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DIRECTORS' AND OFFICERS' LIABILITY INSURANCE, CORPORATE RISK AND RISK TAKING: NEW PANEL DATA EVIDENCE ON THE ROLE OF DIRECTORS' AND OFFICERS' LIABILITY INSURANCE

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ABSTRACT

This article develops and tests hypotheses regarding the relationship between directors' and officers' (D&O) insurance purchase and firm size, governance characteristics, and business risk, using a unique panel data set on Canadian firms for years 1996–2005. The data permit examination of the determinants of insurance pricing, ownership and coverage limits, and the effects of insurance on board characteristics and earnings management. Results using panel data methods and controlling for endogenous prices and endogenous selection into insurance ownership provide strong statistical evidence for the view that D&O insurance markets take corporate risk into account, but that insurance leads to greater risk taking.

INTRODUCTION

Members of the board of directors of publicly traded corporations in many countries around the world face personal liability for breach of the duties of care and loyalty to the company's shareholders (Romano, 1991).¹ Imposing liability is thought to aid in aligning managers' incentives with the interests of shareholders by providing shareholders with a mechanism for recouping losses brought about by director malfeasance. Permitting shareholder suits is also a means to deal with the classic

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¹For more on the jurisprudence regarding directors' and officers' liability insurance, see Priest (1987), Bradley and Schipani (1989), Knepper and Bailey (1998), Emerson and Clarke (2003), Baker and Griffith (2010), and Heys and Berenblut (2012).

agency problem, acting as a disciplinary force on managers and directors (see Becht, Bolton, and Roell, 2003; Bauer, Braun, and Moers, 2008).²

One puzzle long recognized in the literature is that the enforcement power of shareholder liability threats are often mitigated by corporations purchasing directors' and officers' (D&O) insurance on the board's behalf.³ This reduces the directors' and officers' financial risk associated with such suits,⁴ and raises the obvious concern that the deterrent effects of the shareholder liability threat are reduced (Baker and Griffith, 2010). This may result in reduced board oversight of managers' activities and of the financial condition of the firm (Barrese and Scordis, 2007; Bradley and Chen, 2011; Rees, Radulescu, and Egger, 2011). This concern was the main reason why D&O insurance was not allowed in many continental European countries until very recently (see Gutierrez, 2003; Werder, Talaucicar, and Kolat, 2005; LaCroix, 2009).⁵

Specific moral hazard effects of D&O insurance may include inefficient investments (Lin, Officer, and Zou, 2011), aggressive accounting (Cao and Narayanamoorthy, 2011; Boyer and Hanon, 2012), and other actions that benefit management at the expense of shareholders (O'Sullivan, 1997; Chalmers, Dann, and Harford, 2002; Chen Yi, and Lin, 2012). In such cases, a firm's purchase of D&O insurance may reflect opportunism by an entrenched management or board, which receives insurance benefits but does not pay the full cost of insurance.

There are, however, theoretical reasons to expect that D&O insurance purchase could enhance the value of the firm. Drawing on the theory of corporate insurance

²DuCharme, Malatesta, and Sefcik (2004) argue, for instance, that discovered false earning signals have important reputational consequences that result in a higher difficulty of raising capital in the future. The threat of a shareholder suit may reduce earnings restatements and thus increase the value of the firm. McTier and Wald (2011) present an alternative view that shareholder suits arise from "legal rent seeking" by opportunistic plaintiffs' attorneys who sue firms that experience large stock price drops in order to appropriate a settlement from the firm's D&O insurance policies (also see Beck and Bhagat, 1997).

³Of course, D&O insurance policies exclude losses arising from deliberate fraud or dishonesty.

⁴D&O insurance policies offer three different types of coverage, which are called "sides" in the insurance business (Griffith, 2006). "Side A" (or individual) coverage ensures direct reimbursement for directors and officers when a company is unable (for legal reasons or because of bankruptcy) or does not wish to reimburse them. "Side B" (or corporate) coverage is the most common type of D&O coverage, and ensures that a company will be reimbursed for any amounts paid to claimants on behalf of the directors and officers. The third form of coverage is "Side C" (or entity) which provides for direct reimbursement of costs that the company itself may incur from D&O related suits. Most D&O insurance policies consist of a mix of all three types of coverage (Towers-Watson, 2011). Also see Weisdom, McCord, and Williams (2006) for more on the topic.

