Manager Behaviors and Enterprise Green Innovation

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Abstract

In the background of China's rapid economic development, green innovation gives consideration to green development and innovative development, is the important driving force to achieve China's high-quality development and sustainable development. Based on A sample of Chinese A-share listed companies from 2009 to 2021, this paper studies the effects of manager agent behavior under rational assumption and manager short-sighted and manager overconfidence on corporate green innovation. It is found that manager agency behavior under rational assumption will promote the green innovation of enterprises, while manager short-sightedness and manager overconfidence under irrational assumption will inhibit the green innovation of enterprises. This conclusion remains valid after a series of robustness tests, such as replacement of explained variables, PSM and one-stage lag. The extended analysis found that by easing the degree of financing constraints, improving the level of internal governance and ESG performance of the company, the inhibition effect of managers' short-sightedness and managers' overconfidence on corporate green innovation could be eased. This is of great significance for enterprises to respond to the call of the state and accelerate green transformation and green development.

Keywords

Manager Agent; Manager's Short-Sightedness; Managers are Overconfident; Green Innovation.

1. Introduction

Giving consideration to green development and innovative development, green innovation is an important driving force to achieve China's high-quality development and sustainable development. The report of the Party's Second 10th Congress clearly points out that "we must accelerate the green transformation and promote green and low-carbon economic and social development." It stressed that economic development should also pay attention to environmental protection and strengthen the construction of ecological civilization. (CAI Bofeng et al., 2021; Li Wanhong and Li Na, 2023). Green innovation refers to the development of environmentally friendly products and processes, including the use of green raw materials, adhering to the principles of ecological product design, reducing material use, reducing pollutant discharge, and reducing the consumption of water, electricity and other raw materials (Yuan B and Cao X,2022), compared with general technological innovation, Green innovation pays more attention to environmental friendliness and sustainability (Zhang Zengtian et al., 2023). From the macro level, green credit policy (Hong M, et al., 2021; Hu G,et al., 2021; Wang H, et al.,2022; Zhang Y, et al.,2022; Ding Jie et al., 2022; Bian Chen et al., 2022; Fang Zhang and Haiting Yu, 2023; Shu Limin et al., 2023; Xuesong Yao and Xiaoguang Xu, 2023; Yu Bo, 2023), Green Finance Policy (Qi Huaijin and Liu Siqin, 2023), Financial technology (Xiao Quan et al., 2023), Digital financial Inclusion (Liu J, et al.,2022; Rao S, et al.,2022; Wu Hong and Liu Jinghua, 2023; Li Ping and Fang Jian, 2023), environmental taxes (Li Xiaohong and Kim Jungxian, 2023) and government subsidies (Liu Pengzhen et al., 2022; Liu Xuexin and Wang Shupeng, 2022; Xia L, et al.,2022; Ganna Zou et al., 2023; Wang Yonggui and Li Xia, 2023), Environmental

Regulation (Zhao Jinguo et al., 2022; Bian Chen et al., 2022; Li Ping and Fang Jian, 2023; Tan Jin and Xu Guangwei, 2023) and other measures also have a positive effect on corporate green innovation. No matter some mandatory policies or a series of guidance measures by the government, they are all aimed at promoting the green development and innovative development of enterprises. So from the micro enterprise level, how to promote the green innovation of enterprises? The enterprise is the creator of environmental pollution and an important subject of green innovation, and the manager will affect the process and result of the strategic decision of the enterprise. Then what impact will the manager's behavior have on the green innovation of the enterprise?

In the context of China's rapid economic development, green innovation gives consideration to both green development and innovative development, and is an important driving force to achieve China's high-quality development and sustainable development. Based on A sample of China's A-share listed companies from 2009 to 2021, this paper studies the impact of manager agency behavior under rational assumptions and manager short-sighted and overconfidence under irrational assumptions on corporate green innovation. It is found that manager agency behavior under rational assumption will promote the green innovation of enterprises, while manager short-sightedness and manager overconfidence under irrational assumption will inhibit the green innovation of enterprises. This conclusion remains valid after a series of robustness tests, such as replacement of explained variables, PSM and one-stage lag. The extended analysis found that by easing the degree of financing constraints, improving the level of internal governance and ESG performance of the company, the inhibition effect of managers' short-sightedness and managers' overconfidence on corporate green innovation could be eased. This is of great significance for enterprises to respond to the call of the state and accelerate green transformation and green development.

The possible contributions of this paper lie in the following two aspects: First, the manager's agency behavior under rational assumption and the manager's short-sightedness and manager's overconfidence under irrational assumption are included in the same analytical framework, and the relationship between the three kinds of manager's behavior and corporate green innovation is discussed, enriching the research on the driving factors of corporate green innovation. Second, starting from the internal factors of the company, this paper further discusses the regulating effect of managers' behaviors under the irrational assumption on corporate green innovation, which provides certain references for better promoting the green and low-carbon development of enterprises, which is of great significance for enterprises to respond to the call of the country and accelerate the green transformation and green development.

2. Theoretical Analysis and Research Hypothesis

2.1. Management Agency and Enterprise Green Innovation

Based on the principal-agent theory, in contemporary enterprises, due to the separation of the two rights, shareholders entrust managers with professional competence to operate and manage the company in the form of remuneration, thus forming the principal-agent relationship between the two. Managers must create more value for the company through their own efforts while pursuing the maximization of their own benefits. Based on the agent behavior of managers under the rational assumption and the business Empire hypothesis proposed by Stulz in 1990, it is believed that managers often have the desire to expand enterprises, because it can not only bring hidden benefits such as social status and sense of honor to meet their own needs, but also improve the compensation of management. The manager defense hypothesis proposed by Morck and the free cash flow hypothesis proposed by Jensen believe that in the current uncertain external environment, the management faces the pressure of product market

competition and the risk of being replaced is high. Therefore, in the case of sufficient free cash flow, the management tends to over-invest resources in favorable projects and projects of its own expertise. Green innovation refers to the improvement of green technology in the production process of enterprises, which can not only reduce pollution and reduce the cost of pollutant discharge, but also help enterprises save resources and materials and realize economic, environmental and social benefits (Ban Qi, Fan Xiaoyun, 2023). Based on the above theoretical analysis, the following hypothesis 1 is proposed:

Hypothesis 1: Manager agency behavior under the rational assumption promotes enterprise green innovation.

