BOARD STRUCTURE, D&O INSURANCE AND THE VARIABILITY OF FIRM PERFORMANCE

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Abstract

We examine the relation between the disclosure of Directors' & Officers' (D&O) Liability insurance and the variability of firm performance. Our results show D&O insurance is positively correlated with the variability of firm performance. Specifically, the evidence shows a one percent increment in D&O insurance coverage will lead to a 0.31, 30, and 0.0008 percent increase in the variability of corporate performance measured in monthly stock returns, annual accounting returns on assets (ROA), and Tobin's Q respectively. Therefore, instead of reducing risk, the findings of this paper suggest D&O insurance may actually increase firm risk, which is very different from the essential purpose of implementing this insurance.

Keywords: Directors' and Officers' Liability Insurance, D&O Insurance, Corporate Governance, Variability of Firm Performance, Moral Hazard, Taiwan

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1 Introduction

Directors' and Officers' Liability Insurance (often called D&O) is a tool used by firms to reduce liability risk associated with the potential loss arising from possible litigation. The idea is to provide liability protection to the board of directors and executive officers of the firm for accused wrongful acts in their capacity. It is supposed to ultimately protect the firm's shareholder wealth. However, moral hazard[2] may be an issue resulting from the D&O insurance. That is, the firm's directors and officers might be more willing to pursue risky projects because of the protection provided by D&O insurance. As a result, the impact of D&O insurance on shareholder wealth is controversial. We examine the relation between D&O insurance and the variability of firm performance. Our results show D&O insurance is positively correlated with the variability of firm performance. Specifically, the evidence shows if a firm is covered by this insurance, the variability of the firm's performance is higher.

The association between D&O insurance and the variability of corporate performance potentially arises from moral hazard because it weakens the effectiveness of litigation as a managerial control device as suggested by the managerial opportunism argument. Moral hazard arises because an individual or institution does not take the full responsibility for the consequences of its actions, and therefore has a tendency to act less carefully than it otherwise would, leaving another party to shoulder some responsibility for those actions. As prior studies show, moral hazard significantly influences insurance markets (Rubinstein & Yaari, 1983; Chambers, 1989; Cummins & Tennyson, 1996; Chetty, 2008). When a firm is protected by D&O insurance, its directors and executive officers may be more willing to take risks and/or act less carefully, and thus more extreme decisions are more likely to be made. As a result, it is therefore likely, by making more extreme decisions, firms with D&O insurance are associated with more variable firm performance.

We empirically examined our hypothesis using data from 1,067 firms listed on either the Taiwan Stock Exchange (TWSE) or GreTai Securities Market (OTC) in Taiwan over the 2008-2011 period. The results show firms with D&O insurance are associated with higher variability in monthly stock returns, annual accounting returns on assets (ROA), and Tobin's Q. Our tests used both standard deviations and industry-adjusted standard deviations of monthly stock

[2] A moral hazard is a situation where a party will have the tendency to take risks because the costs that might be incurred will not be felt by the party taking the risk. It is a tendency to be more willing to take a risk, knowing the potential costs of taking such risk will be borne, in whole or in part, by others. Moral hazard arises because an individual or institution does not take full responsibility for the consequences of its actions, and therefore has a tendency to act less carefully than it otherwise would.

returns, ROA, and Tobin's Q[3] as dependent variables for the variability in corporate performance. For our economic and corporate governance control variables, our tests not only used average values, but also median and beginning values (first year value in the sample period). Moreover, we used both a binary variable and the actual average amount of insurance coverage to show the protection of D&O insurance to firms.

Overall, the results of this study consistently show the protection of D&O insurance indeed increases the variability of corporate performance and value. Our findings support the managerial opportunism argument that suggests D&O insurance protection magnifies the agency problem faced by firms through moral hazard. Due to information asymmetry, directors and officers have more information about their actions and intentions than shareholders do. Since shareholders cannot usually completely monitor the directors and officers, the directors and officers may have an incentive to act inappropriately (from the viewpoint of shareholders) if their interests and shareholders' interests are not well aligned. This agency problem may be even worse when the coverage of D&O insurance reduces the negative consequences resulting from these inappropriate acts.

The rest of the paper is organized as follows. Section 2 summarizes the relevant literature and develops the hypothesis. Section 3 describes the sample and data. Section 4 explains our variables and algorithm. Section 5 presents the empirical findings. Section 6 concludes this paper.