⁵Besides D&O insurance policies, there are several other contracts that ensure peace of mind to directors and officers in their day-to-day decision making. For example, in Canada and in most U.S. states, corporations are allowed to indemnify directors for legal expenses associated with lawsuits in which they are not found negligent; in these cases D&O insurance may increase moral hazard by increasing directors' indemnification (Romano, 1991, 2006).

purchase, financial risk transfer through insurance is efficiency enhancing for some firms: benefits are more likely for smaller firms, firms with higher costs of financial distress, and firms with higher growth opportunities (Mayers and Smith, 1982, 1990). Protecting directors from liability exposure may also improve firm management, since liability exposure may induce managers to forego risky positive net present value projects (Mayers and Smith, 1987) and risk-averse outside directors may be difficult to attract if exposed to liability risk (Priest, 1987).

Moreover, it has been pointed out that insurers can counter moral hazard by engaging in presale monitoring of corporate government of D&O insurance applicants and negotiating changes in a firm's corporate governance as a condition for obtaining insurance. Examples include diluting the power of the chairman of the board and increasing the number of outsiders on the audit committee (Holderness, 1990). This idea is consistent with corporate insurance theory, which recognizes that insurance can increase firm value through specialized service provision. This has come to be known as the *insurer monitoring hypothesis*; in this view one valuable service of D&O insurers may be monitoring of the firm's directors and officers (Bhagat, Brickley, and Coles, 1987; Holderness, 1990; O'Sullivan, 1997; Baker and Griffith, 2007, 2010; Boyer and Stern, 2014).⁶

Despite the active theoretical interest and the growing importance of D&O insurance among corporations worldwide,⁷ the relative merits of these alternative points of view are not well understood. The determinants of D&O insurance purchase, its role in board contracts, and the effects of D&O insurance protection on corporate risk taking remain subjects of debate. This is likely due to the fact that corporate purchases of D&O insurance are not widely disclosed except where mandated by law, which has limited the scope of empirical

⁶Another version of the monitoring argument is that D&O insurance functions to precommit shareholders to bring suits against negligent directors when litigation is costly and directors have limited wealth (Bhagat, Brickley, and Coles, 1987; Sarath, 1991; Gutierrez, 2003; Chang and Yeh, 2011). See Parry and Parry (1991), Chang and Yeh (2011), Kremslehner (2011), and Rees, Radulescu, and Egger (2011) for alternative models of D&O insurance.

⁷Gutiérrez (2003) reports that D&O insurance was rarely used in continental Europe because it reduces director accountability; she writes that D&O insurance was "forbidden in Germany, where the legislature considers that its use would both reduce the levels of diligence of directors and increase the compensatory demands of plaintiffs" (p. 517). However, the German Corporate Governance Code of 2002 now allows directors to have such insurance (see Werder, Talaucicar, and Kolat, 2005; Talaucicar and Werder, 2008). LaCroix (2009) posts the following: "Most large European companies carry some amount of D&O insurance, although the perceived level of D&O insurance coverage need varies among countries." D&O insurance protection has become the norm for directors in Taiwan (see Chen and Li, 2010). Towers-Watson (2011) reports that 47 percent of for-profit organizations with international operations purchased a local D&O policy in a foreign jurisdiction in 2010, whereas 2 years before, only 2 percent of respondents with international operations had purchased a local policy in a foreign jurisdiction.

research.⁸ To provide new evidence on these questions, this article utilizes a hand-constructed panel of firm-level data to estimate the role and effects of insurance in a relatively large and variable sample of firms.

The estimates use data from Canada, a jurisdiction in which disclosure of D&O insurance purchases is the norm (Chung and Park-Wynn, 2008). The original sample consists of data from over 300 publicly traded corporations listed on the Toronto Stock Exchange. The sample period covers the years 1996 through 2005 and includes firms from seven sectors of the economy, and both newly listed firms and firms that disappear from the data. The resulting sample contains firms that purchase D&O insurance and firms that do not, as well as firms that change their insurance status over the sample period, providing a rich source of variation for empirical testing.