2.2. Managers' Short-sightedness and Corporate Green Innovation

Managers' short-sightedness refers to the short-sightedness of management's decision-making horizon. Based on the time orientation theory of social psychology, people have different time orients, and managers with short-term time orientation tend to be short-sighted and pay more attention to the present (Hu Nan et al., 2021). According to the high-level hierarchy theory, managers' personal characteristics and cognitive structure will affect the strategic decision-making process of an enterprise (Xu et al, 2023). Therefore, short-sighted managers will pay too much attention to short-term interests rather than long-term goals (Cannon et al, 2020). Due to information asymmetry and incomplete contracts, there is a conflict of interest between managers and shareholders. The goal of managers is to maximize their own interests, while the goal of shareholders is to maximize the value of the company. As a result of the difference in the two goals and the financial pressure on the management as well as their own compensation and performance, the management may make use of their resources and personal power to over-invest in short-term businesses with high returns, so as to increase short-term returns and reduce investment in long-term projects conducive to the development of the company (Gibbons, R,2005). As corporate green innovation requires a large amount of capital and investment in innovation elements, the cycle of obtaining returns is very long, and the uncertainty and high risk of the market are likely to lead to the failure of corporate green innovation activities (Wang Yonggui, Li Xia, 2023), short-sighted managers cannot focus on the long-term benefits brought by corporate greeninnovation. Based on the above theoretical analysis, the following hypothesis 2 is put forward:

Hypothesis 2: Managers' short-sightedness inhibits corporate green innovation.

2.3. Managers' Overconfidence and Corporate Green Innovation

The psychological preference characteristics of managers with overconfidence often determine that they will overestimate their own strength, overestimate returns and underestimate risks, like challenging projects, and tend to over-invest in short-term projects in order to prove their ability, which is not conducive to the long-term development of enterprises (Liu Bai et al., 2020). Overconfident managers are risk-oriented managers who tend to implement expansionary financial strategies, which will increase the possibility of enterprises getting into financial difficulties (Jiang Fuxiu et al., 2009). Due to the characteristics of enterprise green innovation, such as long cycle, complexity, large investment, high risk, difficulty to generate short-term benefits, and strict requirements for low pollution and low emission, most enterprises are not highly motivated to carry out green innovation (Jin Yu et al., 2022; Li Xiaole et al., 2023). According to the tradeoff theory, the resources of enterprises are limited, and managers are more inclined to short-term projects with faster investment returns and higher profits (Gao Jieying et al., 2021). Based on the above theoretical analysis, hypothesis 3 is proposed as follows:

Hypothesis 3: Managers' overconfidence inhibits enterprise green innovation.

In view of this, how to promote corporate green innovation?

2.4. Manager Behaviors, Internal Governance and Corporate Green Innovation

Corporate internal governance runs through the operation and management of the whole company and plays an indispensable role. Corporate governance can limit and supervise the self-interested behavior of managers. Companies with poor internal governance are often likely to have financial constraints and face more difficulty in raising the capital needed to invest in potentially expensive projects such as green technology innovation. Poor corporate governance will have a negative impact on green patents and lead to a significant reduction in innovation in the field of green technology (Amore et al.,2016). Therefore, improving corporate governance is conducive to corporate green innovation and can alleviate the inhibiting effect of managers' behaviors under irrational assumptions on corporate green innovation.

2.5. Manager Behaviors, Financing Constraints and Corporate Green Innovation

According to the resource dependence theory, enterprise green innovation requires a large amount of factor input, including manpower, resources, capital, etc. However, the resources of enterprises are limited, and their use to a certain extent may cause the break of the company's capital chain. Therefore, enterprise green innovation needs internal and external financing (Ba Shusong et al., 2022). Financing constraint is an important factor affecting enterprises' green innovation activities. The greater the degree of financing constraint an enterprise faces, the lower its willingness to research and develop green innovation (Zhang Fang and Yu Haiting, 2023). Therefore, by easing the degree of financing constraints, the pressure of cash flow borrowing can be alleviated, the abilityof enterprises to innovate green can be effectively improved, and the inhibiting effect of managers' behaviors under irrational assumptions on enterprises' green innovation can be alleviated.

2.6. Manager Behaviors, ESG Performance and Corporate Green Innovation

ESG is an investment philosophy that integrates environmental, social and corporate governance, which means that companies should not only focus on their own interests, but also pay attention to non-financial performance such as social responsibility and environmental protection. According to stakeholder theory and voluntary disclosure theory, ESG practice plays a positive role in enhancing corporate value and financial performance, obtaining support and help from stakeholders, reducing the degree of information asymmetry among stakeholders, and establishing good cooperative relations (Wang Bo and Yang Maojia, 2022). Based on the signal transmission theory and the resource dependence theory, the development and innovation of enterprises need to obtain resources from the outside, and good ESG performance can convey the positive signal that the company has good performance, strong social responsibility and trustworthiness to the outside world, improve the reputation and image of enterprises, which is conducive to easing the financing constraints of enterprises and reducing corporate risks. It makes it easier for enterprises to obtain external financing (Wang Bo and Yang Maojia, 2022; Wang Linlin et al., 2022). In addition, good ESG performance can reduce agency costs, improve the internal governance mechanism of the company, and then supervise managers more effectively, restrain the self-interested behaviors of the management, which is conducive to the green innovation of the enterprise (Gao Jieying et al., 2021; He F, et al, 2022).

3. Research Design

3.1. Sample Selection and Data Source

This paper takes China's A-share listed companies as the research object and takes 2009-2021 as the sample interval. At the same time, in order to improve the validity of the data, the data are processed as follows: (1) ST, *ST and PT listed companies are excluded. (2) The financial

and insurance listed companies are excluded. (3) Samples with missing data in related variables are excluded. (4) In order to control the influence of extreme values, Winsorise (upper and lower 1%) was performed on continuous variables. The data of enterprise green innovation in this paper are from CNRDS database, and other financial data are from Guotai 'an Data Service Center (CSMAR). After data processing by stata17.0, 25,367 valid samples were obtained in this paper.

