faced by enterprises' R&D activities, but also release favorable signals to external stakeholders. By streamlining administration and delegating power, the government has opened up more space for the entrepreneurship and innovation of market players. Therefore, tax policy has become an important starting point to promote innovation activities of enterprises. The preferential tax policy is the transfer of the interests of the tax right holder to the tax obligor. The government leaves part of the funds that should have been directly handed over to the finance to the enterprise, but does the enterprise that actually receives the preferential tax policy channel its resources to innovation? The answer to this question not only effectively responds to the question of policy makers, but also expands the understanding of enterprise innovation behavior.

As the most important embodiment of innovation behavior and one of the main achievements of R&D activities, patent has strategic significance for the development of enterprises and the establishment of core competitiveness of enterprises. China's patents include invention, utility model and design of three basic forms, among which the invention patent has the highest demand for creativity. According to the World Intellectual Property Index 2020, the number of patent applications received by the State Intellectual Property Office in 2019 reached 1.4 million, ranking first in the world, making China a "patent power" worthy of the name. However, on the whole, the utility model and design patents with lower application conditions and examination requirements become the main body of patent application and authorization, which leads to a large number of "patent bubbles" that do not meet the patentability requirements. In addition, compared with foreign countries, there is an obvious gap in the average duration of domestic invention patents, the number of pages and other items reflecting patent quality. The root cause of this phenomenon needs to be found from the current R&D and innovation tax incentive policy design. Under this policy design, the main topic of this paper is how the degree of tax incentives influences the different types of patent output.

Fang Yuan and Zhu Jiali (2019) found in their research that resources are the basic conditions for enterprises to make strategic decisions. Enterprises with rich resources, especially financial resources, enjoy greater freedom and initiative in strategic decisions. In recent years, China has launched a series of measures to reduce fees. For example, on May 18,2020, China Banking and Insurance Regulatory Commission issued the Notice on Further Standardizing Credit Financing Charges and Reducing Comprehensive Cost of Enterprise Financing [2020] No. 18, requiring the cancellation of some fees and unreasonable conditions in the credit link, and the credit enhancement link to reduce the burden on enterprises through various ways. We will help ease

financing difficulties for small and medium-sized enterprises. In this context, we further study the moderating effect of financing constraints on the relationship between tax incentives and firm innovation performance: for firms with more external financing, will the incentive effect of tax incentives on their innovation performance be enhanced or weakened? This is also one of the concerns of this paper.

II. LITERATURE REVIEW

The academic research literature on innovation performance mainly focuses on its influencing factors and subsequent effects. Specific studies on subsequent effects need to be further explored. In contrast, there are relatively many studies on the influencing factors: Previous studies have explored the external factors (competitive intensity, fiscal and tax policies, government support, marketization degree, etc.), internal factors (organizational structure, employee compensation, organizational learning, resource acquisition, etc.) and social factors (competition and cooperation relationship, legal level, social network of senior executives, etc.) of enterprises.

Among the external factors of enterprises, scholars at home and abroad have conducted further detailed studies on the impact of fiscal and tax policies on innovation performance: compared with the research on the input side of innovation, the research on the impact of fiscal and tax incentives on the output side of innovation appears relatively late: Foreign scholars Jong & Verhoeven(2007) measured the implementation effect of WBSO tax credit in the Netherlands, and the results showed that the implementation of this policy had a significant positive impact on innovation output indicators such as the sales proportion of new products and new services. Cappelen et al.(2012) studied the innovation-oriented tax incentive policy of Norway's Skattefunn, and the results showed that the implementation of the project was helpful for enterprises to research and develop new products and improve production technology, but had no significant effect on patent application behavior. Beck et al.(2014) divided Innovation achievements into two basic forms: Radical Innovation and Incremental Innovation. It is found that the public financial input has a significant positive effect on the original innovation, but has no significant effect on the incremental innovation.

Zhu Pingfang and Xu Weimin (2003) made an empirical analysis of the industry data at the middle level of Shanghai and believed that the government's financial subsidies or subsidies to enterprises had a slow but indirect impact on their patent output. Cheng Hua and Zhao Xiang (2008) analyzed the panel data of large and medium-sized enterprises across the country and believed that the government science and technology funding policies had a positive effect on the R&D and innovation output of enterprises. The research of Zhang Qinhong and Luo Jianwen (2009) showed that the patent subsidy policy implemented in Shanghai at that time significantly promoted the application of invention patents by enterprises, but the quality of enterprises' patents did not show a downward trend due to the increase.

