



# The Impact of Multiple Large Shareholders' Coexistence on Firms' Green Technology Innovation

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**Abstract:** The existence of multiple large shareholders affects the innovative behavior of firms, and green technology innovation has higher risk compared with general innovation. Using a sample of Chinese listed companies from 2006 to 2021, we empirically examine the impact of multiple major shareholders' co-existence on corporate green technology innovation. It is found that the coexistence of multiple major shareholders is positively related to corporate green technology innovation. Through the mechanism test, it is found that the majority shareholders promote green technology innovation by alleviating the degree of corporate financing constraints and management's shortsightedness. Therefore, actively utilizing the resource effect and monitoring effect of multiple major shareholders can accelerate the green transformation and sustainable development of enterprises.

**Keywords:** multiple large shareholders; green technology innovation; financing constraints; management myopia

## 1. Introduction

The existence of multiple major shareholders within the enterprise has been a common phenomenon, this kind of shareholding structure in the management to reduce the agency problem at the same time can also reduce the risk of controlling shareholders to carry out self-interested behavior. It can also inhibit controlling shareholders' short-selling behavior. This structure can significantly improve the performance of corporate social responsibility (CSR). This structure also reduces the risk of controlling shareholders engaging in private behavior and suppresses controlling shareholders' short-selling behavior. The content of corporate social responsibility includes green development, and compared with general technological innovation, green technological innovation has more stringent financial requirements for enterprises, high risk and long return cycle. So, does the existence of multiple large shareholders promote green technological innovation of enterprises? What is the path through which the influence mechanism between the coexistence of major shareholders and green technology innovation is realized? It is of great significance to explore the above questions, to utilize the resource effect and monitoring effect of multiple major shareholders, and to provide theoretical basis and reference for the realization of sustainable development of enterprises.

## 2. Theoretical analysis and research hypothesis

### 2.1 Coexistence of multiple major shareholders and green technology innovation

The coexistence of multiple major shareholders can play a supervisory effect, inhibit the inefficient investment behavior of major shareholders. In addition, the coexistence of multiple major shareholders can alleviate the financial constraints of the enterprise and ensure that the enterprise has sufficient funds to carry out green technological innovation. In addition, from the perspective of enterprise management, when there are multiple major shareholders in an enterprise, the supervision of the management increases, and the risk of detection of self-interested behavior increases. The enterprise's social resources, technological resources and knowledge reserves are important factors for green technological innovation. The presence of multiple major shareholders reduces the risk of a firm's self-interested behavior. The presence of multiple large shareholders reduces the search cost of green innovation. As the public's concern for the environment increases, shareholders will proactively urge firms to engage in green technology innovation based on their own reputational pressure. Based on the above analysis, this paper proposes the following hypotheses. Based on the above analysis, this paper proposes the following hypotheses: H1: Multiple large shareholders and firms' green technology innovation level are positively correlated.

## **2.2 Coexistence of multiple major shareholders, financing constraints and green technology innovation**

According to the theory of financing constraints, when the cost of corporate financing is high, firms will shed some of their investment projects with positive net returns and reduce their innovation funding. Since most investors are risk-averse, they will reduce their investment in green technology innovation activities, which obviously inhibits the efficiency of green technology innovation. The Open source and cost reduction are the two main methods for enterprises to alleviate financing constraints. Analyzing from the perspective of open source, the coexistence of multiple major shareholders can enhance corporate ESG performance. Annual reports serve as a source of information for external investors to understand the development of the enterprise. As the main channel for external investors to understand the development status of enterprises, the better the ESG responsibility performance, the more positive the tone of the annual report text, which can reduce the risk expectations of external investors and lower the cost of external financing[1]. The more positive the tone of the annual report, the less risky the expectations of external investors and the lower the cost of external financing. Analyzed from the perspective of throttling, the agency problem is the main factor affecting corporate financing constraints. Controlling shareholders will use their own rights to make non-efficient investments and crowd out enterprise R&D funds, and other major shareholders play a supervisory role to reduce the hollowing out behavior of controlling shareholders and improve the utilization efficiency of funds. Compared with general technological innovation, enterprises need to utilize external networks to search for knowledge in order to complete green technological innovation[2]. The major shareholders can utilize their resource effects to improve the utilization of funds. Multiple major shareholders can play their resource effect to reduce the knowledge search cost of enterprises and reduce the cost of green technology innovation[3]. Based on the above analysis, this paper proposes the following hypotheses. Based on the above analysis, this paper proposes the following hypotheses:

H2: Multiple large shareholders promote the level of green technology innovation by alleviating the degree of corporate finance constraints.