Using the extant theoretical literature on D&O insurance specifically and on corporate insurance generally, the article develops and estimates empirical models of the demand for D&O liability insurance and the effects of insurance ownership on earnings management. We examine the characteristics of firms that are associated with the use of D&O insurance. We also estimate the factors, including price, associated with the choice of policy limits for an insurance contract. Estimates allow for endogenous selection of firms into D&O insurance ownership. Finally, we provide evidence on the insurer monitoring hypothesis by considering whether the purchase of insurance appears to influence board structure and compensation.

The next section of the article explains more fully how our research advances the existing literature. The “Data and Sample Characteristics” section introduces the data set and describes the sample of firms. The “Estimating D&O Insurance Demand” and “Estimating Effects of D&O Insurance” sections develop the empirical models and tests of hypotheses. Results of estimation are presented in the “Estimation Results” section. The final section of the article provides a summary and conclusions.

RELATIONSHIP TO EXISTING LITERATURE

Much of the early empirical literature on D&O insurance aimed to provide evidence of its effects on firm value via event studies examining share price reactions to D&O insurance purchase announcements, or to other events that reduce directors’ personal liability. Existing studies find no significant reaction of share prices to such events (Janjigian and Bolster, 1990; Brook and Rao, 1994), and some find suggestive evidence of positive share price reactions (Bhagat, Brickley, and Coles, 1987). Thus, these studies provide at least weak support for the idea that D&O insurance may be part of an efficient contract with a firm’s directors and officers.

⁸Existing studies have taken advantage of mandatory disclosure in countries including England (O’Sullivan 1997, 2002), Canada (Core, 1997, 2000), Korea (Park-Wynn 2008), and Taiwan (Chen and Li, 2010; Chen, Yi, and Lin, 2012); others have taken advantage of voluntary D&O insurance disclosures (Bhagat et al., 1987; Zou et al., 2008), proprietary data from insurance brokers (Holderness, 1990; Chalmers, Dann, and Harford, 2002; Kaltchev, 2006; Kim, 2005), or survey data from consulting firms (Cao and Narayanamoorthy, 2011; Fier et al., 2010). We discuss these studies in the literature review.

Nonetheless, another strand of research finds evidence of significant moral hazard effects of D&O insurance. Chalmers, Dann, and Harford (2002) find that the average long-run stock performance of 72 U.S. firms issuing IPOs is negatively related to the amount of D&O insurance purchased. A similar study in a mergers and acquisition context finds that acquiring firms with greater D&O insurance protection are more likely to overpay for the target firm (Lin, Officer, and Zou, 2011). Moral hazard has also been found in the relationship between D&O insurance and the aggressive management of earnings. In a study using data on 203 publicly traded U.S. firms that purchase D&O insurance, Cao and Narayanamoorthy (2011) find that firms that purchase higher than expected amounts of D&O insurance are significantly more likely to engage in earnings restatements. Studies by DuCharme, Malatesta, and Sefcik (2004), Kim (2005), Gillan and Panasian (forthcoming), and Boyer and Hanon (2012) find similar results.

There is also little evidence that D&O insurers provide an effective substitute for shareholders' monitoring of directors' and officers' moral hazard. Although D&O insurance premiums appear to be sensitive to firms' litigation risk (Core, 2000; Boyer and Stern, 2012), it is unclear whether the higher premium charges have disciplinary effects on behavior. Based on interviews with corporate risk managers and D&O insurance professionals, Baker and Griffith (2007, 2010) conclude that D&O insurers do not monitor corporate behavior. Romano (1991) finds that corporations change their governance structures in reaction to D&O litigation, which also suggests that insurers do not monitor (enough).

A smaller empirical literature, more directly related to the aims of the current article, attempts to estimate the demand for D&O insurance. Using cross-sectional data on Canadian and British firms, respectively, Core (1997, 2000) and O'Sullivan (1997, 2002) provide the first such analysis. Core (1997) analyzes D&O insurance purchase decisions and the choice of coverage limits by firms that purchase insurance, using a cross-sectional sample of 222 Canadian firms. Results are generally consistent with rational corporate insurance purchase (Mayers and Smith, 1982), as firms with higher litigation risk and higher risk of financial distress are more likely to purchase insurance and to choose higher coverage limits. Core (1997) also finds that higher levels of insider ownership of voting shares are associated with higher likelihood of D&O insurance purchase. In a follow-up article, Core (2000) finds that the D&O insurance premium varies significantly with the strength of firms' corporate governance.

