Directors' and Officers' Liability Insurance and Corporate Carbon Performance

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Abstract: Currently, global climate change is becoming increasingly severe. Under the urgent situation of global response to climate change, corporate carbon performance has become a key indicator to measure the ability of sustainable development and fulfillment of corporate social responsibility. As the core force in corporate strategic decision-making, directors and senior managers have important responsibilities in addressing corporate carbon risks and improving carbon performance. However, they face many uncertainties and legal risks in the course of fulfilling these responsibilities. Directors and officers liability insurance has emerged as an important enterprise risk management tool. Using the panel data of listed companies from 2013-2023 as the research samples, this paper empirically investigates the relationship between the directors' and officers' liability insurance and the carbon performance of enterprises and its mechanism of action, and the study shows that the directors' and officers' liability insurance has a significant positive contribution to the carbon performance of enterprises. Green technology innovation plays a mediating role in the relationship between directors' liability insurance and corporate carbon performance. Heterogeneity analysis reveals that directors' liability insurance has a more significant effect on carbon performance in non-state-owned enterprises than in state-owned enterprises.

***Keywords*:** Carbon performance; Director's insurance; Green technology innovation; Financing constraints

1. Introduction

In 2024, the CPC Central Committee and the State Council issued the "Opinions on Accelerating Comprehensive Green Transformation of Economic and Social Development", which pointed out that it is necessary to "implement a comprehensive conservation strategy", "promote the transformation and upgrading of traditional industries in a green and low-carbon manner". Vigorously promote energy saving, carbon reduction and efficiency". In the context of comprehensive green transformation of the economy, enterprises need executives to actively make decisions on green and low-carbon transformation, and promote the improvement of corporate carbon performance from the internal governance level[1]. However, the modern enterprise property right system has led to the separation of ownership and operation rights, which has exacerbated the moral hazard of enterprise management and the "tunnel-visioning" of small and medium-sized shareholders by ultimate shareholders, and seriously harmed the legitimate rights and interests of enterprises and small and medium-sized shareholders. Therefore, incentives and behavioral constraints for executives are the key to promoting low-carbon transformation of enterprises. In addition, even if directors and executives fulfill their duties conscientiously, there are still problems such as strategic decision-making errors, which damage the value of the enterprise, and then they are forced to face the risk of shareholder lawsuits and huge compensation liabilities. This series of occupational risks can seriously affect the motivation of corporate management to perform their duties boldly in the course of practicing their profession, making them often hesitant to promote carbon emission reduction initiatives and preventing them from fully utilizing their talents to create more value for the enterprise. With the urgent needs of economic development, directors' liability insurance was born. Directors' liability insurance can not only transfer the practice risk of enterprise management in the process of operation and management to a certain extent, but also motivate them to be more active and enterprising in the process of operation and management in different degrees, so that their talents can be fully utilized and the value of the company can be significantly enhanced. Directors' liability insurance started late in China; In 2002, Ping An Insurance and Chubb Insurance Group launched the first Chinese-language directors' and officers' liability insurance in China, and Wang Shi, the founder of Vanke Group, became the first buyer of directors' liability insurance in China, after which a number of insurance companies launched directors' and officers' liability insurance one after another. With the development of directors' liability insurance in China, domestic scholars' research on directors' liability insurance is increasing, and scholars' research is gradually transitioning from theoretical research to empirical testing. This paper enriches the research results on the economic consequences of directors' liability insurance. It also expands the research results on the quantitative factors affecting corporate carbon performance.