## **2.3 Coexistence of multiple major shareholders, management myopia and green technology innovation**

Principal-agent theory suggests that management, faced with a fiduciary duty, will tend to choose investment projects with short maturities and stable returns as well as low risk, leading to a reduction in the firm's long-term investment, and thus adopting a relatively short-sighted and opportunistic perspective that inhibits the firm's innovative output. Under the pressure of multiple major shareholders and external investors' supervision, the management will make investment decisions with more consideration to the long-term return of the enterprise, which will help to promote the enterprise's green technological innovation. On the other hand, multiple major shareholders' corporate innovation investment can bring excess returns, reduce management's short-sighted demand, and stimulate management's willingness to carry out green technology innovation. Based on the above analysis, this paper proposes the following hypotheses: H3: Multiple large shareholders promote green technology innovation levels by curbing the level of management short-sightedness.

## **3. Study design**

### **3.1 Sample Selection and Data Sources**

This paper takes the A-share listed companies in Shanghai and Shenzhen from 2006 to 2021 as the research sample, and the financial data are selected from CSMAR database. The paper treats the data as follows: (1) excluding the financial industry; (2) excluding the samples with gearing ratio greater than 1; (3) excluding the samples with ST and PT; (4) excluding the samples without large shareholders; (5) excluding the samples with missing data on the key variables; and (6) in order to eliminate the effect of extreme values, the continuous variables involved in this paper are shrink-tailed at the 1% and 99% levels.

### **3.2 Definition of variables**

Enterprise green innovation level (lnGreeni): the number of green invention-type patents applied by the enterprise is used as a proxy variable for the enterprise's green technology innovation level. This paper determines the information of concert parties from the company's annual report, and categorizes the shareholders or concert parties holding 10% or more of the company as major shareholders. When there are two or more major shareholders in a firm, the firm is considered to have a structure with multiple major shareholders coexisting (Multi).

### 3.3 Empirical models

To test the research hypotheses, the following regression model was constructed:

$$\ln \text{Greeni}_{it} = \alpha_0 + \alpha_1 \times \text{Multi}_{it} + \alpha \times \text{Controls}_{it} + \sum \text{Year} + \sum \text{Industry} + \varepsilon_{it} \quad (1)$$

## 4. Empirical analysis

### 4.1 Baseline regression analysis

Table 1 shows the regression results for testing the main hypothesis. In particular, the results in columns (1) and (2) show that the coexistence of multiple majority shareholders promotes firms to engage in green technological innovations regardless of whether the year and industry are fixed, and the results are significant at the 1% and 5% levels, respectively. The results in columns (2) and (3) show that the coefficient of multiple majority shareholders coexistence is significantly positive regardless of the inclusion of control variables, and the results are significant at the 1% level with the inclusion of control variables. It verifies the hypothesis 1 of this paper that multiple majority shareholders can positively influence firms' green technology innovation compared to single majority shareholders.

Table 1. Benchmark regression

Variant	(1)	(2)	(3)	Variant	(1)	(2)	(3)
	lnGreeni	lnGreeni	lnGreeni		lnGreeni	lnGreeni	lnGreeni
Multi	0.025*** (0.007)	0.017** (0.007)	0.022*** (0.007)	Growth			-0.060*** (0.006)
size			0.121*** (0.003)	Dual			0.027*** (0.007)
Lev			0.005 (0.019)	Top3			-0.173*** (0.023)
ROE			0.118*** (0.024)	SOE			0.071*** (0.008)
Cashflow			-0.029 (0.042)	ListAge			-0.047*** (0.004)
REC			0.230*** (0.040)	_cons	0.243*** (0.004)	-0.069*** (0.015)	-2.429*** (0.069)
N	38663.000	38663.000	38663.000	N	38663.000	38663.000	38663.000
r2	0.000	0.079	0.148	r2	0.000	0.079	0.148
ind	No	Yes	Yes	ind	No	Yes	Yes
year	No	Yes	Yes	year	No	Yes	Yes

## 4.2 Robustness Tests

### 4.2.1 Lags of explanatory variables

In order to test whether the influence of multiple major shareholders on the green technology innovation of enterprises will be disturbed by different periods, the explanatory variables are substituted into the model (1) for regression one period in advance and two periods in advance, respectively. From columns (1) and (2) of Table 2, the regression coefficients of multiple major shareholders are 0.023 and 0.016, respectively, and the regression coefficients are not much different from the results of the main hypotheses, and they are significant at the 1% and 5% levels, respectively.

