The Impact of Inspection Supervision on Firms' Innovation Performance - An Analysis of the Moderating Effect Based on Financial Subsidies

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Abstract. Innovation is the first driving force to stimulate the vitality of enterprises and promote their high-quality development. Based on the inspection and supervision activities carried out by the Party Central Committee, we construct a multi-period two-difference model to explore the impact of inspection and supervision on corporate innovation. Using data from Shanghai and Shenzhen A-share listed companies from 2010–2019, this paper finds that inspection supervision significantly increases firms' innovation investment, while having a significant crowding-out effect on firms' innovation efficiency. After being moderated by financial subsidies, the crowding out of inspection supervision on firms' innovation output becomes larger.

Keywords: Financial subsidies · inspection supervision · multi-period double differential · deterrence theory

1 Introduction

Innovation is the leading force in transforming the old and new dynamics and is a vital strategy to speed up China's industrial upgrading. Enterprises often encounter problems when conducting innovation activities; thus, the government will often help enter-prises carry out innovation activities by providing financial support. At the national level, one of the practical tools to promote innovative activities of micro-enterprises is to provide a favorable external environment. Therefore, as an essential means to improve the development environment of enterprises, inspection supervision is included in the deployment of the overall strict governance of the Party.

Based on this, we conduct a quasi-natural experiment using data from Shanghai and Shenzhen A-share listed companies from 2010 to 2019.

N. Akhtar et al. (Eds.): PMIS 2023, AHIS 8, pp. 1228–1234, 2023.
https://doi.org/10.2991/978-94-6463-200-2_130

2 Literature Review and Research Hypothesis

2.1 Literature Review

Financial subsidies is a means of state finance, a powerful tool to speed up the upgrading of China's industrial structure and promote the transformation of the economy from high-speed development to high-quality development. Firms that receive financial subsidies may have more resource endowments and have ample resources to ensure the sustainability of their R&D activities when conducting R&D, promoting their investment in R&D [1]. Studies by scholars such as H.J. Wang (2021) [2], J.P. Zhang (2019) [3], and Z. Sun (2021) [4] indicated that financial incentives have a catalytic effect on the intensity of corporate innovation investment in high-end equipment manufacturing. Shenzhen GEM listed enterprises and strategic emerging enterprises, respectively.

At present, the research results on inspection and supervision policies cover the critical role of inspection supervision [5], the development history and revelation of the inspection system [6, 7], the new development and new characteristics of the Party inspection system since the 18th National Congress [8] and the institutional dilemma of inspection and supervision and response [9].

In summary, the relationship between financial subsidies and business innovation has been explored in existing studies; however, the relationship between inspection supervision, financial subsidies and business innovation needs to be urgently studied.

2.2 The Impact of Inspection Supervision on Business Innovation

General Secretary Xi emphasized that "inspection is an essential duty assigned by the Party constitution, an important initiative to strengthen the Party's construction, an important means to rule the Party and maintain Party discipline strictly, and an essential form of strengthening supervision within the Party". The Porter hypothesis posits that proper environmental regulation encourages technological innovation and may increase costs in the short term, but can increase productivity, increase competitiveness, and boost economic growth in the long term. Inspection supervision also affects corporate micro-decision making through deterrent effects. Based on this, the following hypothesis is proposed in this paper.

H1: Other things being equal, the inspection and supervision carried out by the Party Central Committee has a catalytic effect on corporate innovation.

2.3 Inspection Supervision, Financial Subsidies and Business Innovation

Inspection oversight will have a deterrent effect on senior management, avoiding self-interested behaviour on the part of senior managers and investing more money in innovative corporate activities. In turn, companies receiving financial subsidies signal to their stakeholders that investors have more confidence in the company's growth potential. Inspection and supervision can further moderate the incentive effect of financial subsidies on firms' innovation performance through its deterrent effect. As a result of the above discussion, the paper makes the following hypotheses.

H2: Other things being equal, financial subsidies has a positive effect on the relationship between inspection supervision and firms' innovation performance.

