Directors' and Officers' Liability Insurance and Corporate Idiosyncratic Risk

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ABSTRACT
We examine the effect of directors' and officers' insurance (D&O insurance) on corporate idiosyncratic risk in the Chinese market. We find that D&O insurance in China is negatively associated with corporate idiosyncratic risk. This association is robust to a series of robustness checks, including propensity score matching procedure and the inclusion of some possibly omitted variables. Further analyses show that only the idiosyncratic risk of the state-owned enterprises (SOE) can be significantly affected by the purchase of D&O insurance. Moreover, we find that the impact of D&O insurance on idiosyncratic risk is more pronounced in firms with Big 4 auditors, higher analyst coverage, and higher growth rate. Our findings support the notion that D&O insurance appears to improve corporate governance and provide a new understanding of the effectiveness of D&O insurance in emerging economies.

Keywords: directors' and officers' insurance, corporate idiosyncratic risk, corporate governance.

1. INTRODUCTION

Directors' and officers' liability insurance (hereafter referred to as D&O insurance) protects the personal assets of corporate directors and officers against lawsuits arising out of their poor management decisions, employee dismissals, shareholder grievances, and other acts committed in good faith during their management of the corporation. The purchase of D&O insurance is prevalent in many countries. According to media reports, over 90% of listed firms in the US and nearly 90% of listed companies in Europe have purchased some form of D&O insurance [1].

Prior research has indicated the existence of a correlation between the purchase of D&O insurance and corporate governance, but the actual effect of D&O insurance on corporate governance is inclusive. Most of the studies examine firms in developed western markets and have provided evidence on various impacts of D&O insurance. For example, researchers found that D&O insurance coverage is positively associated with the cost of equity implied in stock prices and analyst forecasts [2].

Higher levels of D&O insurance coverage are associated with higher loan spreads [3].

In addition to exploring the relationship between D&O insurance and corporate governance, since business management is inseparable from market fluctuation, corporate governance is also correlated to the firm's idiosyncratic risk. As idiosyncratic risk is responsible for approximately "80 % of total stock risk and security price fluctuations" [4] and investors, set a lower cost of capital for firms with a lower risk [5], actions that allow firms to lower their idiosyncratic risk can provide managers with more strategic opportunities. Idiosyncratic risk, thus, in turn, influences management policy and investors' willingness to invest, and the understanding of its relationship to D&O insurance is important. The exploration of D&O insurance ownership's effect on idiosyncratic risk can also take two perspectives. The purchase of D&O insurance can lead to moral hazard, and evidence has shown that the purchase of D&O insurance is associated with more aggressive earnings management [6] and financial reporting [3], and thus resulting in more risk-taking and probability of financial restatement. However, insurance companies

may take the role of monitoring executives' decisions, which reduces idiosyncratic risk. Studies have shown that in Canada and the United States, the problem of moral hazard brought by the purchase of D&O insurance seems to prevail [6] when many D&O insurers do not offer real loss prevention services or monitor corporate governance [7]. Thus D&O insurance is associated with higher idiosyncratic risk.

Contrasting to western markets, China provides a distinct setting for analyzing the influence of D&O insurance on corporate governance and corporate idiosyncratic risk. While over 90% of listed firms in western markets hold D&O insurance, the first D&O policy appeared in China in 2002 and, so far, less than 10% of Chinese A-share listed companies have purchased it [1]. Possibly due to the difficulty of gathering data on Chinese firms carrying D&O insurance, there has not been sufficient research evidence on the relationship between D&O insurance and corporate governance in China, and no research has systematically explored the effect of D&O insurance on the idiosyncratic risk in China. Therefore, a question arises whether the purchase of D&O insurance positively affects the corporate governance of insured companies and idiosyncratic risk under the Chinese context.

To address the deficiency of the research, we investigate the effect of D&O insurance on idiosyncratic risk using manually collected data on D&O insurance from China over the period 2002–2016. We discover that the purchase of D&O insurance is negatively associated with corporate idiosyncratic risk. This association passes robustness checks, including propensity score matching (PSM) procedure and the inclusion of some possibly omitted variables. Further analyses show that only the idiosyncratic risk of the state-owned enterprises (SOE) can be significantly affected by the purchase of D&O insurance. Moreover, we find that the impact of D&O insurance on idiosyncratic risk is more pronounced in firms with Big 4 auditors, higher analyst coverage, and higher growth rate.

