

公司治理：董監事責任與董事會結構

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本文目的在於探討沙賓法案 Sarbanes-Oxley Act (SOX)之後，董監事法律責任對公司治理之影響，以及分析董事會組成之決定因素。本研究以台灣上市公司 2003-2007 年之資料進行實證分析，研究結果顯示董事會之獨立性與董監事暨重要職員責任保險、負債比率、執行長之主導權以及高科技產業有顯著正向關係。董事長兼執行長之雙重領導現象(leadership duality)則與公司規模成反向關係，但與高科技產業成正向關係。此外，小型公司之董事會人數可能因有董監事責任保險保障而增加，但是在大型公司中則無此現象。整體而言，本研究結果顯示董監事之法律責任對於董事會的結構具有重要影響力，而其責任保險保障在公司治理上則可提供監督之功能。

關鍵詞：公司治理、董事會結構、董監事責任、董監事暨重要職員責任保險

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Corporate Governance: Directors' Liability and Board Structure

This paper attempts to investigate the effect of directors' liability on corporate governance and the determinants of the board after the Sarbanes-Oxley Act (SOX). Based on the data of public firms in Taiwan during 2003-2007, the empirical findings suggest that board independence is positively related to Directors' & Officers' (D&O) insurance, debt ratio, bargaining power of CEO and high technology industry. Board leadership duality is negatively related to firm size and positively related to high technology industry. The findings also show that board size is positively related to D&O insurance in small firms but unrelated in large firms. The results in general suggest that directors' liability is an important determinant of board structure and D&O insurance provides monitoring incentive for corporate governance.

Keywords: Corporate Governance, Board Structure, Directors' Liability,
Directors' and Officers' Insurance

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1. INTRODUCTION

The unexpected failures of some large public companies in recent years have made corporate governance an important issue in business practice and public policy. The regulations of the Sarbanes-Oxley Act (SOX) of 2002 require public firms to align the incentives of corporate insiders and investors. It also requires the chief executive officer (CEO) and chief financial officer (CFO) to certify the financial statements, which impose more legal liability for the CEO and top managers. In addition to SOX, the stock exchanges (SEC) regulations set the criteria for board independence, including a majority of independent directors on the board and independence in choosing new directors and compensating managers (Chhaochharia and Grinstein 2007). The purpose of these regulations is to have better corporate governance for a firm and more protection for investors since many researches show that better governance implies better performance or firm value, e.g., Gompers, Ishii, and Metrick (2003), Cremers and Nair (2005), and Black, Jang, and Kim (2006).

Although better governance likely contributes to better performance, it is ambiguous whether better board structure implies better governance. In practice, the business operations of a firm are mainly controlled by the CEO and managers who significantly influence the performance. The leadership of the CEO is in fact a critical factor for business success and firm value. Outside directors usually play the role of monitoring insiders and thus might cause conflict with the CEO. Fama and Jensen (1983) suggest that directors may have incentives to build reputations of expert monitoring. The poor performance of a business may increase the monitoring of outside directors, which implies that the CEO prefers a less independent board (Hermalin and Weisbach 1998). Hermalin and Weisbach (2003) explain that the existence of the board of directors should be a market solution for an organizational design problem, instead of just a product of regulation.

In fact, the importance of corporate governance is a consequence of the segregation of ownership and management. The delegation of management might cause friction between the shareholders and the managers, the so-called “agency conflict” (Jensen and Meckling 1976). As indicated by Wright et al. (2007), the agent (manager) may make business decisions for his own interests instead of the shareholders’. Fama and Jensen (1983) suggest that the board of directors has an important function in monitoring the operations of a firm. The purpose of outside directors and board independence is to reduce this agency conflict, which in theory is beneficial to the investors. However, it is empirically unclear whether more outside directors can increase corporate performance. Neither Klein (1998) nor Bhagat and Black (2002) report a significant relationship between firm performance and board independence based on the long-term study of the stock market. Chhaochharia and Grinstein (2007) find that firms less compliant with the SOX provisions earn positive abnormal returns compared with the more compliant firms.

Therefore, the function of the board of directors is a debatable issue in business practice and academic research.

Regardless of the function of the board, the trend appears to be that the investors will sue the firms and their directors and officers when the investments are poor. To reduce liability risk, directors’ and officers’ liability insurance (D&O insurance) has become a popular tool used in modern society. D&O insurance indemnifies directors and officers for the potential loss arising from possible litigations. Especially under the new regulations, directors and officers face unprecedented scrutiny and exposure to liability. The firms may voluntarily purchase D&O insurance even without regulatory requirements. The relationship between D&O insurance and corporate governance is challenging because of the potential impact of insurance on the incentive of care. Chalmers, Dann, and Harford (2002) find that D&O insurance decisions reveal managers’ opportunistic behaviors. However, Priest (1987) indicates that in the US and Canada it is difficult for companies without D&O insurance to have capable independent directors.

This study aims to investigate the relationship between D&O insurance protection and board composition since the purpose of D&O insurance is to manage litigation risk connected to corporate governance. Numerous previous studies have contributed to the investigation of the determinants of board structure and have provided valuable insights, for example, Coles, Daniel, and Naveen (2008) and Boone et al. (2007). However, the role of D&O insurance in the board structure has not yet been examined in depth even if it is popular in the US and UK markets. The papers regarding the impact of D&O insurance on board composition or corporate governance, especially after SOX, are limited. Therefore, this study intends to make up the gap.

Taiwan Stock Exchange Corp. (TSEC) also establishes several regulations similar to SOX during 2001-2003 which enhance the duties of directors.¹ Consequently firms and their directors in Taiwan face more litigation risks than before, and the demand for D&O insurance increases dramatically as shown in the appendix 1. The problems of corporate governance in the U.S. and their research issues described above are also applicable to Taiwan market. Due to data availability constraint, this study analyzes the relationship between directors’ liability and the board composition based on the data of firms in Taiwan instead of in the U.S. However, the findings can provide some suggestions for public policies of corporate governance both in Taiwan and the international markets since most of the modern capital markets in the world encounter similar problems. This paper focuses the analysis of board structure and D&O insurance incentives on three elements, (1) board independence, (2) board leadership,

¹ For example, TSEC revised Company Law to enhance the directors’ duties in year 2001, and establish “Corporate Governance Practice Guidelines for Public Companies” and “Investors Protection Act” in year 2002.

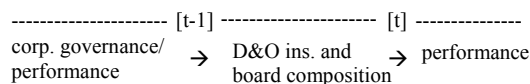
and (3) board size, because these elements are relevant to corporate governance (Linck, Netter, and Yang 2008). The empirical study is based on 299 public companies listed in the Taiwan Stock Exchange in year 2008. The empirical results in general support the monitoring incentive of D&O insurance, especially in the element of board independence. The moral hazard incentive is not significant in our findings.

The paper is organized as follows. The review of previous literature and the development of testing hypotheses are provided in section 2. Section 3 describes the research methodology and sample, and then the results are presented in section 4. The final section provides conclusions and suggestions for future studies.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The impact of D&O insurance on corporate governance is ambivalent. It may generate monitoring incentive as well as moral hazard incentive. The monitoring effect results from capable independent directors and insurer's ex ante underwriting and rating process, while the moral hazard effect is an inherent ex post shortcoming of the insurance mechanism. The causality of D&O insurance and corporate governance is illustrated in figure 1. Therefore, it is not surprising to see in practice that the US advocates but Germany prohibits D&O insurance (Gutierrez 2003). The literature regarding the monitoring incentive and moral hazard of the board and D&O insurance is categorized as follows.

