

Can Director Liability Insurance Promote Company Performance?—Empirical Evidence Based on Chinese Listed Companies

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Abstract: This paper invests the effects of D&O Liability Insurance in Chinese listed companies. We address the sample selection problem by employing the propensity score matching methodology. To reduce the small sample size bias, we use the bootstrap approach to estimate the standard errors. Results show that, (1) The decision of listed companies to buy D&O Liability Insurance is endogenously determined, so it exists sample selection problem; (2) On the whole, performance is negatively related to D&O Liability Insurance even after controlling for sample selection bias, but the negative relationship has been declined; (3) D&O insurance does not play a positive role in corporate governance, and it makes a marked decline in the company value; (4) Other factors, such as company size, executive compensation, ownership concentration and equity of state owned shares, overseas listing all have significant positive effects on purchase of D&O Insurance, but feasibility, executors share holding shown a significant negative impact on purchase of D&O insurance.

Keywords: D&O Liability Insurance, Firm Performance, Propensity Score Matching, Bootstrap

1. Introduction

The Directors and Officers' Liability Insurance (DOI), is an occupational liability insurance that covers the civil liability of directors and officers towards the company and third parties. It is an important part of global listed company governance. In 2002, the China Securities Regulatory Commission (CSRC) issued the Code of Corporate Governance for Listed Companies, which clearly stipulated the civil liability of senior executives of listed companies. DOI was introduced into China's listed companies for the first time. However, due to the low awareness of domestic listed companies to purchase insurance, DOI is still a niche insurance product. With the implementation of the new securities law and the multiple catalysts of cases such as Luckin Coffee, Kangmei Pharmaceutical, and Great Wisdom, DOI has experienced rapid growth for three consecutive years. The Report on the Market of Directors' Liability Insurance for Listed Companies in China (2023) shows that a total of 337 A-share listed companies issued announcements on purchasing directors' liability insurance in 2022.

The function of D&O insurance is not only to spread the operational responsibility risk of directors and senior staff, but also a powerful tool to protect the legitimate rights and interests of investors. It can optimize the corporate governance structure and form effective external supervision. Domestic scholars have mostly analyzed the legal theory and efficacy of D&O insurance from a theoretical perspective (Cai YQ, 2003; Ren ZL et al., 2007; Sun HT, 2010)^[1-3]. In recent years, with the continuous improvement of information disclosure of listed companies in China, some scholars have begun to conduct empirical research on the relationship between directors' liability insurance and corporate governance of listed companies. Xu R et al. (2012)^[4] empirically studied the influencing factors of director liability insurance purchase, and the results showed that a sound corporate governance mechanism can drive listed companies to purchase DOI, significantly reducing the agency costs of listed companies. Hu GL et al. (2014)^[5] found through empirical research that director's liability insurance has a significant inhibitory effect on corporate overinvestment, but cannot alleviate the problem of underinvestment. There is limited research on the impact of purchasing director's liability insurance on company performance and management behavior in domestic literature. Moreover, due to the slow development of this insurance, only a few companies have purchased this type of insurance, resulting in small sample bias. More importantly, there is a certain degree of sample selection bias,

which leads to biased empirical results. This article uses propensity score matching (PSM) and bootstrap method to control sample selection bias and small sample problems.

2. Literature Review and Hypotheses

2.1. Director's Liability Insurance and Company Performance

The impact of director's liability insurance on corporate performance is controversial. The view that supporting director liability insurance can promote a company's performance. Firstly, it can encourage the board of directors to boldly innovate in management. Firstly, the introduction of DOI can reduce the litigation risks and compensation losses that executives may face during their normal performance activities. It encourages executives to make bold business decisions with confidence, which is beneficial to enhancing the enterprise's independent innovation capability (Hu GL et al., 2019)^[6].

Secondly, it is possible to identify and attract outstanding executives and independent directors to join the company's daily operations, in order to increase the company's performance (Priest, 1987)^[7]. Thirdly, DOI plays a governance role in reducing shareholdings for self-interested motives of senior executives rather than for liquidity management motives (Xu R, 2023)^[8].