This study contributes to the existing literature in three ways. First, our study complements the corporate finance literature by providing evidence of the impact of D&O insurance on corporate idiosyncratic risk. Based on the manually collected data, our findings support the notion that D&O insurance improves corporate governance and reduces idiosyncratic risk.

Second, to the best of our knowledge, this study is the first to examine how D&O insurance impacts idiosyncratic risk in China. Prior literature is almost exclusively based on developed economies, and the research has not been done in major emerging economies such as China. The results of this study exhibit a sharp contrast to the previous research on Canadian firms, which suggests that D&O insurance ownership increases corporate risk-taking. In this regard, we believe that this

study adds an interesting and important piece to D&O insurance and encourages further consideration of the relationship between the local financial environment and corporate risk. This study can also serve as a reference for D&O insurance development in other emerging capital markets with backgrounds similar to China's.

Third, our study enhances the understanding of the effectiveness of D&O insurance by exploring the economic consequences of D&O insurance and may provide insight and guidance to listed corporations in China considering purchasing D&O insurance. Though our data supports the contribution of D&O insurance ownership to decreasing corporate idiosyncratic risk, we do not promote a universal implementation of D&O insurance across all listed companies. Rather, whether to purchase D&O insurance or not should be based on careful consideration and evaluation of individual company's situations. The result of our study suggests that D&O insurance is more beneficial to state-owned enterprises and is more effective to firms with better economic standings in affecting idiosyncratic risk. As a result, our study can motivate more firms in China with Big 4 auditors, high analyst coverage, and high growth rate to purchase D&O insurance, which could help support the development of D&O insurance and increase its penetration in China.

The remainder of this study is organized as follows. We develop our hypothesis in Section 2. Section 3 describes the research design, including sample selection, model specification, and variable measurement. The empirical results are discussed in Section 4. Section 5 provides robustness checks, and Section 6 performs further analyses based on additional corporate conditions. Section 7 concludes the paper.

2. HYPOTHESES DEVELOPMENT

Idiosyncratic risk is a type of risk that specifically affects an individual asset or a small group of assets as the source of the risk is inherent within the underlying corporation or industry sector of the asset(s). It is more commonly known as unsystematic risk. Idiosyncratic risk is often highly unique to each corporation, and therefore the elimination or reduction of it requires detailed knowledge of that corporation and its industry. Past studies have revealed that factors that can affect a corporation's idiosyncratic risk include its relative strategic emphasis [8] and its performance in fulfilling its social responsibilities [9]. Unlike these studies, we wish to explore the potential influence of the purchase of D&O insurance on a corporation's idiosyncratic risk.

There are two groups of opposite views on D&O insurance's influence on a corporation's idiosyncratic risk in the current literature. One group suggests that the purchase of D&O insurance, especially one with high coverage and premium, will likely lead a company's

performance to deteriorate in certain ways, causing corporate idiosyncratic risk to increase. In a study of Taiwanese firms, it is shown that given the same level of cash flow, insured firms are more likely to have excessive investment than uninsured firms, which is the result of opportunistic managerial behaviors, fueled by moral hazard inherent in the insurance, as directors and officers are exempt from being personally litigated when investors' interest is infringed by corporate wrongdoing [10]. It has also been shown that the long-run stock price performance of US firms issuing IPOs is negatively related to the amount of D&O insurance they have purchased, mostly due to managerial opportunism [11]. The purchase of D&O insurance is correlated with an increase in aggressive tax reporting behaviors among Canadian firms, as those firms' tax expenses reported in the financial statements were reduced [12]. Moreover, the purchase of larger amounts of D&O insurance is reported to be associated with more aggressive earning management [13]. Suppose the insurance company charges the firm a large amount of premium for the purchase of the insurance. In that case, it shows the insurance company's distrust towards the firm's corporate governance and other risk containing capacities, which in turn suggests that this firm is more susceptible to moral hazards and the potential increase in corporate idiosyncratic risk.

Therefore, we believe that it is reasonable to correlate the purchase of D&O insurance with a surge in risk-taking and opportunistic managerial behaviors. These behaviors can cause the likelihood of corporate wrongdoing [10], which will become the main cause of an increase in the corporate idiosyncratic risk.