Figure 1
Causality of D&O Insurance and Corporate Governance



2.1 Monitoring Incentive

Core (1997) uses data of Canadian firms to investigate the function of D&O insurance for supplementing corporate governance and supports the monitoring hypothesis of D&O insurance. Similar research can be found in O'Sullivan (2002). Redington (2005) discusses the underwriting implications of Section 404 of the Sarbanes-Oxley Act of 2002 on D&O insurance. Adams and Ferreira (2007) suggest that the major functions of the board are monitoring and advising. Cadbury (1992) and Hampel (1998) consider that both the board of directors and D&O insurance have a monitoring function and may complement each other. In general, outside directors are more just and objective than inside directors. Dechow, Sloan, and Sweeney (1996) also find that the firms with financial reports that the SEC reviewed as manipulated usually have a lower number of outside directors. Jensen (1993) suggests that firms with independent boards of directors and chief executive officers

(CEO) usually have better corporate governance. The studies by Priest (1987) and Daniels and Hutton (1993) find that in the US and Canada it becomes difficult for those companies without D&O insurance to have capable independent directors due to the fear of litigation risk. Since D&O insurance affects the directors' and officers' litigation risk, it may influence people's willingness to be the directors. Holderness (1990) finds that firm ownership structure has an impact on firm corporate governance and shows that there are fewer agency conflicts for those companies with D&O insurance due to more significant segregation between ownership and management. Therefore, it is expected that the firm with D&O insurance can encourage independent directors to join the board and will have better board independence because of its monitoring incentive.

In addition to board independence which is usually measured by the proportion of outside directors on the board, the monitoring effect of D&O insurance possibly discourages the chairman of board (COB) to serve as CEO simultaneously (i.e., duality of leadership) to maintain the board independence. Otherwise, how can the board monitor the CEO? On the other hand, Brickley, Coles, and Jarrell (1997) find that excellent CEOs are awarded the COB title for later promotion and succession. In this situation, it is expected that the firm performance is good and consequently there is less litigation and less need of D&O insurance. Thus, duality of leadership is supposed to be negatively related to D&O insurance protection in either case. Yermack (1996) and Eisenberg, Sundgren, and Wells (1998) show that firm value is negatively related to board size. They imply that smaller board size is more effective in monitoring. If D&O insurance can generate monitoring incentive, the firm is expected to have smaller board size. In summary, the testing hypotheses for the monitoring effect of D&O insurance are:

Hypothesis 1a: Board independence is positively related to D&O insurance protection due to its monitoring incentive.

Hypothesis 1b: Board leadership duality is negatively related to D&O insurance protection due to its monitoring incentive.

Hypothesis 1c: Board size is negatively related to D&O insurance protection due to its monitoring incentive.

2.2 Moral Hazard Incentive

D&O insurance might result in moral hazard incentive for the directors. The moral hazard problem of insurance has been a long-term issue in insurance literature (Winter 2000). However, there are no conclusive findings in the previous empirical studies regarding the moral hazard of liability insurance. The moral hazard effect of D&O insurance is still unclear because of the limited number of studies on this issue, even though Chalmers, Dann, and Harford (2002) find that managers' opportunistic behaviors are related to D&O insurance decisions.

Stulz (1988) and Eckbo and Verma (1994) indicate that the inside directors neglect the interests of the other shareholders and promote their own benefits when they are the majority of the board. We expect that in this case the inside directors may apply D&O insurance to protect themselves. Since poor performance of a business may invite the monitoring of outside directors, a CEO with poor performance is expected to prefer a less independent board, as suggested by Hermalin and Weisbach (1998). The CEO probably would like to serve as the chairman of the board to control the board and take more D&O insurance protection. In summary, the moral hazard incentive of D&O insurance may induce the directors to search for more interests for themselves than for the shareholders. Furthermore, Yermack (1996) and Eisenberg, Sundgren, and Wells (1998) both show that firm value is negatively related to board size. This implies that larger boards might encounter more litigation risk and demand more D&O insurance if insurance induces moral hazard. Raheja (2005) indicates that the board size will be smaller when the interests of insiders and shareholders are aligned, which implies less litigation risk and less demand for D&O insurance. Therefore, the testing hypotheses for the moral hazard incentive of D&O insurance can be stated as follows.

Hypothesis 2a: Board independence is negatively related to the D&O insurance protection due to its moral hazard incentive.

Hypothesis 2b: Board leadership duality is positively related to the D&O insurance protection due to its moral hazard incentive.

Hypothesis 2c: Board size is positively related to the D&O insurance protection due to its moral hazard incentive.

3. SAMPLE AND RESEARCH METHODOLOGY

3.1 Sample and Data

The sample for this study is based on 1225 public companies listed in the Taiwan Stock Exchange in year 2008. In Taiwan D&O insurance data are not disclosed in the annual reports of the companies and are not available from the insurers or other public data bases. Thus we searched for the D&O insurance information directly from the companies using a questionnaire. The questionnaire contains information for purchase/not purchase of D&O insurance, amount of insurance coverage, and premium expenditure during 2003-2007 since the governance regulations were set up around year 2002 following the trend of SOX.² Of the 1225 public com-

panies, 299 firms responded to the questionnaire, and the effective response rate is 24.41%. Although the sample obtained from surveys, it includes firms from most industry categories with well diversified distribution as shown in appendix 2. Besides, the t-tests for the means of variables used in the empirical analyses show that their differences between the sample and the population (i.e., all public firms) are insignificantly as shown in appendix 2. Therefore the sample is considered to serve as a reasonable representative for the population. Then, we retrieved the financial data and board structure information from the financial statements and annual reports of these 299 firms. The financial data and board structure information are from the public data bases of the Taiwan Economic Journal (TEJ), Taiwan Stock Exchange Corp. (TSEC), and Market Observation Post System (MOPS) for years 2003-2007.

Because D&O insurance is not compulsory for companies in Taiwan, it has not been popularly used until recent years. Only a few companies in the sample purchased D&O insurance before 2005. Therefore the data finally applied in this study are those of recent three years, 2005-2007.³ After deleting the firms with incomplete data, the descriptive statistics of the sample are summarized in table 1.

Table 1
Summary Statistics of the Sample

Variable	N	Mean	Std Dev	Minimum	Maximum
D&O ins. (yes/no)	733	0.37	0.48	0	1.00
D&O ins. Amount (US\$,000)	268	11,059	20,734	1000	200,000
Prop. Of indep. directors	733	0.52	0.22	0	0.93
Leadership duality	733	0.30	0.46	0	1.00
No. of directors	733	11.93	3.64	5.00	26.00
Total assets (NT\$ million)	733	71,503	279,611	188	2,373,415
Market value of equity (NT\$million)	733	27,802	116,464	61	1,743,504
Debt ratio	733	0.38	0.21	0.01	0.97
Stock volatility	733	2.51	1.33	0.78	29.75
High tech. (yes/no)	733	0.60	0.49	0	1.00
Shares % owned by outsiders	733	8.24	8.32	0	81.53
Avg. shares % per outsider	733	1.82	2.89	0	28.49
Shares % owned by insiders	733	16.42	13.79	0.04	81.96
Shares % owned by CEO	733	0.98	1.53	0	10.30
Industry adjusted ROA	733	-1.34	10.08	-41.87	38.51
Market-to-book (MTB) of equity	733	2.71	2.82	0.15	30.10

Note: D&O insurance is sold based on US\$.

² In Taiwan the regulations for corporate governance and investor protection were established in year 2002. The public information of financial statements and annual reports are available only up to year 2007 when this study was conducted. Therefore we collect data for the period 2003-2007.

