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The Accountability System for Operation and Investment and the Innovation of State-owned Enterprises: Evidence from China

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Abstract

This study employs a multi-period difference-in-differences model to empirically examine the impact of operational and investment accountability on innovation in state-owned enterprises(SOEs), grounded in China's unique phased implementation of this accountability system nationwide. Findings reveal that following the introduction of the accountability framework, innovation outputs in SOEs increased significantly. Government subsidies amplify the positive effect of accountability on innovation, while two-tier agency costs diminish this effect. These findings not only provide new evidence for the effectiveness of the accountability system but also offer important policy implications for promoting innovation in state-owned enterprises.

Keywords

State-owned enterprises; The Accountability System for Operation and Investment; Corporate innovation

1. Introduction

As pillars of the national economy, State-owned enterprises (SOEs) play a critical role; however, mismatched rights and responsibilities arising from owner absence and multi-layered principal-agent relationships have precipitated insider control, inefficient investment, and elevated agency costs, severely stifling corporate innovation. To address this, the General Office of the State Council issued the Opinions on Establishing a System for Accountability for Illegal Operations and Investments in State-owned Enterprises in 2016, instituting a "lifetime accountability for major decisions" framework. By imposing substantial accountability costs, this policy aims to curb managerial self-serving behavior, rectify rights-responsibility mismatches, and align managerial decisions with overall corporate interests. Against this backdrop, this paper empirically investigates whether the operational investment accountability system can effectively drive

innovation in SOEs, along with its underlying mechanisms and boundary conditions. Against the backdrop of the nationwide implementation of the SOEs operational and investment accountability system, this study uses Chinese A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2013 to 2019 as its research sample. It identifies policy shock regions based on institutional documents issued by central enterprises and provincial/municipal-level SASACs, sub-provincial cities, and provincial capitals. State-owned enterprises in pilot regions serve as the treatment group, while those outside pilot regions form the control group. A multi-period difference-in-differences model is employed to empirically examine the impact of the ex-post disciplinary mechanism of the accountability system on corporate innovation.

This study argues that accountability systems for business and investment decisions enhance innovation in state-owned enterprises. Consequently, it employs corporate innovation investment as the outcome variable and tests the moderating effects of government subsidies and dual agency costs. Empirical findings reveal that improvements in the accountability system significantly boost innovation in SOEs, with government subsidies and dual agency costs exerting significant moderating effects. This result remains robust across multiple stability tests. This paper makes contributions to the literature primarily in the following aspects. First, it enriches research on the economic consequences of the operational investment accountability system. By examining the impact of accountability on corporate innovation from an ex-post perspective, this study provides new empirical evidence for evaluating the effectiveness of accountability mechanisms in SOEs. Second, this paper offers significant policy implications. The findings contribute to promoting the establishment and improvement of the accountability system for SOEs in China.

2. Theoretical Analysis and Research Hypotheses

Existing research and practice indicate that complex pyramid structures and the nominalization of state-owned property rights have led to the phenomenon of absent ownership in state-owned enterprises [1]. The potential self-interest motives of management may result in issues such as insider control, soft budget constraints, insufficient incentives, and rent-seeking corruption existing to varying degrees within state-owned enterprises [2], thereby increasing the risk of state-owned asset loss. To promote the preservation and appreciation of state-owned capital and prevent asset loss, the Opinions issued by the State Council in 2016 comprehensively outlined how to implement accountability for operational and investment decisions in SOEs, requiring executives to bear responsibility for their past investment decisions regardless of whether they have left their positions or retired. The core purpose of implementing the operational investment accountability system lies in strengthening oversight and constraints on the power of senior SOE managers. It aims to address the imbalance between their authority

and responsibilities, mitigate short-termism among executives [3], alleviate dual agency costs, thereby enhancing corporate investment decision-making efficiency and elevating innovation levels. Enhancing innovation capacity is crucial for stimulating new growth momentum in state-owned enterprises, building new competitive advantages, and serving as the foundation for achieving high-quality development [4]. Existing research confirms that executive myopia , dual agency costs , and internal control quality are critical determinants of corporate innovation. Based on an in-depth analysis of corporate innovation mechanisms, this study posits that the accountability system for business investment will play a pivotal role in enhancing innovation within SOEs. Consequently, the following hypothesis is proposed:

H1: The accountability system for business investment in SOEs contributes to enhancing innovation within SOEs.