The opposite view suggests that the purchase of D&O insurance would improve corporate governance and reduce firm idiosyncratic risk. A study of D&O insurance in the Chinese market finds that due to the weak corporate governance caused by the highly concentrated owner structure often dominated by state-owned controlling shareholders, D&O insurance has a positive effect on corporate governance. As insurance to cover the losses associated with litigation and compensation, D&O insurance would increase incentives for directors and officers to act on the corporations' behalf and in the interest of shareholders, reducing agency cost, enhancing investor protection, and improving corporate governance [14]. Studies also show that with a good corporate governance system, firms could reduce wrongful actions and would have a greater tendency to improve the quality of corporate social responsibility (CSR) disclosure [15]. As a result, CSR disclosure reduces information asymmetry and increases employee obligation, subsequently lead to the reduction of firms' risk facing penalties and financial cases, especially firm idiosyncratic risk [15].

Hence, we also hypothesize that in the Chinese market context, the purchase of D&O insurance would improve corporate governance and consequently would lead to a decrease in firm idiosyncratic risk.

Therefore, from the two groups of views above, we propose two competing hypotheses for the effect of D&O insurance on idiosyncratic risk.

H1a: The purchase of D&O insurance causes the corporate idiosyncratic risk to increase, other things being equal.

H1b: The purchase of D&O insurance causes the corporate idiosyncratic risk to decrease, other things being equal.

Since the studies cited above mainly concern firms in western open capital markets, we wish to determine which hypothesis can be verified by investigating D&O insurance's effect on Chinese firms' idiosyncratic risk under the Chinese market setting.

3. RESEARCH DESIGN

3.1. Construction of sample

Our research is all based on A-share listed companies and our sample initially comprised all firms listed on the SHSE and SZSE from 2002 to 2016. The data on D&O insurance is manually collected from annual reports and disclosed minutes of boards' and shareholders' meetings. The financial data used in the research are from China Stock Market According Research (CSMAR) system. The stock price information and other related information used in the calculation of corporate idiosyncratic risk are obtained from Wind. We exclude financial firms (e.g., banks, insurance, and investment trusts), firms that lose some data, and companies suspended because they account and report under rules and tend to have a capital structure different from other companies. To avoid the interference of outliers on the regression results, we winsor all continuous variables in this paper at the level of 1%. Finally, our paper got 21,912 firm-year observations.

3.2. Models

The hypotheses to be tested are that idiosyncratic risk is a function of D&O insurance and other control variables. The basic empirical model employed is:

$$IR_{t+1} = \beta_0 + \beta_1 D\&O_t \qquad\qquad (1)$$
$$+ \sum_{q=2}^{m} \beta_q(qth\ ControlVariable_t)$$
$$+ \varepsilon_t$$

3.3. Variables

3.3.1. Dependent variable: idiosyncratic risk

As is pointed out, idiosyncratic risk is a component of intrinsic valuation that is irrelevant to market returns or the returns of some other hedge portfolios. According to Li(2021)[16], we estimate a regression of the daily return differential using contemporaneous leading, lagged daily stock index returns from Mainland China and Hong Kong, and the currency shifts within each company quarter:

$$R_{A-H,t} = \alpha + \sum_{-1}^{1} \beta_i^A R_{M,t+i}^A \qquad (2)$$
$$+ \sum_{-1}^{1} \beta_i^H R_{M,t+i}^H$$
$$+ \sum_{-1}^{1} \beta_i^{FX} R_{FX,t+i} + \varepsilon_{A-H,t}$$

Where $R_{A-H,t}$ is the return difference between A-shares and H-shares. $R_{M,t+i}^A$ and $R_{M,t+i}^H$ are A-shares and H-shares stock market index returns. $R_{FX,t+i}$ is the currency return of Hong Kong dollars relative to the Chinese Yuan. The idiosyncratic risk is calculated as the standard deviation of the residuals of the Equation above. As is pointed out in Gagnon and Karolyi [17], due to the sluggish spread of information, the stock price shows a delayed reaction to market returns. In our model, we regress the return differential to the contemporaneous market and currency returns, as well as 1-day leading and lagging market and currency returns.

3.3.2. Test variable: D&O insurance

Following prior studies [17], we adopt a dummy variable (D&O) to measure D&O insurance, which equals 1 if a firm purchases D&O insurance in year t, and 0 otherwise.