3.2. Definition and Description of Variables

3.2.1. Explained Variable -- Corporate Green Innovation (lnGreTotal1)

Most of the existing literatures use patent application data as a measurement index. Since patent grant requires testing and annual fee payment, there is lag, and patent technology is likely to have an impact on enterprise performance during the application process, application data are more reliable and stable than grant data (Li Wenjing, Zheng Manni, 2016). Therefore, this paper refers to Qi Shaozhou et al. (2018). Ma Yongqiang et al. (2021); In the study of Zhang Fang and Yu Hai (2023), the total amount of green innovation of enterprises was measured by selecting the number of green patent applications of enterprises in the current year. At present, there are two methods to measure corporate green innovation in existing literatures. One is the proportion method, which measures corporate green innovation by the proportion of total green patent applications in total patent applications (Song Deyong et al., 2022). The other is logarithmic method, which takes logarithmic treatment on the number of green patents applied by listed enterprises in the current year (Xu Jia, Cui Jingbo, 2020). Since the green innovation data is distributed to the right, this paper adopts the second method, that is, the number of green patent applications of the enterprise in the year plus a natural logarithm method as a metric. The greater the value, the higher the level of green innovation of the enterprise.

3.2.2. The Main Explanatory Variable -- Managers' Behavior

1) Manager Agency Behavior (Mfee)

In this paper, referring to the research of Hou Qiaoming et al. (2017) and Zhang Duolei and Zhao Shenzhen (2022), the management expense rate is used to measure the management agency behavior, that is, the management expense is divided by the operating income. The greater the value, the higher the level of management agency.

2) Managers from the Myopia perspective

Manager myopia belongs to social psychology, so measuring it is the difficult part of the research. The existing literature mainly uses text analysis and machine learning to construct indicators of manager myopia. Therefore, with reference to the research of Hu Nan et al. (2021), this paper first sets out the direct category seed words set including "within days", "months", "within the year", "as soon as possible", "right away" and the indirect category seed words set including "opportunity", "occasion", "pressure" and "test" related to the short-term horizon in Chinese MD&A. Then, the CBOW model in Word2Vec is used to expand similar word sets, and 33 expanded word sets including "within days", "several days", "immediately" and "immediately" are developed. Finally, the proportion of the total word frequency of 43 words of "short-term vision" in the total word frequency of MD&A is calculated, and then multiplied by 100 to get the index of manager myopia. The larger the value, the higher the level of short-sightedness.

3) The manager is overconfident.

In recent years, there are many ways to measure manager overconfidence at home and abroad. For example, based on five personal characteristics of general managers (Yu Minggui et al., 2013), including gender, age, education, educational background, and the combination of two positions, a comprehensive variable is constructed to measure. Overconfidence was measured by using the business climate index and whether the annual performance report changed (Yu

Minggui et al., 2006). This paper adopts the relative ratio method of executive compensation and refers to the research of Jiang Fuxiu et al. (2009), and adopts the method of dividing the sum of the top three executives' compensation by the sum of all executives' compensation to measure managers' overconfidence. The value greater than the median is assigned as 1, and the value otherwise is 0.

3.2.3. Adjusting Variables

1) Corporate governance level (CG)

Based on the studies of Gu Naikang and Zhou Yanli (2017), Zhang Huili and Lu Zhengfei (2012), this paper adopts the first principal component analysis method to construct a corporate governance index by selecting seven indicators, such as the proportion of senior executives' shares, the proportion of independent directors and the size of the board of directors, and then multiples the index by -1 to obtain the corporate governance level in this paper. The smaller the value, the better the corporate governance.

2) Financing constraints

There are four indexes of financing constraint: FC index, SA index, KZ index and WW index. This paper selects FC index as the measurement of financing constraint with reference to the research of Gu Leilei et al. (2020). The larger the index, the greater the degree of financing constraint.

3) ESG performance within a company

At present, there is no established standard for ESG measurement at home and abroad, which is mainly scored by third-party rating agencies, including Shangdao Ronglv, Huaseng ESG rating, Bloomberg ESG rating, etc. In this paper, the practices of Gao Jieying et al. (2021), Wang Bo and Yang Maojia (2021) are referred to, and the ESG rating of Huazheng is selected to measure the ESG performance within the company. The ESG rating of Huazheng is divided into nine grades, which are AAA, AA, A, BBB, BB, B, CCC, CC and C. The AAA grade is assigned 9 points, and the C grade is assigned 1 point. The higher the score is, the better the internal performance of the company is.

3.2.4. Control Variables

See Li Qingyuan and Xiao Zehua (2020); Yu Zhimai (2021); Li Wanli et al. (2023); The study of Duan Huayou et al. (2023) selected a series of economic characteristics of enterprises that may affect the green innovation of enterprises. Including company Size (Size), asset-liability ratio (Lev), net profit rate on total assets (ROA), cash flow ratio (Cashflow), operating income Growth rate (Growth), Dual value (TobinQ), equity balance degree (Balance1), and shareholding ratio of the largest shareholder (T op1) and 10 influencing factors of the number of directors (Board) as control variables. At the same time, the annual dummy variable (year) and the Industry dummy variable (Industry) are introduced to control the annual fixed effect and the industry fixed effect. The specific definitions of variables are shown in Table 1.

