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Director & Officer Insurance, Corporate Governance, and Asymmetric Information: An Empirical Legal Study of Taiwan
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Abstract

This paper analyzes the relationship between Director & Officer (D&O) insurance and the corporate governance in Taiwan. The monitoring hypothesis suggests that firms with weak corporate governance have a greater incentive to purchase D&O insurance, that monitoring functions and D&O insurance are substitutes for each other, and information about insured firms' corporate governance can be conveyed by D&O insurance. However, this hypothesis is affected by asymmetric information which causes different equilibriums in the market. This paper analyzes these issues in Taiwan where D&O insurance is emerging.

Two major empirical legal works were consulted to clarify this issue. First, the Tobit model and the censored least absolute deviations estimator were applied to test monitoring hypothesis. Empirical evidence showed the monitoring function of D&O insurance is rejected. In contrast, the positive signal effect of D&O insurance is a more important consideration than monitoring function or indemnification for insured firms. Then, the problem of asymmetric information was addressed. After the application of canonical correlation, Pearson correlation, stepwise regression, cluster analysis and discriminate analysis, it was found that there is no evidence supporting the existence of asymmetric information. Accordingly the finding about the rejection of monitoring hypothesis and supporting of signal hypothesis is affirmed. This paper provides empirical legal recommendations about D&O insurance and corporate governance for Taiwan and emerging countries in Asia.

Keywords: Corporate governance, Director & Officer insurance, asymmetric information, empirical legal study, Tobit model, censored least absolute deviations estimator, canonical correlation, Pearson correlation, stepwise regression, cluster analysis, discriminate analysis

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1. Introduction

About the Enron case, John C. Coffee commented that: "Enron is more about gatekeeper failure than board failure". [1] The "gatekeepers" are reputational intermediaries who provide verification and certification services to investors, including lawyers, accountants, investment bankers, auditors and debt rating agencies. [2] In general, major opinions attribute the reason for failure of corporate governance to the failure of gatekeepers. [3] In this line of reasoning, one important gatekeeper is discussed more and more in recent years, which is Directors' and officers' (D&O) liability insurer.

After the problems experienced by Enron, Worldcom and other companies in various financial crises, the monitoring function of D&O insurance has been discussed more frequently, particularly in common law. In the United States, Congress passed the Sarbanes-Oxley Act in 2002. The act focuses on improving corporate governance by protecting shareholders and resulted in increased litigation and more fines and penalties. [4] This also increases the demand of D&O liability insurance. [5] Delaware General Corporation Law regulates that a corporation shall have power to purchase and maintain insurance on behalf of any person who is or was a director, officer, employee or agent of the corporation. [6] So far, the majority of listed corporations in the United States have purchased D&O liability insurance. [7] Given this tendency, [8]

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[1] John C. Coffee, *Understanding Enron: "It's About the Gatekeepers, Stupid"*, 57 BUS. LAW. 1403, 1419 (2002).

[2] *Id.* at 1405.

[3] Frank Partnoy, *Barbarians at the Gatekeepers?: A Proposal for a Modified Strict Liability Regime*, 79 WASH. U. L.Q. 491, 492 (2001). John C. Coffee, *Gatekeeper Failure and Reform: The Challenge of Fashioning Relevant Reforms*, 84 B. U. L. REV. 301, 349 (2004).

[4] Pub. L. No. 107-204, 116 Stat. 745 (2002). According to a 2002 survey, 19% of firms had at least one lawsuit brought against their directors in the previous ten years. M. Martin Boyer, *Three Insights from the Canadian D&O Insurance Market: Inertia, Information and Insiders*, 14 CONN. INS. L.J. 75, 76 (2007).

[5] This positive impact is generally recognized. More detailed discussion and examination, *see* Anna Oh, *Insuring against Another Enron: The Role of Cross-listing Status of Canadian Firms on the Purchase of Directors' and Officers' Insurance in the aftermath of Sarbanes-Oxley Act of 2002,* Cornell University working paper (2009). Available at http://ecommons.cornell.edu/bitstream/1813/14231/2/AnnaOhFinalThesis1.pdf, last visited on Feb. 15, 2012.

[6] 8 Del.C. § 145 (g).

[7] After the advent of coverage C in 1996, D&O liability insurance protects not only the individual's assets but also those of the corporation. This increases the popularity of D&O liability insurance. In the United States, over 90% of D&O insureds reported having entity coverage as of 2002. John C. Coffee, *Reforming the Securities Class Action: An Essay on Deterrence and Its Implementation*, 106 COLUM. L. REV. 1534, 1570 (2006).

[8] After Enron and WorldCom scandals, reforms of the Sarbanes-Oxley and New York Stock Exchange Listing standards, the 1997-98 financial crisis in Asia had a similar effect on Taiwan. *See* Ronald J. Gilson and Curtis J. Milhaupt, *Choice as Regulatory Reform: The Case of Japanese Corporate Governance*, 53 Am. J. Comp. L. 343, FN 1 (2005). More discussion about financial crisis in Taiwan, *see* Lawrence L. C. Lee, *Taiwan's Current Banking Development Strategy: Preparing for Internationalization by Preventing Insider Lending*, 17 UCLA Pac. Basin L.J. 166, 206 (Fall

discussions of this issue have become more popular in Taiwan.[9]

While the importance of D&O insurance has been noticed, more and more recent researchers have expressed opposing opinions. Some empirical studies indicate that in the vast majority of instances, insurers do not provide corporate governance.[10] What is more, because of the differences from the United States, such as the short history of D&O insurance, immature litigation systems, and defects in relevant regulations, how is the impact of D&O insurance on corporate governance in Taiwan? What role does D&O insurance play in corporate governance in Taiwan? Is the purchase of D&O insurance positively related to corporate governance? Is the monitoring function of D&O insurance sustainable in Taiwan? Is it necessary for Taiwan to compulsorily disclose the information about insured corporations, or even to regulate D&O insurance as compulsory for listed corporations? All these issues are not only worth more academic studies, but they are also significant for practice in Taiwan.

The purpose of this paper is to refine the test on the impact of D&O liability insurance on corporate governance in the background of Taiwan. This paper will distinguish the differences in backgrounds of the United States and Taiwan, and try to find optimal solutions for Taiwan. Empirical methods will be employed to test the hypotheses in this paper. In conclusion, this paper is supposed to contribute suggestions for the United States, Taiwan, and even other countries which are considering this issue.

2. Literature review

2.1 Monitoring Hypothesis: positive arguments

In 1990, Clifford G. Holderness pioneered research on D&O insurance and corporate governance. He has several important findings and arguments. First, ownership structure of a corporation has an impact on its performance and corporate governance. Because of more significant segregation between ownership and management, there are fewer agency conflicts for those corporations which have D&O insurance.[11] He proposed that insurers provide an external monitoring function of boards of directors and officers. This so-called "monitoring hypothesis" is supported by the results of his

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1999/Spring 2000).

[9] This can be found by prospering relevant researches, such as: Jui-I Chang, ESSAYS ON DIRECTORS' AND OFFICERS' LIABILITY INSURANCE AND FIRM BEHAVIOR, Ph.D. Dissertation of National Chengchi University (2009). Tsai-Jyh Chen and Chia-Hui Pang, *An Analysis of Determinants of the Corporate Demand for Directors' and Officers' Liability Insurance*, 18:2 NTU Management Rev. 171 (2008).

[10] Tom Baker & Griffith Sean J., *Predicting Corporate Governance Risk: Evidence from the Directors' & Officers' Liability Insurance Market*, 74 U. CHI. L. REV. 487, 1796, 1808 (2007).

[11] Clifford G. Holderness, *Liability Insurers as Corporate Monitors*, 10 INT'L REV. L. & ECON. 115, 127 (1990).

empirical research. [12] This monitoring hypothesis significantly affected many subsequent studies.

In sum, Clifford G. Holderness proposes that the monitoring function of D&O insurance has three dimensions.[13] First, before a policy is issued, the insurer will investigate the factors which affect exposure. This information is critical for the determination of premiums. Corporate governance issues of the insured affect both the potential legal risks of the insured and the indemnification liability of the insurer. In addition, the monitoring function is also revealed in policy coverage, and the conditions and duration of litigation.[14] Given the possibility of being forced to pay compensation, insurers have substantial incentives to monitor the status of the insured and prevent the occurrence of losses. Therefore, the corporate governance of the insured will be monitored.

