

A Study of Heterogeneity in the Role of Exiting Threats of Non-Controlling Majority Shareholders in Different External Environments—Empirical Evidence from Green Innovation

Yanhui Dong^{1,a,*}

¹College of Business, Xi'an International Studies University, Xi'an, Shaanxi, 710128, China

^a1054236964@qq.com

*Corresponding author

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Abstract: In the context of carbon peaking and carbon neutrality, the topic of how to promote green innovation of enterprises has attracted widespread attention, and the level of corporate governance has become a key factor in discussion. Based on micro-enterprise-level governance mechanism, this paper selects A-share listed companies in Shanghai and Shenzhen from 2015 to 2021 as the research object to study the impact of non-controlling major shareholders' exiting threats on enterprises' green innovation, examines the role heterogeneity in different external environments, and puts forward suggestions for non-controlling major shareholders, enterprises, and government departments. The study finds that the exiting threats of non-controlling major shareholder can promote corporate green innovation; the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly in enterprises with low audit quality and high analysts' attention. Accordingly, non-controlling major shareholders should actively use exiting threats, firms should build a check-and-balance shareholding structure, and the government should improve institutional regulations to enhance stock liquidity.

1. Introduction

In September 2020, China proposed the "2030 Peak Carbon and 2060 Carbon Neutral" climate action goals at the United Nations General Assembly, and the "Outline of the Fourteenth Five-Year Plan for the National Economic and Social Development of the People's Republic of China and the Vision for 2035" includes accelerating the promotion of green and low-carbon development as one of the key goals and tasks. Environmental policy adheres to the concept of "ecological priority, green development", and whether it can guide enterprises to carry out green technological innovation is the key to the success of the construction of ecological civilisation [1]. Literature has found that the level of governance can enhance the level of green innovation of enterprises [2], so it is worth thinking about how to improve the level of corporate governance.

In recent years, there have been numerous incidents of controlling shareholders of Chinese listed companies encroaching on the interests of other shareholders, for example, the controlling shareholders and actual controllers of Yunnan BioValley Pharmaceuticals Co. Ltd. have taken up an aggregate of 356 million yuan of BioValley's funds through connected transactions from 2021 to 2022. China's A-share listed companies in 2008-2022, the average shareholding of the first largest shareholder is 34.488%, and the average shareholding of the top five shareholders is 53.409%. It can be seen that the phenomenon of "one-share dominance" is more common in China's listed companies, and there exists the first type of agency problem between shareholders and management, and the second type of agency problem between controlling shareholders and non-controlling shareholders in the company at the same time. It has been confirmed that non-controlling shareholders can reduce the two types of agency costs through the threats of exiting [3], and improve the quality of financial reporting [4].

In social psychology, threat is a communication tool in the game process, which helps to facilitate the negotiation to reach consensus. In this paper, we introduce the communication method of "threat" into the study of corporate governance, explore the governance effect of non-controlling majority shareholders' exiting threats from the perspective of green innovation, and analyse the heterogeneity of its role in different external environments based on audit quality and analysts' attention. This paper enriches the micro-level study of green innovation and expands the study of the economic consequences of the exiting threats of non-controlling majority shareholders.

2. Research Hypothesis

Green innovation is a project with a long payback period and high uncertainty, and the benefits are not immediate. Unlike traditional innovation, green innovation encompasses both greenness and innovativeness, and can simultaneously improve economic performance, innovation performance and environmental performance. Non-controlling majority shareholders usually hold the shares of a company for a long time and pay more attention to the sustainability of the company's value. Management is more willing to undertake projects with high short-term returns due to time in office and performance-related remuneration, while controlling shareholders are more willing to invest in low-risk projects due to the high wealth lock-in effect, and both have the motivation and ability to act for self-interest. Therefore, there is a difference between the green innovation willingness of non-controlling major shareholders and management and controlling shareholders, and the agency problem becomes one of the reasons for the low level of green innovation in enterprises [5].