Table 1. Table of variable definitions

	Variable symbol	Variable name	Variable definition
Explained Variable	lnGreTotal1	Enterprise green innovation	The number of green patent applications of the enterprise in the current year is added to the natural logarithm
Explanatory Variables	Mfee	Administrator agent	Administrative expenses/revenue
	Myopia	Managers are short-sighted	The proportion of the total word frequency of 43 "short view" words to the total word frequency of the MD&A ×100
	Over	Overconfidence of managers	compensation/the sum of all executives' compensation is assigned a value of 1 above the median and 0 otherwise
Control Variables	Size	Size of company	Natural log of total annual assets
	Lev	Asset-liability ratio	Total liabilities at year-end divided by total assets at year-end
	ROA	Net profit margin on total assets	Net profit/Average balance of total asset
	Cashflow	Cash flow ratio	Net cash flow from operating activities divided by total assets
	Growth	Operating revenue growth rate	Current year operating income/Previous year operating income -1
	Dual	Dual roles	Chairman and general manager are the same person 1, otherwise it is 0
	TobinQ	Tobinq value	(Market value of outstanding shares + number of non-tradable shares x net asset value per share + carrying amount of liabilities)/ total assets
	Balance1	Degree of equity balance	Sum of the shareholding ratio of the second largest shareholder divided by the shareholding ratio of the first largest shareholder
	Top1	Proportion of the largest shareholder	Number of shares held by the largest shareholder/total number of shares
	Board	Number of directors	Take the natural logarithm of the number of directors
	year	year	Control annual fixed effects
	Industry	Industry	Control industry fixed effect

3.3. Model Construction

In order to verify hypothesis 1, this study, with reference to Hou Qiaoming et al. (2017) and Zhang Duolei and Zhao Shenzhen (2022), established a model as shown in equation (1) to investigate the relationship between manager agency behavior and corporate green innovation, where the explained variable is $lnGreTotal1_{it}$, representing the level of corporate green innovation; The explanatory variable is $Mfee_{it}$, which represents the level of manager agency in the sample enterprises; $Controls_{it}$ represents the control variable. In formula (1) we mainly focus on the size and sign of the coefficient of the explanatory variable. According to the hypothesis, the expected sign is significantly positive, that is, the manager agent behavior is conducive to improving the green innovation level of the enterprise.

In order to verify hypothesis 2, this paper, with reference to the study of Hu Nan et al. (2021), establishes a model as shown in equation (2) to investigate the relationship between managers' myopia and corporate green innovation, where the explained variable is $lnGreTotal1_{it}$, representing the level of corporate green innovation; The explanatory variable is $Myopia_{it}$, which represents the level of short-sightedness of managers in the sample enterprises; $Controls_{it}$ represents the control variable. In formula (2) we mainly focus on the size and sign of the coefficient of the explanatory variable. According to the hypothesis, the expected sign is significantly negative, that is, managers' short-sightedness will reduce the green innovation level of enterprises.

In order to verify hypothesis 3, this paper refers to the practice of Jiang Fuxiu et al. (2009) and establishes a model as shown in equation (3) to investigate the relationship between managers' overconfidence and enterprises' green innovation, where the explained variable is $\ln\text{GreTotal1}_{it}$, representing the enterprise's green innovation level; The explanatory variable is $Over_{it}$, which represents the degree of managers' overconfidence in the sample enterprises; Controls_{it} represents the control variable. In formula (1) we mainly focus on the size and sign of the coefficient of the explanatory variable. According to the hypothesis, we expect the sign to be significantly negative, that is, managers' overconfidence will also reduce the green innovation level of the firm.

In this paper, industry fixed effects (μ_{it}) and year fixed effects (τ_{it}) are controlled as much as possible in all regression models.

$$\ln\text{GreTotal1}_{it} = \alpha_0 + \alpha_1 \text{Mfee}_{it} + \sum_{j=2}^{11} \alpha_j \, Controls_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it} \qquad (1)$$

$$\ln\text{GreTotal1}_{it} = \beta_0 + \beta_1 \text{Myopia}_{it} + \sum_{j=2}^{11} \beta_j \, Controls_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it} \qquad (2)$$

$$\ln\text{GreTotal1}_{it} = \theta_0 + \theta_1 \text{Over}_{it} + \sum_{j=2}^{11} \theta_j \, Controls_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it} \qquad (3)$$

4. Empirical Test

4.1. Descriptive Statistics

Table 2 shows the main results of descriptive statistics. As can be seen from Table 2, the total sample size is 25367, the mean value of lnGreTotal1 is 0.46, the median is 0.00 and the maximum is 4.14, indicating that there is a large gap between the green innovation capability of Chinese enterprises and the green innovation level of most enterprises is relatively low. The mean of Mfee is 0.09, the median is 0.07 and the maximum is 16.61, indicating that there is a large gap in the degree of manager agency of listed enterprises in our country; Manager Myopia and manager overconfidence (Over) are in line with the available literature. The remaining control variables are within a reasonable range and will not be described here.

Table 2. Descriptive statistics

Variable	N	Mean	p50	SD	Min	Max
lnGreTotal1	25367	0.46	0.00	0.87	0.00	4.14
Mfee	25367	0.09	0.07	0.20	-0.76	16.61
Myopia	25367	0.00	0.00	0.00	0.00	0.01
Over	25367	0.48	0.00	0.50	0.00	1.00
Size	25367	22.25	22.07	1.32	19.41	26.43
Lev	25367	0.43	0.42	0.21	0.03	0.92
ROA	25367	0.04	0.04	0.07	-0.40	0.25
Cashflow	25367	0.05	0.05	0.07	-0.22	0.28
Growth	25367	0.19	0.12	0.42	-0.66	4.33
Dual	25367	0.29	0.00	0.46	0.00	1.00
TobinQ	25367	2.06	1.63	1.41	0.80	17.73
Balance1	25367	0.37	0.29	0.29	0.01	1.00
Top1	25367	0.34	0.320	0.15	0.08	0.76
Board	25367	2.13	2.20	0.20	1.61	2.71

4.2. Regression Analysis

Table 3 shows the main regression results of model (1), where column (1) shows the regression results of manager agency behavior on green innovation, column (2) shows the regression results of manager short-sightedness on green innovation, and column (3) shows the regression results of manager overconfidence on green innovation. From Table 3, it can be seen that the regression coefficient of manager agency (Mfee) is 0.069 and the T-value is 2.63, which is significantly positive at the 1% level, which validts hypothesis 1 in this paper, the regression coefficient of manager agency (MFEE) is -14.502, the T-value is -3.86, and the regression is significantly negative at the 1% level. This tests hypothesis 2 of this paper, the regression coefficient of manager overconfidence (Over) is -0.132, and the T-value is -12.79, which is negatively significant at the 1% level, which tests hypothesis 3 of this paper.