³ We also conduct the analyses based on various sample periods from 1-year to 5-year. The findings are very close, therefore we only report the results based on 3-year data.

3.2 Research Methodology

The analysis of the effect of D&O insurance on the board composition is conducted through several approaches because the board structure is relatively persistent, as suggested by Hermalin and Weisbach (1998). Linck, Netter, and Yang (2008) indicate that the three elements of the board independence, leadership, and size are likely to be endogenously determined and thus need more attention in the analytical methodology. We first conduct the t-test and Wilcoxon test for the means and medians of the two groups of firms, with and without D&O insurance, regarding the three elements of the board. The comparisons of means and medians between two groups can provide initial knowledge for the effect of D&O insurance on the board composition.

Next, regression analysis is applied to study the impact of D&O insurance on the board structure with consideration of firm characteristics. The dependent variable of board structure is represented by board independence, leadership, and size of the board. These variables are measured based on the definition given by Linck, Netter, and Yang (2008). Board size is defined as the number of directors on the board. Board independence is defined as the proportion of outside directors on the board. Board leadership is the CEO duality which means the CEO is also the chairman of the board. The leadership duality is a dummy variable with one for duality and zero for otherwise.

The explanatory variables in the regression analysis include D&O insurance and other control variables for firm characteristics because Himmelberg, Hubbard, and Palia (1999) indicate various factors likely affect the corporate governance. D&O insurance protection is represented by two proxies. The first one is a dummy variable which equals one if the firm has D&O insurance and zero if it doesn't have insurance protection. The second proxy is the natural logarithm of insurance amount. The variables for firm characteristics include firm size, debt ratio, stock volatility, industry, shareholding percentages of the directors and the top management, and firm performance.

Firm size and debt ratio are for firm complexity because the monitoring cost naturally increases with firm complexity and more capable independent directors are needed to advise the operations as suggested by Boone et al. (2007). Leadership duality probably is helpful for a large firm as found by Linck, Netter, and Yang (2008). Thus firm size is expected to be positively related to the three elements of board structure. Firm size is measured by the natural logarithm of market value of equity (MVE) as used in Linck, Netter, and Yang (2008), and we add another alternative - the natural logarithm of book value of total assets. Because capital requirements are different for different industries in Taiwan, equity size is not necessarily consistent with asset size and firm complexity. Thus two alternative variables are considered for the firm size. The debt ratio is equal to the book value of debt to book value of debt plus market value of equity. The firm with high debt ratio may have higher probability of financial distress

and thus need more monitoring and advising from the independent directors. Thus we expect the board independence to increase with the debt ratio. Besides, the board size may increase due to more outside directors are recruited if the previous directors remain on the seats. The effect of debt ratio on leadership is unknown because separation of leadership can help prevent financial manipulation but the CEO probably prefers to control the board when the financial condition is not good.

Stock return volatility is another proxy for monitoring cost. Fama and Jensen (1983) indicate that firms with high stock return volatility probably have specific information unknown to outsiders, and Maug (1997) considers it costly for the firm with high information asymmetry to transfer information to the outside directors. Shu (2000) also considers that the litigation risk is positively related to the stock volatility although the empirical evidence is insignificant. Adams and Ferreira (2007) suggest that the number of outside directors decreases with the monitoring cost. Therefore, the board size and independence are expected to be negatively related to stock volatility, but the leadership duality increases with it. The measurement for stock volatility is the standard deviation of monthly stock returns.

Industry is another variable related to information issue. It is expected that firms in the high technology industry have higher information asymmetry between the officers and the investors. The CEOs and officers in these firms usually have superior knowledge and own certain shares due to employee-stock plans. The board independence is expected to increase for high technology firms because they need more advising and monitoring from outsiders. The leadership duality is also expected to increase because technology expertise is a required qualification for a leader in such firms. However, the board size is expected to decrease in these firms to avoid inefficiency. The measurement for industry is a dummy variable which equals one for high technology and zero for others.

The shareholding percentage of the outside directors and the top management represents the ownership incentives. Raheja (2005) indicates that the board size will be smaller when the incentives of inside directors are aligned with those of shareholders. It is expected the board independence and size decrease with the shares-holding by the insiders. The leadership duality is expected to increase with the CEO's shares-holding. The measurement for insiders' ownership is percentage of shares owned by the CEO (top management).⁴ The measurement for outsiders' ownership is the percentage of shares owned by the outsiders and the average percentage of shares owned per

⁴ The shares percentage owned by CEO used in the empirical study in fact is that for top management together instead of CEO only because separate data are unavailable. An alternative measurement usually used for the insiders' incentive is the percentage of shares owned by the inside directors. We also apply this alternative in our empirical analysis and the results can be requested from the authors.

outsiders.⁵ The board independence and size are expected to decrease with per outsider's ownership due to the number of outsiders, but increase with the shares percentage of total outsiders. However, the relationship between leadership duality and the outsider's shares percentage is unknown because few studies refer to this issue. Thus we follow after Linck, Netter, and Yang (2008) and do not include the outsiders' incentive in the model for testing leadership duality.

Finally the firm performance is a proxy for the CEO bargaining power because a CEO with good performance is likely to have better bargaining power. Previous studies have different comments on the relationship between board independence and CEO bargaining power. Hermalin and Weisbach (1998) suggest a negative relationship that board independence decreases with the CEO's bargaining power. Raheja (2005) considers it positive because the board needs more outsiders to counterbalance the CEO's influence. The firm performance is measured by the industry-adjusted return on assets (ROA) and market-to-book ratio of equity (MTB). ROA is traditionally a standard measure for firm performance and MTB is the proxy for growth opportunity (Gaver and Gaver 1993). We expect that the board independence decreases but the leadership duality increases when the CEO contributes higher ROA and MTB. The board size is expected to decrease with performance because previous literature suggests the inefficiency of large board size.

As the causality illustrated in figure 1 above, the variables for firm characteristics applied in the regression analysis are the year-end data of $t-1$ so that they can affect the decision of board composition since the board is elected at the beginning of year t . The D&O insurance is purchased at the beginning of year t to cover the board directors in that year. Therefore insurance data of year t is applied to the analysis. The models for empirical testing for hypotheses (1) and (2) are specified as follows. The definitions of variables and expected signs are listed in table 2.

$$\begin{aligned} \text{BoardIndep}_{it} = & \alpha + \beta_1 \text{D\&O}_{it} + \beta_2 \text{FirmSize}_{it-1} \\ & + \beta_3 \text{DebtRatio}_{it-1} + \beta_4 \text{StockVolatility}_{it-1} \\ & + \beta_5 \text{Industry}_{it-1} + \beta_6 \text{OutsiderShares\%}_{it-1} \\ & + \beta_7 \text{CEOShares\%}_{it-1} + \beta_8 \text{ROA}_{it-1} + \beta_9 \text{MTB}_{it-1} \\ & + \varepsilon_{it-1} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{BoardLeaders}_{it} = & \alpha + \beta_1 \text{D\&O}_{it} + \beta_2 \text{FirmSize}_{it-1} \\ & + \beta_3 \text{StockVolatility}_{it-1} + \beta_4 \text{Industry}_{it-1} \\ & + \beta_5 \text{CEOShares\%}_{it-1} + \beta_6 \text{ROA}_{it-1} + \beta_7 \text{MTB}_{it-1} \\ & + \varepsilon_{it-1} \end{aligned} \quad (2)$$

$$\begin{aligned} \text{BoardSize}_{it} = & \alpha + \beta_1 \text{D\&O}_{it} + \beta_2 \text{FirmSize}_{it-1} \\ & + \beta_3 \text{DebtRatio}_{it-1} + \beta_4 \text{StockVolatility}_{it-1} \\ & + \beta_5 \text{Industry}_{it-1} + \beta_6 \text{OutsiderShares\%}_{it-1} \\ & + \beta_7 \text{CEOShares\%}_{it-1} + \beta_8 \text{ROA}_{it-1} + \beta_9 \text{MTB}_{it-1} \\ & + \varepsilon_{it-1} \end{aligned} \quad (3)$$

⁵ In addition to the total shares percentage owned by outsiders, we use the average shares percentage per outsider to take into account the number of outsiders.