3 Research and Design

3.1 Sample Selection and Data Sources

We selected A-share listed companies from 2010 to 2019 as a sample. In this paper, the samples were treated as follows: (a) st and st* firms were excluded, (b) missing data samples were eliminated, and (c) all continuous variables were winsored by 1% to remove the influence of extreme values. Enterprise financial data were obtained from the CSMAR database. Inspection and supervision data were obtained according to the information disclosed on the official website of the Central Commission for Discipline Inspection and Supervision, screening the enterprises inspected by the Party Central Committee and getting the subordinate units of the inspected enterprise group from the official website of Qi Cha Cha. Company patent data were obtained from CNRDS. Data processing software included Excel and Stata16.

3.2 Model Setting and Variable Definition

We constructed Models 1 to examine the impact of inspection supervision on firm innovation. To verify the moderating effect of financial subsidies, model (2) was constructed.

$$innov_{it} = \alpha_0 + \alpha_1 treat_{it} + \alpha_2 Controls + \sum ind + \sum year + \varepsilon_i \quad (1)$$

$$innov_{it} = \beta_0 + \beta_1 treat_{it} * rds_{it} + \beta_2 rds_{it} + \beta_3 treat_{it} + \beta_4 Controls + \sum ind + \sum year + \varepsilon_i \quad (2)$$

Innov denotes firm innovation and is measured by innovation output (apply), innovation input (rdsale) and innovation efficiency (eff) respectively. Innovation output is measured by Ln (total number of patent applications +1 in the lag period). Innovation input is measured as the ratio of R&D investment to operating revenue, and innovation efficiency is measured as the ratio of the sum of the number of patents filed in the current period to the sum of R&D investment in the current and previous periods. Rds denotes corporate financial subsidies and is measured as Ln (financial subsidies +1), and tr is tax benefits and is measured as the ratio of corporate income tax expense to EBITDA. For inspection and supervision data, we refer to studies by scholars such as Chen Kejian [10] and Zhang Ziliang [11] and use Treat to determine whether a firm is inspected in the current year, with a value of 1 for being inspected and 0 assigned otherwise. Represents an individual fixed effect and represents an annual dummy variable, a random error term. In order to improve the accuracy of the regression, the effect on the analysis results should be attenuated. In this paper, we control for a number of indicators such as the level of financialisation, the number of R&D personnel, the size of the firm, the strength of intellectual property protection, the firm growth index, the growth rate of sales revenue and the growth rate of net assets.

Table 1. Descriptive statistical results of main variables

Variables	N	mean	sd	min	max
apply	7,362	3.57	2.12	0.00	7.98
rdsales	8,148	4.40	4.45	0.04	27.33
eff	8,180	8.78	17.19	0.00	118.80
treat	8,180	0.05	0.21	0.00	1.00
rds	8,180	15.93	2.99	0.00	20.19
tr	8,180	0.13	0.13	−0.41	0.68
growth	8,180	0.17	0.35	−0.49	2.07
netasset	8,180	0.18	0.55	−0.87	3.59
rdpr	8,180	8.11	12.35	0.00	62.58
ipp	8,170	0.02	0.04	0.00	0.16
size	8,180	22.11	1.14	19.94	25.52
fin	8,180	0.04	0.06	0.00	0.34
sr	8,180	21.52	1.32	18.90	25.19

4 Empirical Analysis

4.1 Descriptive Results Analysis

Results of descriptive statistics are shown in Table 1. The distribution of each indicator of enterprise innovation varied widely; the average and median innovation output were 3.57 and 2.12, respectively, indicating that the innovation output varied between different enterprises. In contrast, the innovation investment level between different enterprises was greater; thus, the average level needs to be improved. In terms of innovation efficiency, the mean and median values were 8.78 and 17.19, respectively, with significant differences in innovation efficiency among different firms. In terms of financial subsidies, the mean and median were 15.93 and 2.99. The mean value of tax benefits was 0.13, the maximum value was 0.68, and the minimum value was -0.41. The value of inspection and supervision was 0.05, demonstrating that 5.00% of the selected 818 enterprises received inspection between 2010 and 2019, and the coverage rate of inspection and supervision was low.