3.3.3. Control variables

We control for several factors that have been shown to affect future stock price crash risk in prior studies. The variable *Aget* is the listing age of listed companies, *Aget* is calculated as one plus the company's listing year and minus the current year, we log the result. *Lev* is the debt to asset ratio. It is used to measure the company's ability to use creditors to provide funds for business activities and to reflect the security of creditors' loans. It is obtained by comparing the company's total liabilities with the total assets, which is reflected in the debt ratio of the company's total assets. *Lev* is calculated as total liabilities divided by total assets in year t. *Roa* is the return on assets, and it is an index used to measure how much net profit is created per unit of asset. It is also a useful indicator for assessing a company's profitability relative to its total asset value. The calculation method is the company's annual profit divided by the total asset value in year t.

Growth is the company's main business growth rate, and it can be used to measure the company's product life cycle and determine the stage of its development. *Growth* is calculated as the main business income in year t minus the main business income in year t-1 and then divided the result by the main business income in year t-1. *CrossListt* is used to judge whether the listed company is cross-listed, which equals 1 if a firm is cross-listed in year t, and 0 otherwise. *GDP* is Gross Domestic Product in year t, and it is the result of the production activities of all resident units in a country (or region) within a certain period. *GDP* is the core indicator of national economic accounting, and it is also an important indicator to measure the economic status and development level of a country or region.

4. EMPIRICAL ANALYSES

4.1. Descriptive statistics

Table 1 contains descriptive statistics of the variables we used in the empirical analysis. There are 21,912 observations, and we calculated each variable's mean, standard deviation, minimum value, median, and maximum value. The mean of the idiosyncratic risk measure, IR_{t+1}, is 0.896. The firm with minimal idiosyncratic risk has a measure of 0.311, while the firm with maximal risk measures 1.628. The large span within the idiosyncratic risk measures suggests that we indeed selected a sample of firms with various risk levels. Among all firms in the sample, about 5.2% of them purchased the D&O insurance. They have an average listing age of 2.607, average leverage of 0.486, an average return on assets of 0.033, and an average main business growth rate of 0.214. 8.4% of the firms are cross-listed. The *GDP* indicator has an average of 0.131.

TABLE 1. DESCRIPTIVE STATISTICS OF INDEPENDENT VARIABLES

Variable	N	mean	sd	min	p50	max
IR_{t+1}	21,912	0.896	0.278	0.311	0.874	1.628
$D\&O_t$	21,912	0.052	0.222	0	0	1
Age_t	21,912	2.607	0.415	1.386	2.639	3.332
Lev_t	21,912	0.486	0.211	0.062	0.489	1.128
Roa_t	21,912	0.033	0.062	-0.254	0.032	0.197
$Growth_t$	21,912	0.214	0.588	-0.649	0.118	4.297
$CrossList_t$	21,912	0.084	0.277	0	0	1
GDP_t	21,912	0.131	0.048	0.070	0.104	0.231

4.2. Correlation analysis

We calculated the correlation coefficients between each pair of variables and showed the results in Table 2. The negative coefficient of -0.039 between IR_{t+1} and $D\&O_t$ suggests that idiosyncratic risk and purchase of D&O insurance may be negatively correlated, consistent with Hypothesis H1b. On top of that, the correlations between all the independent variables are mostly rather low.

We calculated the variance inflation factor (VIF) for each independent variable to test whether multicollinearity exists in our sample. The results are shown in Table 3, with the largest VIF value being 1.27.

Since only VIF values larger than 5 or 10 are considered problematic in most studies, and our values are well below 5, we believe that multicollinearity is not a significant problem in our sample.

TABLE 2. CORRELATION TABLE

	IR_{t+1}	$D\&O_t$	Age_t	Lev_t	Roa_t	$Growth_t$	$CrossList_t$	GDP_t
IR_{t+1}	1	-0.039***	-0.073***	0.057***	-0.047***	0.015**	-0.022***	0.194***
$D\&O_t$	-0.039***	1	0.085***	0.087***	-0.033***	-0.028***	0.199***	-0.029***
Age_t	-0.045***	0.079***	1	0.116***	-0.073***	-0.146***	0.090***	-0.323***
Lev_t	0.050***	0.080***	0.128***	1	-0.410***	0.033***	0.070***	0.080***
Roa_t	-0.029***	-0.027***	-0.046***	-0.410***	1	0.302***	-0.004	0.060***
$Growth_t$	0.040***	-0.021***	-0.030***	0.051***	0.191***	1	-0.015**	0.198***
$CrossList_t$	-0.019***	0.199***	0.089***	0.073***	-0.009	-0.021***	1	0.023***
GDP_t	0.244***	-0.030***	-0.278***	0.088***	0.021***	0.088***	0.023***	1