OLS regression is applied for board independence and size in models (1) and (3), and logistic regression is applied for leadership duality in model (2) respectively. These OLS regressions, which assume error terms, are exogenous and independent and are conducted individually for the initial analysis. Then we use the simultaneous equations framework to estimate the three models jointly to consider possible endogeneity among the elements of board structure and D&O insurance. Furthermore, the analysis is extended to include the interaction between D&O insurance and other explanatory variables because the decision on board composition is likely influenced by the combined effect of D&O insurance and firm characteristics.

Empirical analyses are also conducted on the subset of data which are categorized based on firm size and industry. Previous literature shows that there are significant differences in corporate governance between large firms and small firms. The firms with total assets greater than the sample median are grouped into large firms, otherwise into small firms. The high technology industry is unique in the Taiwan economy and its management is distinctive from that of other industries, and thus its corporate governance is likely to present different prospects.

Additionally, we conduct an event study to trace the changes in board composition after the initial purchase of D&O insurance to supplement the findings of regression analyses because regression explains the relationship between the variables but probably not their causality. We trace the changes in board independence, leadership duality, board size and number of outside directors for one and two years after the initial purchase of D&O insurance for those firms that were insured during 2003-2007.

4. EMPIRICAL RESULTS

The comparisons of board structure and firm characteristics between the firms with and without D&O insurance are shown in Table 3. The results of the t-test indicate that board independence is higher in the firms with D&O insurance, which is confirmed by the nonparametric Wilcoxon test. The difference in leadership duality is not significant according to both tests. The tests on board size also show significant difference according to t-test and the Wilcoxon test, which indicates firms with D&O insurance has larger board size. Additionally, both of the tests show that firms with D&O insurance have lower debt ratio and shares % owned by the insiders, and higher MTB ratio, and are located more in the high technology industry. The stock volatility of firms with D&O insurance is higher according to t-test. The Wilcoxon test indicates some more items of differences in the firm characteristics. For example, the percentage of shares owned by the CEO is lower in the firms with D&O insurance, and ROA is better for this group of firms. The firms with D&O insurance also present more total assets and higher equity value. The extra items of significant variables under Wilcoxon test probably result from the assumption of probability distribution.

Table 2
Definitions of Variables and Expected Signs for Testing

Model	(1)Board independence	(2)Board leadership	(3) Board size
Variables	no. outsiders/ total directors	1 if CEO=COB, 0 otherwise	no. of directors on the board
D&O insurance yes/no=1/0 ln(\$amount)	+ (H1a), - (H2a)	- (H1b), + (H2b)	- (H1c), + (H2c)
Firm size ln(total assets) ln(MV of equity)	+ +	+ +	+ +
Debt ratio BVD/(BVD+MVE)	+		+
Stock volatility stock returns volatility	-	+	-
Industry tech./nontech. =1/0	+	+	-
Outsiders' ownership shares % by outsiders average shares % per outsider	+ - -		+ - -
Insiders' ownership shares % by CEO	-	+	-
Performance industry adj-ROA market-to-book ratio of equity (MTB)	- - -	+ + -	- - -

Table 3
Comparisons between the Firms with and without D&O Insurance

Variable	Mean-yes	Mean-no	t-test	Wilcoxon test
Board independence	0.57	0.49	-5.03 ***	4.71 ***
Board leadership duality	0.29	0.30	0.29	-0.29
Board size	12.30	11.72	-2.07 *	3.24 ***
Total assets (NT\$million)	72,800	70,700	-0.10	3.53 ***
Market value of equity (NT\$million)	34,489	23,949	-1.18	5.23 ***
Debt ratio	0.36	0.39	2.16 *	-1.87 *
Stock volatility	2.62	2.44	-1.71 +	0.47
Industry (high tech. =1)	0.74	0.52	-6.06 ***	5.92 ***
Shares % owned by outsiders	8.45	8.11	-0.53	0.49
Avg. shares% per outsider.	1.63	1.93	1.33	-1.35 +
Shares % owned by insiders	14.38	17.60	3.06 **	-3.96 ***
Shares % owned by CEO	0.87	1.04	1.39	1.44 +
Industry-adj ROA	-0.79	-1.65	-1.11	2.33 **
Market-to-book ratio of equity	3.00	2.54	-2.12 *	3.57 ***
Sample size	268	465		

Note: Mean-yes is the mean for the firms with D&O insurance, and Mean-no is the mean for those without D&O insurance. t-test and Wilcoxon test are for differences in means and medians.
Significance levels: + p<0.10; * p<0.05; ** p<0.01; *** p<0.001.

Table 4a
OLS Regression for Board Structure

Variable	Board independence		Leadership Duality		Board size	
	Estimate	p-value	estimate	p-value	estimate	p-value
Intercept	0.979 ***	<.001	1.421	0.11	-1.89 +	0.10
D&O ins (yes/no)	0.067 ***	<.001	-0.055	0.75	0.074	0.76
Ln(total assets)	-0.040 ***	<.001	-0.165 **	0.00	0.958 ***	<.001
Debt ratio	0.151 ***	<.001			-1.199 +	0.09
Stock volatility	-0.002	0.67	0.001	0.98	-0.115	0.21
Industry (high tech. =1)	0.141 ***	<.001	0.428 **	0.02	-0.157	0.55
Avg. shares % per outsider.	-0.013 ***	<.001			-0.21 ***	<.001
Shares % owned by CEO	0.012 **	0.01	-0.011	0.84	0.146 +	0.06
Industry-adj ROA	0.004 ***	<.001	-0.013	0.20	0.029 +	0.06
MTB ratio of equity	0.006 **	0.04	-0.005	0.90	0.020	0.72
adj-R ² or logistic R ²	0.375		0.052		0.295	
Sample size	733		733		733	

Table 4b
OLS Regression for Board Structure – Alternative Variables

Variable	Board independence		Leadership duality		Board size	
	Estimate	p-value	estimate	p-value	estimate	p-value
Intercept	0.676 ***	<.001	-0.438	0.406	3.752 ***	<.001
D&O ins (yes/no)	0.069 ***	<.001	-0.093	0.606	0.085	0.741
Ln(market value of equity)	-0.04 ***	<.001	-0.096 +	0.094	0.953 ***	<.001
Debt ratio	0.017	0.655			1.639 **	0.019
Stock volatility	-0.002	0.762	0.020	0.755	-0.155 +	0.104
Industry (high tech. =1)	0.149 ***	<.001	0.525 **	0.005	-0.169	0.531
Shares % owned by outsiders	0.003 ***	<.001			0.016	0.279
Shares % owned by CEO	0.013 **	0.003	0.004	0.935	0.132 +	0.102
Industry-adj ROA	0.004 ***	<.001	-0.011	0.288	0.031 *	0.054
MTB ratio of equity	0.010 ***	0.001	-0.003	0.938	-0.015	0.803
Adj-R ² or logistic R ²	0.365		0.039		0.239	
Sample size	733		733		733	

*** significance at 0.1%; ** significance at 1%; * significance at 5%; + significance at 10%.

The regression results for the board structure are shown in tables 4a and 4b for alternative explanatory variables.⁶ In general, the results of the two tables reveal similar information. The prediction power of the model is highest for board independence and lowest for leadership duality. Both tables show that board independence is positively related to D&O insurance and thus supports hypothesis 1a of monitoring incentive. The firm characteristics also have a significant impact on the board independence. The effect of firm size is negative and inconsistent with the prediction. The debt ratio and technology industry dummy positively affect board independence as the prediction. The effect of stock volatility is insignificant in both models. The impact of outsiders' incentives is also significant and consistent with the prediction. Board independence is negatively related to the average shares percentage per outsider and positively related to the total share percentage owned by the outsiders. The effect of CEO incentive is positive on the board independence, and the performance (ROA and MTB) also has a positive relationship with board independence. These results contradict the prediction of bargaining power theory but support the argument of Raheja (2005) that the board needs more outsiders to counterbalance the CEO's influence.