Most of the above studies on the impact of centralized fiscal subsidy policies on innovation performance are limited to data at the regional and industry level, and there is no further analysis on the structure of innovation output in the research on innovation performance. there is little literature consider tax breaks for invention patents, utility models and designs will produce different influence on the form of three patents. Therefore, this paper studies the incentive effect of tax incentives on enterprise innovation activities by expanding the sample range, thus the conclusion is more general and reference.

III. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

Preferential tax policy is the benefit transfer of tax right holder to tax obligor, and its essential purpose is to reduce tax burden. The promotion effect of preferential tax policy on enterprise innovation is mainly shown in: On the one hand, tax incentives play a guiding role in the development of the technology industry, fully expressing the government's supportive attitude towards enterprises' innovation activities to the society, and pooling more resources in the field of innovation with the help of the market mechanism. On the other hand, it directly adjusts the after-tax earnings of enterprises' innovation activities, and the actual effect is to reduce the cash outflow of enterprises, reduce the marginal cost of enterprises' R&D investment, improve the level of free cash flow, increase the retained earnings of enterprises, and further stimulate enterprises to increase R&D investment and actively engage in R&D activities. The innovation results generated by R&D activities can in turn increase the intensity of corporate tax incentives, so that enterprises have more funds to expand reproduction and innovation, thus forming a virtuous cycle of tax incentives: increased funds for innovation activities —more tax incentives—more funds for innovation activities.

Therefore, we put forward the hypothesis:

H1*: Controlling other factors unchanged, the greater the degree of tax incentives an enterprise enjoys, the better its innovation performance will be.*

From the perspective of innovation output structure, invention patents have some breakthroughs and can be called technological innovation, while utility models and appearance designs are small improvements on the original basis and can only be called technological imitation. Due to the limitation of resources, enterprises need

to make choices in the structure of innovation output. Generally speaking: If an enterprise to put more resources into invention patent in less investment on appearance design and utility model, on behalf of the invention patent of technology innovation takes longer development time, the result of the high uncertainty and away from the organization innovation of existing behavior, instead, on behalf of the technology of imitation utility models and designs to the existing technology and the change of the market is relatively small, It can better maintain the existing advantages of the enterprise, and the innovation results are more deterministic, the results are produced faster and the feedback is clearer.

Furthermore, the current preferential tax policies in China are not strict enough on the creativity and novelty of invention patents, and the preferential tax conditions for non-invention patents (i.e. utility models and designs) are more relaxed and lack of support for invention patents. To high-tech enterprises enjoy tax breaks that conditions, for example, its need to quantify the innovation ability of enterprises, has more than 1 item and Ⅰ class intellectual property (including invention patent) can get 7-8 points, with 1-2 item Ⅱ class intellectual property (including utility model patents, exterior design patents) can get 1-2 minutes, Owning 5 or more category 2 intellectual property rights will earn 5-6 points. Though a patent for invention is a utility model or design can obtain higher recognition score, but companies can have a number of utility model or design increases the chance to be considered, a high and new technology enterprise, driven by the preferential tax policy of enterprise more inclined to increase innovation output utility models and designs.In addition, the technology transfer patent that can enjoy the preferential income tax policy of technology transfer in China includes not only the invention of exclusive right granted by law, but also the appearance design of utility model and non-simple change of product pattern, which also lacks the high requirement of creativity and novelty of patent.

Based on the above statement, we believe that there is heterogeneity in the incentive effect of tax incentives on different forms of innovation output, so we put forward the following hypothesis:

H2a*: Controlling other factors unchanged, the incentive effect of tax incentives on invention patents is not obvious.*

H2b*: Controlling other factors unchanged, the more tax incentives an enterprise enjoys, the more utility model and design patents it produces.*