3. Research Design

3.1. Data Source and Sample Selection

Considering the impact of the COVID-19 pandemic in 2020 on the operational conditions of enterprises nationwide, this study selects Chinese A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2013 to 2019 as its research subjects. Following the methodology of Xin Yu et al. [5], this study only counts institutional documents issued by central enterprises and those issued by SASACs at the provincial, sub-provincial city, and provincial capital city levels. The original data underwent the following processing: (1) Financial sector observations were excluded due to significant differences in financial statement structures and key accounting items compared to other industries; (2) Data from ST and *ST companies were removed; (3) Companies with missing data were eliminated. After these adjustments, a final sample of 6,569 observations was obtained.

To mitigate the impact of extreme values, all continuous variables underwent Winsorization capping at the 1st percentile and 99th percentile. The accountability system data for operational and investment activities was manually collected and organized. Innovation data originated from the CNRDS database, while other data sources included the Guotai An database (CSMAR). Data analysis primarily utilized Stata 18.0 and Excel for data organization and econometric analysis.

3.2. Model Setting and Variable Definition

To test Hypothesis 1, Model (1) was constructed to examine whether an accountability system for business investment contributes to enhancing corporate innovation levels.

$$Patent_{i,t} = \beta_0 + \beta_1 Post_{i,t} + Controls_{i,t} i,t + Industry + Year + \varepsilon_{i,t} \quad (1)$$

In the formula, i and t denote individual firms and years, respectively; Patent represents firm innovation output; Post is the explanatory variable; Control is a set of control variables; Industry is the industry fixed effect; Year is the time fixed effect; ε denotes the random residual term.

To test the regulatory effect, models (2) and (3) were constructed.

$$Patent_{i,t} = \beta_0 + \beta_1 Post_{i,t} + \beta_2 GB_{i,t} * Post_{i,t} + \beta_3 GB_{i,t} + Controls_{i,t} i,t + Industry + Year + \varepsilon_{i,t} \quad (2)$$

Model (2) builds upon Model (1) by adding the moderator variable Government Subsidies (GB) and the interaction term between the moderator and the core explanatory variable, GB*Post.

$$Patent_{i,t} = \beta_0 + \beta_1 Post_{i,t} + \beta_2 Agency_cost_{i,t} Post_{i,t} + \beta_3 Agency_cost_{i,t} + Controls_{i,t} i,t + Industry + Year + \varepsilon_{i,t} \quad (3)$$

Model (3) builds upon Model (1) by adding the moderator variable Agency_cost and the interaction term Agency_cost*Post between the moderator and the core explanatory variable.

The specific measurement standards of each variable are shown in Table 1.

Table 1. Variable Definition Table

Variable Type	Variable Name	Variable Symbol	Definition Description
Dependent Variable	Enterprise Innovation Output	Patent	Natural logarithm of the number of granted invention patents plus 1
Explanatory Variable	Whether the region implements an accountability system for business investment	Post	Dummy variable: 1 if the region where the listed company is located implemented an operational investment accountability system in year t; 0 otherwise
Moderator variable	Government subsidies	GB	Government subsidy item details Current period amount/100,000,000
	Double Agency Costs	Agency_cost	Ratio of Administrative and Selling Expenses to Operating Revenue
Control Variable	Company Size	Size	Natural logarithm of total assets of listed companies
	Profitability	ROA	Return on Assets, Net Profit / Total Assets
	Shareholding Concentration	Top 10	Top 10 Shareholders' Shareholding Ratio
	Debt Level	LEV	Debt-to-Asset Ratio, the ratio of total liabilities to total assets
	Equity multiplier	EM	Ratio of total assets to total shareholders' equity
	Board size	Board	Natural logarithm of total board seats
	Proportion of Independent Directors	Ind	Ratio of Independent Director Seats to Total Board Seats
	Dual roles	CEO_duality	If the Chairman and General Manager positions are held by the same individual, the value is 1; otherwise, it is 0
	Largest shareholder's stake	Top1	Ratio of the largest shareholder's holdings to the company's total shares
	Type of Social Audit Firm	Big4	If the accounting firm auditing the annual financial statements is one of the domestic "Big Four," the value is 1; otherwise, it is 0
Control Variable	Management Compensation	salary3	Natural logarithm of the total compensation for the top three executives