### 4.2.2 Changing the sample interval

The global financial crisis began in 2007 and did not end until 2012. Therefore, this paper chooses to change the sample interval to test the robustness of the main effect and selects the sample from 2013-2021 for the regression, and column (3) of Table 2 shows that the regression coefficient of Multi is significantly positive at the 5% level, which proves the robustness of the findings of this paper.

**Table 2. Robustness regression results**

Variant	(1)	(2)	(3)
	Lead time	Two issues ahead	Changing the sample interval
	F.InGreeni	F2.InGreeni	InGreeni
Multi	0.023*** (3.00)	0.016** (2.00)	0.020** (2.29)
Constant	-2.535*** (-33.68)	-2.657*** (-32.41)	-2.780*** (-30.80)
Observations	33,703	29,730	27,762
R-squared	0.151	0.153	0.153
year	Yes	Yes	Yes
ind	Yes	Yes	Yes

## 5. Further analysis

The previous section has confirmed that the coexistence of multiple large shareholders is positively related to corporate green technology innovation, and the impact mechanism between the two will be further analyzed next. This paper argues that the existence of multiple majority shareholders can promote corporate green technology innovation by way of alleviating financing constraints and management’s short-sighted behavior, which is measured in this study using the financing constraint SA. Referring to Hu Nan[4] (2020), we calculate the ratio of the total word frequency of “short-term perspective” words to the total word frequency of MD&A, and multiply it by 100 to get the indicator of managerial myopia (MA). Referring to Jiang Ting[5] (2022), the following model was constructed:

$$SA/MA_{it} = \alpha_0 + \alpha_1 \times Multi_{it} + \alpha \times Controls_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (2)$$

The regression results are presented in Table 3. The results show that the regression coefficients of Multi on SA and MA are 0.014 and 0.004, respectively, and are significantly positive at the 1% and 5% levels. The results confirm hypotheses 2 and 3.

**Table 3. Mechanism test regression results**

Variant	(1)	(2)
	SA	MA
Multi	0.014*** (0.002)	-0.004** (0.002)
_cons	-3.775*** (0.023)	0.232*** (0.015)
N	38663.000	38189.000
r2	0.452	0.146
ind	Yes	Yes
year	Yes	Yes

## 6. Conclusions and recommendations

As the actual controller of the enterprise as well as the owner of the final revenue, the supervisory role of multiple major shareholders on controlling shareholders and management as well as the resource effect brought by themselves will have an important impact on the level of green technology innovation of the enterprise. Therefore, from the perspective of multiple major shareholders, this paper utilizes the green technology innovation data of listed companies from 2006 to 2021 to establish a model to examine the relationship between the two. It is found that multiple major shareholders increase the level of firms’ green technological innovation by alleviating firms’ financing constraints and reducing management’s myopia, a finding that still holds significantly after endogeneity and robustness tests. From the above conclusions, this paper puts forward the following suggestions: First, the resource effect of multiple major shareholders should be fully utilized to attract more external investment and guarantee that the enterprise carries out green innovation without affecting

its normal production and operation. At the same time, the industry resources as well as knowledge and technology held by the shareholders should be utilized to reduce the cost in the innovation process of the enterprise and improve the innovation conversion rate. Secondly, enterprises should strengthen the synchronization of information between departments, enhance the efficiency of shareholders' access to information, reduce the barriers to access to information, and create an environment for shareholders to actively play their role in supervision. Third, government departments should improve the flow of capital market funds, direct investors' attention to green innovation enterprises, encourage institutional investors to enter innovation enterprises, and strengthen the resource and monitoring effects of multiple large shareholders.

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