2. Literature review and hypothesis development

2.1. Agency problem

One of the most challenging issues facing firms today is the agency problem between shareholders and management. The agency problem results from the misalignment between shareholder and manager interests. Jensen and Meckling (1976) argued zero or partial ownership by firm managers causes them to work less vigorously and pursue personal benefits because shareholders bear most of the costs. Besides pecuniary benefits, managers will also pursue non-pecuniary benefits at the cost of shareholders. Managers enjoy power and prestige associated with their positions, and this can lead to over-expanding firm size (empire building). Harris and Raviv (1990) argued managers prefer continuation of the firm to keep their control benefits even if liquidation would be better for shareholders. Loughran and Vijh (1997) documented, during a five-year period following an acquisition, on average, firms that complete stock mergers earn significantly negative excess returns of -25.0 percent. As prior studies have shown, the agency problem can induce managerial decisions and acts that destroy shareholder wealth.

2.2 Moral hazard

Moral hazard seems to be an inherent characteristic of the insurance mechanism.

The insured party will have the tendency to take risks because the costs that might be incurred will not be felt by the party taking the risk. It is a tendency to be more willing to take a risk, knowing the potential costs of taking such risk will be borne, in whole or in part, by others. Cummins and Tennyson (1996) provided evidence there is a significant moral hazard in automobile insurance markets. D&O insurance protects directors and executive officers from liability loss due to litigation by shareholders or other stakeholders. This insurance protection is likely to reduce the directors' and officers' incentive of care because the litigation risk is diversified.

Prior studies have shown moral hazard significantly influences insurance markets. Chambers (1989) showed full insurance contracts are shown to be dominated by contracts involving coinsurance and deductibles in the presence of moral hazard. Chetty (2008) argued moral hazard is an important determinant for the optimal level of unemployment insurance benefits. Rubinstein and Yaari (1983) argued discounts offered by insurance companies to clients who possess a favorable record of past claims provide a mechanism enabling both the insurer and insured to counteract the inefficiency arising from moral hazard.

2.3 Hypothesis development

Pauly (1968) showed, even if all individuals are risk-averters, insurance against some types of uncertain events may be non-optimal. According to the managerial opportunism argument, D&O insurance can worsen the agency problem because it protects directors and executive officers from liability loss due to litigation. This insurance protection is likely to reduce the directors' and officers' incentive of care and/or increase their willingness to take on more risky projects for their own interests. As a result, it is therefore very likely the directors and officers will be less cautious and/or take more extreme decisions. This defective decision-making triggered by the moral hazard associated with D&O insurance certainly could influence firm performance. There are two opposing

[3] Industry-adjusted standard deviation of monthly stock returns is the standard deviation of the difference between an individual stock's monthly stock return and the monthly value-weighted market return within the sample period. Industry-adjusted standard deviation of ROA is the standard deviation of the difference between an individual firm's annual net income before interests and taxes and the industry's average then scaled by total assets within the sample period. Industry-adjusted standard deviation of Tobin's Q is the standard deviation of the difference between the market value of the firm divided by total assets and the industry's average within the sample period.

arguments about D&O insurance have been studied in the literature: the monitoring hypothesis and the managerial opportunism argument. The monitoring hypothesis argues that D&O insurance plays a governance role because an insurer thoroughly scrutinizes the insured. Contrarily, the managerial opportunism argument suggests that this insurance weakens the effectiveness of litigation as a managerial control device and may ultimately lead to a reduction of firm performance. Chalmers et al. (2002) examine the purchase of D&O insurance around initial public offerings of 72 U.S. firms, and find these firms' long-run stock performance is negatively related to the amount of D&O insurance purchased. Kim (2005) uses proprietary data to construct a matched sample of 93 U.S. firms and finds that firms which purchase excessive amount of D&O insurance are significantly more likely to engage in earnings restatements. Boubakri et al. (2008) use data from a sample of 138 Canadian seasoned equity offerings to examine the relationship between D&O insurance and earnings management. Similar to Kim, they find that excessive D&O insurance coverage is associated with more aggressive earnings management. Chi et al. (2011) find that managers are more likely to misstate company's earnings when they are covered by D&O insurance. Zou et al. (2008) find that the announcements of D&O insurance decisions in firms that engage in earnings management, and/or are controlled by a local government, seem to have a negative wealth effect. Lin et al. (2011) examine the effect of directors' and officers' liability insurance on the outcomes of merger and acquisition decisions. The authors find that acquirers whose executives have a higher level of D&O insurance coverage experience significantly lower announcement-period abnormal stock returns. Moreover, acquirers with a higher level of D&O insurance protection tend to pay higher acquisition premiums and their acquisitions appear to exhibit lower synergies. According to these research findings, D&O insurance may indeed be associated with greater agency conflict between managers and shareholders and could cause more litigation, as suggested by Shleifer and Vishny (1997).