4. Empirical Results and Analysis

4.1. Descriptive Statistical Analysis

Regarding corporate innovation indicators, the mean innovation output of Chinese listed companies is 1.254 with a standard deviation of 1.472, indicating uneven R&D output across different listed firms. For government subsidy metrics, the maximum value is 9.004 and the minimum is 0, suggesting significant disparities in subsidy amounts received by different enterprises.Regarding the double agency cost indicator, while fluctuations exist across different observations, the overall average level is 0.135, with relatively moderate volatility.Beyond the aforementioned variables, Table 2 also presents statistical results for firm size, profitability, equity concentration, debt levels, leverage ratio, board size, proportion of independent directors, dual-role appointments, largest shareholder ownership, type of social audit firm, and executive compensation. The reduction in executive compensation observations stems from missing data values, while the distributions of other variables fall within reasonable ranges, consistent with existing literature.

Table 2. Descriptive Statistical Analysis

	(1)	(2)	(3)	(4)	(5)
	N	mean	sd	min	max
Patent	6,569	1.254	1.427	0	5.561
post	6,569	0.189	0.391	0	1
GB	6,569	0.471	1.316	0	9.004
Agency_cost	6,569	0.135	0.104	0.0133	0.580
Size	6,569	22.88	1.409	20.15	27.04
Lev	6,569	0.502	0.203	0.0822	0.938
EM	6,569	2.534	1.680	1.075	11.93
ROA	6,569	0.0288	0.0492	-0.176	0.165
Board	6,569	2.194	0.194	1.609	2.708
Ind	6,569	37.21	5.466	33.33	58.33
CEO_duality	6,569	0.0956	0.294	0	1
TOP1	6,569	39.24	15.19	11.68	76.52
TOP10	6,569	58.47	15.53	25.69	92.29
Big4	6,569	0.104	0.305	0	1
salary3	6,558	14.49	0.650	12.92	16.38

4.2. Identify 4.2. Benchmark Regression Result Analysis

Table 3 presents the regression results for the relationship between management investment accountability and innovation output levels in state-owned enterprises. Column (1) shows the regression results without control variables, while Column (2) presents the results after incorporating control variables.The regression coefficient for post in Column (1) is 0.080, which is positively significant at the 1% level. Similarly, the coefficient for post in Column (2) is 0.090 and positively significant at the 1% level. This indicates that after implementing the operational investment accountability system, the number of granted invention patents for listed state-owned enterprises significantly increased. Thus, the operational investment accountability system contributes to enhancing the innovation level of state-owned

enterprises, as evidenced by the significant increase in granted invention patents. Hypothesis 1 is supported.

Table 3. Relationship Between Management Accountability for Investment and Innovation Output Levels in State-Owned Enterprises

	(1)	(2)
Variable	Patent	Patent
post	0.080***	0.090***
	(2.78)	(3.18)
Size		0.461***
		(23.04)
Lev		-0.231**
		(-1.99)
EM		-0.032***
		(-3.10)
ROA		-0.875***
		(-3.76)
Board		0.102
		(1.19)
Ind		0.003
		(1.08)
TOP1		0.001
		(0.62)
TOP10		-0.003**
		(-2.15)
CEO_duality		-0.067**
		(-2.05)
Big4		-0.031
		(-0.54)
salary3		0.038
		(1.50)
Industry FE	YES	YES
Year FE	YES	YES
Constant	-0.025	-10.773***
	(-0.09)	(-19.42)
N	6,569	6,558
R2	0.111	0.138

*Note: *, *, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are clus tered at the city level. The same below.