4.2 Basic Regression

The specific regression results are shown in Table 2, where inspection and supervision has a catalytic effect on firms' innovation investment and is significant at the 1% level, while it shows a significant crowding out effect on firms' innovation efficiency. In other words, hypothesis 1 was not tested. It indicates that the impact of inspection supervision on firm innovation is reflected differently in different dimensions. Secondly, the moderating effect of financial subsidies was further examined using model (2), which showed that

Table 2. Basic regression

	apply	rdsales	eff	apply	rdsales	eff
	(1)	(2)	(3)	(4)	(5)	(6)
1.treat	−0.081	0.583**	−3.541**	0.264	0.560	−1.940
	(0.112)	(0.226)	(1.630)	(0.220)	(0.383)	(2.374)
rds				0.011**	0.019	0.081
				(0.005)	(0.013)	(0.067)
1.treat*rds				−0.021*	0.001	−0.098
				(0.011)	(0.023)	(0.119)
_cons	−8.539***	11.659***	1.519	−8.546***	11.452***	2.656
	(1.281)	(2.687)	(13.795)	(−6.64)	(4.27)	(0.19)
N	7353	8138	8170	7353	8138	8170
id/year	control	control	control	control	control	control
adj.R2	0.764	0.786	0.331	0.764	0.786	0.332

Note: *, **, *** indicate statistical significance of 10%, 5%, and 1% respectively

the moderating effect of financial subsidies was negative, leading to a stronger crowding-out effect of inspection supervision on firms' innovation output, and significant at the 10% level.

4.3 Robustness Tests

To ensure the smooth implementation of the multi-period double-difference model, passing the parallel trend test was one of the essential preconditions. As shown in Fig. 1, the policy implementation coefficient was around 0, the 95% confidence interval also contained 0, and there was a slight increase, indicating that the coefficient was not significant at that time. From Fig. 1, the treatment and control groups had a consistent development trend before implementing the policy through the parallel trend test.

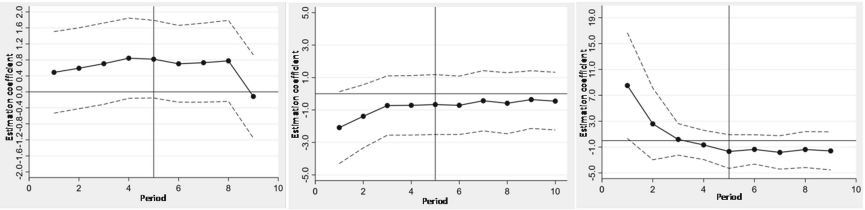

Fig. 1. Parallel trend test

5 Conclusions and Recommendations

Since the 19th National Congress, the Party Central Committee has comprehensively strengthened the strategic position of inspection and supervision from the top to curb corruption. Therefore, in this paper, we used balanced panel data of listed firms from 2010 to 2019 to test the impact of financial subsidies and inspection and supervision policies on firm innovation.

We have drawn several key conclusions. First, inspection oversight, an important measure of government regulation, has a significant incentive effect on firms' input in innovation but a significant crowding-out effect on their innovation efficiency. Second, financial subsidies play a negative moderating role between inspection supervision and firms' innovation output, facilitating a stronger and significant crowding-out effect of inspection supervision on firms' innovation output.

Based on the above findings, we put forward some policy recommendations. First, the granting of financial subsidies should consider the nature of the enterprise, the size, innovation, and other reasons for a comprehensive analysis. Second, at present, inspection supervision is mainly focused on state-owned enterprises; however, in the future, consideration can be given to strengthening inspection super-vision of public enterprises. Stakeholders should improve the supervision system, improve the inspection methods, ensure the purity and authority within the inspection team, and strengthen the training and assessment of inspection personnel.

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