Jeffrey Pfeffer(1979) first proposed the theory of resource dependence; The viability of an organization is affected by its ability to interact with the external environment. In the face of a turbulent and uncertain competitive environment, an organization usually constantly improves its viability through communication, negotiation and negotiation with the external environment to enhance the diversity and stability of its access to resources. Similarly, enterprises' technological innovation activities need not only the accumulation of internal resources, but also the acquisition of required resources from the external environment. Fang Yuan and Zhu Jiali (2019) found that resources are the basic conditions for enterprises to make strategic decisions. Money as an important financial resources, enterprises preferential tax incentive effects on innovation performance has also been enterprise financing ability of regulation, financing constraint degree reflects a company's ability to obtain external financial financing, in particular, in the lower level of financing constraints of enterprises, as companies can use relatively low cost to obtain external finance, Even if an enterprise enjoys less tax incentives and bears more tax burden, it can still raise the funds needed for innovation projects through external financing in the face of important innovation opportunities. So enjoy less tax, also won't directly affect the enterprise innovation performance, in this case, the preferential tax incentive effects on innovation performance of enterprises is weak, but in enterprise financing constraints is higher, the tax payable and innovation investment become a choice of choice, it is easier to form a mutually exclusive effect, so the preferential tax incentive effects on innovation performance is more obvious.

Therefore, we put forward the hypothesis:

H3: *For enterprises with high degree of financing constraints, the more tax incentives they enjoy, the better their innovation performance will be.*

IV. STUDY DESIGN

4.1 Sample Selection And Data Sources

In this paper, all A-share listed companies from 2012 to 2019 are selected. In order to increase the comparability of the sample, enterprises that do not enjoy tax incentives at the same time are screened out, and companies with abnormal data in the sample are excluded, such as *ST, ST and delisted companies. Secondly, the data of asset-liability ratio and tax preference less than 0 are removed; Finally, Winsorize the 1% and 99% percentiles of All continuous variables. The patent data and financial data used in this paper are from the National Patent Database, CSMAR database and the annual financial statements of enterprises.

4.2 Variable Design

Dependent variable: Based on the research of Zhu Pingfang and Xu Weimin (2005), this paper measures innovation output by taking the number of enterprises' patents authorized, the number of enterprises' invention authorized, and the number of non-invention patents authorized as the dependent variable.

Core variables: This paper draws on the research of Ma Weihong (2011), Using the logarithm of tax incentives as the core explanatory variable, Tax Preferences = profit total × (nominal income tax rate—the actual income tax rate), The effective income tax rate is equal to the ratio of income tax expense to EBIT.

Moderator variables: In terms of the measurement methods of financing constraints, existing studies mainly fall into two categories. One adopts indirect method, such as cash-cash flow sensitivity; The other uses the direct method, such as the KZ index. In this study, financing constraint is the independent variable, so it refers to the KZ index in the direct method of Wei Zhihua (2014) to measure the degree of enterprise financing constraint.

Control variables: Referred to most domestic literatures. Enterprise scale, asset-liability ratio, enterprise age, return on assets, capital density (fixed assets ratio), ownership concentration degree.

4.3 Model Establishment

This paper uses unbalanced panel data to conduct empirical research at three levels.

Establish a model (1) to verify Hypothesis 1:

$$lnZL_{it} = \alpha_0 + \beta_1 SSYH_{it} + \sum \lambda Control_{it} + \varepsilon_{it} \quad (1)$$

ZL_{it} represents the innovation performance of the enterprise, which is measured by the number of patents authorized by the enterprise; $SSYH_{it}$ represents the degree of tax incentives enjoyed by the enterprise. The natural logarithm of corporate income tax incentives is measured by Ln [total profit × (nominal income tax rate-actual income tax rate)], $Control_{it}$ represents the control variable.If hypothesis 1 holds, then β_1 should be significantly positive.

To verify Hypothesis 2, the following empirical models (2) and (3) are established.

$$lnFM_{it} = \alpha_0 + \beta_1 SSYH_{it} + \sum \lambda Control_{it} + \varepsilon_{it} \quad (2)$$

$$lnNFM_{it} = \alpha_0 + \beta_1 SSYH_{it} + \sum \lambda Control_{it} + \varepsilon_{it} \quad (3)$$

FM_{it} represents the authorized number of invention patents, and NFM_{it} represents the sum of the authorized number of utility model and design. If Hypothesis 2 is true, β_1 in the regression result of empirical model (2) is not significant, while β_1 in the regression result of model (3) is significantly positive.

To verify Hypothesis 3, an empirical model (4) is established.

$$lnZL_{it} = \alpha_0 + \beta_1 SSYH_{it} + \beta_2 RZYS_{it} + \beta_3 SSYH_{it} \times RZYS_{it} + \sum \lambda Control_{it} + \varepsilon_{it} \quad (4)$$

If hypothesis 3 is true, then coefficient β_3 is significantly positive in the regression results of empirical model (4).

