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The Heterogenous Effect of Tax Incentives on Different Types of Enterprise Innovation: Evidence from China

Yiqi He[1,a], Zhihui Li[1,b], Wenhong Yan[2,c,*]

[1]School of Accounting, Nanjing University of Finance and Economics, Nanjing, 210023, China
[2]School of Public Finance and Taxation, Nanjing University of Finance and Economics, Nanjing, 210023, China
[a]9120091024@nufe.edu.cn, [b]18228309675@163.com, [c]wenhong.yan@outlook.com
[*]Corresponding author

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Abstract: Government interventions, especially tax incentives, are vital to corporate innovation. However, is the effect of tax incentives heterogeneous across different types of innovation? Do tax incentives affect innovation differently in different business environments? This study approaches these questions empirically using data from China's listed companies from 2010 to 2020, analyzes the effect of tax incentives on enterprises' exploratory and developmental innovation, and discusses the impact of the business environment on such a relationship. The results suggest that tax incentives can promote exploratory innovation and developmental innovation, and have a greater impact on developmental innovation, and a good business environment strengthens this role.

1. Introduction

Encouraging and supporting innovation through internal and external means is crucial to scholars and practitioners. One prominent view is that the government should intervene in innovation activities and provide them with policy support,with tax incentives being particularly important (Hall, 2021)[1].Fu et al(2024)[2] found that tax incentive policies are beneficial for independent innovation in enterprises. However, the business environment is an essential but overlooked factor. Therefore, this study will analyze the impact of tax incentives on enterprise developmental innovation and exploratory innovation, and explore the moderating effect of the business environment on this impact.

2. Theoretical Analysis and Research Hypotheses

2.1 The Relationship between Tax Incentives and Enterprises' Innovation

It is too general to discuss only the overall innovation, so this study divides innovation into exploratory innovation and developmental innovation. Through exploratory innovation, enterprises can gain valuable knowledge about market trends, customer preferences, technological progress,

and competitive dynamics(sarfo et al.,2024)[3]. For external investors, tax incentives can ease the financing pressure and encouraging enterprises to carry out exploratory innovation.For internal investors, tax incentives can carry out exploratory innovation through cost compensation and risk reduction(Mason et al., 2022)[4].Developmental innovations compete for resources with exploratory innovations within an enterprise,it is usually less costly.Therefore, to avoid reduced executive compensation, declining stock prices, and increased employee turnover (Han et al., 2021)[5], managers who do invest in R&D prefer developmental innovation. As a result, given the same level of tax incentives, managers' willingness to invest in developmental innovation exploratory innovation has decreased. Based on the above analysis, hypothesis 1 was formulated.

H1: Tax incentives can promote exploratory innovations and developmental innovations, and have a greater impact on developmental innovation.

2.2 The Role of Business Environment in Tax Incentives

Enterprises' operation is closely related to the business environment.A good business environment can reduce transaction costs and strengthen the initiative of enterprises to innovate (Niu et al., 2022)[6],and promote the innovation of the tax incentive system (Li et al., 2023)[7]. When a region's business environment is stable and fair, the degree of government intervention reduces gradually, the innovation achievements will be effectively protected and transformed, and enterprises are more willing to invest exploratory innovation and developmental innovation (Xie & Wang, 2021)[8].Based on the above analysis, hypothesis 2 was formulated.

H2: A good business environment positively moderates the relationship between tax incentives and enterprises' exploratory and developmental innovation.

3. Research Design

3.1 Sample and Data Sources

This study uses financial and patent data of all Chinese listed companies between 2010 and 2020 for empirical verification, and we obtain data from the CSMAR database in conjunction with the China Research Data Service Platform (CNRDS). After data preprocessing, which includes removing companies with missing key variables, excluding companies under special treatment (ST and ST*), and winsorizing continuous variables at 1% and 99%. The final study sample includes a total of 19888 observed values from 1808 listed companies.

3.2 Definition of Variables

The variables and their definitions are shown in Table 1.

Table 1: Definition of variables.