In summary, due to the moral hazard problem and greater agency conflict between managers and shareholders associated with D&O insurance, we propose D&O insurance is positively correlated with the variability of firm performance. That is, if a firm is covered by this insurance, the variability of the firm's performance will be higher.

3 Sample

The sample employed to test our hypothesis contains listed firms, traded on either the Taiwan Stock Exchange (TWSE) or GreTai Securities Market (OTC), in Taiwan from 2008 to 2011. The reason we use 2008 as the starting year of our sample is the mandatory disclosure of D&O insurance began in 2008. Including the year of financial crisis in our sample may misestimate the linkage between board structure, D&O insurance, and the variability of firm performance. To consider this effect, we use the average of each variable during the sample period to reduce the bias. Each firm in our sample represents only one observation because we focus on the variability of firm performance over the entire sample period. For this reason, in the sample selection process, we require all sample firms to be listed from 2008 without any missing data for our empirical tests. Moreover, we exclude financial firms from our sample because these companies face more distinctive regulations than firms in other industries. We also exclude firms with variability measures in the top 1 percent. Our final sample consists of 1,067 observations representing over 90% of all listed firms in 2008[4].

4 Variables

The key variables in our empirical tests are measures for the variability of firm performance, board structure, and D&O insurance. For the variability of firm performance, we use the following variables in line with Cheng (2008) based on the financial and accounting information of firms: the standard deviation of monthly stock return, the standard deviation of annual net income before interest and taxes scaled by total assets, and the standard deviation of annual Tobin's Q during the four-year sample period. The calculation of Tobin's Q is the total assets minus the book value of equity, then adding the market value of equity and dividing by the total assets at year-end[5].

For board structure, we incorporate three measures: board size, the percentage of independent directors, and CEO duality. Board size is the number of directors of the board. The percentage of independent directors is calculated as the number of independent director(s) scaled by the number of total directors. CEO duality is a dummy variable which is 1 if the CEO is also the chairman and 0 otherwise.

For D&O insurance, we simply use a dummy variable to identify if an observation firm is covered by this insurance. A similar approach could be found in, for example, Core (1997) and O'Sullivan (1997).

Except for the aforementioned variables, additional control variables are used in our regressions including total assets to proxy firm size, R&D

[4] Firms with accounting periods not ending in December, non-traded firms, and firms with less than a year of establishment are all excluded as we dropped firms not having the required information. Measures of the variability of firm performance include the standard deviation of monthly stock return, standard deviation of annual income before interest and taxes scaled by total assets, and the standard deviation of annual Tobin's Q; these variables with the value over 33.88, 29.32 and 1.96 are deleted, respectively.

[5] While the degrees of variability could be sensitive to industry characteristics, industry adjusted measures of these variables are also applied in our robustness tests.

expenditure scaled by net sales to proxy growth opportunity, total assets divided by total debts to measure financial leverage, number of years since establishment to represent firm age, and number of shares held by managers to estimate the alignment of interest between managers and shareholders. Finally, industry indicators are also adopted in each regression to capture the impact of firm characteristics on the variability of firm performance. The empirical model is as follows:

Standard deviation of monthly stock return, annual ROA, or Tobin's Q= α_0
+ α_1 log (board size)
+ α_2 percentage of independent directors
+ α_3 CEO is chairperson of the board
+ α_4 D&O insurance
+ α_5 log (total assets)
+ α_6 R&D scaled by sales
+ α_7 financial leverage
+ α_8 log (firm age)
+ α_9 log (managerial ownership)
+ industry dummies + errors. (1)

Table1. Summary statistics

The sample consists of 1,067 listed firms in Taiwan in the period 2008 to 2011. MRet std. is the standard deviation of monthly stock returns within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by the total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the average number of directors on the board during the sample period. Ind. director pct. is the average percentage of independent directors on the board for each firm during the sample period. Dual CEO is the average of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is the average of an indicator during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the average of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the average of research and development expenses scaled by the average of net sales during the sample period. Leverage is the average of total debts divided by the average of total assets during the sample period. Firm age is the average number of years since establishment during the sample period. Managerial ownership is the average of the percentage of shares held by managers during the sample period.