However, opponents of D&O insurance argue that it can create moral hazard issues. Barrese and Scordis (2006)^[9] suggest that the moral hazard associated with D&O insurance can lead to opportunistic management behavior that reduces firm value. Zou H et al. (2008)^[10] studied the relationship between the purchase of corporate insurance and company value, and found that there is a U-shaped linear relationship between the two. After the inflection point, the cost of insurance no longer brings additional economic benefits, which can lead to a decline in company value. Lai L et al. (2019)^[11] found that companies that purchased DOI made more short-term investments. The company has fewer short-term loans from banks and higher operational risks. Instead of playing a role in risk governance, DOI has induced more risky behaviors among managers and increased the operational risks of enterprises. Therefore, we propose two opposing hypotheses regarding the relationship between director's liability insurance and company performance in Chinese listed companies:

H1A: Director's liability insurance promotes company performance and increases shareholder wealth.

H1B: Director's liability insurance reduces the company's performance and reduces shareholder wealth.

2.2. The impact of purchasing director's liability insurance on company agency costs

As an incentive mechanism, the purpose of introducing DOI is to encourage directors to actively progress, fulfill their loyalty and diligence obligations, transfer the risk responsibility caused by the board of directors' negligence or improper behavior, and play a supervisory role in the governance of listed companies (O'Sullivan, 1997)^[12]. Insurance companies have the motivation to understand the operation and management of companies, and restrict the behavior of company directors through the review of insurance applications and insurance contract terms, thereby reducing the damage caused by directors' misconduct to the interests of minority shareholders (Shi WZ, 2004)^[13]. On the other hand, the establishment of DOI is an insurance protection for the behavior of directors, which may increase the likelihood of directors infringing the rights and interests of minority shareholders and has certain moral hazards. Chalmers (2002)^[14] conducted an empirical study on 72 IPO companies in the United States and found that there was a significant negative correlation between the stock price performance of the company three years after its initial public offering and the board's decision to purchase director liability insurance. Moreover, the risk of litigation for directors and executives is often related to their stock price manipulation behavior. They believe that the purchase of director liability insurance has led to such opportunistic behavior by directors and executives. Based on the above discussion, two opposing hypotheses are proposed regarding the effect of DOI clauses on agency costs:

H2A: Purchasing director's liability insurance will help protect investors' rights and interests, thereby reducing agency costs.

H2B: Purchasing director's liability insurance is not conducive to protecting investors' rights and interests, leading to an increase in agency costs.

3. Data and Variables

The data is sourced from the Directors and Officers Liability Insurance Database (CDOD) of CNRDS. It is a professional database established based on the purchasing information of board of directors, shareholders' meetings, annual reports and other announcements of listed companies in Shanghai and Shenzhen A-shares. The database has comprehensive data and covers all the purchasing information of board of directors, shareholders' meetings, and annual reports that can appear in all announcements of listed companies. The article will use the announcement form of listed companies in the database from 2012 to 2021 to purchase DOI as the basis, and set the dummy variable DOI to 1, otherwise it will be 0. Other data such as agency costs of listed companies, key corporate governance mechanism indicators, and enterprise characteristics are from the CSMAR database. We excluded ST companies and some missing data samples, and also conducted a trimming process on the main variables to overcome the influence of outliers.

In order to reflect the company's performance more reasonably and realistically, referring to previous literature (Hu GL et al., 2014^[5]), the most commonly used market and accounting indicators are selected from various aspects such as the company's market value, profitability, agency costs, investment capabilities, and other factors to measure company performance. Using a single indicator to measure company performance is vulnerable to manipulation, such as when listed companies alter or distort actual financial information in order to avoid losses or meet regulatory requirements from the China Securities Regulatory Commission. To ensure the accuracy of empirical results and the objectivity of conclusions, this article selects indicators from multiple perspectives to measure the performance of companies.

Table 1: Descriptive Statistics of Variables.

Variable	Mean	S. D	Min	Max
ROE	0.074	0.153	-0.819	0.765
ROA	0.041	0.063	-0.261	0.249
AC	0.099	0.107	0.009	0.919
INVEST	0.061	0.056	0.000	0.264
TQ	1.946	1.269	0.530	9.109

4. Experimental Design

4.1. PSM value

In PSM analysis, it is necessary to determine the propensity score matching (PSM) value first. To determine the paired variables in the PSM estimation, this article draws on the discussion of relevant variables in the decision equation for directors' liability insurance by Hu GL et al. (2014)^[5] and Zhao Y (2014)^[15], and uses a stepwise regression method in the Logit regression model to pair variables from the internal characteristics of listed companies, corporate governance variables, and financial characteristics variables. In addition, due to industry differences and fluctuations in macroeconomic conditions in different years, the performance of listed companies will be affected to some extent. Therefore, it is necessary to control the industry and year of the company.