Besides, the duties of directors[15] are always emphasized and proper risk management method for directors should not be ignored.[16] Otherwise, directors might manage businesses in a conservative way to avoid potential liability, or even be afraid to take the position. D&O insurance can both relieve the risks faced by boards of directors and encourage them to manage corporations in an active manner. Moreover, good corporate governance contributes to lowering the premiums needed to maintain D&O insurance.[17] D&O liability insurance can provide incentive for good corporate governance. George Kalchev confirms that insurance can mitigate the risk of bankruptcy, and firms with higher returns demand less insurance.[18] M. Martin Boyer even suggests that D&O insurance protects the wealth of shareholders to a greater extent than is the case for boards of directors.[19]

The monitoring hypothesis has also discussed and tested in jurisdictions other than the United States. In 1997, Noel O'Sullivan empirically tested Holderness's monitoring hypothesis in the United Kingdom. Noel O'Sullivan sampled 366 companies. He

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[12] *Id.*, 129 (1990).

[13] *Id.*, at 118-20.

[14] *Id.*, at 119-20.

[15] Fiduciary duty can be divided in to two main branches - the duty of loyalty and the duty of care. The duty of loyalty is primarily a negative duty not to harm the principal. The duty of care is positive - a duty to promote the ends of the principal. Arthur B. Laby, *Resolving Conflicts of Duty in Fiduciary Relationships*, 54 Am. U. L. Rev. 75, 78 (2004). More discussion, *see* Alan R. Palmiter, *Reshaping the Corporate Fiduciary Model: A Director's Duty of Independence*, 67 Tex. L. Rev. 1351, 1353 (1989).

[16] Youngman, Ian, Directors' and Officers' Liability Insurance: A Guide to International Practice 3 (Woodhead Pub., 2nd ed., 1999).

[17] Joshua Gold, *Director and Officer Insurance Personal and Advertising Injury Liability*, 32662 NBI-CLE 99, 118 (2006).

[18] George Kalchev, *The Demand for Directors' and Officers' Liability Insurance by US Public Companies* (July 2004). Available at SSRN: http://ssrn.com/abstract=565183 last visited on Feb. 15, 2012.

[19] M. Martin Boyer, *Directors' and Officers' Insurance and Shareholder Protection* (March 2005). Available at SSRN: http://ssrn.com/abstract=886504 last visited on Feb. 15, 2012.

examined the relationship between purchases of D&O liability insurance and board composition, managerial ownership, and external shareholder control. His research supported the monitoring hypothesis.[20] John E. Core gathered data from Canadian firms, and examined the factors that determine firms' demand for D&O insurance. He found that companies that face greater litigation risks are more likely to purchase insurance and to carry higher limits and deductibles.[21] Confirmatory evidence was provided that the D&O insurance premium reflects the quality of the firm's corporate governance.[22] The overall results suggest that D&O premiums contain useful information about the quality of firms' governance. In Taiwan, Tsai-Jyh Chen and Chia-Hui Pang surveyed 105 of the largest 500 enterprises in 2008. Their research found that the potential demand for D&O insurance is related to overseas investments and the stock holdings of inside directors. In other words, purchases of D&O insurance is significantly related to corporate governance.[23]

2.2 Missing monitor: opponent arguments

By contrast, some researchers argue against the monitoring hypothesis and the positive relationship between the purchase of D&O insurance and corporate governance. Tom Baker and Sean J. Griffith examine how liability insurers transmit and transform the content of corporate and securities law. This article discusses how D&O insurers evaluate risk in order to arrive at that premium number. It found that, in addition to financial analysis of corporations, underwriters focus primarily on the corporate governance of the prospective insured, especially "deep governance" variables such as culture and character[24]. In other words, D&O insurers do not offer loss prevention services to their insured corporations, and they do no monitor the corporate governance of their insured corporations[25].

Besides, moral hazard is a significant concern in liability insurance. D&O liability insurance may considerably nullify the deterrence effects of litigation against directors, causing directors to be less attentive to their duties to shareholders[26]. Some

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[20] Noel O'Sullivan, *Insuring the Agents: The role of directors' and officers' insurance in corporate governance*, 64 J. RISK & INS. 545, 554 (1997).
[21] John E. Core, *On the Corporate Demand for Director' and Officers' Insurance*, 64 J. RISK & INS. 63, 63 (1997).
[22] The other research of John E. Core supports this conclusion as well. *See* John E. Core, *The Directors' and Officers' Insurance Premium: An Outside Assessment of the Quality of Corporate Governance*, 16 J.L. ECON. & ORG. 449, 450 (2000).
[23] Tsai-Jyh Chen and Chia-Hui Pang, *supra note 9,* at 171.
[24] Tom Baker & Sean J. Griffith, *supra note 10*, at 543.
[25] DIR. & OFF. LIAB § 4:27. *Also see* Tom Baker & Sean J. Griffith, *How the Merits Matter: Directors' and Officers' Insurance and Securities Settlements*, 157 U. Pa. L. Rev. 755, 831 (2009).
[26] Clifford G. Holderness, *supra note 11*, at 115.

countries such as Germany prohibit D&O liability insurance because of the problem of moral hazard[27]. The underwriting cycle also plays an important role.[28] In a difficult market, underwriters become more selective, more interested in higher attachment points, less willing to offer high limits, less willing to negotiate contract terms, and able to command dramatically higher prices for what amounts to less coverage[29]. Hence, premiums are not always related to litigation risk of insured corporations. This provides a different viewpoint from previous studies.

The similar perspective is further provided by Tom Baker and Sean J. Griffith. They indicate again that in the vast majority of instances, insurers do not provide corporate governance[30]. Usually insurers might be expected to provide loss prevention functions. For, example, insurers might provide discounts to encourage corporations to improve corporate governance and thus decrease litigation risks. However, according to empirical results, insurers do not do this. Sometimes insurers give advice to corporations, but that is usually ignored by the corporations. In the end, D&O insurers do not provide loss prevention function[31].

Tom Baker and Sean J. Griffith conducted in-depth interviews with underwriters, actuaries, brokers, lawyers and corporate risk managers. They found that what underwriters are concerned about are "deep governance" variables such as culture and character, variables which are not confined to the financial analysis of the insured companies[32]. Moreover, the advice given by insurers is usually ignored by insured companies[33].

Besides, Joshua Dobiac evaluates how corporate governance may be a compelling factor in individualized underwriting. In conclusion, he has a similar opinion as Baker and Sean J. Griffith: the governance role of D&O liability insurance is minor and whatever effect poor governance has on pricing is not adequate to change corporate behavior[34]. Boyer and Delvaux-Derome's conclude that firms with weak governance systems facilitate opportunistic behavior and are consequently to buy D&O

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[27] María Gutiérrez, *An Economic Analysis of Corporate Directors' Fiduciary Duties*, 34(3) RAND J. ECON.516, 517 (2003).
[28] *See* Joshua Dobiac, *I Came, I Saw, I Underwrote: D & O Liability Insurance's Past Underwriting Practices and Potential Future Directions*, 14 CONN. INS. L.J. 487, 495 (2008).
[29] Tom Baker & Sean J. Griffith, *supra note 10*, at 507.
[30] As one of their interviewees stated: "You had asked me on the phone whether companies ... changed their behavior... for the benefit of the D&O insurers. I don't think they are. I think the brokers sometimes can put lipstick on the pig, but that is a marketing feature. And it seems to me that however high D&O premiums climb, they are not going to climb high enough to get the companies to really, really pay attention." Tom Baker & Sean J. Griffith, *The Missing Monitor in Corporate Governance: The Directors' and Officers' Liability Insurer*, 95 GEO. L.J. 1795, 1808 (2007).
[31] *Id*, at 1808-12.
[32] Tom Baker & Sean J. Griffith, *supra note 10*, at 543.
[33] Tom Baker & Sean J. Griffith, *supra note 30*, at 1808-12.
[34] Joshua Dobiac, *supra note 28*, at 508.

insurance[35]. This implies that the positive relationship between the purchase of D&O insurance and corporate governance of the insured companies is questionable. From this point of view, the purchase of D&O insurance is not necessary for the purposes of corporate governance and risk management. This is also the reason this proposal intends to reexamine the relationship between D&O insurance and corporate governance in Taiwan.