Table 3. Main regression

	(1)	(2)	(3)
	lnGreTotal1	lnGreTotal1	lnGreTotal1
Mfee	0.069***		
	(2.63)		
Myopia		-14.502***	
		(-3.86)	
Over			-0.132***
			(-12.79)
Size	0.186***	0.186***	0.177***
	(35.24)	(35.30)	(33.35)
Lev	0.150***	0.149***	0.138***
	(4.54)	(4.49)	(4.19)
ROA	0.769***	0.729***	0.683***
	(8.24)	(7.85)	(7.37)
Cashflow	-0.025	-0.019	-0.007
	(-0.31)	(-0.24)	(-0.09)
Growth	-0.060***	-0.066***	-0.058***
	(-4.82)	(-5.26)	(-4.68)
Dual	0.051***	0.047***	0.052***
	(4.50)	(4.18)	(4.60)
TobinQ	0.007	0.008*	0.010**
	(1.64)	(1.93)	(2.34)
Balance1	-0.010	-0.014	-0.007
	(-0.44)	(-0.63)	(-0.33)
_cons	-4.018***	-3.989***	-3.642***
	(-34.42)	(-34.30)	(-30.56)
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes
N	25367	25367	25367
r2	0.185	0.185	0.190
adj. R^2	0.183	0.183	0.188

Note: * p<0.1, ** p<0.05, *** p<0.01; t statistics in parentheses; The following table is the same.

4.3. Robustness Test

4.3.1. Lag One Phase of Explained Variables and Explanatory Variables

Table 4. Delayed one-phase test

	(1)	(2)	(3)	(4)	(5)	(6)
	l_lnGreTotal1	l_lnGreTotal1	l_lnGreTotal1	lnGreTotal1	lnGreTotal1	lnGreTotal1
Mfee	0.060**					
	(2.12)					
Myopia		-14.433***				
		(-3.45)				
Over			-0.130***			
			(-11.39)			
l_Mfee				0.107***		
				(3.14)		
l_Myo					-17.126***	
					(-4.24)	
l_Over						-0.130***
						(-11.45)
Size	0.193***	0.193***	0.184***	0.195***	0.195***	0.186***
	(32.76)	(32.82)	(31.17)	(33.35)	(33.38)	(31.57)
Lev	0.152***	0.150***	0.140***	0.147***	0.139***	0.129***
	(4.10)	(4.06)	(3.82)	(3.98)	(3.78)	(3.53)
ROA	0.499***	0.466***	0.419***	0.670***	0.626***	0.604***
	(4.78)	(4.49)	(4.05)	(6.46)	(6.07)	(5.86)
Cashflow	0.073	0.078	0.090	0.028	0.032	0.043
	(0.80)	(0.85)	(0.98)	(0.31)	(0.35)	(0.48)
Growth	-0.056***	-0.061***	-0.054***	-0.070***	-0.065***	-0.057***
	(-3.91)	(-4.31)	(-3.78)	(-4.86)	(-4.60)	(-4.04)
Dual	0.050***	0.047***	0.052***	0.048***	0.044***	0.050***
	(3.99)	(3.69)	(4.10)	(3.84)	(3.48)	(4.00)
TobinQ	0.011**	0.011**	0.013***	0.009*	0.010**	0.011**
	(2.27)	(2.47)	(2.85)	(1.93)	(2.22)	(2.45)
Balance1	-0.016	-0.020	-0.014	-0.018	-0.024	-0.017
	(-0.67)	(-0.83)	(-0.60)	(-0.75)	(-1.02)	(-0.71)
Top1	-0.091*	-0.094*	-0.072	-0.078	-0.085*	-0.060
	(-1.87)	(-1.93)	(-1.48)	(-1.62)	(-1.77)	(-1.23)
Board	0.096***	0.102***	0.047	0.125***	0.132***	0.083***
	(3.23)	(3.41)	(1.56)	(4.20)	(4.46)	(2.79)
_cons	-4.129***	-4.103***	-3.763***	-4.250***	-4.209***	-3.876***
	(-31.64)	(-31.56)	(-28.26)	(-32.75)	(-32.57)	(-29.31)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	21668	21668	21668	21668	21668	21668
r2	0.188	0.188	0.193	0.192	0.192	0.196
adj. R^2	0.186	0.187	0.191	0.190	0.190	0.195

In order to further ensure the robustness of the results and mitigate the influence of endogeneity on the conclusion of this paper to a certain extent, the explained variables with a one-stage lag are used for regression. The regression results are shown in columns (1), (2) and (3) of Table 4. It can be seen that, The regression coefficient of one-stage lag between l_lnGreTotal1 and Mfee is 0.06, and the T-value is 2.12, and there is a significant positive correlation at 5% level, indicating that the higher the level of manager agency, the more inclined to carry out enterprise green innovation. Regression coefficients for corporate green innovation (l_lnGreTotal1) being one year behind are -14.433 and -0.130 from managers' Myopia and -3.45 and -11.39 from managers' overconfidence, and significantly negatively correlated at the 1% level. This proves that the higher the level of myopia and overconfidence of managers, the lower the level of green innovation of enterprises, which proves that the conclusion of the article has a certain robustness.

In addition, explanatory variables with one-stage lag are used for regression in this paper. The regression results are shown in columns (4), (5) and (6) of Table 4. It can be seen that the regression coefficient between l_Mfee and lnGreTotal1 is 0.107, and the T-value is 3.14. And there is a significant positive correlation at the level of 1%. The regression coefficients of manager myopia (l_Myo) lagging one stage, manager overconfidence (l_Over) and lnGreTotal1 are -17.126 and -0.130 respectively, and the T-values are -4.24 and -11.45 respectively, and the correlation is significantly negative at 1% level. This proves that the conclusions of this paper are robust to a certain extent.

4.3.2. Replace the Explained Variables

This paper further takes substitution of explained variables for robustness test. According to Xu Jia, Cui Jingbo (2020); According to the research of Wang Xin and Wang Ying (2021) and the Green List of International Patent Classification issued by the World Intellectual Property Organization (WIPO) in 2010, the number of green patent applications of enterprises in that year was further subdivided into the number of green invention patent applications and the number of green practical patent applications. While green invention patents (lnGreInvia1) focus on reflecting the "quantity" of enterprises' green innovation, and green practical patents (lnGreUmia1) focus on reflecting the "quality" of enterprises' green innovation. Consistent with the above, in order to eliminate the influence of the right distribution of patent data, the number of green invention patent applications and green utility patent applications is added to the natural logarithm to replace the explained variable to perform robustness test.