Table 2: Descriptive Statistics of Paired Variables.

Vriable	Mean Value	Standard Deviation	Minimum Value	Maximum Value
SIZE	21.698	1.292	18.592	26.681
LEV	0.463	0.244	0.041	1.644
PROF	0.083	0.189	-0.941	1.049
TANG	0.410	0.189	0.010	0.844
GPAY	14.474	0.768	12.388	16.650
MAGSTK	4.879	12.376	0.000	60.398
CR5	0.539	0.174	0.024	1.915
State	0.497	0.500	0.000	1.000
Ratio_IND	0.723	0.402	0.167	9.000
HB	0.043	0.203	0.000	1.000

First, we determined the matching variables required for propensity score matching estimation (see

Table 3), and examined the explanatory variable in column (1) that only included the dummy variable of purchasing director's liability insurance (DOI); In columns (2)-(6), multiple regression is used. In addition to purchasing DOI explanatory variables that have been previously identified as influencing corporate performance and purchasing behavior were also controlled. The impact of DOI on corporate performance variables such as ROE, ROA, agency costs (AV), investment expenditure rate (INVEST), and Tobin's Q was estimated separately. In column (7), the stepwise regression method was used, with the purchase of director and officer insurance (DOI) as the explanatory variable, and the company characteristic variables used for matching were screened. The regression model had a Pseudo R² of 0.1971 and an AUC of 0.838, indicating good model fitting. The explanatory variables in the (7) column of the Logist regression are used as matching variables for matching. From the model, we can see that company size (SIZE), executive compensation (GPAY), equity concentration (CR5), state-owned share ownership structure (STATA), and overseas listing (HB) all have a significant positive impact on the purchase of directors' liability insurance, while profitability PROF and executive shareholding ratio (MAGSTK) have a significant negative impact on the purchase of directors' liability insurance.

Table 3: OLS regression and screening of matching variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ROE	0.001	ROE					
ROA	-0.010***		ROA				
AC	-0.027***			AC			
INVEST	-0.005*				INVEST		
TQ	-0.465***					TQ	
DOI		-0.016**	-0.009***	0.011**	-0.005	0.133**	DOI
SIZE		-0.005***	-0.001**	-0.029***	0.005***	-0.457***	0.441***
LEV		0.074***	-0.041***	0.046***	-0.022***	0.724***	
PROF		0.323***	0.220**	-0.036***	0.010**	0.467***	-1.093***
TANG		0.003	-0.002	-0.084***	0.021***	-0.628***	
GPAY		0.035***	0.015***	0.000	0.001**	0.117***	0.525***
CR5		0.091***	0.030**	-0.046***	0.027**	-0.935***	0.705**
RATIOIND		-0.001	-0.002**	0.009**	-0.003**	0.147**	
MAGSTK		0.000	0.000**	-0.000***	0.000***	-0.015***	-0.210***
State		-0.010***	-0.003***	-0.004**	-0.006***	0.029	0.507**
HB		0.002	-0.002	0.034***	-0.006***	0.246***	0.444**
INDUSTRY		YES	YES	YES	YES	YES	YES
YEAR		YES	YES	YES	YES	YES	YES
N		13385	13385	13385	13385	13385	13385
Adj. R2		0.208	0.637	0.185	0.087	0.296	0.1971
AUC							0.838

Note: * p<0.1, ** p<0.05, *** p<0.01.

4.2. Matching effect analysis

In order to make the empirical conclusions more credible, it is necessary to test the fitting effect of the model and measure whether the model can meet the common support assumption and parallel assumption conditions of PSM. Figure 1a shows the results of the treatment group and the control group. The AUC area is close to 0.8, indicating that it has achieved a good matching effect. From the graph, the area under the ROC curve is 0.844, indicating that the overall matching effect of the model is good. Figure 1b is to test the hypothesis of mutual support, with an AUC close to 0.5. The area under the ROC curve is 0.536, indicating that PSM satisfies the assumption of common support.