The effect of D&O insurance on the leadership duality is insignificant, according to the results in tables 4a and 4b. Besides, most of the firm characteristics do not exhibit significant impact either, which is similar to the results in previous literature. The only variables significantly related to leadership duality are firm size and industry. The small firms are more likely to have a CEO who also served as a COB, which contradicts the theoretical prediction but reflects the reality of business culture in Taiwan. The high technology firms usually prefer leaders with expertise and thus have positive effect on the leadership duality as predicted. The board size is not significantly related to D&O insurance. However, it is positively related to firm size and negatively related to the average shares percentage per outsider as predicted. The results of the alternative model in table 4b indicate that board size is also positively related to debt ratio as predicted. Besides, it has positive relationship with CEO's shares % and ROA, which again contradicts the prediction of bargaining power but supports the argument of counterbalancing the CEO's influence.

The empirical results based on simultaneous equations model are presented in table 5.⁷ The simultaneous equations model includes equations (1)-(3) and an additional equation for D&O insurance demand because it may have endogenous relation with the board composition.

The findings are very close to those of OLS regressions in the basic analyses because the correlations between the three elements of board structure are low. That is, the endogeneity problem among the three elements of board structure is not serious in our sample. The board composition in the previous period may influence the D&O insurance demand. Board independence has a positive effect on insurance demand, while board size is negatively related to D&O insurance. The result implies that a more independent and efficient board will prefer D&O insurance, or on the other hand the insurer is willing to supply insurance to such board. This finding suggests the D&O insurance has a monitoring function for the board composition.

The empirical results based on the models with the interaction of D&O insurance and firm characteristics are shown in table 6. The prediction power (R^2) is a little higher than the basic model in table 4a. The relationship between explanatory variables and board independence is the same as those in table 4a. Additionally, the interaction terms provide some extra messages for the role of D&O insurance. The interactions of D&O insurance with technology industry, CEO shares %, or MTB have a negative impact on the board independence, which is opposite to the effects of using single variables only. This result implies that D&O insurance not only affect the board independence by itself by also through the indirect influences on other variables.

The new information revealed for the board leadership duality from the interaction model includes the interaction effect of D&O insurance with firm size and CEO shares %. D&O insurance coverage may encourage large firm to have dual leadership, but it monitors shares % owned by CEO. The analysis for board size also provides new findings in addition to those in the basic model. The results in table 6 show that board size is negatively related to stock volatility as predicted but positively related to the interaction stock volatility and D&O insurance, which implies that the monitoring function of D&O insurance encourages more outside directors on the board when the volatility is high. The results in table 6 also show that MTB has a positive impact but the interaction of MTB and D&O insurance has a negative impact on the board size, which implies D&O insurance can improve the efficiency of board size when a firm with growth opportunity (MTB).

⁶ The proxy for firm size used in table 4a is $\ln(\text{total assets})$, and it is $\ln(\text{MV of equity})$ in table 4b. The proxy for outside directors' incentive is average shares percentage per outsider in table 4a, and it is total shares % owned by the outsiders in table 4b.

⁷ The empirical results for the alternative variables are omitted in the paper because they do not provide much additional information, but they can be requested from the authors.

Table 5 Simultaneous Equations Regression for Board Structure

Variable	Board indep _{it}	Leadership duality _{it}	Board size _{it}	D&O ins. _{it}
Intercept	0.979 ***	0.708 ***	-1.894 +	-1.113 ***
Board indep _{it-1}				0.525 ***
Leadership duality _{it-1}				-0.048
Board size _{it-1}				-0.014 **
D&O ins (yes/no)	0.067 ***	-0.013	0.074	
Ln(total assets)	-0.040 ***	-0.030 **	0.958 ***	0.088 ***
Debt ratio	0.151 ***		-1.200 *	-0.274 **
Stock volatility	-0.002	0.001	-0.115	0.024 +
Industry (high tech. =1)	0.141 ***	0.086 **	-0.157	0.179 ***
Avg. shares % per outsider.	-0.013 ***		-0.21 ***	0.001
Shares % owned by CEO	0.012 **	-0.002	0.146 +	-0.016
Industry-adj ROA	0.004 ***	-0.003	0.029 +	-0.001
MTB ratio of equity	0.006 **	-0.001	0.020	-0.010
adj-R ² or logistic R ²	0.375	0.026	0.295	0.108
Sample size	733	733	733	733

*** sig. at 0.1%; ** sig. at 1%; * sig. at 5%; + sig. at 10%. P-values are omitted due to space constraint. The simultaneous equations model includes eq. (1)-(3) in the methodology section and an equation for D&O insurance demand as follows.

$$D\&O_{it} = \alpha + \lambda_1 BoardIndep_{it-1} + \lambda_2 BoardLeaders_{it-1} + \lambda_3 BoardSize_{it-1} + \sum \lambda_k Firm\ Features_{it-1} + \varepsilon_{it}$$

Table 6 Regression for Board Structure with Interaction Terms

Variable	Board independence		Leadership duality		Board size	
	estimate	p-value	estimate	p-value.	estimate	p-value.
Intercept	0.961 ***	<.001	3.321	0.017	-1.234	0.443
D&O ins (yes/no)	0.246 +	0.077	-3.967 **	0.045	2.580	0.297
Ln(total assets)	-0.040 ***	<.001	-0.29 *	<.001	0.975 ***	<.001
Debt ratio	0.166 ***	<0.001			-0.377	0.652
Stock volatility	-0.014	0.235	0.019	0.898	-0.82 ***	<.001
Industry (high tech. =1)	0.165 ***	<.001	0.369 +	0.103	-0.019	0.951
Avg. shares % per outsider.	-0.012 ***	<.001			-0.23 ***	<.001
Shares % owned by CEO	0.018 ***	<.001	0.030	0.612	0.095	0.271
Industry-adj ROA	0.002	0.122	-0.011	0.440	0.004	0.835
MTB of equity	0.015 ***	0.001	-0.005	0.925	0.199 **	0.011
Ln(total assets)*D&O ins	-0.006	0.489	0.260 *	0.023	-0.209	0.152
Debt ratio*D&O ins	-0.011	0.899			-1.501	0.331
Stock volatility*D&O ins	0.016	0.219	-0.032	0.846	0.917 ***	<.001
Industry *D&O ins	-0.082 **	0.010	0.173	0.677	-0.412	0.467
Avg. shares% per outsider*D&O ins	-0.001	0.806			0.107	0.221
Shares % owned by CEO*D&O ins	-0.023 *	0.040	-0.297 +	0.060	0.302	0.121
Ind.-adj ROA*D&O ins	0.004 *	0.023	-0.005	0.795	0.033	0.305
MTB of equity*D&O ins	-0.015 *	0.018	0.048	0.569	-0.38 ***	<.001
Adj-R ² or logistic R ²	0.389		0.076		0.322	
Sample size	733		733		733	

*** significance at 0.1%; ** significance at 1%; * significance at 5%; + significance at 10%.

The empirical analyses on the subset of the data are presented in tables 7a and 7b for different firm sizes and in tables 8a and 8b for different industries. Table 7a shows that D&O insurance has a positive impact on board independence for a large firm, which supports the hypotheses of monitoring incentive. In table 7b for the

small firms, D&O insurance also has a positive impact on board independence. However, it has a positive impact on board size, thus supporting the hypothesis of moral hazard. Therefore, the incentive effect of D&O insurance on the small firms is mixed.