Variable type	Variable name	Variable symbol	Variable calculation formula
Explained Variable	Overall Innovation	*Patent*	$ln(number\ of\ patent\ applications\ +1)$
	Exploratory Innovation	*Patent1*	$ln(number\ of\ invention\ patent\ applications\ +1)$
	Developmental Innovation	*Patent2*	$ln(number\ of\ utility\ model\ patent\ applications\ +\ number\ of\ design\ patent\ applications\ +1)$
Explanatory Variable	Tax Incentives	*TI*	$\frac{taxes\ and\ fees\ return\ received}{taxes\ and\ fees\ return\ received + taxes\ and\ fee}$
Moderating Variables	Business Environment	*BE*	$BE = \begin{cases} 1\ if\ PMI_{j,t} > NAMI_t \\ 0\ if\ PMI_{j,t} \leq NAMI_t \end{cases}$
Control Variables	Asset Liability Ratio	*ALR*	$\frac{overall\ liabilities}{overall\ assets}$
	Current Ratio	*CR*	$\frac{current\ liabilities}{current\ assets}$
	Enterprise Size	*SIZE*	$ln(overall\ assets)$
	Return on Equity	*ROE*	$\frac{net\ profit}{net\ assets}$
	Nature of the Enterprise	*NOE*	$BE = \begin{cases} 1\ if\ state\ owned \\ 0\ if\ privately\ owned \end{cases}$
	Concentration of Equity	*COE*	The shareholding ratio of the largest shareholder

3.3 Empirical Specification

This study constructs the following regression models based on the theoretical analysis section.To test H1 and H2, models 1 and 2 are set up respectively.

$$Patent_{it} = \beta_0 + \beta_1 TI_{it} + \beta_{2-8} \sum controls_{it} + \mu_i + \sigma_t + \varepsilon_{it} \quad (1)$$

$$Patent_{it} = \beta_0 + \beta_1 TI_{it} \times BE_{it} + \beta_3 BE_{it} + \beta_{4-10} \sum controls_{it} + u_i + \sigma_t + \varepsilon_{it} \quad (2)$$

Where $\sum$controls are control variables, and β_0 is the constant term, μ_i refers to enterprise-level fixed effect, σ_t refers to time fixed effect, and ε_{it} is the random disturbance term. Subscripts i and t refer to enterprises and years, respectively. $TI_{it} \times BE_{it}$ represents the interaction between tax incentives and the business environment.

4. Empirical Analysis

4.1 Descriptive Statistics

Table 2 shows the descriptive statistics. The mean of exploratory innovation selected in this study is 1.622, while the mean of developmental innovation is 1.826. So, the mean of developmental innovation is slightly greater than that of exploratory innovation. Furthermore, the minimum value of tax incentive (TI) is 0.000, and the maximum value is 0.808, indicating that the degree of tax incentive varies greatly among different enterprises.

Table 2: Descriptive statistical.

Variable name	Symbol	Obs.	Mean	Median	SD	Min	Max
Exploratory Innovation	*Patent1*	19888	1.622	1.386	1.579	0.000	6.111
Developmental Innovation	*Patent2*	19888	1.826	1.792	1.696	0.000	6.163
Tax Incentives	*TI*	19888	0.124	0.024	0.190	0.000	0.808
Current Ratio	*CR*	19888	2.144	1.459	2.394	0.000	16.207
Asset Liability Ratio	*ALR*	19888	0.472	0.474	0.218	0.052	0.954
Enterprise Size	*SIZE*	19888	22.482	22.269	1.498	19.585	27.955
Return on Equity	*ROE*	19888	0.057	0.065	0.136	-0.787	0.340
Concentration of Equity	*COE*	19888	34.504	32.220	15.131	8.480	74.570
Nature of the Enterprise	*NOE*	19888	0.505	1.000	0.500	0.000	1.000
Business Environment	*BE*	19888	0.791	1.000	0.407	0.000	1.000

4.2 Baseline Regression Analysis

This section uses the model 1 to analyze the relationship between tax incentives, and exploratory innovations, and developmental innovation, the results of the baseline regression are shown in Table 3.The coefficients in the column (1) and (2) are 0.346 and 0.401,respectively, and is significant at the 1% level. It suggests that tax incentives promote exploratory innovation and developmental innovation positively. In addition, tax incentives play a more prominent role in enterprise developmental innovation, validating hypothesis H1.

Table 3: Baseline regression results.