TABLE 3. VARIANCE INFLATION FACTOR FOR INDEPENDENT VARIABLES

Variable	VIF	1/VIF
Lev	1.280	0.782
Roa_t	1.270	0.784
Age_t	1.120	0.889
GDP_t	1.110	0.897
$Growth_t$	1.070	0.937
$CrossList_t$	1.050	0.950
$D\&O_t$	1.050	0.952
Mean VIF		1.140

4.3. Univariate analysis

Table 4 shows the results of univariate analysis on the key variable, IR_{t+1}. The mean of idiosyncratic risk measure for D&O insured firms is 0.850, and for uninsured firms, the mean is 0.899. With t=5.797, this difference is significant at a 1% significance level. Therefore, it is extremely likely that firms that purchased D&O insurance have lower idiosyncratic risk than those that didn't.

TABLE 4. UNIVARIATE ANALYSIS ON IR_{t+1}

Variables	D&O=0	Mean1	D&O=1	Mean2	Mean Diff	t-Value
IR_{t+1}	20,773	0.899	1,139	0.850	0.0490	5.797***

4.4. Multivariate results

Table 5 displays the results of our regression model incorporated with other variables, including age, finical leverage, return on asset (ROA), growth, cross-listing, and local GDP of companies.

The first column shows the result of our regression model fixing industry and year effect without control variables. And the D&O coefficient -0.030 with a t-value -2.59 indicates the significant and negative effect of D&O insurance on firm idiosyncratic risk. The second column shows the result after incorporating control variables of age, finical leverage, return on asset, growth, cross-listing, and local GDP. As we could see from column two, the D&O coefficient is still negative and statistically significant at 1% level, which is consistent

with Hypothesis H1b that in the Chinese market, the purchase of D&O insurance reduces firm idiosyncratic risk even with the addition of other variables weakens the influence of D&O insurance.

The following table indicates that firm age also has a negative influence on idiosyncratic risk. The results are consistent with the notion that firms with higher age are more likely to be sophisticated and well-organized, and thereby reducing their idiosyncratic risk. Other variables such as firm growth and local GDP have the same effect.

TABLE 5. BASIC REGRESSION RESULT

	(1) IR	(2) IR
D&O	-0.030***	-0.028***
	(-2.59)	(-3.98)
Age		-0.013***
		(-2.67)
Lev		-0.010
		(-1.13)
Roa		-0.175***
		(-6.19)
Growth		0.023***
		(8.55)
CrossList		-0.004
		(-0.74)
GDP		-6.286***
		(-9.23)
_cons	0.690***	1.330***
	(37.48)	(19.84)
N	21912	21912
Industry_fixed_effect	Yes	Yes
Year_fixed_effect	Yes	Yes
r2_a	0.340	0.343

5. ROBUSTNESS CHECK

5.1. PSM procedure

To rule out the influence of self-selection bias that a well-developed company with lower idiosyncratic risk may be more financially capable of purchasing D&O insurance, we check the robustness of our model to ensure its validity. We perform robustness checks of

propensity score matching (PSM) and inclusion of omitted variables.

We match companies that purchased D&O insurance with uninsured companies similar in size, age, financial leverage, ROA, growth, and Book-to-Market (BM) ratio. Therefore, we could re-estimate the model to check the robustness of our model.

For Table 6, we could see from column 6 that the t-value after the PSM procedure is sufficiently small, indicating the effectiveness of the matching. Figure 1 also indicates the effectiveness of matching as the standardized percentage bias of each dimension is around zero after PSM.
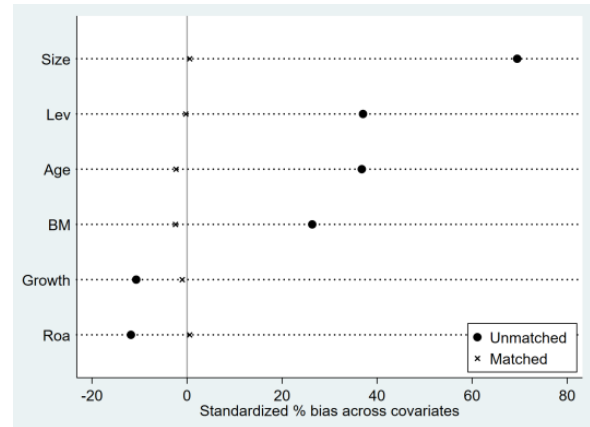

Figure 1. Standardized bias

After the PSM procedure, we re-estimate the model. The results in Table 7 indicate that the D&O coefficient is still negative and statistically significant at a 1% level. Thus, we could declare the robustness of our model.