From the analysis of literature above, it could be found that D&O liability insurance's impact on corporate governance is highly controversial. There are two main opposing arguments about this issue. One opinion argues that D&O liability insurance plays an important corporate governance role. This is mainly based on the monitoring hypothesis in which an insurer will thoroughly scrutinize the insured. On the other way, opponents argue that there is no relationship between the purchase of D&O liability insurance and corporate governance. D&O liability insurance does not always play an important role in corporate governance. Moreover, moral hazard might cause more negative effects. In the situation that D&O liability insurance is purchased out of managerial opportunism, it is more impractical to believe D&O liability insurance's positive impact on corporate governance. The purpose of this paper is to examine the monitoring hypothesis in Taiwan. Besides, because of many differences between the United States and Taiwan, there are many problems waiting to be solved. The hypotheses can be developed after the analysis of corporate governance and development of D&O insurance in Taiwan.

2.3   Proposal of signal hypothesis

Analysis above demonstrates different argument about monitoring hypothesis and the monitoring function of D&O insurance. Even though they have different argument and reasoning about the monitoring function of S&O insurance, but most of them admit that D&O insurance can convey certain signal. In other words, even though D&O insurance cannot play a role of spur to urge firms optimize their corporate governance, it may be an important signal to the market.[36] From the details of insurance package and premiums, insurers' assessment for the insured firms would convey to the investors. Besides, if D&O insurance enhances the protection of directors and implies the concern of corporate governance of firms, then D&O

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[35] M. Martin Boyer & Mathieu Delvaux-Derome, *The Demand for Directors' and Officers' Insurance in Canada* (2002), *available at* http://ideas.repec.org/p/cir/cirwor/2002s-72.html, last visited on Feb. 15, 2012.

[36] *See* Sean J. Griffith, *Unleashing a Gatekeeper: Why the SEC Should Mandate Disclosure of Details Concerning Directors' & Officers' Liability Insurance Policies,* pp. 28 (March 24, 2005). U of Penn, Inst for Law & Econ Research Paper No. 05-15. Available at SSRN: http://ssrn.com/abstract=728442 or doi:10.2139/ssrn.728442, last visited on Feb. 15, 2012.

insurance shall imply good signal. In contrast, if D&O insurance would induce moral hazard, opportunistic behavior and problem of asymmetric information, this implies damages would happen. As a result, D&O insurance would convey negative signal.

The signal effect of D&O insurance can also be found by the attitude of the insured firms. Jinyoung Park tests D&O insurance and voluntary disclosure of Canadian firms. He finds that an association exists between D&O insurance coverage, disclosure frequency and precision.[37] The more insurance coverage, the more optimistic information is disclosed. That information would also be more precise and timely.[38] Besides, significantly favorable response to this information will be given by market. [39] This implies the signal effect of D&O insurance, and the favorable response from market gives firms more intensives to purchase D&O insurance.

Because D&O insurance will emit some signal to the market, the decision of D&O insurance purchase might not be a pure consideration of insurance purchase. If D&O insurance can bring positive effect, firms with good corporate governance might purchase D&O insurance to demonstrate their emphasis on corporate governance and attract more investors. For the firms with bad corporate governance, it is also possible for them to purchase D&O insurance to establish their reputation.[40] In contrast, if D&O insurance can bring negative effect, every firm will avoid purchasing D&O insurance because this may signalize that there are some problems in companies.[41] In the end, what firms cares is not only the indemnification function of D&O insurance, but also how to create the signal they desired.

Followed by previous literature review, this paper proposes the alternative hypothesis to monitoring hypothesis, which is signal hypothesis. This hypothesis argues that D&O insurance has significant effect in signal transmission. In addition to indemnification, the signal effect is another important consideration in insurance purchase. Except signal effect, other additional function of D&O insurance is disputable, especially monitoring function. D&O insurance is not a component of monitoring mechanism for firms, and its monitoring function is limited. In consequence, the argument of monitor hypothesis that the firms with poor corporate governance will have more demand for D&O insurance is not sustainable.

A series of empirical tests will be conducted in this paper. The signal effect of D&O

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[37] *See* Jinyoung Park, *The Effect of Directors' and Officers' Liability Insurance and Indemnification on Voluntary Disclosure: Evidence from Canadian Firms*, University of Michigan working paper, pp. 4, Available at http://som.umflint.edu/research/docs/20052006/200506_JP_I.pdf, last visited on Feb. 15, 2012.

[38] *Id.*

[39] *Id.*

[40] *See* M. Martin Boyer, *supra note 19,* at 8-9.

[41] *Id.*

insurance is tested. This paper also exam its tendency and magnitude. The concerns about asymmetric information and adverse selection will also be tested to make sure the previous results will not be influenced.

3. Hypothesis development

3.1 The test of monitoring and the signal effect on D&O insurance

Foreign investors are usually believed to care about the corporate governance of firms in which they invest. Although emerging markets are usually characterized by weak corporate governance, foreign investors still must deal with the criteria that control corporate governance in their home country.[42] They will maintain their stricter criteria even in emerging markets, and avoid involvement with local firms that are riddled with scandals.[43] In emerging markets, corporate governance has additional importance in terms of its role in attracting foreign investment.[44] In addition to investment, foreign investors often bring in foreign expertise and monitoring, and improve the quality of corporate governance.[45] Firms sometimes even improve their corporate governance in order to attract more foreign investors.[46] Foreign investment is critical for the role it plays in stimulating the economies of developing countries.[47] In addition, foreign investors are usually not familiar with local corporation laws, securities laws, and the local corporate governance regime.[48] This implies that they will tend to rely on signals conveyed by firms when they decide their investment strategies. If the corporate governance of firms is good, more foreign investors are attracted. This is emphasized in Taiwan. It is possible that the improvement of corporate governance in Taiwan in recent years is a result of influence exerted by foreign investors.[49]

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[42] *See* Julien Chaisse, *Corporate Governance and Financial Reform in China: Jing Leng*, 40 Hong Kong L. J. 239, 239 (2010).

[43] *Id.*

[44] *See* Varun Bhat, *Corporate Governance in India: Past, Present, and Suggestions for the Future*, 92 Iowa L. Rev. 1429, 1431 (2007).

[45] *See* Terry E. Chang, *The Gold Rush in the East: Recent Developments in Foreign Participation within China's Securities Markets as Compared to the Taiwanese Model*, 44 Colum. J. Transnat'l L. 279, 310 (2005).

[46] Such as the Hyundai Heavy Industry in South Korea, *see* Craig Ehrlich Dae-Seob Kang, *U.S. Style Corporate Governance in Korea's Largest Companies*, 18 UCLA Pac. Basin L.J. 1, 56 (2000). Caslav Pejovic also proposes that Japanese corporate governance should be further adjusted to attract more foreign investors. Caslav Pejovic, *Japanese Corporate Governance: Behind Legal Norms*, 29 Penn St. Int'l L. Rev. 483, 519 (2011).

[47] *See* Cheryl W. Gray, William W. Jarosz, *Law and the Regulation of Foreign Direct Investment: The Experience from Central And Eastern Europe*, 33 Colum. J. Transnat'l L. 1, 1 (1995).

[48] *See* Ali Adnan Ibrahim, *Developing Governance and Regulation for Emerging Capital and Securities Markets*, 39 Rutgers L.J. 154 (2007).

[49] *See* Terry E. Chang, *supra note 45*, at 310. However, the author provides another argument against this. *Id*, at 311.

The literature emphasizes the positive effects of foreign investments on corporate governance. One result is that the shares held by foreign investors is used as the proxy variable for signal hypothesis in this paper. If the number of shares held by foreign investors is positively correlated with the purchase of D&O insurance, this indicates that foreign investors really do care about D&O insurance. This also implies that D&O insurance does have a positive effect and foreign investors will be attracted, which supports the signal hypothesis about D&O insurance. On the other hand, if the relationship is not statistically significant or negative, this implies that foreign investors do not care D&O insurance to a significant degree. This implies that D&O insurance has no significant signal effect, and foreign investors will not be attracted. There is no evidence to support the signal hypothesis regarding D&O insurance in Taiwan. In order to thoroughly examine foreign investors, the shares hold by foreign natural persons, foreign juristic persons and foreign financial juristic persons[50] will be considered in this empirical analysis. They are represented by *FNP*, *FJP* and *FFJP* respectively.