	Mean	Min	1%	Median	99%	Max
MRet std.	14.8	3.70	5.69	14.3	28.0	33.9
ROA std.	0.25	0.02	0.03	0.16	1.37	4.27
TobinsQ std	5.12	0.04	0.36	3.82	24.8	31.6
Board size	6.79	4.25	4.5	6.75	15	26.8
Ind. director pct.	0.16	0	0	0.07	0.45	0.6
Dual CEO	0.30	0	0	0	1	1
D&O insurance	0.54	0	0	0.75	1	1
Assets	14,701	68	310	3,238	245,383	1,048,032
R&D / sales	4.12	0	0	1.53	35.4	448
Leverage	0.36	0.02	0.06	0.35	0.80	0.96
Firm age	27.5	4	7	25	59	65
Managerial ownership	1.62	0	0	0.73	10.6	19.1

In Table 1, except for the first three measures representing the standard deviations of firm performance during the sample period from 2008 to 2011, all other variables are the average numbers during the sample period. The median as well as the mean of board size is around 6.8, indicating, on average, there are about seven directors on the board of non-financial firms while the largest board may have over 26 directors. For the percentage of independent directors, differing from what the literature has documented for western countries in which most boards are dominated by independent directors, the mean (median) is 0.16 (0.07), suggesting most boards are dominated by insider directors. With an average number of seven directors on a board, the number of independent directors would be about one. This evidence may not necessarily imply independent directors are worthless. It simply shows firms under a specific culture and regulation in Taiwan still hesitate to increase the number of independent directors on their board despite the government administration strongly encouraging them to do so in recent years. For the distribution of CEO duality, the proportion of listed firms in Taiwan is relatively low compared with U.S. firms. This fact indicates powerful CEOs are not commonly seen in Taiwan because funding families can perhaps strengthen their power through other means.

Table 2. Correlation

The sample consists of 1,067 listed firms in Taiwan in the period from 2008 to 2011. MRet std. is the standard deviation of monthly stock returns within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the average number of directors on the board during the sample period. Ind. director pct. is the average percentage of independent directors on the board for each firm during the sample period. Dual CEO is the average of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is the average of an indicator during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the average of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the average of research and development expenses scaled by the average of net sales during the sample period. Leverage is the average of total debts divided by the average of total assets during the sample period. Firm age is the average number of years since establishment during the sample period. Managerial ownership is the average of the percentage of shares held by managers during the sample period. ***. ** and * represent the significance levels at 1%, 5% and 10%, respectively.

	MRet Std.	ROA std.	TobinsQ std	Board size	Ind. director pct.	Dual CEO	D&O insurance	Assets	R&D/sales	Leverage	Firm age
ROA std.	0.39***										
TobinsQ std	0.34***	0.33***									
Board size	-0.18***	-0.10***	-0.04								
Ind. director pct.	0.17***	0.09***	0.12***	-0.05*							
Dual CEO	0.11***	0.03	0.06*	-0.14***	0.04						
D&O insurance	0.09***	0.06*	0.08***	0.05*	0.29***	-0.04					
Assets	-0.15***	-0.05	-0.05*	0.25***	0.01	-0.03	0.08**				
R&D / sales	0.08***	0.05	0.16***	0.00	0.10***	0.01	0.09***	-0.03			
Leverage	0.15***	0.07**	-0.06*	-0.03	-0.10***	-0.04	-0.04	0.08***	-0.19***		
Firm age	-0.27***	-0.12***	-0.17***	0.13***	-0.47***	-0.03	-0.28***	0.07**	-0.16***	0.06*	
Managerial ownership	0.03	-0.07**	0.02	-0.04	0.14***	-0.03	0.13***	-0.09***	0.04	-0.06*	-0.23***

For the D&O insurance indicator, in contrast to samples in developed countries such as the U.S. and Canada in which around 90% of listed firms have this insurance, the average number of our sample firms covered by this insurance is just slightly over 50%. Although the proportion of firms having D&O insurance continues to increase during the sample period, the development of this insurance still seems to be at an early stage in Taiwan. We believe this unique sample of Taiwan can enrich the study of the literature on D&O insurance because it helps us better understand the value of this insurance in the early stage of its introduction to a country.

