

Tax incentives, financial flexibility, and corporate innovation

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Abstract: Innovation is the primary driving force for development. Enterprises as the main body of innovation research and development, its scientific and technological innovation ability reflects the whole society's innovation ability, therefore, the government needs to use tax preferential policies to encourage enterprises to innovate research and development. At the same time, it is difficult for enterprises to obtain external investment due to the long research and development cycle of innovation R&D, high capital investment demand, high risk and uncertain outcome transformation. However, when enterprises have sufficient financial flexibility in reserve, they can provide funds for innovation to support innovation research and development. Under the government's introduction of a series of innovation-related preferential tax policies, how to maintain financial flexibility reserve to provide support for enterprise innovation research and development needs to be further studied. Therefore, this paper adds financial flexibility into the study of the impact of tax incentives on enterprise innovation through literature research and empirical analysis methods to study the relationship between the three.

1. Theoretical analysis and research hypothesis

1.1 The impact of tax incentives on innovation incentives

Tax incentives can improve the quality of innovation resources and the willingness of enterprises to innovate^[1]. Therefore, through the implementation of preferential tax policies, the state reduces the tax burden of enterprises, saves a sum of cash expenditure for enterprises, and then increases innovation investment for enterprises' innovation research and development^[2]. In addition, due to the high risk of innovation projects, social investors' willingness to invest in innovation projects is not high, which is not conducive to enterprise innovation. However, enterprises that can enjoy preferential tax policies generally represent good business conditions and strong innovation ability, which can

strengthen investors' willingness to invest in enterprise innovation projects to a certain extent^[3].

Hypothesis 1: Tax incentives can significantly stimulate enterprise innovation.

1.2 Influence of incentive effect of financial flexibility innovation

Enterprises will be influenced by the external environment when they make decisions about innovation projects. If the external environment is unstable, the firm will tend to choose more stable investment projects^[4]. Sufficient financial flexibility reserve can provide financial support for enterprise innovation projects and help enterprises carry out rational research and development activities. According to the theory of financial flexibility, if an enterprise has financial flexibility management, it can use financial flexibility to provide sufficient financial support for its innovation projects in two ways: high cash reserves and low financial leverage, so as to stimulate its R & D and innovation^[5].

Hypothesis 2: Financial flexibility can promote enterprise innovation.

1.3 The regulatory effect of financial flexibility

In the case of market failure, the government needs to readjust the allocation of market resources to make it Pareto optimal. When enterprises reserve sufficient financial flexibility, they can alleviate financing constraints through financial flexibility reserve^[6]. At the same time, the government often uses preferential tax policies to guide enterprises to innovate, and enterprises can take advantage of preferential tax policies to reserve financial flexibility. When enterprises enjoy tax incentives, they can quickly invoke the reserved financial flexibility resources to invest in enterprise innovation. This paper holds that under reasonable tax incentives, financial flexibility reserve can provide sufficient funds for innovation activities, reduce the risk of enterprise innovation, and promote enterprise innovation.

Hypothesis 3: The incentive effect of tax incentive on enterprise innovation will be enhanced with the increase of fiscal flexibility reserve.

2. Empirical research design

2.1 Variable selection and indicator interpretation

2.1.1 Explained variables

The indicators selected by the explanatory variables in this paper are R&D input (RD) and patent output (INP). This paper takes "current R & D expenditure/operating income" as the R&D investment index, the number of patent applications is taken as the basic indicator in this paper.

2.1.2 Explanatory variables

(1) TAX benefits

According to the above arrangement of preferential tax policies, it can be seen that there are innovation-related policies in value-added tax, enterprise income tax and other preferential tax policies. Therefore, when determining the definition of tax incentive variables, we should not only focus on income tax incentive policies, but also include other taxes. Therefore, this paper defines the explanatory variables as "all tax rebates received / (all tax rebates received + all taxes paid)".

(2) Financial flexibility (FF)

This paper selects the dual-index measurement method to measure financial flexibility, respectively from the two dimensions of cash and debt. The specific calculation method is as follows:

Financial flexibility = cash flexibility + liability flexibility

Cash flexibility = Corporate cash ratio - industry average cash ratio

Debt flexibility = Max(0, industry average debt ratio - business debt ratio)

Where, cash flexibility is the ratio of monetary funds to current liabilities, and the debt ratio is the ratio of total liabilities to total assets.