The robustness test results of the replacement explained variables are shown in Table 5. It can be seen that the regression coefficients of the management agent for lnGreInvia1 and lnGreUmia1 are 0.070 and 0.023 respectively, and the T-values are 3.28 and 3.30 respectively, and there is a significant positive correlation at the level of 1%. The regression coefficient of managers' myopia for lnGreInvia1 is -7.251 and T-value is -2.35, which is significantly negatively correlated at 5% level; the regression coefficient for lnGreUmia1 is -12.059 and T-value is -4.31, which is significantly negatively correlated at 1% level. The regression coefficients of managers' overconfidence on lnGreInvia1 and lnGreUmia1 are -0.101 and -0.068 respectively, and the T-values are -11.91 and -9.45 respectively, and the correlation is significantly negative at the 1% level. The main conclusions of this paper have not changed, which proves that the conclusions of this paper have a certain robustness.

Table 5. Replaces the test of explained variables

	(1)	(2)	(3)	(4)	(5)	(6)
	lnGreInvia1	lnGreInvia1	lnGreInvia1	lnGreUmia1	lnGreUmia1	lnGreUmia1
Mfee	0.070***			0.023***		
	(3.28)			(3.30)		
myopia		-7.251**			-12.059***	
		(-2.35)			(-4.31)	
Over			-0.101***			-0.068***
			(-11.91)			(-9.45)
Size	0.165***	0.164***	0.157***	0.106***	0.106***	0.101***
	(38.04)	(37.98)	(36.20)	(22.24)	(22.45)	(21.30)
Lev	0.075***	0.071***	0.064**	0.124***	0.125***	0.118***
	(2.75)	(2.60)	(2.36)	(5.72)	(5.77)	(5.48)
ROA	0.550***	0.517***	0.477***	0.413***	0.392***	0.373***
	(7.18)	(6.78)	(6.28)	(7.00)	(6.67)	(6.35)
Cashflow	-0.040	-0.041	-0.028	0.028	0.036	0.038
	(-0.61)	(-0.62)	(-0.43)	(0.53)	(0.68)	(0.73)
Growth	-0.047***	-0.051***	-0.046***	-0.036***	-0.039***	-0.034***
	(-4.60)	(-4.97)	(-4.53)	(-4.70)	(-5.18)	(-4.55)
Dual	0.048***	0.046***	0.049***	0.030***	0.028***	0.031***
	(5.15)	(4.94)	(5.24)	(3.73)	(3.37)	(3.80)
TobinQ	0.014***	0.015***	0.016***	-0.003	-0.003	-0.002
	(4.09)	(4.48)	(4.87)	(-1.43)	(-1.28)	(-0.89)
Balance1	-0.006	-0.008	-0.004	0.016	0.012	0.017
	(-0.33)	(-0.43)	(-0.22)	(1.04)	(0.79)	(1.12)
Top1	-0.089**	-0.093***	-0.073**	0.020	0.017	0.031
	(-2.48)	(-2.58)	(-2.04)	(0.61)	(0.53)	(0.97)
Board	0.083***	0.086***	0.046**	0.065***	0.069***	0.040*
	(3.75)	(3.89)	(2.08)	(3.11)	(3.28)	(1.88)
_cons	-3.584***	-3.557***	-3.291***	-2.311***	-2.300***	-2.121***
	(-37.42)	(-37.26)	(-33.64)	(-21.74)	(-21.70)	(-19.73)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	25367	25367	25367	25367	25367	25367
r2	0.163	0.163	0.168	0.163	0.164	0.166
adj. R^2	0.162	0.162	0.166	0.162	0.163	0.165

4.3.3. Tend to Score Matches

In order to overcome the influence of sample self-selection on the conclusion of this paper, this paper adopts the propensity score matching (PSM) method, takes the median sample of manager agency and manager myopia as the standard, defines the experimental group of manager agency and manager myopia higher than the median sample, and defines the overconfidence value of 1 as the experimental group. With reference to the research of Li Qingyuan and Xiao Zehua (2020), Select company Size (Size), asset-liability ratio (Lev), net profit rate on total assets (ROA), cash flow ratio (Cashflow), operating income Growth rate (Growth), Dual value (TobinQ), equity balance degree (Balance1), shareholding ratio of the largest shareholder (Top1) and the number of directors (Board) were taken as covariables, and the definitions of specific variables were shown in Table 6. Then, one-to-one nearest distance matching is performed, and finally regression is performed with matched samples. The

regression results are shown in Table 6. It can be seen that The regression coefficient of manager agency (Mfee) and corporate green innovation (lnGreTotal1) is 0.071, significantly positive correlation at 5% level, the regression coefficient of manager Myopia and corporate green innovation (lnGreTotal1) is -13.560, significantly negative correlation at 5% level, The regression coefficient between managers' overconfidence and corporate green innovation (lnGreTotal1) is -0.133 and significantly negative at 1%, indicating that none of the main conclusions of the article have changed.

Table 6. Matching propensity scores

	(1)	(2)	(3)
	lnGreTotal1	lnGreTotal1	lnGreTotal1
Mfee	0.071**		
	(2.31)		
Myopia		-13.560**	
		(-2.53)	
Over			-0.133***
			(-9.72)
Size	0.168***	0.186***	0.164***
	(16.73)	(20.83)	(18.22)
Lev	0.221***	0.134***	0.220***
	(4.70)	(3.15)	(5.16)
ROA	0.809***	0.784***	0.890***
	(5.93)	(6.68)	(7.38)
Cashflow	-0.034	-0.068	-0.055
	(-0.31)	(-4.62)	(-0.54)
Growth	-0.061***	-0.068***	-0.070***
	(-3.75)	(-4.62)	(-4.72)
Dual	0.055***	0.055***	0.047***
	(3.17)	(3.50)	(2.99)
TobinQ	0.006	0.007	0.005
	(0.95)	(1.52)	(1.03)
Balance1	-0.003	-0.016	-0.012
	(-0.09)	(-0.57)	(0.42)
Top1	0.017	-0.141**	-0.040
	(0.25)	(-2.32)	(-0.66)
Board	0.045	0.151***	0.048
	(1.04)	(3.84)	(1.18)
_cons	-3.530***	-4.038***	-3.381***
	(-15.69)	(-19.93)	(-16.61)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	11224	13512	13056
r2	0.172	0.190	0.180
adj. R^2	0.169	0.187	0.177

5. Further Analysis

The above regression analysis and a series of robustness tests have verified the relationship between managers' behavior and corporate green innovation. This part further discusses the role of managers' myopia and managers' overconfidence under irrational assumptions on corporate green innovation from three perspectives: corporate governance level, financing constraints and ESG performance within the company. How to further promote corporate green innovation?