2. Research hypothesis

The management incentive hypothesis suggests that director's liability insurance reduces management's practice risk, risk aversion, and stimulates their motivation to perform their duties, so that managers are less likely to turn down risky but valuable projects, which enhances the value of the company and promotes carbon performance[2]. First, directors' liability insurance increases executives' willingness to take risks. Directors' liability insurance shares the risk of personal liability that directors and executives need to bear due to decision-making errors, so that they have more courage to take risks when making and promoting decisions such as carbon emission reduction strategies, and do not have to worry about huge losses of personal property due to decision-making failures. When considering investing in new carbon emission reduction technology research and development projects, the existence of director's liability insurance will make management more willing to approve projects that have long-term carbon emission reduction benefits but higher short-term risks[3], thus accelerating the pace of corporate carbon emission reduction technological innovation, and helping to enhance corporate carbon performance. Second, the purchase of director's liability insurance prompts enterprises to pay more attention to corporate governance and risk management, which in turn influences their carbon strategy decisions. Enterprises can increase their investment in the research and development of clean energy technologies, the purchase of energy-saving and emission reduction equipment, and the training of employees in carbon emission reduction, so as to improve the overall carbon emission reduction capability and carbon performance level of the enterprise. The external monitoring hypothesis suggests that a company's purchase of directors' and officers' liability insurance indirectly promotes corporate carbon performance through the insurance company's monitoring of management to prevent management from engaging in environmentally damaging behaviors[4]. Directors' liability insurance is introduced into corporate governance as an external monitoring mechanism, which conveys to the outside world the signal that the company actively governs and pays attention to risk prevention and control, and helps to establish a good reputation in the market. In terms of carbon performance, such a good reputation can enable enterprises to build up an image of actively addressing carbon risks and committing to sustainable development in the minds of consumers, investors and other stakeholders[5]. Therefore, this paper proposes the following hypotheses:

H1: Directors' and officers' liability insurance improves corporate carbon performance.

Green technology innovation plays a mediating role in the study of the relationship between directors' liability insurance and corporate carbon performance. On the one hand, directors' liability insurance provides an effective risk-sharing mechanism for corporate directors and executives [6]. In the process of green technology innovation, it is often faced with many uncertainties, such as the risk of possible failure in the development of new technologies, and the difficulty of predicting market acceptance after the application of new technologies. The existence of directors' liability insurance reduces the personal legal liabilities and economic losses that directors and executives may bear due to the fear of these risks, which makes them more willing to approve and promote green technology innovation projects, and to increase the financial investment in green technology R&D, manpower deployment and other resource inputs, so as to promote the development of green technology innovation activities. On the other hand, the purchase of director's liability insurance by enterprises helps to send positive governance and risk control signals to the outside world, which is advantageous for attracting professionals with green technology innovation ability. Excellent researchers and engineers are more willing to join enterprises with director's liability insurance and standardized management. To summarize, director's liability insurance promotes green technology innovation activities by reducing the risk of enterprise green technology innovation and attracting related resources. The direct emission reduction and resource utilization efficiency improvement brought by green technology innovation activities further improve the carbon performance of enterprises.

H2: Directors and Officers Liability Insurance Enhances Corporate Carbon Performance Levels by Promoting Green Technology Innovation.

3. Empirical research design

In this paper, China's A-share listed companies in Shanghai and Shenzhen from 2013 to 2023 were selected as a sample to carry out empirical research on the impact of directors' and officers' liability insurance on the level of carbon performance of enterprises in China. The initial data were processed as follows: (1) excluding the samples from the financial industry and the insurance industry; (2) excluding the samples of ST and *ST companies; (3) excluding the sample companies with missing key variables; (4) Wnsorize the tails of all the continuous variables at the 1% and 99% levels in order to eliminate the effects of extreme values and outliers on the regression model. The data on directors' insurance involved in this paper are manually collated from board of directors' announcements, reports of shareholders' meeting resolutions, and annual reports. Industry carbon emissions are obtained from the CSMAR database.

3.1 Measurement of variables

3.1.1 Explanatory variables

In this paper, whether to purchase or not to purchase is selected as the measurement variable of directors' liability insurance. A dummy variable is used to represent whether or not director's insurance is purchased. It takes the value of 1 if the company has purchased directors' liability insurance for the current year and 0 otherwise.