2.1.3 Control variables

In order to obtain more reliable regression results, the following variables are selected as control variables: enterprise SIZE (SIZE), current ratio (CR), ownership concentration (OC), net profit rate on total assets (ROA), operating income growth rate (RI), financial leverage (FI), and enterprise AGE (AGE).

2.2 Model construction

Since the sample data of different enterprises and different years are quite different, the bidirectional fixed effect model of control year and enterprise is chosen in this paper. And through the Hausmann test, the bidirectional fixed effect model can eliminate the influence of unobserved factors.

To verify hypothesis 1, the following model is constructed:

$$RD_{it} = \alpha_0 + \alpha_1 TAX_{it} + \alpha_2 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (1)$$

$$INP_{it} = \alpha_0 + \alpha_1 TAX_{it} + \alpha_2 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (2)$$

To verify hypothesis 2, build the following model:

$$RD_{it} = \alpha_0 + \alpha_1 FF_{it} + \alpha_2 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (3)$$

$$INP_{it} = \alpha_0 + \alpha_1 FF_{it} + \alpha_2 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (4)$$

To verify hypothesis 3, build the following model:

$$RD_{it} = \alpha_0 + \alpha_1 TAX_{it} + \alpha_2 FF_{it} + \alpha_3 TAX_{it} * FF_{it} + \alpha_4 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (5)$$

$$INP_{it} = \alpha_0 + \alpha_1 TAX_{it} + \alpha_2 FF_{it} + \alpha_3 TAX_{it} * FF_{it} + \alpha_4 Control_{it} + \mu_i + \lambda_t + \varepsilon \quad (6)$$

3. Empirical results and analysis

3.1 Descriptive Statistics

Descriptive statistical analysis was conducted on all variables involved in the sample in this paper, and the relevant data results are shown in Table 1.

Table 1: Descriptive statistical table

Variables	Samples	Average	Standard Deviation	Minimum	Maximum
Research and development investment	11683	0.023	0.017	0	0.101
Patent output	11683	3.359	1.477	0	7.403
Tax benefits	11683	0.179	0.192	0	0.821
Financial flexibility	11683	0.246	0.825	1.146	5.293
Enterprise size	11683	22.489	1.199	20.16	26.44
Current ratio	11683	2.067	1.552	0.352	11.718
Return on total assets	11683	0.035	0.059	0.285	0.206
Ownership concentration	11683	31.986	13.691	8.12	70.76
Operating revenue growth rate	11683	0.152	0.302	0.494	2.117
Business age	11683	2.981	0.257	2.303	3.526

3.2 Correlation analysis

Pearson correlation test was conducted for the correlation coefficient between variables. The closer the Pearson correlation coefficient is to 1, the higher the correlation is. According to the results in the table, most of the absolute values of their correlation coefficients are lower than 0.4, indicating that there is no serious collinearity problem between variable indicators.

(1) The correlation coefficient between R&D investment intensity (RD) and TAX incentive degree (TAX) is 0.19 and significant at 1% level, indicating that tax incentive degree is positively correlated with R&D investment. The coefficient between patent output (NP) and TAX incentive degree (TAX) is 0.1 and significant at 1% level, that is, tax incentive degree has a positive promoting effect on patent output. Therefore, the intensity of tax incentives has an incentive effect on enterprise innovation, and hypothesis 1 is preliminarily verified. (2) The coefficient between financial flexibility (FF) and R&D investment intensity (RD) is 0.049, and it is significant at the significance level of 1%; The correlation coefficient between financial flexibility and patent output (INP) is 0.095, which is significant at 1% level. This result indicates that financial flexibility is positively correlated with firm innovation, that is, it preliminarily validates hypothesis 2, that financial flexibility reserve has a promoting effect on firm innovation.

3.3 Regression Analysis

3.3.1 Regression analysis of tax incentives and enterprise innovation

According to the results of Hausmann test, this paper uses the fixed effect model for empirical analysis. On STATA17, regression analysis is carried out on the observed values of Shanghai-Shenzhen A-share listed companies from 2015 to 2021. The regression results are shown in Table2:

As can be seen from the data in the above table, when the explanatory variable is R&D investment intensity (RD), tax incentives are significant at the level of 1%, indicating that the degree of tax incentives received by enterprises is significantly positively correlated with enterprise innovation. Meanwhile, when the explained variable is patent output, tax incentives are significant at the level of 1%, indicating that the degree of tax incentives is significantly positively correlated with innovation output. Therefore, preferential tax policies can effectively stimulate enterprise innovation activities,

stimulate enterprise innovation enthusiasm, and promote social innovation progress, that is, hypothesis 1 is verified.