4.3. Robustness Tests

4.3.1. Parallel Trend Test

When employing a double-difference model, the parallel trend test must be satisfied. This requires that prior to the policy shock, both the treatment and control groups exhibit relatively parallel and stable trends in their normalized operational levels. To test this assumption, this study references the research by Baker et al. [6] and designs the following model:

$$Patent = \beta_0 + \beta_1 Before4_{i,t} + \beta_1 Before4_{i,t} + \beta_2 Before3_{i,t} + \beta_3 Before2_{i,t} + \beta_4 Before1_{i,t} + \beta_5 Current_{i,t} + \beta_6 After1_{i,t} + \beta_7 After2_{i,t} + Controls_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (4)$$

In this model, Before3, Before2, Before1, Current, After1, and After2 represent the 4 years prior to policy implementation (including earlier years), the 3 years prior, the 2 years prior, the 1 year prior, the current year, the 1 year after, and the 2 years after, respectively. The year before policy implementation (Before1) serves as the base period. Definitions of other variables can be found in Table 2.

Figure 1 displays the coefficient results obtained from estimating the above model (4) at the 90% confidence interval. The plotted results represent the coefficient estimates for the dependent variable, firm innovation output (Patent).The results indicate that prior to the implementation of the business investment accountability system, there was no substantial difference in corporate innovation output between the experimental and control groups relative to the baseline. After the system's implementation, the experimental group's innovation output declined significantly compared to the control group, satisfying the parallel trends basic assumption.

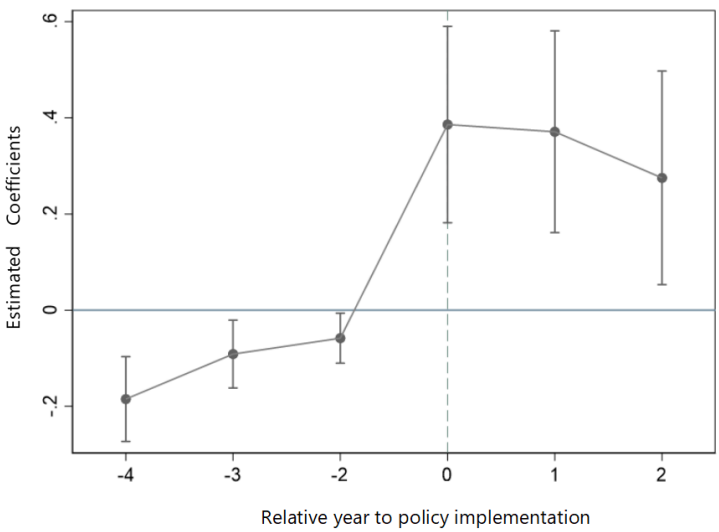


Figure 1. Parallel Trends Test

4.3.2. Placebo Test

This study randomly selected 123 observations from the entire sample as a "sham experimental group" for the placebo test. This random sampling process was repeated 500 times, and the product of these observations with the time dummy variable was used as the core explanatory variable for a new regression.Figure 2 displays the coefficient distribution of the regression results for the explained variable. The figure shows that the estimated coefficients of the spurious difference-in-differences term cluster around zero, indicating that the randomly

sampled sample combinations had no impact on corporate innovation output. Therefore, it can be concluded that the regression results in the baseline regression are robust.