3.2 Test of Asymmetric information

3.2.1 Theory of asymmetric information and D&O insurance

If insurance is so effective in conveying good signals, the question arises why do not all firms buy D&O insurance? One possible reason is that, in comparison with book value, EPS, number of independent directors and so on, insurance contracts are decided by both the intentions of firms and insurance providers. Why do some firms not have any insurance? It may not be the case that they do not want to have it, but rather that they are unable to obtain it. If the insurer has the ability to judge the essential qualities of firms, they will review those qualities in their underwriting and decide whether or not to offer insurance, how much they will charge, and how much coverage they will offer. In contrast, if the insure does not have the ability when underwriting to review the risks of the firms, this may lead to the conclusion that

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[50] Institutional investors are also believed to have positive effect on corporate governance. *See* David P. Porter, *Institutional Investors and Their Role in Corporate Governance: Reflections By a "Recovering" Corporate Governance Lawyer*, 59 Case W. Res. L. Rev. 627, 653-4 (2009). For more arguments about the role of institutional investors in corporate governance, *see* Edward S. Adams, *Corporate Governance after Enron and Global Crossing: Comparative Lessons for Cross-National Improvement*, 78 Ind. L.J. 723, 740 (2003). They usually have more interest in, and the ability to influence. the behavior of companies. *See* David P. Porter, *Id*, at 654-81. In Taiwan, the majority of companies are owned by families and individual shareholders, and the role of institutional investors is more important. *See* Yin-Hua Yeh, Tsun-siou Lee & Tracie Woidtke, Family Control and Corporate Governance: Evidence from Taiwan, 2 Int'l Rev Fin. 21 (2001). Individual investors account for 70% of stock market transactions in Taiwan. *See* Yu-Hsin Lin, *Modeling Securities Class Actions outside the United States: The Role of Nonprofits In The Case of Taiwan*, 4 N.Y.U. J. L. & Bus. 143 (2007).

firms with poor corporate governance can still can obtain insurance, which will convey positive signals to the market. In other words, underwriting as conducted by insurers is helpful for understanding why firms cannot buy unlimited insurance for the purpose of conveying positive signals.

Concerns about the adverse selection of D&O insurance can be found in the literature. Directors who intend to breach their duties are more likely to purchase D&O insurance, which will lead to more derivative suits.[51] The equilibrium of the supply and demand for D&O insurance will also affected by adverse selection. Under adverse selection circumstances, the insurance pool contains more high risk individuals than low risk individuals who pay the same premium. This will damage insurers and cause insurers to raise their premiums. The consequence is that the equilibrium will change.[52] The more severe the adverse selection is, the more equilibrium will be affected.[53] In addition, another byproduct of asymmetric information is market segments.[54] If the large pool contains large numbers of high-risk individuals and just charges them the same as low risk individuals, this pool tends to decay.[55] The pool tends to become segmented.[56] This implies that the equilibrium of different segments is different from each other. If this is true, our previous test regarding the signal effect of D&O insurance is that the entire market will be influenced. As regards the reliability of the previously discussed signal hypothesis, this paper will test and determine whether or not adverse selection exists in the Taiwanese D&O insurance market.

Adverse selection may exist in D&O insurance, and may lead to malfunctions of insurance and market segments. All of these factors will influence the hypothesis regarding the signal effect with respect to D&O insurance. The less the adverse selection, the less the signal hypothesis will be affected. This paper assumes null hypothesis to the effect that there is no adverse selection in the Taiwanese D&O insurance market. If the following empirical test does not reject this hypothesis, this assumption will not be rejected, and the signal hypothesis will not be affected. This paper proposes that the hypothesis that there is no adverse selection in the Taiwanese D&O insurance market.

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[51] *See* Mark D. West, *The Pricing of Shareholder Derivative Actions in Japan and the United States*, 88 Nw. U. L. Rev. 1436, 1502 (1994).
[52] More detailed discussion, *see* Ralph A. Winter, *The Liability Crisis and the Dynamics of Competitive Insurance Markets*, 5 Yale J. on Reg. 455, 488-9 (1988).
[53] *Id.*
[54] *See* Cassandra Jones Havard, *Democratizing Credit: Examining the Structural Inequities of Subprime Lending*, 56 Syracuse L. Rev. 233, 262 (2006).
[55] *See* Anthony S. Chen, Margaret Weir, *The Long Shadow of the Past: Risk Pooling and the Political Development of Health Care Reform in the States*, 34 J. Health Pol. Pol'y & L. 679, 687 (2009).
[56] *Id.*

Adverse selection will cause market segmentation and affect the equilibrium of supply and demand. However, if market segments are complementary, the insurance mechanism will not be influenced. For example, insurers can contract with applicators they complementary to work with and vice versa. Under such circumstances, even though market segments exist, different premiums will be charged in accordance with different risk classifications. Therefore the insurance pool will not be harmed.[57] Rational insurers will attempt to contract with low risk applicators.

Empirical research has shown that scandal-based events directly impact insurer pricing behavior.[58] The ability of insurers to distinguish between low risk and high risk applicators is important, or else adverse selection will occur.[59] If the process of underwriting works properly, insurers can distinguish between the risks of different applicators and filter out high-risk applicators. This paper hypothesizes that D&O insurance underwriting functions properly in the Taiwanese market. In other words, insurers can filter out applicators they do not want.
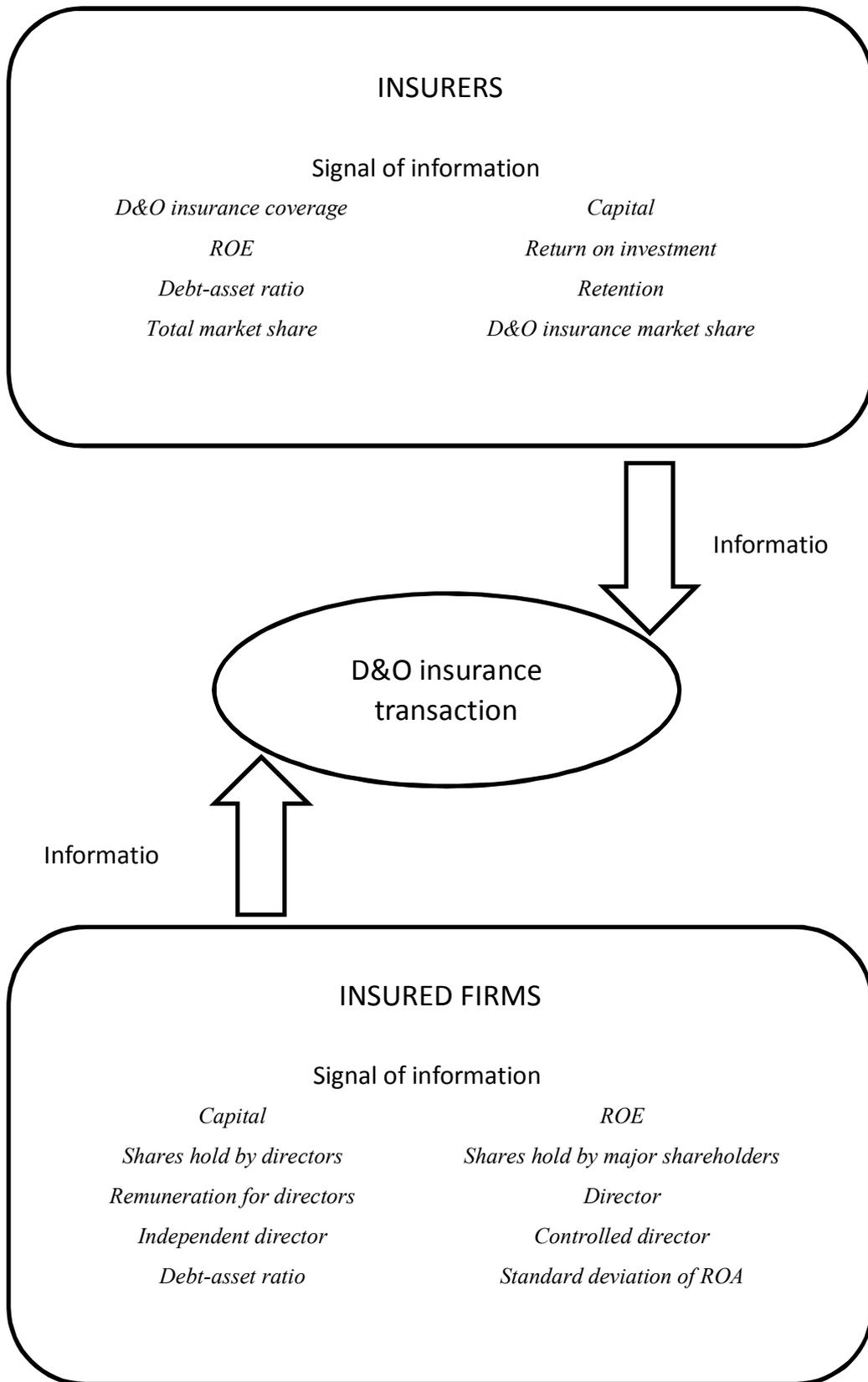
Insurance applicators similarly seek to contract with low-risk insurers. In the absence of asymmetric information, applicators should also have complete information regarding insurers and can contract with any insurers they deserve. Just as in case of the reasoning about insurers, this paper also hypothesizes that insurance applicators can filter out insurers they do not desire.