5.1. Corporate Governance Level

Table 7. Moderating effect -- Corporate governance

	(1)	(2)	(3)	(4)
	CG_dum2_0	CG_dum2_1	CG_dum2_0	CG_dum2_1
Myopia	-28.827***	-5.832		
	(-4.90)	(-1.08)		
Over			-0.122***	-0.148***
			(-8.51)	(-9.94)
Size	0.174***	0.199***	0.164***	0.191***
	(16.82)	(22.08)	(15.99)	(20.99)
Lev	0.215***	0.063	0.199***	0.059
	(5.00)	(1.35)	(4.68)	(1.26)
ROA	0.851***	0.587***	0.811***	0.533***
	(8.30)	(4.06)	(7.94)	(3.72)
Cashflow	-0.224**	0.244**	-0.211**	0.254**
	(-2.13)	(2.19)	(-2.01)	(2.29)
Growth	-0.081***	-0.056***	-0.069***	-0.053***
	(-5.89)	(-3.43)	(-5.08)	(-3.24)
Dual	0.046***	0.051*	0.047***	0.053**
	(3.34)	(1.89)	(3.44)	(1.98)
TobinQ	0.008*	0.006	0.010**	0.008
	(1.69)	(1.15)	(2.08)	(1.46)
Balance1	-0.043	0.013	-0.034	0.017
	(-1.44)	(0.42)	(-1.18)	(0.55)
Top1	-0.098	-0.038	-0.060	-0.011
	(-1.44)	(-0.58)	(-0.89)	(-0.17)
Board	0.037	0.289***	-0.005	0.242***
	(0.96)	(4.70)	(-0.12)	(3.94)
_cons	-3.454***	-4.735***	-3.157***	-4.394***
	(-14.42)	(-20.34)	(-13.22)	(-18.70)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	12346	12347	12346	12347
r2	0.149	0.225	0.153	0.231
adj. R^2	0.1464	0.2224	0.1498	0.2280
Experience P- value	0.000		0.010	

The median level of corporate governance is used as the standard to divide, and the value above the median is assigned as 1, otherwise 0, and then regression is performed. Columns (1) and (2) in Table 7 respectively show the regression results of managers' short-sightedness on

corporate green innovation under different corporate governance levels. In the case of good corporate governance level, the regression coefficient of lnGreTotal1 is -28.827, with a significant negative correlation at 1% level. When the corporate governance level is poor, the regression coefficient of corporate green innovation (lnGreTotal1) is -5.832, and it is not correlated, and the empirical p value is 0.000, and the coefficient difference between groups is significant. It shows that improving corporate governance level can alleviate the restraining effect of managers' short-sightedness on corporate green innovation. Columns (3) and (4) respectively show the regression results of managers' overconfidence on corporate green innovation under different corporate governance levels. When corporate governance level is good, the regression coefficient of corporate green innovation (lnGreTotal1) is -0.122, with a significant negative correlation at 1% level. In the case of poor corporate governance level, the regression coefficient of corporate green innovation (lnGreTotal1) is -0.148, which is significantly negatively correlated at 1% level, and the empirical p value is 0.010, with significant differences between groups. It shows that when corporate governance level is good, managers' overconfidence has a more obvious inhibiting effect on corporate green innovation.

5.2. Financing Constraints

Table 8. Moderating effect -- financing constraint

	(1)	(2)	(3)	(4)
	FC_dum2_0	FC_dum2_1	FC_dum2_0	FC_dum2_1
Myopia	-20.578***	-12.077**		
	(-4.51)	(-1.97)		
Over			-0.088***	-0.203***
			(-7.11)	(-12.35)
Size	0.147***	0.230***	0.138***	0.218***
	(12.99)	(21.74)	(12.27)	(20.70)
Lev	0.226***	0.182***	0.215***	0.175***
	(5.60)	(3.51)	(5.34)	(3.38)
ROA	0.719***	0.741***	0.703***	0.652***
	(7.18)	(5.27)	(7.04)	(4.66)
Cashflow	-0.188**	0.259**	-0.191**	0.287**
	(-2.01)	(2.14)	(-2.04)	(2.39)
Growth	-0.049***	-0.081***	-0.040***	-0.073***
	(-3.49)	(-5.31)	(-2.90)	(-4.85)
Dual	0.040***	0.057***	0.042***	0.071***
	(3.10)	(2.68)	(3.27)	(3.31)
TobinQ	0.003	0.015***	0.005	0.017***
	(0.71)	(2.72)	(0.98)	(3.15)
Balance1	0.030	-0.071**	0.039	-0.066*
	(1.17)	(-2.05)	(1.50)	(-1.92)
Top1	-0.037	-0.153**	-0.006	-0.126*
	(-0.64)	(-2.23)	(-0.11)	(-1.85)
Board	0.051	0.197***	0.009	0.121**
	(1.52)	(4.18)	(0.27)	(2.57)
_cons	-2.953***	-5.254***	-2.684***	-4.782***
	(-12.00)	(-21.08)	(-10.89)	(-19.06)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	13623	11744	13623	11744
r2	0.110	0.239	0.112	0.248
adj. *R²*	0.1075	0.2367	0.1096	0.2456
Experience P- value	0.010		0.000	