3.1.2 Explained Variables

Carbon Performance (CP). Drawing on the practice of Yan Huahong et al. to divide carbon emissions[7] by operating income per million, i.e., income per unit of carbon emissions as a measure of carbon performance, the larger the value, the better the carbon performance. Since the carbon emissions data of Chinese enterprises cannot be obtained directly, the operating cost is borrowed to estimate the carbon emissions of enterprises from the industry carbon emissions. The data of industry carbon emissions are from CSMAR database.

Corporate Carbon Performance = Corporate Revenue / Corporate Carbon Emissions

Corporate Carbon Emissions = (Industry Carbon Emissions * Corporate Operating Costs) / Industry Operating Costs

3.1.3 Mediating variables

Green technological innovation (GI), this paper selects the number of green patent applications as a measure of green technological innovation.

3.1.4 Control variables

With reference to previous studies on carbon performance, this paper selects the following control variables: board size, firm size, operating cash flow, capital intensity, gearing ratio, profitability and equity concentration, and the nature of property rights. Meanwhile, in order to reduce the impact of industry and economic form on carbon performance, this paper controls the dummy variables Year and Industry.

3.2 Model construction

Through the above assumptions and analysis, a main effect model is first constructed to examine the effect of directors' insurance on corporate carbon performance.

$$CP_{it} = \alpha_1 + \alpha_2 Doins_{it} + \sum Control_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (1)$$

In order to test the mediating role of green technology innovation between directors' insurance and corporate carbon performance, the following model is constructed:

$$GI_{it} = \alpha_1 + \alpha_2 Doins_{it} + \sum Control_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (2)$$

$$CP_{it} = \alpha_1 + \alpha_2 Doins_{it} + \alpha_3 GI_{it} + \sum Control_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (3)$$

4. Empirical testing and analysis of results

4.1 Descriptive statistical analysis

Table 1 shows the descriptive statistical characteristics of directors' liability insurance, corporate carbon performance and other control variables. From the descriptive statistical results, it can be seen that: (1) the mean value of carbon performance of listed companies is 10.68, the median is 11.07, which is at a higher level, and the standardized chi-squared deviation is 1.138, with a maximum of 16 and a minimum of 7.705, which shows that the level of carbon performance varies greatly among the sample companies. (2) The mean value of listed companies taking out director's liability insurance is 0.083, indicating that the recognition of listed companies in China for director's liability insurance is relatively low, and the proportion of insurance is less than 10%. Compared with the high insurance rate in foreign capital markets, directors' liability insurance has great development prospects in China.

Table 1. Descriptive statistics

variant	sample size	average value	upper quartile	(statistics) standard deviation	maximum values	minimum value
CP	21220	10.68	11.07	1.138	16.00	7.705
Doins	21220	0.0830	0	0.276	1	0
Age	21220	2.881	2.944	0.329	3.611	1.386
Roe	21220	0.0800	0.0800	0.107	0.414	-0.962

variant	sample size	average value	upper quartile	(statistics) standard deviation	maximum values	minimum value
Growth	21220	0.168	0.117	0.335	3.808	-0.653
Board	21220	2.113	2.197	0.195	2.708	1.609
Dual	21220	0.330	0	0.470	1	0
Top1	21220	0.343	0.323	0.145	0.758	0.0810
Size	21220	22.11	21.89	1.236	26.43	19.59

4.2 Multiple regression analysis

4.2.1 Director's insurance and carbon performance

The first column of Table 3.2 shows the regression results of directors' liability insurance on corporate carbon performance. From the test results, it can be seen that the regression coefficient of directors' liability insurance on corporate carbon performance is 0.1049, which is positive and significant at 1% level, indicating that corporate directors' liability insurance can promote corporate carbon performance, which verifies the research hypothesis 1 of this paper, and indicates that corporations can effectively share the pressure of operation and decision-making of directors and senior executives through the directors' liability insurance, which promotes the enthusiasm of directors and senior executives, and alleviates the principal-agent problem to a certain extent. It shows that enterprises can effectively share the operating pressure and decision-making pressure of directors and executives through taking out directors' liability insurance, and promote the motivation of directors and executives, which alleviates the principal-agent problem to a certain extent.