Finally, our summary statistics indicate some of the control variables are highly skewed. As a result, we use a natural log of these variables in our empirical tests. The arrangement of these variables follows Cheng (2008) in examining the relation between board size and the variability of firm performance.

Table 3. Regression results

The sample consists of 1,067 listed firms in Taiwan in the period from 2008 to 2011. All regressions are ordinary least squares (OLS) analyses. Dependent variables are MRet std., ROA std. and TobinsQ std. in regression (1), (2) and (3) respectively. MRet std. is the standard deviation of monthly stock return within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the average number of directors on the board during the sample period. Ind. director pct. is the average percentage of independent directors on the board for each firm during the sample period. Dual CEO is the average of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is the average of an indicator during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the average of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the average of research and development expenses scaled by the average of net sales during the sample period. Leverage is the average of total debts divided by the average of total assets during the sample period. Firm age is the average number of years since establishment during the sample period. Managerial ownership is the average of the percentage of shares held by managers during the sample period. Industry dummies are indicators defined by industry classification codes from Taiwan Stock Exchange (TWSE). ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

	MRet std. (1)	ROA std. (2)	TobinsQ std. (3)
Log (Board size)	-0.318	0.152	0.072
	(-0.55)	(0.24)	(1.32)
Ind. director pct.	-0.755	-0.300	-0.011
	(-0.86)	(-0.32)	(-0.18)
Dual CEO	0.485*	-0.048	0.013
	(1.71)	(-0.16)	(0.59)
D&O insurance	0.485*	0.865***	0.031*
	(1.86)	(2.85)	(1.71)
Log (Assets)	-0.943***	-0.994***	-0.051***
	(-8.35)	(-6.90)	(-3.31)
R&D / sales	0.011	0.010	0.002
	(1.62)	(0.85)	(1.14)
Leverage	7.381***	3.852***	0.129
	(7.89)	(3.53)	(1.35)
Log (Firm age)	-1.487***	-0.605	-0.041**
	(-4.47)	(-1.54)	(-1.97)
Log (Managerial ownership)	-0.639***	-1.205***	-0.028**
	(-2.96)	(-5.10)	(-2.02)
Industry dummies	Yes	Yes	Yes
R^2	0.30	0.17	0.14

5 Results

5.1 D&O insurance and the variability of firm performance

Table 2 reports the correlations between variables. All of the three measures of the variability of firm performance are significantly and positively correlated with each other. The percentage of independent directors and CEO duality are both significantly and positively correlated with the variability of firm performance. The negative relation between board size and the three measures of the variability of firm performance is consistent with Cheng (2008) which documents that board size is negatively associated with the variability of corporate performance. Interestingly, D&O insurance is significantly and positively correlated with all three measures of the variability of firm performance, indicating a higher variability of firm performance for insured companies.

Table 3 presents the estimates of Model (1). The results consistently show D&O insurance is significantly and positively associated with standard deviations of corporate stock performance, accounting performance, and value, suggesting when a firm is insured by D&O insurance, firm performance and value become more variable. Specifically, the coefficient of D&O insurance is significantly positive for the standard deviation of monthly stock returns (0.485), annual ROA (0.865), and Tobin's Q (0.031). The patterns of other variables are generally consistent with Adams et al. (2005). For example, firm size and firm age decrease the variability of firm performance.

Table 4. Regression results: industry adjusted

The sample consists of 1,067 listed firms in Taiwan in the period from 2008 to 2011. All regressions are ordinary least squares (OLS) analyses. Dependent variables are MRet std., ROA std. and TobinsQ std. in regression (1), (2) and (3) respectively. MRet std. is the standard deviation of the difference between an individual stock's monthly stock return and the monthly value-weighted market return within the sample period. ROA std. is the standard deviation of the difference between an individual firm's annual net income before interests and taxes and the industry's average then scaled by total assets within the sample period. TobinsQ std. is the standard deviation of the difference between the market value of the firm divided by total assets and the industry's average within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the average number of directors on the board during the sample period. Ind. director pct. is the average percentage of independent directors on the board for each firm during the sample period. Dual CEO is the average of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is the average of an indicator during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the average of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the average of research and development expenses scaled by the average of net sales during the sample period. Leverage is the average of total debts divided by the average of total assets during the sample period. Firm age is the average number of years since establishment during the sample period. Managerial ownership is the average of the percentage of shares held by managers during the sample period. Industry dummies are indicators defined by industry classification codes from Taiwan Stock Exchange (TWSE). ***. ** and * represent the significance levels at 1%, 5% and 10%, respectively.