Non-controlling majority shareholders hold larger shares and have better access to internal corporate information than small and medium-sized shareholders. Based on the signalling theory, the exit of non-controlling majority shareholders will bring negative signals to the capital market, leading to a decline in share price, increasing the probability of management change [6] and M&A [7], and threatening the security of management positions and the control of controlling shareholders. Weighing the benefits of non-controlling shareholders' exit against the benefits of self-interested behaviour, management and controlling shareholders will make decisions that are in line with the non-controlling shareholders' ideas [4] to promote corporate green innovation.

H1: The threats of exiting by non-controlling majority shareholders can promote firms' green innovation.

External audits can fulfil an external governance role, and enterprises with different audit qualities have different internal and external governance and information environments. The audit of financial statements aims to improve the quality and substance of the financial statements and increase the level of confidence of intended users other than management. The auditor's opinion on whether the financial statements have been prepared in accordance with applicable accounting

standards and are fairly stated in all material respects after the audit helps to reduce information asymmetries within and outside the enterprise. At the same time, the auditor is able to check the soundness and implementation of internal control of the enterprise through the implementation of audit procedures, identify internal control deficiencies and make recommendations for improvement, which helps to improve the quality of internal control. It can be seen that in enterprises with high audit quality, the higher the transparency of information, the better the quality of internal control, the less self-interested behaviour of management and controlling shareholders, and the more limited the governance effect of the exiting threats of non-controlling shareholders. Therefore, there is a governance substitution relationship between non-controlling shareholder exiting threats and external audit, and exiting threats has a stronger effect on promoting green innovation in firms with low audit quality.

H2: Among firms with low audit quality, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly.

Analyst attention can reduce the degree of information asymmetry, and the speed of signal transmission varies for companies with different levels of analyst attention. As an important information intermediary in the capital market, analysts obtain direct and indirect information through visits, telephone interviews, annual reports, etc., evaluate and predict the performance of enterprises based on the information obtained, and transmit them to external investors in a timely manner in the form of research reports, which helps to increase the speed of signal transmission of enterprises. For firms with high analyst attention, the negative signals of exit by majority shareholders are transmitted faster, resulting in a faster decline in share price and greater damage to the interests of management and controlling shareholders, thus making the facilitating effect of the exiting threats more significant.

H3: Among firms with high analyst attention, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly.

3. Research Design

3.1 Data Sources and Sample Selection

This paper takes the new development concept put forward in 2015 as the starting point, selects A-share listed companies in China's Shanghai and Shenzhen cities from 2015 to 2021 as the initial research samples, and screens them according to the following principles: ① eliminate ST, PT, and *ST companies ② eliminate samples with outliers and missing values ③ eliminate companies in the financial industry, and finally obtains 22,855 samples, and carries out the upper and lower 1% for all continuous variables. The data in this paper comes from China Research Data Service Platform, Oriental Wealth Network, RESSET Database, and CSMAR Database.

3.2 Description of Variables

3.2.1 Explained variables

Green innovation (Gi): drawing on Tao Feng [8] et al. (2021), green innovation is measured using the natural logarithm of the total number of patent applications for green inventions plus one.

3.2.2 Explanatory variables

The exiting threats of non-controlling large shareholder (Net): In this paper, we draw on Chen Kejing [3] (2019)'s study, which takes 5% shareholding as the definitional criterion for large

shareholders. The specific computational model is as follows:

$$NET_{i,t} = LIQUIDTY_{i,t} \times BHCOMP_{i,t} \quad (1)$$

$NET_{i,t}$ is the exiting threats of non-controlling majority shareholders of firm i in year t ; $LIQUIDTY_{i,t}$ is the stock liquidity of firm i in year t , measured by the average daily turnover of outstanding shares.

$$BHCOMP_{i,t} = \sum_{k=1}^N \left(\frac{NCLS_{k,i,t}}{SSBH_{i,t}} \right)^2 \quad (2)$$

$BHCOMP_{i,t}$ is the degree of competition from non-controlling majority shareholders of firm i in year t ; $SSBH_{i,t}$ is the shareholding of all large shareholders of firm i in year t ; $NCLS_{k,i,t}$ is the shareholding of the k th non-controlling major shareholder of firm i in year t .