4.2.2 The mediating role of green technology innovation

The second column of Table2 shows the results of the impact of directors' liability insurance on enterprises' green technological innovation. From the test results, it can be seen that the insured status of director's liability insurance is significant at 1% level on the green technology innovation of enterprises, with a coefficient of 0.0744, which indicates that the insured status of director's liability insurance can promote enterprises to carry out green technology innovation. The third column adds the variable of green technology innovation, and the results show that the regression coefficient of director's insurance on carbon performance decreases from 0.1049 to 0.1002 and is significant at the 1% level, indicating that green technology innovation plays a mediating role in the process of the influence of director's insurance on the carbon performance of enterprises.

Table 2. Regression results

	(1)	(2)	(3)
	CP	GI	CP
Doins	0.1049***	0.0744***	0.1002***
	(4.1133)	(3.5380)	(3.9362)
GI			0.0627***
			(7.5382)
FirmAge	-0.1565***	-0.1815***	-0.1452***
	(-6.7474)	(-9.4866)	(-6.2548)
ROE	1.0646***	0.3439***	1.0430***
	(16.2022)	(6.3435)	(15.8789)
Growth	-0.0126	-0.0859***	-0.0072
	(-0.5944)	(-4.9035)	(-0.3412)
Board	-0.2014***	0.0723**	-0.2058***
	(-5.4860)	(2.3877)	(-5.6144)
Dual	0.1313***	0.0550***	0.1278***
	(8.9558)	(4.5513)	(8.7295)
Top1	-0.1759***	-0.0465	-0.1729***
	(-3.6921)	(-1.1841)	(-3.6344)
Size	-0.1407***	0.2096***	-0.1538***
	(-22.2810)	(40.2358)	(-23.5122)
	(12.1253)	(2.7817)	(11.9962)

	(1)	(2)	(3)
	CP	GI	CP
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
_cons	13.3240 ***	-4.1272 ***	13.5828 ***
	(82.5670)	(-31.0007)	(82.4324)
N	21220	21240	21220
adj. R2	0.283	0.140	0.285

4.3 Robustness tests

Considering that there may be a causal relationship between directors' liability insurance subscription and corporate carbon performance, this paper selects the number of independent directors with overseas working background (Oversea_IND) as an instrumental variable, and conducts regression analysis using the two-stage least squares (2SLS) method. Independent directors with overseas working background know more about the operation mechanism of director's liability insurance, not only have higher awareness of practice risk avoidance but also know how to use director's liability insurance to avoid the performance risk in their work, theoretically, independent directors with overseas working background will not have a direct impact on the choice of corporate R&D accounting policy. The results are shown in Table 3, the number of independent directors with overseas working background and directors' liability insurance are significant at 1% level, indicating that the instrumental variables have good explanatory power. According to the results of the second-stage regression, the regression coefficient of directors' liability insurance on corporate carbon performance is 1.8536, which is significant at the 1% level and the baseline regression result is robust after considering the endogeneity issue.