	MRet std. (1)	ROA std. (2)	TobinsQ std. (2)
Log (Board size)	0.146	0.395	0.058
	(0.27)	(0.69)	(1.12)
Ind. director pct.	-0.984	0.206	-0.005
	(-1.21)	(0.23)	(-0.09)
Dual CEO	0.288	-0.199	0.020
	(1.03)	(-0.69)	(0.97)
D&O insurance	0.445*	0.789***	0.043**
	(1.80)	(2.76)	(2.47)
Log (Assets)	-1.277***	-1.018***	-0.044***
	(-11.85)	(-7.31)	(-2.98)
R&D / sales	0.010	0.005	0.002
	(1.60)	(0.40)	(1.63)
Leverage	7.948***	3.369***	0.178*
	(8.50)	(3.26)	(1.92)
Log (Firm age)	-1.566***	-0.453	-0.036*
	(-4.84)	(-1.21)	(-1.84)
Log (Managerial ownership)	-0.793***	-1.166***	-0.029**
	(-3.83)	(-5.29)	(-2.19)
Industry dummies	Yes	Yes	Yes
R^2	0.31	0.18	0.39

Because the variability of performance is related to unpredictability, we also use three proxies for "unexpected" corporate stock and accounting performance in Table 4. The first proxy is the market-adjusted monthly stock return, calculated as the difference between the firm's monthly stock return and the market's value-weighted stock return. The second proxy is the industry-adjusted ROA, defined as the difference between the firm's annual ROA and the average ROA of the firms in the same industry in the same year. The third proxy is the industry-adjusted Tobin's Q, defined as the difference between the firm's Tobin's Q and the average of Tobin's Q of the firms in the same industry in the same year. The results in Table 4 confirm the results in Table 3. Specifically, the coefficient of D&O insurance is significantly positive for the standard deviation of market-adjusted stock returns (0.445), industry-adjusted ROA (0.789), and industry-adjusted Tobin's Q (0.043).

Table 5 uses the median values of all the independent variables in our regression analyses instead of average values. For example, the board size we use in the regressions of Table 5 is the median number of directors on the board during the sample period, as opposed to the average number used in Table 3. Similarly, the leverage of a firm is the median number of total debt divided by the median number of total assets during the sample period. Again, the results in Table 5 are consistent with the results in Table 3. Particularly, the coefficient of D&O insurance is significantly positive for the standard deviation of monthly stock returns (0.454), annual ROA (0.912), and Tobin's Q (0.032).

Table 5. Regression results: median

The sample consists of 1,067 listed firms in Taiwan in the period from 2008 to 2011. All regressions are ordinary least squares (OLS) analyses. Dependent variables are MRet std., ROA std. and TobinsQ std. in regression (1), (2) and (3) respectively. MRet std. is the standard deviation of monthly stock return within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the median number of directors on the board during the sample period. Ind. director pct. is the median percentage of independent directors on the board for each firm during the sample period. Dual CEO is the median of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is the median of an indicator during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the median of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the median of research and development expenses scaled by the median of net sales during the sample period. Leverage is the median of total debts divided by the median of total assets during the sample period. Firm age is the median of years since establishment during the sample period. Managerial ownership is the median of the percentage of shares held by managers during the sample period. Industry dummies are indicators defined by industry classification codes from Taiwan Stock Exchange (TWSE). ***. ** and * represent the significance levels at 1%, 5% and 10%, respectively.

	MRet std. (1)	ROA std. (2)	TobinsQ std. (3)
Log (Board size)	-0.314	0.327	0.074*
	(-0.54)	(0.52)	(1.82)
Ind. director pct.	-0.691	-0.293	-0.007
	(-0.79)	(-0.32)	(-0.12)
Dual CEO	0.319	-0.042	0.015
	(1.18)	(-0.14)	(0.76)
D&O insurance	0.454*	0.912***	0.032*
	(1.78)	(3.00)	(1.66)
Log (Assets)	-0.948***	-1.017***	-0.053***
	(-8.54)	(-7.02)	(-7.28)
R&D / sales	0.014	0.010	0.002***
	(1.63)	(0.80)	(2.86)
Leverage	7.081***	3.575***	0.110**
	(7.56)	(3.31)	(1.97)
Log (Firm age)	-1.476***	-0.596	-0.040*
	(-4.43)	(-1.52)	(-1.67)
Log (Managerial ownership)	-0.682***	-1.260***	-0.032**
	(-3.22)	(-5.45)	(-2.34)
Industry dummies	Yes	Yes	Yes
R^2	0.30	0.17	0.14