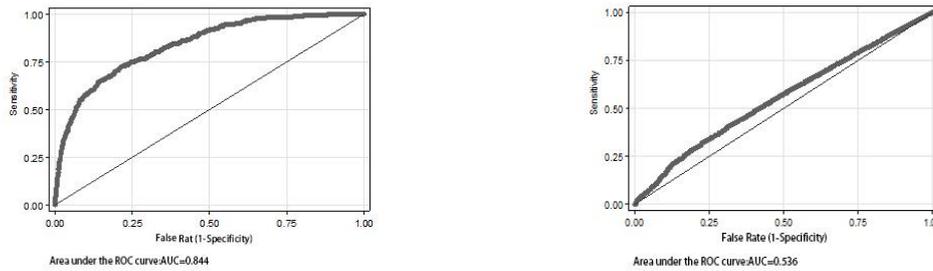


Figure 1a: ROC curve before matching in Figure. Figure 1b: ROC curve after matching in Figure

Another important premise of PSM is the parallel hypothesis. When the treatment group and control group have no significant differences after variable matching, their standard deviations will also decrease. Figure 2 shows the kernel density functions of the treatment group and control group before and after matching. It is obvious from Figure 1a that before matching, there is a significant difference in the kernel density function between companies that have purchased DOI and those that have not. If all companies are used as control groups and treatment groups for comparison in the study, the results may be biased. Based on propensity score matching (PSM), the control group companies were selected to match the control group. As shown in Figure 2(b), the kernel density functions of the two groups after matching are very close, indicating that the characteristics of the two groups of variables are very similar. We also used radius matching and kernel matching for both groups, and the results were very similar. After matching, it is no longer possible to distinguish whether a listed company purchases director liability insurance based on its characteristic variables, indicating that the PSM parallel hypothesis is satisfied overall.

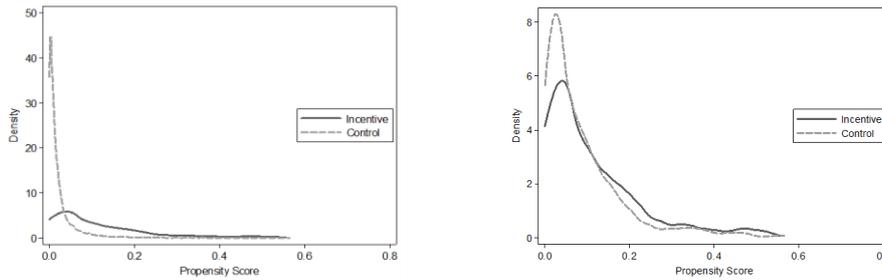


Figure 2a: Kernel density map before matching. Figure 2b: Kernel density map after matching

5. Results and Discussion

5.1. Analysis of matching results

We use the three methods mentioned above to estimate the average processing effect of the treatment group. The following discussion is based on the nearest neighbor matching method, while the other two types of methods serve as robustness tests. Table 4 shows the average processing effect ATT based on the nearest neighbor matching method before and after pairing.

Table 4: Nearest Neighbor Matching Method ATT before and after Pairing.

variable	sample	Processing Group	control group	difference	S.D.	T value
ROE	Before matching	0.075	0.074	0.001	0.008	0.1
	After matching	0.075	0.086	-0.011	0.011	-1.0
ROA	Before matching	0.031	0.041	-0.010	0.003	-2.9***
	After matching	0.031	0.039	-0.008	0.004	-1.9**
AC	Before matching	0.072	0.010	-0.027	0.006	-4.6***
	After matching	0.072	0.070	0.002	0.006	0.4
TOBIN	Before matching	1.493	1.959	-0.465	0.069	-6.7***
	After matching	1.493	1.587	-0.094	0.064	-1.4
INVEST	Before matching	0.056	0.061	-0.005	0.003	-1.7*
	After matching	0.056	0.058	-0.002	0.004	-0.4

Note: * p<0.1, ** p<0.05, *** p<0.01.

Whether before or after matching, the purchase of DOI has no significant impact on the ROE of listed companies; However, it has a significant negative impact on ROA, indicating that purchasing DOI does reduce the performance of the company, but the negative impact is lower than before the pairing. The purchase of DOI before matching resulted in a significant decrease in the agency cost, investment, and Tobin Q of listed companies, but the impact of DOI purchase after matching on these three indicators is no longer significant. The empirical results show that after using PSM to control for endogenous effects, although purchasing DOI has a negative impact on the enterprise performance indicator ROA, the impact is reduced compared to before matching. Previously, under the full sample, DOI purchases had a significant negative impact on the agency costs and investment of the company, as well as Tobin's Q. However, after controlling for the endogeneity of the sample, we have no evidence that purchasing DOI will significantly reduce the agency costs, investment, and Tobin's Q of the company.