V. EMPIRICAL RESULTS AND ANALYSIS

Before the regression analysis, Hausman test was carried out, and the test results supported the fixed-effect model, as did the F-test. Therefore, in this study, bidirectional fixed effect models controlling industry and year were selected for empirical test, and inter-group heteroscedasticity and intra-group autocorrelation problems were corrected by Cluster Robust Standard Error (Cluster).

Table1: Descriptive statistics of variables

Variables	Sample Size	Min	Max	Mean	Median	Sd
lnZL	14950	0	8.598	1.844	1.792	1.514
lnFM	14950	0	7.948	0.98	0.693	1.153
lnNFM	14950	0	8.337	1.46	1.099	1.495
SSYH	14950	-780.8	141.8	0.83	0.867	6.774
RZYS	14950	-366.8	15.72	1.512	1.703	3.676
Size	14950	2.346	16.92	8.355	8.153	1.357
Lev	14950	-0.195	5.681	0.417	0.401	0.224
Age	14950	4	61	17.25	17	5.397
Roa	14950	-1.872	7.109	0.038	0.038	0.105
Zbmd	14950	0	0.954	0.214	0.185	0.154
Firstshare	14950	0.003	0.894	0.336	0.315	0.145

Table1 shows the descriptive statistical results of variables. The average number of enterprise patents and invention patents is 0.98, far less than the number of non-invention patents, which is 1.46. It can be seen that the R&D and innovation output of Chinese enterprises is mainly in utility model and appearance design, and invention patents are relatively scarce.

Table2: Pearson correlation coefficient

Variables	LNZL	LNFM	LNNFM	SSYH	RZYS	Size	Lev	Age
lnZL	1							
lnFM	0.729***	1						
lnNFM	0.913***	0.472***	1					
SSYH	0.024***	0.011	0.036***	1				
RZYS	-0.045***	-0.035***	-0.030***	0.149***	1			
Size	0.151***	0.211***	0.140***	-0.072***	0.179***	1		
Lev	0.018**	0.030***	0.044***	0.096***	0.478***	0.466***	1	
Age	-0.101***	-0.045***	-0.088***	-0.027***	0.134***	0.204***	0.193***	1
Roa	0.096***	0.079***	0.073***	-0.233***	-0.236***	0.022***	-0.370***	-0.094***
Zbmd	0.0110	-0.00300	0.017**	0.100***	0.273***	0.034***	0.068***	-0.028***
Firstshare	0.079***	0.035***	0.096***	-0.085***	-0.040***	0.176***	0.021***	-0.117***
	Roa	Zbmd	Firstshare					
Roa	1							
Zbmd	-0.087***	1						
Firstshare	0.134***	0.083***	1					

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

In Table 2, tax incentives (SSYH) are significantly positively correlated with the amount of patents granted (LNZL) and the amount of non-invention patents granted (LNNFM), but there is no significant correlation with the amount of invention granted (LNFM). The correlation coefficient between the degree of financing constraint (RZYS) and the amount of patent granted (LNZL) is significantly negative, which supports the hypotheses 3 of this paper. The correlation coefficients between patent grant amount (LNZL), invention grant amount (LNFM) and non-invention patent grant amount (LNNFM) were 0.729 and 0.913, indicating a high consistency. The correlation coefficients between other variables were all below 0.6, indicating that there was no multicollinearity among the variables.

Table3: Regression results of tax incentives and enterprise innovation performance

Variables	Dependent Variable: Amount Of Enterprise Invention Authorization (LNFM)		
	All the samples	**State-owned sample**	**Non-national sample**
SSYH	0.235**	0.269	0.258**
	(0.101)	(0.188)	(0.110)
Size	0.390***	0.474***	0.358***
	(0.028)	(0.047)	(0.033)
Lev	-0.300**	-0.795***	-0.074
	(0.123)	(0.255)	(0.130)
Age	-0.018***	-0.013	-0.021***
	(0.005)	(0.010)	(0.005)
Roa	1.686***	1.519**	1.819***
	(0.247)	(0.593)	(0.264)
Zbmd	0.194	0.471	0.126
	(0.174)	(0.305)	(0.209)
Firstshare	0.223	-0.518	0.504***
	(0.158)	(0.315)	(0.180)
_cons	-2.613***	-3.115***	-2.405***
	(0.271)	(0.468)	(0.332)
N	15098	4551.	10547
r2	0.307	0.417	0.272
r2_a	0.303	0.407	0.266
ind	control	control	control
year	control	control	control

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

Table 3 shows the relationship between the degree of corporate tax incentives (SSYH) and innovation performance (LNFM) in the full sample, state-owned sample and non-state-owned sample. Data show that in the full sample and non-state-owned enterprise sample, the positive correlation between tax incentives and innovation performance is significant at the level of 5%, but not significant in the state-owned enterprise sample, verifying Hypothesis 1.From the Angle of the control variables, the enterprise scale (Size) and return on total assets (Roa) and was significantly positively related to innovation performance, consistent with the existing research conclusion, that in the field of innovation, Large and profitable enterprises still have significant advantage.