3.2.3 Control variables

In this paper, firm size (Size), solvency (Lev), profitability (Roa), cash flow level (Cfo), fixed asset intensity (Fixed), growth (Growth), year of establishment (Age), board size (Bsize), ratio of independent directors (Outr), and two positions in one (Dual) are selected as control variables.

3.2.4 Other variables

Audit quality: drawing on Xu Yekun [7] et al. (2024), the receipt of a non-standard audit opinion in the current year represents high audit quality and vice versa represents low audit quality.

Analyst attention: drawing on Li Zhihui [8] et al. (2022), analyst attention is measured using the logarithm of the number of stocks being researched plus one.

3.3 Modelling

All the green innovations in the regression model of this paper use $t+1$ period. Model (3) is designed to analyse the effect of non-controlling major shareholders' exiting threats on firms' green innovation as follows:

$$Gi_{i,t+1} = \alpha_0 + \alpha_1 Net_{i,t} + \vartheta \sum \text{Control} + \sum \text{Industry} + \sum \text{Year} + \varepsilon_{i,t} \quad (3)$$

Hypothesis H1 is valid if α_1 significantly positive. Then, this paper regresses the samples in groups according to audit quality and analysts' attention respectively to test hypotheses H2 and H3.

4. Empirical Results

4.1 Descriptive Statistical Analyses

As shown in Table 1, the mean value of corporate green innovation (Gi) is 0.666, and the standard deviation is 1.024, which indicates that there are differences in the level of green innovation among different enterprises. The mean value of non-controlling major shareholders' exiting threats (Net) is 0.0031 with a median of 0, confirming the prevalence of one-share dominance in China's listed companies.

Table1: Descriptive statistics

Variable	N	Mean	SD	Min	p25	p50	p75	Max
Gi	22855	0.666	1.024	0.000	0.000	0.000	1.099	4.443
Net	22855	0.003	0.010	0.000	0.000	0.000	0.000	0.066
Size	22855	22.250	1.295	19.970	21.320	22.060	22.980	26.270
Lev	22855	0.412	0.202	0.059	0.248	0.402	0.559	0.887
Roa	22855	0.036	0.068	-0.302	0.014	0.038	0.069	0.196
Cfo	22855	0.048	0.068	-0.155	0.010	0.048	0.087	0.241
Fixed	22855	0.197	0.154	0.002	0.077	0.164	0.281	0.674
Growth	22855	0.176	0.407	-0.581	-0.020	0.111	0.279	2.473
Bsize	22855	2.222	0.173	1.792	2.079	2.303	2.303	2.708
Outr	22855	0.378	0.054	0.333	0.333	0.364	0.429	0.571
Dual	22855	0.308	0.462	0.000	0.000	0.000	1.000	1.000
Age	22855	2.961	0.295	2.197	2.773	2.996	3.178	3.526

4.2 Analysis of Regression Results

As shown in Table 2, Column (1) shows the regression results for the full sample, and the results show that the Net coefficient is significantly positive, indicating that the non-controlling majority shareholders' exiting threats promote corporate green innovation, which verifies this paper's research hypothesis 1.

Columns (2) and (3) show the regression results for the low-audit-quality and high-audit-quality groups, respectively, and the Net coefficient of Column (2) is significantly positive, while the Net coefficient of Column (3) is insignificant, which indicates that in the low-audit-quality enterprises, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly, which verifies the research hypothesis 2 of this paper.