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[57] This is also the reason why sufficient risk classification is often considered as a measure for mitigating adverse risk. For example, Peter Siegelman, *Adverse Selection in Insurance Markets: An Exaggerated Threat*, 113 Yale L.J. 1223, 1279 (2004). Amy Monahan, Daniel Schwarcz, *Will Employers Undermine Health Care Reform by Dumping Sick Employees?*, 97 Va. L. Rev. 125, 135 (2011).
[58] *See* Stephen G. Fier Fier, Kathleen A. McCullough, Joan T. A. Gabel and Nancy R. Mansfield, *The Directors and Officers Insurance Marketplace: An Empirical Examination of Supply and Demand in Uncertain Times*, pp. 31 (December 15, 2009). Available at SSRN: http://ssrn.com/abstract=1524063, Feb. 15, 2012.
[59] Detailed explanation, *see* Eric Mills Holmes, *Solving the Insurance/Genetic Fair/Unfair Discrimination Dilemma in Light of the Human Genome Project*, 85 Ky. L.J. 503, 544-5 (1996-1997).

Figure 1 Framework of Research

INSURERS

Signal of information

D&O insurance coverage	*Capital*
ROE	*Return on investment*
Debt-asset ratio	*Retention*
Total market share	*D&O insurance market share*

Informatio

D&O insurance
transaction

Informatio

INSURED FIRMS

Signal of information

Capital	*ROE*
Shares hold by directors	*Shares hold by major shareholders*
Remuneration for directors	*Director*
Independent director	*Controlled director*
Debt-asset ratio	*Standard deviation of ROA*

4. Empirical results and analysis

   4.1 The test of monitoring and signal hypothesis

The result of the Tobit model shows that the number of controlled directors and debt-asset ratio variables are significant variables. They are inversely related to D&O insurance coverage. This implies that more controlled directors and debt-asset ratios will result in less demand for insurance. The monitoring hypothesis stipulates that firms that have poor qualities should exhibit greater demand for D&O insurance. However, this hypothesis is rejected using the empirical results of the Tobit model. In contrast, the proxy variable of the signal hypothesis is significant. The variable for the number of shares held by foreigner financial juristic persons is positively significant in 2009 and 2010, and signal hypothesis is thus supported.

Again, Censored Least Absolute Deviations (CLAD) is carried out to confirm the previous Tobit model. The result is even more obvious. Firms with greater returns will have less demand for D&O insurance. On the contrary, greater remuneration still results in increased demand for insurance, which differs from the monitoring hypothesis. In a similar manner, independent director, shares held by directors, shares held by major shareholders, controlled directors, internal risks and debt-asset ratios are all negatively correlated to the demand for insurance. The result is that monitoring hypothesis is rejected, which is also supported by CLAD. Attention should be given to the results that the number of shares held by foreign person variable is negatively significant. This indicates that more shares that are held by foreign persons, the more likely it is to result in decreased demand for insurance. However, the numbers of shares held by foreign juristic persons and foreign financial juristic persons are both positively significant. This matches with the previous results. In comparison with natural persons, foreign institutional investors are usually concerned primarily with corporate governance in relationship to investment targets. Accordingly, the signal effect of D&O insurance is still supported by this result.

The empirical results have two implications. First, the monitoring hypothesis is rejected with respect to Taiwan. Firms with good corporate governance will have greater levels of demand for D&O insurance. Secondly, the signal hypothesis is supported. Foreigner investors, meaning the proxy for the signal hypothesis, are positively related to demand for D&O insurance. This implies that D&O does indeed convey positive signals that attract investors. This also explains the reason behind the first implication. Firms with good corporate governance usually publicize their corporate governance practices, and are willing to purchase additional D&O insurance in order to convey the impression that they emphasize corporate governance and attract investors.

4.2 The test of asymmetric information

4.2.1 Canonical correlation analysis

In canonical correlation analysis, the number of canonical variables should be equivalent to, or less than, the minimum of the number of x variables and the number of y variables.[60] There are 10 covariates and 8 dependent variables that were used in this research, and thus the number of canonical variables is equal to, or less than, 8.

The canonical correlations of these eight canonical variables are 0.61543, 0.21424, 0.12490, 0.07047, 0.04318, 0.04079, 0.03414 and 0.02673. Only x_1 and x_2 are significant (p-value < 0.05), but can still explain 96.1616% of all of the variance. It should be noted that the first canonical variable x_1 alone can explain 89.12897% of all of the variance. The following discussion is based on these two canonical variables.

First, the empirical evidence shows that 4.96822% of the variance in the set of x can be explained by the opposite canonical variable η_1, and 13.11728% of the variance in the set of x can be explained by its canonical variable x_1. In addition, 0.37423% of the variance in the set of x can be explained by the opposite canonical variable η_2 and 8.15357% of the variance in the set of x can be explained by its canonical variable x_2. In contrast, 16.22262% of the variance in the set of y can be explained by its canonical variable η_1, and 6.14438 % of the variance in the set of y can be explained by the opposite canonical variable x_1. Finally, 11.85339% of the variance in the set of y can be explained by its canonical variable η_2, and 0.54404% of the variance in the set of y can be explained by the opposite canonical variable x_2.

When evaluating canonical correlations, the relationship of variables lower than 0.3 is usually is regarded as being insufficient to affect canonical variables.[61] This study excludes variables whose canonical loading is less than 0.3. In the first set of canonical variables, ρ^2 is 0.37875, which indicates that x_1 can explain 0.37875% of the variance of η_1. In addition, the capital of insured firms (-.922651) and remuneration of directors (.66596) affects insurers' debt-asset ratios (.33814), ROE (-.86634), retention (.37841) and overall market shares (-.39758) by x_1 and η_1. This implies that the capital and remuneration of insured firms, debt-asset ratios, ROE, retention and overall market share of insurers are important concerns when D&O insurance is contracted. In the second set of canonical variables, ρ^2 is .04590, which indicates that

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[60] *See* Abdelmonem A. Afifi, Virginia Clark, Susanne May, COMPUTER-AIDED MULTIVARIATE analysis, CRC Press 239 (2004).W. J. Dixon, BMDP STATISTICAL SOFTWARE MANUAL: TO ACCOMPANY BMDP RELEASE 7, University Of California Press 925 (1992).

[61] *See* Wendy Currie, VALUE CREATION FROM E-BUSINESS MODELS, Butterworth-Heinemann 197 (2004).

x_1 can explain .04590 % of the variance of η_1. Similarly, the capital (.31435), remuneration (.51005), numbers of independent directors (-.31695) and debt-asset ratios (.36303) of insured firms do indeed affect insurance coverage (.87945) and D&O insurance market share (-.36359) of insurers by x_2 and η_2.

In addition, the cumulative redundancy indexes are 5.34245% and 6.68842%. This means that the qualities of insurers can be explained or predicted to be around 6% using the qualities of insured firms, and vice versa. This result has two implications. On one hand, it is usually the case (90% plus) that the identities of insurers who offer D&O insurance cannot be predicted using the qualities of insured firms. Neither can the identities of insured firms be predicted using the qualities of insurers. If there are some asymmetric information problems and adverse selection problems in the Taiwanese D&O market, certain symptoms such as market tendencies should be easy to find.

However, the empirical evidence does not provide such proof. It may be reasonable to infer that the Taiwanese market does not have significant market segments. Additional tests are carried out in the following stepwise regression. Under these circumstances, obvious asymmetric information and adverse selection do not exist, and the signal effect with respect to D&O insurance is not influenced.

On the other hand, about 6% of the variance of the qualities of insurers and insured firms can be predicted using the qualities of the insured firms and insurers. This indicates that there exist relationships between certain characteristics of insured firms and certain characteristics of insurer with whom they contract. However, this is not equal to asymmetric information and adverse selection. If insured firms contract with the insurers which have similar qualities of governance, this result may be fairly reasonable. Accordingly, asymmetric information and adverse selection still do not exist and the signal effect of D&O insurance will not be influenced by adverse selection.