5.2. Robustness testing

In Table 5, the treatment effect (ATT) is estimated by the nearest neighbor matching method, radius matching method and kernel matching method respectively, and the standard error is obtained by Bootstrap to reduce the problem of small sample bias. The results still show that purchasing director's liability insurance has a significant negative impact on the ROA of corporate performance for listed companies. The ATT estimate stabilizes at -0.008 under three matching methods, which indicates that, controlling for other features that affect company performance ROA, the purchase of DOI at least lowers the ROA indicator of listed companies by 0.008. The kernel matching results showed a significant negative impact on the company's Tobin Q. The robustness test of other indicators also indicates that purchasing DOI has no significant impact on performance indicators such as ROE, agency cost, and investment.

Table 5: Performance Variable ATT Robustness Test.

Variables	Nearest Neighbor Matching				Radius matching				Nuclear matching			
	ATT	Bootstrap Std Err	Z value	P> Z	ATT	Bootstrap Std Err	Z value	P> Z	ATT	Bootstrap Std Err	Z value	P> Z
ROE	-0.011	0.014	-0.81	0.419	-0.016	0.011	-1.52	0.128	-0.010	0.007	-1.49	0.138
ROA	-0.008**	0.004	-1.97	0.049	-0.008**	0.003	-2.56	0.011	-0.008***	0.003	-3.39	0.001
AC	0.002	0.008	0.29	0.769	-0.002	0.004	-0.55	0.579	-0.007	0.004	-1.49	0.135
INVEST	-0.002	0.005	-0.35	0.729	-0.005	0.004	-1.24	0.216	-0.004	0.002	-1.60	0.111
TQ	-0.094	0.081	-1.17	0.243	-0.038	0.060	-0.64	0.524	-0.155**	0.036	-4.27	0.000

Note: * p<0.1, ** p<0.05, *** p<0.01.

6. Conclusion

This article conducts a study on the impact of directors' liability insurance on corporate performance based on the purchase data of A-share listed companies in China from 2012 to 2021. The propensity score matching (PSM) method is used to control sample selection bias, and the nearest neighbor matching, radius matching, and kernel matching are used to match the observed values in the sample with the most suitable target companies. The bootstrap method is further used to calculate the standard error to overcome the problem of small samples. The empirical results show that: (1) the decision of listed companies to purchase DOI is endogenously determined, and there is a serious self-selection bias in the sample; (2) After controlling for self-selection bias using propensity score matching (PSM), the negative impact of directors' liability insurance on corporate performance and value is significantly reduced; (3) DOI does not play a positive governance role, but instead significantly reduces the company's value ROA and Tobin's Q; (4) Other factors such as company size, executive compensation, equity concentration, state-owned equity, and overseas listing have a significant positive impact on the purchase of directors' liability insurance, but profitability and executive shareholding ratio have a significant negative impact on the purchase of DOI. Currently, DOI has not alleviated agency conflicts, played a positive governance role, and enhanced corporate value. At present, the actual threat of infringement lawsuits against directors and executives of listed companies in China is very limited, and there is a significant difference between the risks that listed companies attempt to avoid and the scope of coverage of DOI. It has not alleviated the agency conflict between managers and owners, played a positive governance role, and improved corporate value.

Given the strong dependence of DOI on legal systems, the improvement of the directors' liability system and the civil compensation system will be the cornerstone of the development of DOI in China.

At the same time, insurance companies should actively design and promote insurance products that meet the responsibilities of senior executives and directors in China, targeting target customers such as large state-owned enterprises and overseas listed companies, turning their potential needs into real and effective demands, and promoting the further development of China's directors' liability insurance. With the revision and improvement of the company law, the risks of senior executives' performance in listed companies continue to increase. It is necessary to actively introduce DOI. On the one hand, it can use the market-based risk transfer mechanism to hedge the increasingly serious professional risks that directors and executives may face. On the other hand, it can explore the positive governance function of this type of insurance and improve the external governance mechanism.

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