5.2 Endogeneity

While the discussions in Section 5.1 suggest a causal relationship from D&O insurance protection to corporate performance variability, the findings reported in Table 3 could also be consistent with reverse causation, as choices for D&O insurance are endogenously determined. For example, knowing litigation risk is high, companies with more variable performance may be more likely to purchase D&O insurance. In Table 6, we address this endogeneity concern by replacing a firm's average value of an independent variable in Model (1) with the firm's first-year observation on the variable during the sample period. For example, the board size we use in regressions of Table 6 is the number of directors on the board of a firm in the first year during the sample period, as opposed to the average number used in Table 3. When re-estimating Model (1) in this way, we use values of the independent variables in the first year during the sample period to explain the variability of the firm's performance over subsequent years. Therefore, this method should mitigate the concern that performance variability leads to decisions on D&O insurance. The results of this method are very similar to those in Table 3, although the sample size is reduced to 975 firms. Specifically, the coefficient of D&O insurance is significantly positive for the standard deviation of monthly stock returns (0.545), annual ROA (0.716), and Tobin's Q (0.031). These results suggest the causation goes from D&O insurance to firm performance variability.

Table 6. Regression results: beginning of the period

The sample consists of 975 listed firms in Taiwan in the period from 2008 to 2011. All regressions are ordinary least squares (OLS) analyses. Dependent variables are MRet std., ROA std. and TobinsQ std. in regression (1), (2) and (3) respectively. MRet std. is the standard deviation of monthly stock return within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the number of directors on the board in the first year during the sample period. Ind. director pct. is the percentage of independent directors on the board in the first year for each firm during the sample period. Dual CEO is an indicator in the first year during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O insurance is an indicator in the first year during the sample period; this indicator is 1 if the firm is covered by D&O insurance within the sample year and is 0 otherwise. Assets is the total assets measured in millions of New Taiwanese Dollars in the first year during the sample period. R&D / sales is the research and development expenses scaled by the average of net sales in the first year during the sample period. Leverage is the total debts divided by the total assets in the first year during the sample period. Firm age is the number of years since establishment in the first year during the sample period. Managerial ownership is the percentage of shares held by managers in the first year during the sample period. Industry dummies are indicators defined by industry classification codes from Taiwan Stock Exchange (TWSE). *** and ** represent the significance levels at 1% and 5%, respectively.

	MRet std. (1)	ROA std. (2)	TobinsQ std. (3)
Log (Board size)	-0.710	-0.188	0.030
	(-1.29)	(-0.32)	(1.11)
Ind. director pct.	-0.849	-0.543	-0.011
	(-0.97)	(-0.58)	(-0.22)
Dual CEO	0.410	-0.239	0.015
	(1.50)	(-0.84)	(0.94)
D&O insurance	0.545**	0.716**	0.031**
	(2.09)	(2.42)	(2.04)
Log (Assets)	-0.911***	-0.847***	-0.030***
	(-8.01)	(-7.13)	(-4.03)
R&D / sales	0.010**	0.008	0.001
	(2.00)	(0.92)	(1.32)
Leverage	6.995***	4.047***	-0.005
	(7.29)	(3.89)	(-0.08)
Log (Firm age)	-1.562***	-0.839**	-0.054***
	(-4.71)	(-2.43)	(-3.04)
Log (Managerial ownership)	-0.666***	-1.176***	-0.032***
	(-3.02)	(-5.27)	(-2.95)
Industry dummies	Yes	Yes	Yes
R^2	0.31	0.18	0.15

5.3 Economic significance of empirical results

Table 7 shows the economic significance of our results by using actual D&O insurance coverage of firms instead of just a dummy variable showing whether a company has D&O insurance. Consider the case in which D&O insurance coverage increases by 1 million New Taiwanese Dollars from an original coverage of 100 million (one percent increase). This change in insurance coverage leads log (D&O coverage) to increase by about 0.01. According to the results in column (1) of Table 7, the dependent variable changes by 0.046 x 0.01 = 0.00046, representing a 0.31% (0.32%) increase from the mean (median) value of the standard deviation of monthly stock returns. That is, a one percent increase in D&O insurance coverage will lead to a 0.31 percent increase in the variability of corporate performance. Similarly, the results in column (2) imply, for the same change in D&O insurance coverage, the standard deviation of annual ROA increases by 0.00075, or 30% (47%) from the mean (median). Further, according to the results in column (3) the change in D&O insurance coverage leads to an increase of 0.00004 in the standard deviation of Tobin's Q, which is a 0.0008% (0.001%) increase from the mean (median).