Take the median of the FC index as the standard to divide, assign the value higher than the median as 1, otherwise 0, and then perform regression. Columns (1) and (2) in Table 8 respectively show the regression results of managers' shortsightedness on corporate green innovation under different levels of financing constraints. In the case of low financing constraints, the regression coefficient of lnGreTotal1 is -20.578, with a significant negative correlation at 1% level. In the case of high financing degree, the regression coefficient of corporate green innovation (lnGreTotal1) is -12.077, and the correlation is negative at 5% level. The empirical p value is 0.010, and the coefficient difference between groups is significant. This indicates that the impact of managers' short-sightedness on corporate green innovation is more obvious when the degree of financing constraint is low. Columns (3) and (4) respectively show the regression results of managers' overconfidence on corporate green innovation under different levels of financing constraints. In the case of low financing constraints, the regression coefficient of corporate green innovation (lnGreTotal1) is -0.088, with a significant negative correlation at the level of 1%. In the case of high degree of financing constraint, the regression coefficient of lnGreTotal1 is -0.203, with a significant negative correlation at 1% level. The empirical p value is 0.000, and the coefficient difference between groups is significant. It shows that the influence of managers' overconfidence on corporate green innovation is more obvious when the degree of financing constraint is high.

5.3. ESG Performance Within the Company

Table 9. Moderating effect -- internal ESG performance

	(1)	(2)	(3)	(4)
	ESG_dum2_0	ESG_dum2_1	ESG_dum2_0	ESG_dum2_1
Myopia	-9.069	-24.043***		
	(-1.38)	(-5.19)		
Over			-0.147***	-0.121***
			(-8.82)	(-9.48)
Size	0.200***	0.134***	0.193***	0.124***
	(20.21)	(15.69)	(19.50)	(14.55)
Lev	0.250***	0.123***	0.229***	0.113***
	(4.38)	(3.37)	(4.02)	(3.11)
ROA	0.744***	0.650***	0.712***	0.615***
	(4.45)	(6.76)	(4.27)	(6.43)
Cashflow	-0.045	0.012	-0.031	0.019
	(-0.37)	(0.12)	(-0.25)	(0.20)
Growth	-0.097***	-0.040***	-0.094***	-0.030**
	(-5.62)	(-3.11)	(-5.48)	(-2.33)
Dual	0.060***	0.040***	0.066***	0.044***
	(2.93)	(2.92)	(3.20)	(3.23)
TobinQ	-0.005	0.008*	-0.003	0.010**
	(-0.74)	(1.95)	(-0.52)	(2.28)
Balance1	0.042	-0.063**	0.040	-0.051**
	(1.16)	(-2.43)	(1.14)	(-1.97)
Top1	-0.188***	-0.021	-0.176**	0.018
	(-2.67)	(-0.36)	(-2.50)	(0.32)
Board	0.107**	0.140***	0.051	0.087**
	(2.18)	(4.11)	(1.04)	(2.52)
_cons	-4.308***	-2.847***	-3.984***	-2.518***
	(-19.14)	(-14.89)	(-17.52)	(-13.06)
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	10476	14554	10476	14554
r2	0.258	0.125	0.263	0.129
adj. R^2	0.255	0.123	0.260	0.126
Experience P- value	0.000		0.000	

The median ESG score of China Securities was used as the standard for division, and the value higher than the median was assigned as 1, otherwise 0, and then regression was carried out. Columns (1) and (2) in Table 9 respectively show the regression results of managers' short-sightedness on corporate green innovation under different ESG performance. In the case of good ESG performance within the company, the regression coefficient of lnGreTotal1 is -24.043, with a significant negative correlation at 1% level. In the case of poor internal ESG performance, the regression coefficient of lnGreTotal1 is -9.069, which is not correlated, and the empirical p value is 0.000, with significant difference between groups. This indicates that the impact of managers' short-sightedness on corporate green innovation is more obvious when the internal ESG performance is better. Columns (3) and (4) respectively show the regression results of managers' overconfidence on corporate green innovation under different ESG performance. When the internal ESG performance is good, the regression coefficient of corporate green innovation (lnGreTotal1) is -0.121, with a significant negative correlation at 1% level. In the case of poor ESG performance within the company, the regression coefficient of lnGreTotal1 is -0.147, with a significant negative correlation at 1% level. The empirical p value is 0.000, and the coefficient difference between groups is significant. This indicates that the influence of managers' overconfidence on corporate green innovation is more obvious when the internal ESG performance is poor.

6. Conclusion and Enlightenment

Giving consideration to green development and innovative development, green innovation is an important driving force to achieve China's high-quality development and sustainable development. Based on A sample of China's A-share listed companies from 2009 to 2021, this paper studies the impact of manager agency behavior under rational assumptions and manager short-sighted and overconfidence under irrational assumptions on corporate green innovation. It is found that manager agency behavior under rational assumption will promote the green innovation of enterprises, while manager short-sightedness and manager overconfidence under irrational assumption will inhibit the green innovation of enterprises. This conclusion remains valid after a series of robustness tests, such as replacement of explained variables, PSM and one-stage lag. The extended analysis found that by easing the degree of financing constraints, improving the level of internal governance and ESG performance of the company, the inhibition effect of managers' short-sightedness and managers' overconfidence on corporate green innovation could be eased. This is of great significance for enterprises to respond to the call of the state and accelerate green transformation and green development. According to the conclusions of the above empirical analysis, the implications of this paper are as follows:

(1) Green innovation is of great significance for achieving the goal of high-quality economic development, sustainable development and "double carbon" in China. Enterprise is an important subject to achieve the goal of double carbon, and the management is an important decision maker of enterprise strategy, responsible for the operation and management of the enterprise, the different psychological characteristics of managers affect the future development of the enterprise, and may even determine the survival of the enterprise. Therefore, the management should have a long-term vision, adhere to the concept of long-term development. This also has some practical implications for enterprises, that is, when selecting managers, enterprises should pay attention to not only their personal professional ability, but also their psychological characteristics and the characteristics of time cognition.

(2) The internal governance of enterprises plays an important role in green innovation. Enterprises should further improve the corporate governance mechanism, formulate a governance structure in line with their own characteristics, improve the level of corporate

governance, and give full play to the supervisory role. Good ESG performance can ease the degree of financing constraints of enterprises, and then promote corporate green innovation. While focusing on their own development, enterprises should also fulfill their social responsibilities and improve their reputation. The sustainable development of enterprises cannot be separated from ESG governance.

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