TABLE 6. PROPENSITY SCORE MATCHING RESULT

	Unmatched	Mean		%reduct	t-test		V(T)/
Variable	Matched	Treated	Control	%bias	bias	t	p>t	V(C)
Size	U	22.715	21.711	69.5		26.53	0.000	1.88*
	M	22.715	22.707	0.5	99.2	0.12	0.906	1.19*
Age	U	2.742	2.595	36.8		11.51	0.000	0.84*
	M	2.742	2.751	-2.3	93.6	-0.60	0.552	1.12
Lev	U	0.557	0.481	37.0		11.71	0.000	0.88*
	M	0.557	0.557	-0.3	99.2	-0.07	0.946	0.90
Roa	U	0.026	0.033	-11.8		-3.81	0.000	0.96
	M	0.026	0.025	0.5	95.5	0.13	0.897	1.04
Growth	U	0.161	0.217	-10.7		-3.11	0.002	0.56*
	M	0.161	0.167	-1.0	90.4	-0.27	0.790	0.75*
BM	U	0.712	0.648	26.3		8.65	0.000	1.04
	M	0.712	0.718	-2.5	90.7	-0.57	0.566	1.00

TABLE 7. RE-ESTIMATED REGRESSION AFTER PSM

	(1) IR	(2) IR
D&O	-0.029*** (-4.22)	-0.028*** (-3.96)
Age		-0.010** (-2.02)
Lev		-0.007 (-0.82)
Roa		-0.180*** (-6.26)
Growth		0.022*** (7.57)
CrossListt		-0.005 (-0.80)
GDP		-6.106*** (-8.81)
_cons	0.691*** (49.70)	1.308*** (19.19)
N	21554	21554
Industry_fixed_effect	Yes	Yes
Year_fixed_effect	Yes	Yes
r2_a	0.337	0.340

5.2. Inclusion of omitted variables

The second method we use to check the robustness is to include omitted variables into our model. To rule out the influence of firm management on idiosyncratic risk, we add the age, gender, and position status of firm managers. We could see from Table 8 after we include these variables, the coefficient of D&O insurance is still negative and significant, proving our model's robustness.

TABLE 8. REGRESSION WITH OMITTED VARIABLES

	(1) IR
D&O	-0.028*** (-3.95)
Age	-0.012*** (-2.60)
Lev	-0.009 (-1.02)
Roa	-0.172*** (-6.08)

Growth	0.023***
	(8.43)
CrossListt	-0.004
	(-0.61)
GDP	-6.411***
	(-9.33)
Gender	0.003
	(0.60)
ln_age	-0.023***
	(-2.58)
Is_duality	0.011
	(0.91)
_cons	1.426***
	(18.23)
N	21909
Industry_fixed_effect	Yes
Year_fixed_effect	Yes
r2_a	0.343

6. FURTHER ANALYSES

We conducted the following analysis to further explore whether D&O purchases will produce different results between different companies (companies with different ownership, companies with different external governance environments).

6.1. SOE (state-owned enterprises)

We divide the sample into two subsets: SOE (State-owned enterprises) and non-SOE. Then we re-estimate Model 1 with the two subsets separately. To save space, we report the result in Table 9. The estimated coefficient of D&O in column 2 is -0.008 and is not significant. In contrast, the coefficient of D&O in column 1 is -0.032, significant at the 1% level. This indicates that the effect of D&O insurance on future idiosyncratic risk is more pronounced in SOE.