Table 7a
OLS Regression for Board Structure of Large Firm

Variable	Board independence		Leadership duality		Board size	
	Estimate	p-value	estimate	p-value	estimate	p-value
Intercept	0.549 ***	<.001	0.986	0.563	-6.377 **	0.006
D&O ins (yes/no)	0.051 **	0.009	0.320	0.212	-0.500	0.195
Ln(total assets)	-0.012 +	0.069	-0.178 +	0.055	1.345 ***	<.001
Debt ratio	0.137 *	0.015			-1.048	0.345
Stock volatility	-0.036 *	0.015	0.202	0.301	-1.21 ***	<.001
Industry (high tech. =1)	0.166 ***	<.001	0.601 *	0.030	0.163	0.709
Avg. shares % per outsider.	-0.011 ***	0.001			-0.18 ***	0.001
Shares % owned by CEO	0.009	0.338	-0.006	0.958	-0.215	0.275
Industry-adj ROA	0.002	0.112	-0.02	0.274	-0.001	0.973
MTB ratio of equity	0.007	0.120	0.008	0.878	0.105	0.230
Adj-R ² or logistic R ²	0.250		0.085		0.369	
Sample size	367		367		367	

Table 7b
OLS Regression for Board Structure of Small Firm

Variable	Board independence		Leadership duality		Board size	
	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	1.599 ***	<.001	11.63 ***	<.001	13.25 ***	<.001
D&O ins (yes/no)	0.085 ***	<.001	-0.410	0.117	0.744 **	0.003
Ln(total assets)	-0.081 ***	<.001	-0.86 ***	<.001	-0.118	0.537
Debt ratio	0.157 **	0.003			-0.983	0.182
Stock volatility	0.001	0.986	-0.023	0.795	0.004	0.959
Industry (high tech. =1)	0.107 ***	<.001	0.193	0.476	-0.197	0.461
Avg. shares % per outsider.	-0.015 ***	<.001			-0.24 **	<.001
Shares % owned by CEO	0.009 **	0.052	-0.037	0.547	0.191 **	0.002
Industry-adj ROA	0.004 ***	<.001	0.005	0.749	0.056 ***	<.001
MTB ratio of equity	0.008 +	0.059	-0.041	0.540	-0.027	0.646
Adj-R ² or logistic R ²	0.354		0.099		0.215	
Sample size	366		366		366	

*** significance at 0.1%; ** significance at 1%; * significance at 5%; + significance at 10%.

The results in table 8a and 8b show that D&O insurance has a positive impact on board independence for both technology and non-technology firms, thus supporting the hypothesis of monitoring incentive. The results also suggest that there is no significant relationship between D&O insurance and the other two elements of board structure in either industry. The effect of firm characteristics on board structure for the subset data is similar to those for the aggregate data and thus the discussion is omitted.

The empirical results based on the alternative dependent variable, D&O insurance amount, are shown in table 9. For those firms with D&O insurance, the

regression analysis shows that board independence and leadership duality are not influenced by insurance amount. However, board size decreases with insurance amount which implies that efficiency is encouraged by the insurance underwriting process. The effects of other firm characteristics on the board structure are similar to those in table 4a. The regression results based on alternative variables of firm characteristics are close to those in table 9. Therefore the reports are omitted. Furthermore, all the analyses are also conducted for different time period, such as one year and five years, and the findings are similar to those presented here.

Table 8a
OLS Regression for Board Structure of Technology Firm

Variable	Board independence		Leadership duality		Board size	
	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	1.267 ***	<.001	2.362 *	0.044	2.448 +	0.059
D&O ins (yes/no)	0.041 **	0.011	-0.138	0.517	0.335	0.175
Ln(total assets)	-0.049 ***	<.001	-0.166 *	0.026	0.610 ***	<.001
Debt ratio	0.167 **	0.003			-0.521	0.541
Stock volatility	0.003	0.545	-0.058	0.567	0.044	0.590
Avg. shares % per outsider.	-0.014 ***	<.001			-0.19 ***	<.001
Shares % owned by CEO	0.005	0.368	-0.192 **	0.014	0.093	0.240
Industry-adj ROA	0.004 ***	<.001	-0.004	0.776	0.033 *	0.039
MTB ratio of equity	0.005 +	0.099	-0.037	0.460	0.024	0.632
Adj-R ² or logistic R ²	0.251		0.049		0.189	
Sample size	438		438		438	

Table 8b
OLS Regression for Board Structure of Non-Technology Firm

Variable	Board independence		Leadership duality		Board size	
	estimate	p-value	estimate	p-value	estimate	p-value
Intercept	0.922 ***	<.001	-0.497	0.752	-2.966	0.165
D&O ins (yes/no)	0.130 ***	<.001	0.303	0.392	-0.295	0.558
Ln(total assets)	-0.037 ***	<.001	-0.139	0.118	1.177 ***	<.001
Debt ratio	0.151 *	0.016			-2.123 +	0.091
Stock volatility	-0.031 *	0.032	0.235	0.209	-1.12 **	<.001
Avg. shares % per outsider.	-0.010 **	0.002			-0.205 **	0.002
Shares % owned by CEO	0.030 ***	<.001	0.344 **	0.002	0.281 +	0.073
Industry-adj ROA	0.002	0.215	-0.035	0.119	-0.018	0.595
Market-to-book ratio of equity	0.019 *	0.036	0.259 *	0.021	0.058	0.761
Adj-R ² or logistic R ²	0.205		0.137		0.398	
Sample size	295		295		295	

*** significance at 0.1%; ** significance at 1%; * significance at 5%; + significance at 10%.

Table 9
OLS Regression for Board Structure and Insurance Amount

Variable	Board independence		Leadership Duality		Board size	
	estimate	p-value	estimate	p-value.	estimate	p-value.
Intercept	1.221 ***	<.001	-2.323	0.305	7.135 *	0.017
D&O ins (\$amount)	-0.001	0.919	0.173	0.346	-0.596 **	0.014
Ln(total assets)	-0.045 ***	<.001	-0.096	0.349	0.979 *	<.001
Debt ratio	0.155 *	0.043			-2.079 +	0.101
Stock volatility	0.002	0.718	-0.014	0.852	0.097	0.323
Industry (high tech. =1)	0.083 **	0.004	0.456	0.205	-0.114	0.812
Avg. shares % per outsider.	-0.013 **	0.002			-0.107	0.137
Shares % owned by CEO	-0.005	0.622	-0.257 +	0.080	0.357 *	0.037
Industry-adj ROA	0.006 ***	<.001	-0.015	0.344	0.028	0.244
MTB of equity	-0.001	0.946	0.043	0.494	-0.180 *	0.025
adj-R ² or logistic R ²	0.278		0.043		0.195	
Sample size	268		268		268	

*** significance at 0.1%; ** significance at 1%; * significance at 5%; + significance at 10%.

Although the regression analyses explain the determinants of board structure and the relationship between D&O insurance and board composition, they do not explain the causality directly. The event study probably can help to provide some evidences beyond the regression relationship. Therefore we investigate the changes in board composition of each company after initial purchase of D&O insurance. Table 10 reports the means and medians of board composition for the initial year with insurance and one year before insurance.⁸ The results indicate that board independence and size are significantly increased after purchase of D&O insurance, which results from the increase in the number of outside directors. The impact of D&O insurance on leadership duality is not significant.