Table 1 The summarized result of canonical analysis

This table contains the final result of canonical analysis. The Wilks L. of both canonical variables are significant at 5% level.

X (Insured firms)	x_1	x_2	Y (Insurers)	η_1	η_2
Log of capital	-.92265	.31435	Log of D&O coverage	-.06914	.87945
ROE	.02218	-.07046	Log of capital	-.01038	-.05867
Log of remuneration	.66596	.51005	Debt-asset ratio	.33814	-.06160
Director	.00143	.23929	ROE	-.86634	.09405
Independent director	.02307	-.31695	Return on investment	-.23534	.04553
Controlled director	.01442	-.13561	Retention	.37841	-.08772
Shares hold by directors	-.01242	-.26077	Total market share	-.39758	.12962
Shares hold by major shareholders	.02268	-.04345	D&O insurance market share	.26717	-.36359
Debt-asset ratio	.06378	.36303			
Standard deviation of ROA	.10476	-.27135			
Proportion of variance explained by opposite canonical variable	4.96822	0.37423	Proportion of variance explained by its own canonical variable	16.22262	11.85339
Cumulative proportion of variance explained by opposite canonical variable	4.96822	5.34245	Cumulative proportion of variance explained by its own canonical variable	16.22262	28.07601
Proportion of variance explained by its own canonical variable	13.11728	8.15357	Proportion of variance explained by opposite canonical variable	6.14438	0.54404
Cumulative proportion of variance explained by its own canonical variable	13.11728	21.27084	Cumulative proportion of variance explained by opposite canonical variable	6.14438	6.68842
Wilks L.	0.57745*	0.92951*			
Eigenvalue	0.60967	0.04811			
Percentage	89.12897	7.03262			
Cumulative percentage	89.12897	96.1616			
Canonical correlation	0.61543	0.21424			
Squared correlation	0.37875	0.0459			

* Significant at 0.05 level

Figure 2 Path diagram of canonical analysis
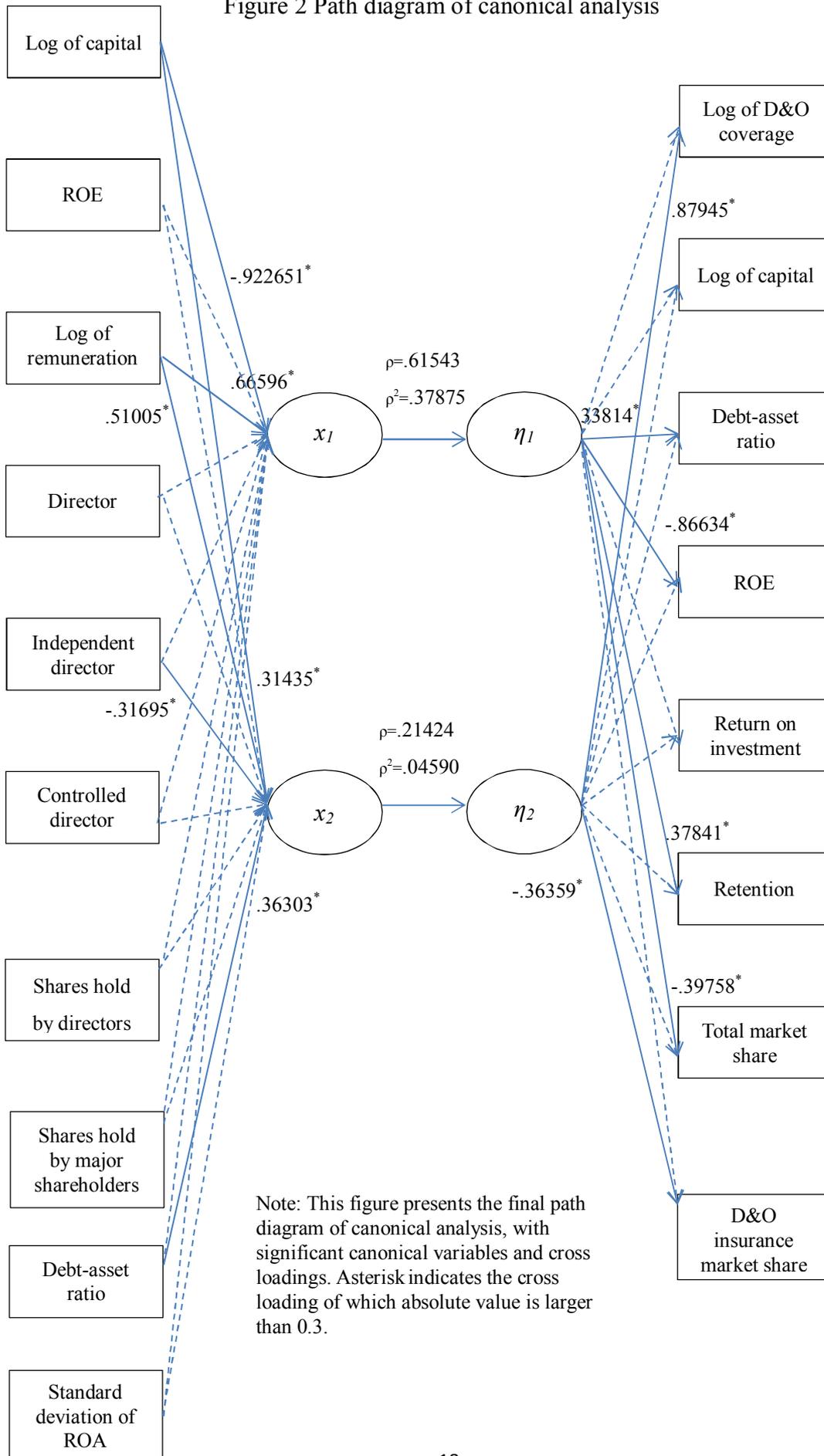
Note: This figure presents the final path diagram of canonical analysis, with significant canonical variables and cross loadings. Asterisk indicates the cross loading of which absolute value is larger than 0.3.

4.2.2   Pearson's correlation

In order to further test the canonical analysis results, Pearson's correlation analysis is carried out to test covariates and independent variables. It is found that the capital of insured firms is significantly associated with debt-asset ratios, ROE, retention and the overall market share of insurers. This confirms the results of canonical analysis to the effect that these variables are associated with two canonical variables x_1 and η_1. Similarly, insurance coverage is significantly related to the capital, remuneration of directors, the numbers of independent directors and debt-asset ratios of insured firms. However, the D&O insurance market share of insurers is not significantly related to the number of independent directors and the debt-asset ratios of the insured firms. The results regarding canonical variables x_2 and η_2 is partially supported by Pearson's correlation analysis. In general, the results of canonical analysis can be confirmed using Pearson's correlation analysis, particularly the first set of canonical variables, which explain 89.12897% of the variance, is fully supported by the empirical evidence. The conclusion in the previous test to the effect that there is a relationship between certain characteristics of insurers and insured firms is confirmed.

4.2.3   Stepwise regression

In this section, the proxy variables of qualities of insured firms are used as independent variables, and the proxy variables of qualities of insurers are used as dependent variables in stepwise regression. This is done in to explore the qualities of insured firms and the qualities of insurers with whom they contract. Such associations and magnitudes are helpful for assessing the functions and criteria of insurers' underwriting, and whether or not adverse selection exists.

When the dependent variable is insurance coverage, the insured firms' capital, remuneration and debt-asset ratios are positively significant, whereas the number of independent directors and controlled directors, and the number of shares owned by directors, are negatively significant. This indicates that insured firms with more capital, remuneration and better debt-asset ratio intend to purchase more coverage, or obtain more coverage from insurers. In terms of insured firms with more independent directors, controlled directors and greater numbers of shares owned by directors, such companies intend to purchase less coverage, or obtain fewer coverage from insurers. Several inferences can be made from these findings. First, the finding that positive relationships exist between remuneration and insurance coverage rejects the argument that they are substitutes. In addition, firms with smaller numbers of shares being owned by directors and controlled directors have more insurance coverage. This confirms our argument that Taiwanese firms with better qualities have greater demand

for D&O insurance. This also implies that the underwriting of insurers function properly and can avoid offering redundant coverage to firms with higher internal risks. Although the coefficient of debt-asset ratios is positive, its magnitude is comparatively small. The information about debt-asset ratios is also disclosed, and everyone including insurers can access that easily.