TABLE 9. SOE & NON-SOE ANALYSIS RESULT

	(1)	(2)
	SOE	NON SOE
D&O	-0.032***	-0.008
	(-3.82)	(-0.62)
_cons	0.528***	0.768***
	(11.90)	(16.29)
N	12002	8947
Controls	YES	YES
Industry_fixed_effect	YES	YES
Year_fixed_effect	YES	YES
r2_a	0.365	0.275

6.2. Big 4 auditors

We divide the sample into two subsets: the firms that appoint to provide annual reports auditing service and those that do not appoint Big 4 auditors. Then we re-estimate Model 1 with the two subsets separately. To save

space, we report the result in Table 10. The estimated coefficient of D&O in column 2 is-0.014 and is not significant. In contrast, the coefficient of D&O in column 1 is -0.032, significant at the 5% level. This indicates that the effect of D&O insurance on future idiosyncratic risk is more pronounced in firms that belong to Big 4 auditors.

TABLE 10. BIG4 & NON-BIG4 ANALYSIS RESULT

	(1)	(2)
	Big4	NON Big4
D&O	-0.032**	-0.014*
	(-2.28)	(-1.73)
_cons	0.666***	1.408***
	(2.79)	(20.12)
N	1546	20366
Controls	YES	YES
Industry_fixed_effect	YES	YES
Year_fixed_effect	YES	YES
r2_a	0.419	0.342

6.3. High Analyst

We divide the sample into two subsets: the firms that hire more high analysts and those that hire more low analysts. Then we re-estimate Model 1 with the two subsets separately. To save space, we report the result in Table 11. The estimated coefficient of D&O in column (2) is-0.024 and is not significant. In contrast, the coefficient of D&O in column 1 is -0.031, significant at the 1% level. This indicates that the effect of D&O insurance on future idiosyncratic risk is more pronounced in firms that hire more high analysts.

TABLE 11. HIGH-ANALYST & LOW-ANALYST ANALYSIS RESULT

	(1)	(2)
	High Analyst	Low Analyst
D&O	-0.031***	-0.024*
	(-3.59)	(-1.87)
_cons	1.301***	1.500***
	(16.33)	(11.72)
N	14567	7345
Controls	YES	YES
Industry_fixed_effect	YES	YES
Year_fixed_effect	YES	YES
r2_a	0.346	0.344

6.4. High Growth

We divide the sample into two subsets: firms with a high growth rate of profit and those with a low growth rate of profit. Then we re-estimate model (1) with the two subsets separately. To save space, we report the result in Table (12). The estimated coefficient of D&O in column (2) is-0.023 and is not significant. In contrast, the coefficient of D&O in column (1) is -0.036, significant at the 1% level. This indicates that the effect of D&O

insurance on future idiosyncratic risk is more pronounced in firms with a high growth rate of profit.

Taken the above together, we find that the negative relationship between D&O insurance and corporate idiosyncratic risk becomes more pronounced in firms with non-SOE, non-Big 4 auditors, more low analysts, and low growth rates.

Table 12. High growth & Low growth analysis Result

	(1) High Growth	(2) Low Growth
D&O	-0.036***	-0.023***
	(-2.85)	(-2.72)
_cons	1.620***	1.176***
	(15.11)	(13.71)
N	7811	14101
Controls	YES	YES
Industry_fixed_effect	YES	YES
Year_fixed_effect	YES	YES
r2_a	0.362	0.336

7. CONCLUSION

Using a unique data set of corporate purchases of D&O insurance by China's listed firms, we investigate the impact of D&O insurance on idiosyncratic risk. We find that the purchase of D&O insurance is negatively associated with corporate idiosyncratic risk after controlling for other predictors of idiosyncratic risk, suggesting that the purchase of D&O insurance reduces idiosyncratic risk and appears to improve corporate governance. Further analyses show that the impact of D&O insurance on future crash risk is more pronounced in state-owned enterprises (SOE) and in firms with Big 4 auditors, higher analyst coverage, and higher growth rate.

Overall, our findings support the notion that D&O insurance appears to improve corporate governance and reduce idiosyncratic risk. This is different from prior research under the context of developed capital markets. In countries like Canada, under rigorous regulations from various parties, D&O insurance ownership led to moral hazard and increased risk-taking, which then increases idiosyncratic risk. While in developing regions, such as China, the D&O-insured firms tend to have a lower corporate idiosyncratic risk.

Our study adds to the growing literature on D&O insurance and its implications on firms and investors. We focus on the role of D&O insurance in reducing idiosyncratic risk and provide a new understanding of the effectiveness of D&O insurance based on different corporate conditions. Our results are beneficial to listed firms and investors who want to manage idiosyncratic risk and who are considering purchasing D&O insurance in China and other similar emerging economies.

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