Table 3. Instrumental Variable Method

	(1)	(2)
	Doins	CP
Ovesea_IND	0.0375 (***	
	(11.34)	
Doins		1.8536 ***
		(5.5189)
FirmAge	0.0482 ***	-0.2255***
	(8.37)	(-7.2694)
ROE	-.0985 ***	1.2702 ***
	(-4.67)	(13.1510)
Growth	-0.0020	-0.0054
	(-0.33)	(-0.2066)
Board	0.0061	-0.2254 ***
	(0.61)	(-5.4630)
Dual	-0.0160***	0.1635 ***
	(-4.66	(9.6108)
Top1	-0.0048	-0.1586 ***
	(-0.37)	(-2.8894)
Size	0.0514 ***	-0.2381***
	(24.32)	(-12.2443)
_cons	-1.1064	15.3677 ***
	-20.95	(36.2043)
N	20297	20297
adj. R2	0.123	0.131

4.4 Heterogeneity test

In studying the conditions of different property rights nature, this paper divides the sample data into state-owned

enterprises and non-state-owned enterprises shows the effect of property rights nature on directors' liability insurance and corporate carbon performance. The results show that the coefficient of director's liability insurance on corporate carbon performance of state-owned enterprises is 0.0844, which is significant at the 5% level. The coefficient of directors' liability insurance on corporate carbon performance of non-state-owned enterprises is 0.1803, which is significant at 1% level. It shows that compared with state-owned enterprises, director's liability insurance plays the role of incentive and supervision more effectively in non-state-owned enterprises and promotes the level of corporate carbon performance.

Table 4. Regression results for subgroups on the nature of property rights

	(1)	(2)
	state enterprise	non-state enterprise
Doins	0.0844**	0.1803***
	(2.2662)	(5.0048)
FirmAge	-0.1288**	-0.0948***
	(-2.4407)	(-3.5770)
ROE	1.7700***	0.7593***
	(13.2665)	(9.8120)
Growth	-0.1316***	-0.0073
	(-2.9793)	(-0.2988)
Board	0.0494	-0.1877***
	(0.6960)	(-4.2983)
Dual	0.1583***	0.0869***
	(3.5910)	(5.3984)
Top1	-0.3694***	0.1607***
	(-3.9286)	(2.7887)
Size	-0.1666***	-0.0859***
	(-14.8506)	(-10.2326)
Year	Yes	Yes
Industry	Yes	Yes
_cons	13.3033***	12.0541***
	(44.6215)	(54.9796)
N	5518	15281
adj. R2	0.328	0.222

5. Conclusions and recommendations of the study

The study finds that directors' liability insurance has a significant positive effect on corporate carbon performance. Green technology innovation plays a mediating role in the relationship between directors' liability insurance and corporate carbon performance. The heterogeneity test shows that the directors' liability insurance has a more obvious effect on carbon performance in non-state-owned enterprises compared with the management of state-owned enterprises. The government should further improve relevant laws and regulations and strengthen policy incentives and guidance. Enterprises can utilize the opportunity of purchasing director's liability insurance to further improve their corporate governance structure.

References

[1] Zhu Weihua, Tang Hongju, Yang Yifei. How capital market participants influence corporate carbon performance — Based on the perspective of institutional investors [J]. New Finance, 2025, (02): 69-79.

[2] LEE K T,CHOI J W.The characteristics of Korean firms purchasing directors'and officers'insurance[J].Korean Journal of Insurance, 2006, 74: 1-32.

[3] Hu Guoliu, Hu Jun. Director and executive liability insurance and corporate risk taking: theoretical path and empirical evidence [J]. Accounting Research, 2017, (5): 40-46.

[4] Li Conggang, Xu Rong. Insurance governance and corporate violations — The governance effect of director executive liability insurance [J]. Financial Research, 2020, (6):188-206.

[5] Bai Fuping, Shang Mengting, Huang Yujie. Director, Executive liability Insurance and corporate ESG performance: Power or resistance?[J]. Southern Finance, 2023, (11): 35-48.
[6] Zhang Ruigang, Yin Jingjing. The impact of director executive liability insurance on green innovation — the threshold effect based on financing constraints [J]. Accounting Monthly, 2023, 44(08): 143-150.
[7] Yan Huahong, Jiang Jie, Wu Qifu. Research on the impact of carbon performance on financial performance based on the analysis of property rights [J]. Mathematical Statistics and Management, 2019, 38(01): 94-104.

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