This is insufficient to prove the malfunction of underwriting or adverse selection. A more reasonable explanation is that firms with higher debt-asset ratios experience greater demand for insurance coverage. When the dependent variable is the insurers' debt-asset ratios, then the insured firms' capital and the number of shares owned by directors are negatively significant, and the number of directors is positively significant. This indicates that insured firms with lower capital and fewer shares being owned by directors are companies that intend to contract with insurers who have higher debt-asset ratios, and insured firms with more directors also intend to contract with insurers who have higher debt-asset ratios. When the dependent variable is the insurers' D&O market share, it shows that insured firms with greater numbers of independent directors, and insured firms with less capital, intend to contract with insurers who have large shares of the D&O insurance market.

When the dependent variable is insurers' return on investments, this indicates that insured firms with more capital and insured firms with fewer directors intend to contract with insurers who experience greater returns on their investments. When the dependent variable is insurers' market shares, this shows that insured firms with greater amounts of capital intend to contract with insurers with greater overall market share. In contrast, insured firms with high debt-asset ratios, numerous directors, and independent directors intend to contract with insurers with less overall market share. Again, insured firms with less capital intend to purchase insurance from insurers with higher retention rates. In contrast, insured firms with low debt-asset rations intend to contract with insurers with lower retention rates. As regards the ROE of insurers, insured firms with greater amounts of capital and greater numbers of shares being owned by directors intend to contract with insurers with higher ROEs. However, insured firms which offer greater remuneration for directors and which have higher debt-asset ratios intend to contract with insurers with lower ROEs.

Certain associations between the qualities of insured firms and insurers and the attributes of D&O insurance transactions can be found in these results. Still, there is no obvious evidence that shows that there is any form of malfunction of underwriting and adverse selection, such as consistently negative associations between the qualities of insured firms and insurers, or situations where insured firms with poor qualities can obtain contracts from insurers with good reputations or large market shares. Except or

the ROE of insurers, the R-square scores of other regressions are around, or less than, 5%. This implies that generally such associations between the qualities of insured firms and insurers are quite weak, and adverse selection occurs where insured firms with poor qualities contract with good insurers.

In addition, significant variables cannot be found using stepwise regression when the dependent variable is the capital of insurers. This implies that there is a rare relationship between the qualities of insured firms and the capital of insurers. D&O insurance applicators may not be excessively concerned about the capital of insurers. This matches with previous analysis of the Taiwanese D&O insurance market and descriptive analysis. The amounts of capital held by D&O insurers in Taiwan are quite similar among insurance firms and this does not influence D&O insurance sales.

In conclusion, there is some association between the qualities of insured firms and the qualities of insurers with whom they contract. However, the explanatory ability of this association is quite limited. This confirms the previous results of canonical and Pearson correlation analysis. The evidence regarding the tendencies of the Taiwanese D&O insurance market is weak, and the problem of moral hazard occurs with poor-quality insured firms that contract with high-quality insurers. Future cluster analysis and discriminant analysis will provide stronger evidence to mitigate concerns about adverse selection.

4.2.4   Cluster analysis

The proxy variables of qualities of insurers and the insured firms are used as criteria for attempting to classify 2,485 D&O insurance contracts. The purpose of this analysis is to determine whether some clusters of each of the components are similar to each other and different than other observations of other clusters. If so, some tendencies of D&O markets might be revealed. Given the number of observations in each cluster, the magnitude of such tendencies can be observed. In addition, the association between the qualities of insurers and insured firms is also helpful for examining concerns about adverse selection.

As regards clarification and convenience, the default number of clusters is set as 3.[62] As regards the results, regardless of which variable is used as criteria, the result of classification and the centers of clusters are identical. There are 86 observations in cluster 1, 2,393 observations in cluster 2, and 6 observations in cluster 3. These empirical results can be interpreted from two perspectives. On one hand, if the

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[62] This study attempts to classified all observations into more than 3 clusters, but the results are quite similar. For example, the tendencies of these tests are similar, and cluster 2 in them always contains more than 90% of the observations.

majority of observations were classified into one group, then it can be inferred that most transactions are similar and no adverse selection exists.

On the other hand, given that all of the observations can be classified into several groups, this is not equivalent to that market being problematic. If good insured firms are matched with good insurers by means of insurance contracts, or bad insured firms are match with bad insurers, then it can be inferred that underwriting functions properly, insured firms and insurers can filter the proper counterparties, and no asymmetric information and adverse selection exist.

As regards the previous results of canonical analysis, Pearson analysis and stepwise regression will also be confirmed. First, empirical results show that there are 3 clusters for which the observations have significant differences. In cluster 1, insured firms have the highest amount of capital, larger ROE, numbers of directors and independent directors. They also have the smallest numbers of controlled directors, the smallest numbers of shares owned by directors, the smallest numbers of shares owned by major shareholders, and highest debt-asset ratio. The comparatively low standard deviations of ROA show that these firms are less opportunistic. In comparison with other groups, insured firms in cluster 1 have the best qualities among the three groups. Insurers in cluster 1 have the smallest amounts of capital, investment returns and D&O market shares, medium retention rates, and the highest levels of ROE. In comparison with other groups, the insurers in cluster 1 are small scale and have high profitability.

This result implies that insured firms and insurers in this cluster both have better qualities. Transaction negotiation and insurance underwriting should function properly, and consequently better-insured firms obtain offers from better insurers. This is quite reasonable and fair, and no clue about information asymmetries and adverse selections are revealed.

Cluster 2 contains 2,393 observations, about 96% of all 2,485 observations. Even though different proxy variables of qualities of insurers and insured firms are used as criteria, the number of observations and the centers of the clusters are the same. The observations in cluster 2 should be similar to each other and different than observations for other groups. Because 96% of the observations are classified into an identical group where the components are similar, the entire Taiwanese D&O insurance market is almost homogeneous and market segmentation is limited. This result is further confirmed by the robustness check. Even when using different variables as criteria, the result remains consistent. Even though this study attempts to classify all of the observations into more than 3 groups, cluster 2 consistently contains more than 90% of all of the observations. The majority of insurance transactions are

homogeneous, and there is no evidence of asymmetric information and adverse selection.

On the other hand, if the focus moves to the qualities of the firms that are in cluster 2, the concerns about asymmetric information and adverse selection are still rejected. In comparison, the insured firms in cluster 2 have intermediate qualities. They have medium amounts of capital, ROEs, shares of directors, standard deviations of ROA and remuneration for directors. Their insurers also have medium amounts capital, ROEs and D&O insurance market shares. Insured firms and insurers find and contract counterparties they deserve. The same result emerged: no evidence of asymmetric information and adverse selection was found.

Cluster 3 contains bad insured firms and insurers. As regards insured firms, they have the lowest amounts of capital and ROEs. In addition, they also have highest numbers of shares that are owned by directors and major directors, and high debt-asset ratios. They have the highest standard deviation of ROAs, which implies that these firms intend to engage in opportunistic behavior. Insurers in cluster 3 have the highest retention rates and the lowest ROEs. Although these insured firms get the greatest amounts of coverage, the qualities of the insurers are comparatively low. This implies that bad insured firms cannot obtain large amount of coverage from good insurers. This result is reasonable and the problem of asymmetric information and adverse selection does not appear. One possible explanation for high coverage is they require more insurance, because they actually do have poor qualities and experience the highest possible level of risk. This is also why they cannot obtain offers from better insurers, and they must purchase insurance from other insurers.

In conclusion, there cluster analysis above leads to two important findings. First, the majority of the observations can be classified into a single group whose components should be similar. Most of the market is homogenous. Second, given the 3 clusters in the results, insurers contract with insured firms according to their status. . This shows that no party obtained any advantages in negotiation or insurance underwriting, and that asymmetric information and adverse selection did not exist. Hence, the equilibrium of the Taiwanese D&O insurance market is close to being homogenous and asymmetric information and adverse selection did not occur. The signal effect of D&O insurance is not influenced by adverse selection.