Table4：Regression results of tax incentives and enterprise patent output structure

Variables	lnFM	lnNFM
SSYH	0.095	0.283***
	(0.097)	(0.080)
Size	0.318***	0.354***
	(0.026)	(0.024)
Lev	-0.133	-0.322***
	(0.115)	(0.096)
Age	-0.015***	-0.006*
	(0.005)	(0.003)
Roa	1.587***	0.699***
	(0.239)	(0.186)
Zbmd	0.339**	-0.134
	(0.165)	(0.132)
Firstshare	0.305**	-0.003
	(0.151)	(0.127)
_cons	-2.200***	-2.675***
	(0.248)	(0.240)
N	15185	15108
r2	0.310	0.244
r2_a	0.306	0.240
ind	control	control
year	control	control

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

Column 2 and Column 3 in Table 4 respectively show the regression results of the impact of tax incentives on invention patents and non-invention patents. Data show that the impact of tax incentives on invention patents is not significant, while the impact of tax incentives on non-invention patents is significant at the level of 1%, verifying Hypothesis 2. In the control variables, the enterprise size and the coefficient of return on total assets are significantly positive, while the asset-liability ratio is significantly negative. The conclusion is consistent with the theory.

Table5：Regression results of tax incentives, financing constraints and firm innovation performance

Variables	lnFM
SSYH	0.275***
	(0.102)
C_SSYH*C_RZYS	7.722***
	(2.814)
RZYS	1.693***
	(0.552)
Size	0.389***
	(0.027)
Lev	-0.157
	(0.133)
Age	-0.018***
	(0.005)
Roa	1.598***
	(0.246)
Zbmd	0.271
	(0.174)
Firstshare	0.191
	(0.158)
_cons	-2.685***
	(0.270)
N	15098
r2	0.309
r2_a	0.304
ind	control
year	control

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

Financing constraint (RZYS) is added as the moderator variable in Table 5. In order to reduce multicollinearity, the variables in the adjustment item are centralized. Data show that interactive items (C_SSYH * C_RZYS) coefficient in the 1% significance level is positive significant. It indicates that the degree of financing constraint can strengthen the positive correlation between tax incentives and firm innovation performance. Hypothesis 3 is supported by empirical evidence.

VI. Advice

From the analysis of this paper, it can be found that in recent years, the number of patent grants in China has increased sharply, and the innovation ability has improved significantly. However, innovation output of Chinese enterprises is mainly reflected in utility models and appearance designs, and invention patents are relatively lacking. There is still a big gap between the innovation ability of key core technologies and the international advanced level. Therefore, this paper puts forward the following policy suggestions.

Firstly, increase the requirements for the creativity and novelty of the tax incentives for technological innovation, add provisions to prevent the abuse of tax policies, and strictly set the conditions for non-invention patents to enjoy tax incentives. Increase the scores that can be obtained when the core invention patents are identified as high-tech enterprises. For the patents purchased by enterprises, the provisions of the patent box system in the BEPS action plan can be used for reference: strengthen the consideration of the material factors of the foreign purchase of patents, restrict the foreign purchase of patents that do not conform to the material transaction activities to enjoy the tax preference of high-tech enterprises, and prevent the foreign purchase of patents from becoming a tool of tax arrangement.

Secondly, preferential tax policy in China more tends to incentives for back-end activities of innovation chain, which lacks of front-end encouragement and support, so we can make the preferential policy tilt in the front-end of innovation chain, Thus, the research and development activities of enterprises have a more direct incentive effect. Specific methods include paying more attention to accelerated depreciation, additional deduction of R&D expenses, investment credit, tax credit and the improvement of R&D reserve system.

Thirdly, Set up special preferential terms for small and medium-sized enterprises, in order to make them have more power in innovation activities and practice the tax principle of quantifiable taxation.

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