In summary, a one percent increase in D&O insurance coverage will lead to a 0.31, 30, and 0.0008 percent increase in the variability of corporate performance measured in monthly stock returns, annual accounting returns on assets (ROA), and Tobin's Q respectively.

Table 7. Regression results: insurance coverage

The sample consists of 1,067 listed firms in Taiwan in the period from 2008 to 2011. All regressions are ordinary least squares (OLS) analyses. Dependent variables are MRet std., ROA std. and TobinsQ std. in regression (1), (2) and (3) respectively. MRet std. is the standard deviation of monthly stock return within the sample period. ROA std. is the standard deviation of annual return on assets within the sample period. Return on assets is the net income before interests and taxes scaled by total assets at the end of the year. TobinsQ std. is the standard deviation of the market value of the firm divided by total assets at the end of the year within the sample period. The market value is the total assets minus the book value of equity and then adding the market value of equity. Board size is the average number of directors on the board during the sample period. Ind. director pct. is the percentage of average independent directors on the board for each firm during the sample period. Dual CEO is the average of an indicator during the sample period; this indicator is 1 if the chairman is also the CEO and is 0 otherwise. D&O coverage is the average of the insurance coverage during the sample period. Assets is the average of total assets measured in millions of New Taiwanese Dollars during the sample period. R&D / sales is the average of research and development expenses scaled by the average of net sales during the sample period. Leverage is the average of total debts divided by the average of total assets during the sample period. Firm age is the average number of years since establishment during the sample period. Managerial ownership is the average of the percentage of shares held by managers during the sample period. Industry dummies are indicators defined by industry classification codes from Taiwan Stock Exchange (TWSE). ***. ** and * represent the significance levels at 1%, 5% and 10%, respectively.

	MRet std. (1)	ROA std. (2)	TobinsQ std. (3)
Log (Board size)	-0.345	0.115	0.070
	(-0.59)	(0.18)	(1.28)
Ind. director pct.	-0.792	-0.323	-0.017
	(-0.90)	(-0.34)	(-0.28)
Dual CEO	0.488*	-0.045	0.013
	(1.72)	(-0.15)	(0.61)
Log (D&O coverage)	0.046**	0.075***	0.004**
	(2.19)	(3.01)	(2.43)
Log (Assets)	-0.955***	-1.008***	-0.053***
	(-8.44)	(-6.94)	(-3.37)
R&D / sales	0.011	0.010	0.002
	(1.62)	(0.85)	(1.14)
Leverage	7.347***	3.797***	0.126
	(7.85)	(3.48)	(1.33)
Log (Firm age)	-1.465***	-0.575	-0.039*
	(-4.40)	(-1.45)	(-1.86)
Log (Managerial ownership)	-0.639***	-1.201***	-0.028**
	(-2.96)	(-5.10)	(-2.06)
Industry dummies	Yes	Yes	Yes
R^2	0.31	0.17	0.14

6 Conclusions

This paper shows corporate performance and value become more variable as a firm is protected by D&O insurance. The empirical results from 1,067 firms listed on either the Taiwan Stock Exchange (TWSE) or GreTai Securities Market (OTC) in Taiwan over the 2008-2011 period establish this relation for monthly stock returns, annual ROA, and Tobin's Q. Our findings provide evidence for the managerial opportunism argument, which suggests that D&O insurance protection magnifies the agency problem faced by firms through moral hazard. Specifically, because of information asymmetry, firms' directors and officers may act in their own best interests since shareholders cannot usually monitor the directors and officers completely. By reducing the negative consequences resulting from these inappropriate acts of directors and officers, the agency problem may be worse when the protection of D&O insurance makes a firm's directors and executive officers become more willing to take risks and/or act less carefully. As a result, our contribution with this paper is showing rather than reduce risk, D&O insurance may actually increase firm risk, which is totally opposite to the essential purpose of implementing this insurance.

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