Table 2: Regression results of the impact of tax incentives on enterprises' innovation incentives

Variables	Research and development investment	Patent output
Tax benefits	0.699 * * *	0.227 * *
	(6.85)	(2.51)
Business size	9.022 * * *	5.913 * * *
	(8.65)	(9.89)
Current ratio	4.331 * * *	4.726
	(-3.48)	(-0.38)
Return on total assets	7.952 * * *	1.887 * * *
	(3.67)	(1.47)
Concentration of ownership	10.66 * * *	3.489
	(8.39)	(-0.93)
Revenue growth rate	5.926 * * *	1.928 *
	(4.57)	(1.18)
Age of business	7.614 * * *	2.159 * *
	(-17.83)	(-15.74)

3.3.2 Regression analysis of financial flexibility and enterprise innovation

Perform regression according to model (3) and model (4) to verify hypothesis 2. The regression results are shown in Table 3 below:

Table 3: Regression results of the impact of financial flexibility on enterprise innovation incentives

variable	Research and development investment	Patent output
Financial flexibility	0.950 * * *	0.811 * * *
	(8.71)	(12.23)
Business size	0.972 *	0.16 *
	(1.84)	(1.39)
Current ratio	0.870	0.986 *
	(-0.91)	(1.86)
Return on total assets	0.917 * *	1121 * * *
	(2.11)	(3.62)
Ownership concentration	0.242 * * *	0.908 *
	(10.15)	(-1.85)
Operating revenue growth rate	0.155 *	0.328 *
	(-1.08)	(1.13)
Age of business	0.216	0.732 * *
	(-0.24)	(-2.66)

According to the regression results in Table 3, the correlation coefficient between financial flexibility and R&D input is 0.95, and is significantly correlated at the 1% level, while the correlation coefficient between financial flexibility and patent output is 0.811, and is significantly correlated at the 1% level, indicating that financial flexibility can effectively promote enterprises. Hypothesis 2 is verified.

3.3.3 Analysis of the regulatory effect of financial flexibility

In order to verify the moderating effect of financial flexibility on the incentive of enterprise innovation by tax incentives, model (5) and model (6) were used for regression, and the regression results were shown in Table 4. The regression results show that both tax incentives and financial flexibility can promote the increase of R&D and innovation output. The cross-multiplying coefficients of tax incentives and financial flexibility with R&D input and patent output are 0.22 and 0.252, respectively, and both are significant at 5% level, indicating that financial flexibility, as a moderating variable, has a positive effect on the impact of tax incentives on R&D and innovation. When enterprises enjoy tax incentives, they reduce the capital expenditure of enterprises, so as to use the saved funds as the financial flexibility reserve of enterprises, which can be re-invested in innovation activities in the future, forming a virtuous circle, and then provide sufficient financial support for enterprises in innovation activities. Hypothesis 3 can be verified.

Table 4: Regression results of the regulatory effect of financial flexibility

Variables	Research and development investment	Patent output
Tax benefits * Financial flexibility	0.22 **	0.252 **
	(2.42)	(2.55)
Tax benefits	0.686 **	0.244 *
	(2.04)	(1.71)
Financial flexibility	0.903 ***	1.022 **
	(3.48)	(2.83)
Business size	0.228 **	0.963 ***
	(2.10)	(12.06)
Current ratio	4.254	8.36 ***
	(-0.32)	(4.45)
Return on total assets	1.810 **	1.261 **
	(2.60)	(2.02)
Concentration of ownership	1.038	2.832 *
	(0.86)	(1.75)
Operating revenue growth rate	3.903 ***	1.929 *
	(11.58)	(-1.47)
Business age	1.114 **	1.980 *
	(2.06)	(1.08)

4. Research conclusions

This paper sorts out and summarizes the research results on the relationship between tax incentives, financial flexibility and enterprise innovation, focusing on the study of financial flexibility as a moderating variable, and how financial flexibility plays a role in tax incentives and enterprise innovation after adding the interaction term. In addition, the listed companies are grouped according to property rights nature and enterprise types for regression. The regulatory effects of financial flexibility on tax incentives and enterprise innovation are different. Through the empirical test, the following conclusions are drawn:

- (1) Tax preference has a positive promoting effect on enterprise innovation incentive;
- (2) Financial flexibility has a positive effect on enterprise innovation incentive;

(3) Financial flexibility has a positive moderating effect on tax incentives and enterprise innovation incentives, and there are differences in different enterprises.

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