Table 2 Final Cluster Centers of Cluster Analysis

| | | Cluster | | |
		1	2	3
Insurers	Log of capital	Low	Medium	High
	Return on investment	Low	High	Medium
	Retention	Medium	Low	High
	ROE	High	Medium	Low
	Debt-asset ratio	Low	Medium	High
	Log of D&O insurance coverage	Medium	Low	High
	Total market share	Medium	Large	Small
	D&O insurance market share	Small	Medium	Large
Insureds	Log of capital	High	Medium	Low
	ROE	High	Medium	Low
	Director	High	Low	Medium
	Independent director	High	Low	Medium
	Controlled director	Low	High	Medium
	Shares hold by directors	Low	Medium	High
	Shares hold by major shareholders	Medium	Low	High
	Debt-asset ratio	Medium	Low	High
	Standard deviation of ROA	Low	Medium	High
	Log of remuneration	Low	Medium	High

4.2.5   Discriminant analysis and multinomial logistic regression

According to previous cluster analyses, all D&O insurance contracts can be classified into three categories. Discriminant analysis is used to determine whether such classifications are proper or not. The result shows that 99.9% of original grouped cases are correctly classified. As regards the figure of canonical discriminant functions, it is easy to observe that the three clusters are separately scattered. The result is that the classification of cluster analysis is confirmed.

Figure 3 Canonical discriminant functions
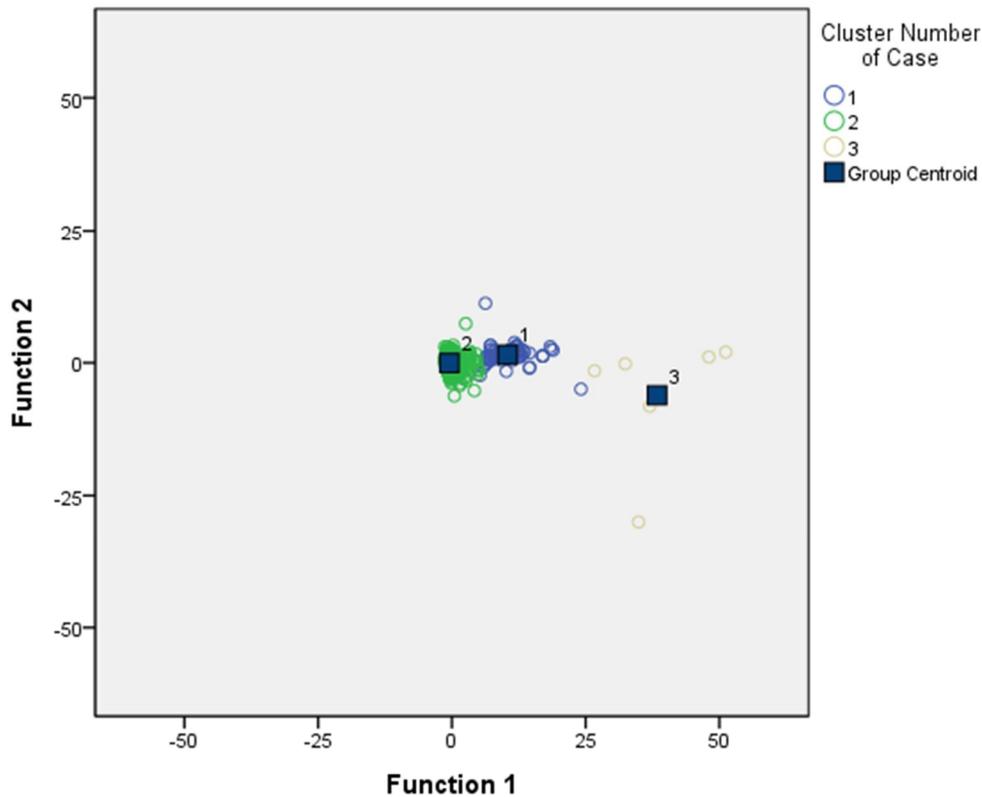
Among the two canonical Discriminant Functions here, the first can explain 97.8% of all of the variance, and the second one can explain about 2.2% of the variance. Both of their Wilks' Lambdas are significant. Two sets of Standardized Canonical Discriminant Function Coefficients are presented below:

y_1=.001LN_s_coverage-.027LNcapital2+.000DAratio2+.059ROE2-.017investment+.036retention+.026marketshare+.035DOmarketshare-.065LNcapital-.072ROE-.021LNRemu-.020Director+.037IDirector+.045Ctrldirector-.063SD-.075SMH+1.011DAratio+.060StdDevROA…………………………………………………………………………(1)

y_2=.033LN_s_coverage+.065LNcapital2-.100DAratio2-.039ROE2-.051investment+.096retention-.133marketshare-.101DOmarketshare+.327LNcapital+.778ROE-.045LNRemu+.406Director+.132IDirector-.242Ctrldirector-.086SD-.044SMH+.001DAratio-.225StdDevROA………………………………………………………………….(2)

It should be noted that discriminant analysis assumes that the variance of discriminant

variables are homogenous across groups.[63] This is done to ensure that the groups from the same parameter.[64] The test score of Box's test is 0.000, which is less than 0.05. The null hypothesis of equal population covariance matrices is rejected. This nevertheless does not mean this result is not reliable. First, Box's test is quite sensitive to the sample size.[65] The larger the sample size, the more easily the covariance assumption is violated. Given a large sample, a violation of this assumption is not significant.[66] Moreover, discriminant analysis is robust with respect to violations of the assumption of covariance.[67] All of the observations come from the Taiwanese public market and thus are certainly from the same parameter. Given the large sample of 2,485 observations in this study, and the similarities of the result of cluster analysis, this violation should not be critical.

Furthermore, logistic regression is usually applied when the assumptions of discriminant analysis are violated.[68] As regards the robustness check, multinomial logistic regression is conducted with the second cluster as base group. The result shows that the model is significant and exhibits goodness-of-fit. This indicates that the classification based on cluster analysis is confirmed. The qualities of insurers and insured firms may lead to some different characteristics in D&O insurance contracts, but such characteristics are quite limited. Most of the observations are in cluster 2, which implies that the Taiwan D&O market is close to being homogenous. The differences between the three clusters are significant and the characteristics provide no evidence of adverse selection.

5. Conclusions

This paper sought to analyze the relationship between D&O insurance and the corporate governance of insured companies in Taiwan, and determined the theory which can explain the situation in Taiwan. The monitoring hypothesis suggests that D&O insurers work as outside monitors who promote corporate governance. Given that this is the purpose of monitoring, D&O insurance and other monitoring mechanisms all have monitoring functions. Hence, D&O insurance and other monitoring mechanisms can be substituted for each other. Companies which have better corporate governance have less demand for D&O insurance. A variety of

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[63] *See* Neil J. Salkind, Encyclopedia of Research Design, SAGE 350 (2010).
[64] *Id.*
[65] *Id.*
[66] *See* Dennis R. Jones, The Relationship between Working Conditions and Musculoskeletal Disorders in an Assembly Facility, The University of Wisconsin – Madison, 179 (2006).
[67] *See* Neil J. Salkind, *supra note 63*, at 350. *Also see* Lawrence S. Meyers, Glenn Gamst, A. J. Guarino, Applied Multivariate Research: Design and Interpretation, SAGE 270 (2006).
[68] *See* Neil J. Salkind, *Id,* at 350.

empirical methods are applied to examine the situation in Taiwan. The results show that the monitoring hypothesis is rejected. There is a tendency for companies with good corporate governance to purchase more D&O insurance, while companies with poor corporate governance are less likely to do so. In contrast, the signal effect is supported by the empirical research in this paper. Foreign investors who care more about corporate governance indeed emphasize the purchase of D&O insurance, and D&O insurance also has positive effects on the stock market. This result indicates that D&O insurance has produces positive signals and accordingly the signal hypothesis is supported.

Afterwards, the problems of adverse selection and insurance underwriting are tested. If these problems occur, the equilibrium of demand and supply may be influenced, insurers would not be able to screen the insured firms sufficiently and thus the signal effect of D&O insurance will not be reliable. The results of canonical analysis, Pearson analysis, stepwise regression, cluster analysis, discriminant analysis and multinomial logistic regression lead to three important findings. First of all, there is some association between the qualities of insurers and insured firms. This implies that certain characteristic of insured firms and insurers are emphasized in negotiations and underwriting. Second, when using different methods of classification, the majority of D&O insurance contracts are still belong in a single group. This implies that the Taiwanese D&O insurance market is close to being homogenous. Third, there was no evidence that proved that there was unfairness in the associations between the qualities of insured firms and the insurers with whom they contracted. Insured firms with poor qualities intend to contract with insurers whose qualities are not very good, and vice versa. This shows that the majority of the market is homogenous, and the risk classification in the Taiwan D&O insurance market is also good and sufficient. No significant evidence of asymmetric information and adverse selection can be found. This paper concludes that insurance underwriting, the homogeneity of the Taiwanese market, and the signal effect of D&O insurance are unbiased.