In this paper, the samples are grouped and regressed according to the annual average of analysts' attention, Column (4) and Column (5) are the regression results of the low analysts' attention group and high analysts' attention group, respectively. Column (4) Net is not significant, and Column (5) Net coefficient is significantly positive, which indicates that in the enterprises with high analyst attention, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly, which verifies the research hypothesis 3 of this paper.

Table2: Analysis of regression results

	(1)	(2)	(3)	(4)	(5)
	full sample	Low audit quality	High audit quality	low level of concern	high level of interest
Net	1.457** (2.338)	1.503** (2.384)	0.736 (0.269)	1.047 (1.431)	2.523** (2.512)
Constant	-9.207*** (-23.250)	-9.428*** (-23.454)	-2.950*** (-3.587)	-6.238*** (-15.546)	-10.799*** (-18.630)
Control	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
N	22855	22072	783	12317	10538
adj. R ²	0.365	0.372	0.166	0.238	0.427

Note: *p<0.10, **p<0.05, ***p<0.01, t-values in parentheses, standard errors have been Cluster-treated at the company level, below.

4.3 Robustness Tests

Table3: Robustness test

	(1)	(2)	(3)	(4)	(5)
	Gi	Gi	Gp	Net	Gi
Ncet	2.163*				
	(1.952)				
Nset		0.546*			
		(1.725)			
Net			1.326***		24.280***
			(3.012)		(3.012)
Pnet				0.677***	
				(11.020)	
Constant	-9.181***	-9.200***	-5.707***	0.023***	-9.789***
	(-23.213)	(-23.240)	(-18.224)	(9.110)	(-21.689)
Control	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
N	22855	22855	22855	22855	22855
adj. R2	0.365	0.365	0.281	0.039	0.315

4.3.1 Replacement of explanatory variables

Recalculate the exiting threats (*Ncet*) by using 10 per cent shareholding as the definitional criterion for large shareholders. Recalculate the degree of competition by substituting the number of non-controlling large shareholders into model (2) and recalculates the exiting threats (*Nset*). The regression results are shown in column (1)(2) of Table 3, and the coefficients of *Ncet* and *Nset* are significantly positive, confirming the robust results.

4.3.2 Substitution of explained variables

The logarithm of the number of patents granted for green inventions plus one is used as a proxy variable for firms' green innovation (*Gp*). The regression results are shown in column (3) of Table 3, and the *Net* coefficient is significantly positive, confirming that the results are robust.

4.3.3 Instrumental variable

Endogeneity tests are conducted using the annual regional average of the exiting threats of non-controlling majority shareholders (*Pnet*) as an instrumental variable. Column (4) of Table 3 reports the first-stage results, showing a significantly positive *Pnet* coefficient. After controlling for relevant endogeneity issues, the regression results are reported in column (5) of Table 3 and the *Net* coefficient is significantly positive, confirming robust results.

5. Conclusion

This paper selects A-share listed companies in China's Shanghai and Shenzhen cities from 2015 to 2021 as the research sample, studies the impact of non-controlling major shareholders' exiting threats on corporate green innovation, and examines the role heterogeneity in different external environments. The following conclusions are drawn: (1) The non-controlling major shareholders'

exiting threats can promote corporate green innovation. (2) In firms with low audit quality, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly. (3) Among firms with high analyst attention, the non-controlling majority shareholders' exiting threats promote corporate green innovation more strongly.

According to the findings of this paper, the following insights are obtained: (1) This paper verifies the governance effect and role heterogeneity of exiting threats from the perspective of green innovation, and the non-controlling majority shareholders can participate in corporate governance by selecting the exiting threats according to the external environment of the company, and they have to actively learn the professional knowledge to improve the governance efficiency. (2) This paper confirms that the participation of non-controlling majority shareholders in corporate management can improve the level of corporate governance and green innovation. Enterprises should actively introduce non-controlling majority shareholders to build a reasonable equity structure. (3) This paper side by side demonstrates the positive effects of equity checks and balances and stock liquidity on corporate governance. Government departments should strengthen the system design to enhance stock liquidity.

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