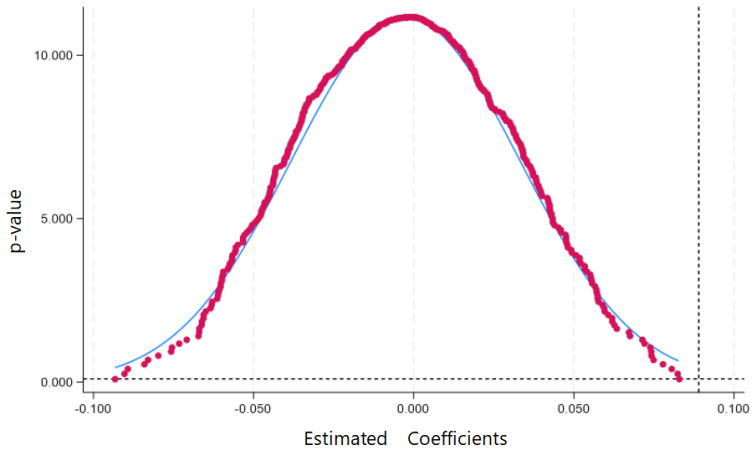


Figure 2. Placebo Test

5. Moderating Effect Analysis

Government subsidies serve as a critical instrument for state regulation of markets and the economy, playing a pivotal guiding role in corporate resource allocation. Government subsidy policies enjoyed by firms, including fiscal subsidies and tax incentives, are accounted for in accordance with government subsidy accounting standards [7]. Firms receiving substantial government subsidies possess greater disposable funds, enabling them to allocate resources to R&D projects that would otherwise remain unfunded, thereby fostering corporate innovation. Consequently, compared to firms with lower subsidies, those with higher government subsidies face reduced financial constraints and lower marginal costs of increasing R&D intensity, making them more conducive to innovation.

The dual principal-agent relationship inherent in State-Owned Enterprises (SOEs) results in excessive agency costs, which correspondingly leads to low investment efficiency [8]. An elongated agency chain impedes information transmission, thereby exacerbating information asymmetry. Such information asymmetry may incentivize managers to prioritize personal interests over corporate welfare, engaging in behaviors detrimental to the firm and unfavorable to innovation. As agents, SOE executives participate in corporate operations and management, bearing primary responsibility for the quality of internal controls and overall management [9]. Opportunistic behavior by agents may compromise the firm's long-term interests, including suppressing innovation activities in pursuit of short-term gains .

Columns (1) and (2) in Table 4 report the positive moderating effect of government

subsidies on the relationship between operational investment accountability and innovation in state-owned enterprises. The regression coefficient for the interaction term is 0.075 and significant at the 1% level, indicating that government subsidies enhance the promotional effect of operational investment accountability on corporate innovation.

Columns (3) and (4) of Table 4 demonstrate the negative moderating effect of double agency costs between the accountability system for operational investment and corporate innovation. The interaction coefficient between agency costs and post is -0.490, significant at the 5% level, indicating that double agency costs weaken the promotional effect of operational investment accountability on corporate innovation.

Table 4. Moderation Effects

	(1)	(2)	(3)	(4)
Variable	Patent	Patent	Patent	Patent
post	0.071**	0.079***	0.142***	0.147***
	(2.42)	(2.77)	(3.78)	(4.01)
GB*post	0.090***	0.075***		
	(3.38)	(2.90)		
GB	0.029***	-0.001		
	(3.41)	(-0.07)		
Agency_cost*Post			-0.525**	-0.490**
			(-2.56)	(-2.44)
Agency_cost			-0.339*	0.468***
			(-1.94)	(2.68)
Size		0.460***		0.468***
		(22.85)		(23.03)
Lev		-0.229**		-0.221*
		(-1.98)		(-1.90)
EM		-0.032***		-0.031***
		(-3.11)		(-3.03)
ROA		-0.874***		-0.770***
		(-3.75)		(-3.21)
Board		0.108		0.109
		(1.26)		(1.26)
Ind		0.003		0.003
		(1.13)		(1.04)
TOP1		0.001		0.001
		(0.64)		(0.66)
TOP10		-0.003**		-0.003**
		(-2.22)		(-2.17)
CEO duality		-0.066**		-0.067**
		(-2.01)		(-2.04)
Big4		-0.030		-0.035
		(-0.52)		(-0.61)
salary3		0.039		0.038
		(1.53)		(1.51)
Industry FE	YES	YES	YES	YES

Year FE	YES	YES	YES	YES
Constant	-0.063	-10.770***	0.030	-11.021***
	(-0.23)	(-19.38)	(0.10)	(-19.56)
N	6,569	6,558	6,569	6,558
R2	0.107	0.138	0.112	0.138

6. Conclusions and Implications

This study empirically investigates the influence of operational investment accountability on corporate innovation. Findings indicate that accountability mechanisms significantly enhance innovation in state-owned enterprises (SOEs). Heterogeneity analysis reveals significant moderating effects: government subsidies positively moderate this relationship by providing external resource support, while dual agency costs negatively moderate it by introducing internal governance friction that attenuates the innovation dividends of accountability.

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