Variable	Exploratory Innovation	Developmental Innovation
	(1)	(2)
Tax Incentives (*TI*)	0.346***	0.401***
	(0.105)	(0.119)
Current Ratio (*CR*)	-0.012**	-0.015**
	(0.006)	(0.006)
Asset Liability Ratio (*ALR*)	-0.130	-0.178
	(0.105)	(0.114)
Enterprise Size (*SIZE*)	0.360***	0.356***
	(0.032)	(0.032)
Return on Equity (*ROE*)	0.023	0.027
	(0.054)	(0.063)
Concentration of Equity (*COE*)	-0.003*	-0.001
	(0.002)	(0.002)
Nature of the Enterprise (*NOE*)	0.022	0.033
	(0.072)	(0.073)
Constant	-6.703***	-6.365***
	(0.686)	(0.688)
Individual Fixation Effect	Yes	Yes
Time Fixed Effect	Yes	Yes
Observations (N)	19888	19888

Note: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3 The Moderating Effect of the Business Environment

This section uses the model 2 to analyze the moderating effect of the business environment,the results are shown in Table 4.Tax incentives and exploratory innovation are significantly positively correlated at the 1% level, with a coefficient of 0.329, while tax incentives and business environment intersection (TI×BE) are significantly and positively correlated at the 1% level. Tax incentives and developmental innovation are significantly positively correlated at the 1% level, with a coefficient of 0.394, while tax incentives and business environment intersection (TI×BE) are significantly and positively correlated at the 10% level. The business environment positively moderate the relationship between tax incentives and exploratory innovation, and developmental innovation. Therefore, we verify H2.

Table 4: Regression results of the moderating effect.

Variable	Exploratory Innovation	Developmental Innovation
	(1)	(2)
Tax Incentives (*TI*)	0.329***	0.394***
	(0.060)	(0.068)
Business Environment (*BE*)	0.059**	0.024
	(0.024)	(0.027)
Tax Incentives × Business Environment (*TI*×*BE*)	0.555***	0.249*
	(0.118)	(0.133)
controls	Y	Y
Constant	-6.705***	-6.366***
	(0.270)	(0.303)
Individual Fixation Effect	Yes	Yes
Time Fixed Effect	Yes	Yes
Observations (N)	19888	19888

Note: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

4.4 Robustness Test

Table 5: Instrumental regression results.

Variable	Stage I	Stage II	Stage II
	Tax Incentives	Exploratory Innovation	Developmental Innovation
Tax Incentives (*TI*)		2.036***	2.149***
		(0.075)	(0.081)
Lagged Tax Incentives in Stage I (*LT I*)	0.728***		
	(0.015)		
Lagged tax incentives in Stage II (*LT II*)	0.163***		
	(0.01478)		
controls	Y	Y	Y
Constant	-0.0024***	-7.471***	-6.055***
	(0.0106)	(0.223)	(0.239)
Observations (N)	16272	16272	16272

Note: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01.

This study uses the two-stage least square (2SLS) method to address the endogeneity issue. We select the one-period and two-period lags of tax incentives as the instrumental variables, the results are shown in Table 5. According to the second stage results, the coefficients of tax incentives and overall innovation, exploratory innovation, and developmental innovation are all significant at the 1% level. Therefore, tax incentives promote enterprises' innovation after controlling for endogeneity. The results are consistent with the baseline regression results, indicating that the results are robust.

5. Conclusions and Policy Implications

This study empirically studies the effect of tax incentives on dual innovation and the role of the business environment in such an effect, and we conclude the study as follows. First, tax incentives can significantly promote exploratory innovations and developmental innovations, and have a greater impact on developmental innovation. Second, the business environment has a positive moderating effect in the process of tax incentives promoting enterprises' exploratory and developmental innovation.

This study suggests the following for policy practice. First, when formulating relevant tax policies to support enterprises' innovation, the government should be more discriminatory by focusing on exploratory innovation and formulating specific measures according to the innovation activities' difficulty, depth, and potential value. Specifically, the government should implement innovation quality-based tax treatments by consulting experts to classify the enterprise patent applications and support quality exploratory innovations with higher technical value and practical significance. The government should also reduce one-size-fits-all, unclassified tax incentives to avoid less efficient allocation of resources. Second, we must further improve the business environment for enterprises, improve the tax collection system, and create a favorable tax environment to promote enterprises' innovation. To do so, the government must establish a transparent and effective administrative environment, simplify and facilitate the approval procedures and processes, and provide enterprises with high-quality and efficient government services. The government should also create a fair market and improve the local financial environment, especially for small and medium-sized enterprises and in economically underdeveloped areas.

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