Additional information provided in appendix 3 shows that the number of insured firms with increase in board independence is greater than that with reduction. The leadership duality is almost unchanged when compared with that in one year before insurance, but more firms reduce the duality if compared with that in two years before insurance. The changes in these two elements suggest that D&O insurance does improve the board structure of insured firms. The number of firms that increase board size after insurance purchase is somewhat greater than that reduce it. This evidence initially seems implying that D&O insurance makes the board inefficient. However, a further investigation on the number of outside directors indicates that the increase in board size is primarily due to the increase in the number of outside directors. For example, 39 firms increase their board size after initial purchase of D&O insurance during the 2003-2007, and among them 35 firms are identified with increases in the number of

outside directors. Whether the increase of outside directors and consequently the board size will result in inefficiency is undetermined in the literature.

Next, we use a sample of firms based on the reelections of board members during 2005-2007 to conduct the correlation and regression analysis between D&O insurance decision and changes in board composition. This sample includes only the data of reelection years to avoid the mixture of lagged and contemporaneous relation because public firms usually reelect their directors every three years.⁹ The results also suggest that D&O insurance does significantly influence the board structure. The correlation coefficients between changes in D&O insurance decision and changes in board independence, size, and outsiders are all significantly positive (see appendix 3). The regression analyses of models (1)-(3) based on the data of reelection years presents almost the same results as those in tables 4 and 5 which suggest that board independence is positively related to D&O insurance decision. A further investigation is conducted for the changes themselves. The changes in board independence, leadership, size, and number of outside members between reelection year (t) and one year before reelection (t-1) are taken as dependent variables, and changes in D&O insurance decision is the explanatory variable. Table 11 presents the regression results of simultaneous equations and suggests a positive relation between D&O insurance decision and board composition changes except for leadership duality.

⁸ The analysis for two years before insurance is similar to that for one year shown in table 10.

⁹ According to Company Law, a stock company must reflect its directors at least every three years (§195) and the directors may be reelected before the due date of 3-year tenure (§199).

Based on these evidences, it is reasonable to conclude that D&O insurance provides a monitoring incentive for the board through increases in outside directors and board independence, although inefficiency may be present in the board because of the enlarged size. However, the inefficiency mainly results from the in-

crease in outside directors that usually have less agency conflicts with the shareholder. Thus the negative influence from D&O insurance is expected not huge. In general the results based on event study are consistent with previous analyses of basic models.

Table 10 Board Structures before and after D&O insurance

Board composition	Initial year with D&O insurance (year t)	One year before D&O insurance (year t-1)	t-test for means t-stat. (p-value)	Wilcoxon test for medians W-stat. (p-value)
Independence				
Mean	0.558	0.500	4.49(<0.001)***	
Median	0.615	0.571		621(<0.001)***
Duality				
Mean	0.236	0.256	-0.53(0.595)	
Median	0.000	0.000		-7.5(0.791)
Size				
Mean	12.254	11.376	4.04(<0.001)***	
median	12.000	11.000		504(<0.001)***
No. of outsiders				
mean	7.082	5.954	4.62(<0.001)***	
median	8.000	6.000		486(<0.001)***
No. of firms			109	109

Note: This table is based on the sample firms which make their initial purchase of D&O insurance during 2003-2007. The firms already covered with D&O insurance in year 2003 are not included in the table since we cannot trace the differences in board composition before and after the purchase of D&O insurance. t-test and Wilcoxon test are for differences in means and medians. Significance levels: + p<0.10; * p<0.05; ** p<0.01; *** p<0.001.

Table 11 Simultaneous Equations Regression for Board Composition Changes

Variable	Δ in Board independ.	Δ in Leader. duality	Δ in Board size _t	Δ in No. of outsiders
Intercept	-0.098	0.039	-1.761 +	-2.098 *
Δ in D&O ins (yes/no)	0.059 **	-0.013	1.130 ***	1.437 ***
Ln(total assets)	0.006		0.047	0.109 +
Debt ratio	-0.026	-0.005	1.690 **	0.261
Stock volatility	-0.002	-0.036	-0.046	-0.064
Industry (high tech. =1)	0.020		0.071	0.217
Avg. shares % per outsider.	0.010 ***	-0.009	0.164 ***	0.180 ***
Shares % owned by CEO	-0.003	0.003	-0.124	-0.124
Industry-adj ROA	0.001	0.004	0.013	0.012
MTB ratio of equity	-0.001		0.046	0.012
adj-R ² or logistic R ²	0.073	-0.007	0.108	0.107
Sample size	363	363	363	363

*** sig. at 0.1%; ** sig. at 1%; * sig. at 5%; + sig. at 10%. P-values are omitted due to space constraint. The regression equation is: $\Delta Y_{it} = \alpha + \beta_1 \Delta D\&O_{it} + \sum \beta_i \text{Firm characteristics}_{it-1} + \epsilon_{it-1}$, where Y is the board composition element. The year of reelection (t) may be different among firms since each firm has its own schedule of reelection. $\Delta Y = Y_t - Y_{t-1}$. For example, Δ in board independence_{it} = (board independ)_{it} - (board independ)_{it-1}; $\Delta D\&O_{it}$ = (D&O decision dummy)_{it} - (D&O decision dummy)_{it-1}.

5. Conclusion

D&O insurance indemnifies directors and officers for the potential loss arising from possible litigations, which implies possible negative impact on directors' and officers' moral hazard. However, it also helps in inviting capable directors and managers to work for the firms. The monitoring functions of independent directors can mitigate the agency conflicts between the shareholders and the managers. Additionally, the insurer's underwriting process also provides some monitoring incentive for the board. The combined effect of D&O insurance on the corporate governance is unknown yet, especially after SOX. This paper intends to make up the gap and provide suggestions for public policy regarding D&O insurance and corporate governance.

This study conducts empirical analyses of the role of D&O insurance in the board structure, which is one of the most important constructs of corporate governance. The empirical results in general support the monitoring incentive of D&O insurance, especially in board independence. The moral hazard incentive is not significant in our findings. In summary, the purchase of D&O insurance presents a positive function for corporate governance of public firms according to these empirical results. The purchase decision can increase board independence and insurance amount can reduce board size, which probably is due to the monitoring function of insurance underwriting process. These findings are somewhat different from those studies based on the U.S. and Canadian data where moral hazard was detected in the firms with D&O insurance. This diverse outcome probably results from the differences in business culture and legal environment between Taiwan and North America. It implies that the public policy of D&O insurance for corporate governance should be adjusted with local business culture and litigation system.

The empirical analyses based on different firm sizes confirm that D&O insurance has a monitoring effect for large firms. However, its impact on small firms is mixed. Although D&O insurance increases board independence in small firms, it also raises their board size which implies inefficiency. These findings suggest that compulsory D&O insurance for all public firms in Taiwan probably is not a suitable policy at this moment because it can induce moral hazard for some firms. More detailed investigation is required to provide a sound understanding of D&O insurance. Future studies should explore the effect of D&O insurance on firm performance so as to confirm the positive function of monitoring on corporate governance.

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APPENDIX 1

1. Some newly established regulations around year 2002 pertaining to directors' liability for corporate governance are listed as follows.

(1) Corporate Governance Practice Guideline for Public Firms: §23 (requiring the increase of seats for independent directors), §24 (requiring the proportion of independent directors higher than 20% of the board), and §39 (allowing the firms to purchase D&O insurance for their directors).

(2) Securities and Futures Investors Protection Act: §10-1 (allowing the protection institutions to litigate the directors.)

2. The litigation risk faced by firms is illustrated by the number and the claim amounts of class actions brought by investors as shown in table A1.

Table A1
Class Actions Brought by Investors to Public Firms

Year	No. of class actions	Claim amount (NT\$1000)	No. of claimants
1998	1	69,824	334
1999	1	59,348	130
2000	3	437,337	906
2001	1	385	36
2002	2	29,541	81
2003	2	416,417	839
2004	7	6,612,581	13,226
2005	4	11,099,794	34,006
2006	9	2,859,394	7,236
2007	10	1,805,456	5,045
2008	20	1,727,962	3,321
2009/08	10	4,668,217	7,637

Source: Securities and Futures Investors Protection Center (www.sfipc.org.tw).

3. The trend of D&O insurance demand (measured in premium incomes) and the incurred losses of D&O policies in Taiwan are shown in table A2.

Table A2
Premium Incomes and Incurred Losses of D&O Insurance in Taiwan

Year	Premium Incomes		Incurred Losses		
	No. of policies	Amount (NT\$)	No. of policies	Amount (NT\$)	Loss ratio
2003	152	249,005,329	27	9,877,340	6.73
2004	391	479,071,117	18	4,070,978	1.10
2005	540	551,495,933	17	7,150,148	1.37
2006	687	559,767,097	47	11,313,662	2.15
2007	838	623,158,249	83	98,670,166	16.37
2008	972	595,938,701	108	274,269,964	44.41

Source: Taiwan Insurance Institute (www.tii.org.tw)

APPENDIX 2

1. The distribution of sample firms among industry categories is shown in table A3.

Table A3
The Distribution of Industry Categories of the Sample Firms

Industry Category	Industry ID.	Population (P)	Sample (S)	S/P %
Cement	M1100	8	1	12.5
Food	M1200	19	6	31.6
Plastics	M1300	31	12	38.7
Textile & Fabrics	M1400	62	12	19.4
Electric Machinery	M1500	55	8	14.5
Electricity & Cables	M1600	14	4	28.6
Chemical & Biotech.	M1700	73	23	31.5
Glasses & Porcelain	M1800	7	0	0
Paper	M1900	7	3	42.9
Steel	M2000	38	17	44.7
Rubber	M2100	10	2	20.0
Automobile	M2200	5	2	40.0
Electron & Computer	M2300	688	152	22.1
Material & Construction	M2500	48	5	10.4
Aviation & Shipping	M2600	22	3	13.6
Sightseeing	M2700	13	3	23.1
Financial	M2800	46	22	45.8
Trading & Grocery	M2900	17	4	23.5
Public Utility	M9700	16	4	25.0
Other	M9900	47	16	34.0
No. of firms		1,225	299	24.41

Note: Population = all the public companies listed on Taiwan SEC in year 2008.

Sample = the public companies that responded the questionnaire.

2. The t-tests for the differences in means of variables between the population and the sample are shown in table A4.

Table A4
Comparison of Descriptive Statistics between Population and Sample

Variables	Population mean (std. dev)	Sample mean (std. dev)	t-test	p-value
Prop. of outside directors	0.45 (0.22)	0.44 (0.22)	0.96	0.337
Leadership duality	0.28 (0.45)	0.25 (0.43)	0.96	0.337
No. of directors	9.61 (2.63)	10.26 (3.28)	-3.05	0.002 **
Total assets (NT\$ million)	35,861 (204,629)	87,010 (356,962)	-2.26	0.024 *
Stock volatility	3.05 (2.57)	3.17 (4.3)	-0.52	0.604
Debt ratio	38.26 (19.3)	40.88 (20.7)	-1.91	0.056 *
D& O Average Compensation	0.87 (2.21)	1.18 (2.88)	-1.6	0.109
Shares % owned by CEO	1.83 (2.88)	1.69 (3.11)	0.66	0.512
Return on assets (ROA)	8.24 (10.5)	7.64 (10.49)	0.94	0.348
No. of firms ¹	1,254	298		

Note1: All figures are computed based on public data in year 2007. The number of firms may vary for each variable due to some missing data. The firm numbers range from 1,203 to 1,256 in the population, but most of them are 1254. The firm numbers range from 290 to 298 in the sample, but most of them are 298.

APPENDIX 3

1. The changes in board structure after D&O insurance are shown in table A5.

Table A5
The Effect of Purchasing D&O Insurance on Board Structure

Board composition	Effect of D&O ins. (year t)	1 year before D&O insurance (year t-1)	2 year before D&O insurance (year t-2)
Independence	+	44 ¹	43
	0	46	34
	-	19	15
Duality	+	6	8
	0	95	70
	-	9	20
Size	+	39	33
	0	48	43
	-	23	22
No. of outsiders	+	38	38
	0	56	39
	-	16	21
No. of firms		110	98

Note 1: This table is based on the sample firms which make their initial purchase of D&O insurance during 2003-2007. The firms already covered with D&O insurance in year 2003 are not included in the table since we cannot trace the differences in board composition before and after the purchase of D&O insurance. “+” = increased, “0” = unchanged, “-” = reduced. The numbers in the table are the number of firms that increase, unchange, or reduce their board independence, leadership duality, size, and number of outside directors after purchasing D&O insurance when they are compared with the situations before insurance. For example, 44 insured firms increase their board independence when compared with that of one year before insurance, and 43 insured firms increases their board independence when compared with that of two years before insurance.

Table A6
Pearson Correlation Coefficients (p-values are in parentheses)

	Δ D&O (yes/no)	Δ board independ	Δ board leadership	Δ board size	Δ no. of outsiders
Δ D&O (yes/no)	1.00000				
Δ board independ	0.21212 ($<.0001$)***	1.00000			
Δ board leadership	-0.00049 (0.9918)	-0.05699 (0.2361)	1.00000		
Δ board size	0.21830 ($<.0001$)***	0.54442 ($<.0001$)***	-0.12402 (0.0097)**	1.00000	
Δ no. of outsiders	0.25312 ($<.0001$)***	0.87470 ($<.0001$)***	-0.10753 (0.0251)*	0.81198 ($<.0001$)***	1.00000

Note: $\Delta Y = Y_t - Y_{t-1}$.

Table A7
Simultaneous Equations Regression for Board Composition

Variable	Board independ.	Leadership duality	Board size	No. of outsiders
Intercept	1.074 ***	0.883 ***	-1.891	6.999 ***
D&O ins (yes/no)	0.068 ***	0.046	0.157	1.346 **
Ln(total assets)	-0.044 ***	-0.037 **	0.907 ***	-0.134
Debt ratio	0.175 ***		0.996	2.191 *
Stock volatility	-0.006	-0.004	-0.026	-0.034
Industry (high tech. =1)	0.127 ***	0.045	-0.526	1.347 ***
Avg. shares % per out- sider.	-0.012 ***		-0.164 **	-0.193 ***
Shares % owned by CEO	0.007	-0.023	0.003	0.025
Industry-adj ROA	0.004 ***	0.0003	0.048 *	0.063 ***
MTB ratio of equity	0.006	-0.001	0.064	0.120
adj-R ² or logistic R ²	0.336	0.014	0.326	0.136
Sample size	363	363	363	363

*** sig. at 0.1%; ** sig. at 1%; * sig. at 5%; + sig. at 10%. P-values are omitted due to space constraint.