O'Sullivan's studies relate the D&O insurance purchase decisions of 386 firms in the United Kingdom to their corporate governance characteristics. He finds that insured companies are typically larger, more exposed to U.S. litigation, and experience greater share price risk; insured companies also exhibit lower levels of inside ownership and have a higher percentage of outsiders on their boards. These results tend to favor Holderness' (1990) view that D&O insurance serves as a form of monitoring of directors and officers.

A drawback of the early studies on D&O insurance demand is that they are limited to cross-sectional analysis, which hinders identification of causal relationships. Several more recent studies use panel data, but in most of them (Kim, 2005; Chung and Park-Wynn, 2008) firms' demand for D&O insurance is considered only as the first stage of

another estimation problem and the panel nature of the data set is not utilized (e.g., by including firm or time dummies). The first true panel data estimates of D&O insurance demand are reported in a study by Kaltchev (2006), which provides dynamic panel data estimates of D&O insurance purchase amounts. The study uses data on 113 U.S. publicly traded firms that obtained D&O insurance through two insurance brokerage firms during 1997–2003. GMM estimates of insurance coverage limits suggest that litigation risk and risk of financial distress are positively related to insurance limits, consistent with earlier studies. The estimates also suggest that corporate governance is not a significant determinant of insurance limits.⁹ Limitations of the study stem primarily from the source of data: only firms that purchase insurance and use the sampled brokerage firms for multiple years can be included in the estimates, which may create selection bias.

A more universal limitation of studies in this literature is the failure to separately identify insurance demand from supply. To our knowledge, all existing studies of the demand for D&O insurance estimate reduced-form models of the relationship between firm characteristics and insurance ownership (omitting price). This failure is most likely due to data constraints associated with cross-sectional samples, missing prices, or lack of sufficient variation in firms' purchase decisions. The panel data set constructed for use in the current article offers the potential for more careful estimation of the demand for D&O insurance, and for causal analysis of many important questions in the D&O insurance literature.

DATA AND SAMPLE CHARACTERISTICS

A panel data set of firms is constructed using publicly available data from stock-exchange-traded Canadian companies. The companies in the sample are traded on the Toronto Stock Exchange, but are not limited to being in the index. The data set includes information on D&O insurance purchases, coverage limits, and premium charges, along with extensive information on the financial and governance characteristics of each firm. Information regarding D&O coverage and board composition and compensation is collected from the firms' annual management proxy and information circular.¹⁰ Firms' financial data are obtained from Compustat; stock prices and total returns are drawn from the Toronto Stock Exchange data retrieval services. The firms are drawn from seven economic sectors that include pharmaceuticals, paper products, industrial products, high technology, consumer goods, merchandising, and media.¹¹ Approximately one-third of our data comes

⁹Governance measures examined have included an array of variables such as the number of members on the board, the board's composition, the combining of the CEO and chairman positions, the percentage blockholding, the number of blockholders, and insider ownership.

¹⁰Data reported by firms also sometimes include the deductible of the D&O insurance policy, but this reporting is not consistent across firms. Among those firms that report deductible amounts these tend to be small relative to the policy limits.

¹¹Data on financial services and energy firms were not collected due to concerns that unique regulations and accounting rules would influence the estimates. Data on mining firms were not collected because the sector contains many small firms, which increases both the cost of data collection and the likelihood of exclusion from Compustat.

from the industrial products sector, but there is a broad distribution of the remaining firms across the other six sectors. The sample period encompasses years 1996 through 2005, with the ending date 2005 chosen due to important securities reforms becoming law in Canada at the end of 2005.¹²

We initially obtained data on a total of 328 firms and 2,192 firm-year observations over the 1996 through 2005 sample period. Because of missing information about Canadian companies in the Compustat database, the number of firm-year observations available for statistical analysis using financial characteristics is smaller than the number of observations for analysis of board characteristics and D&O insurance ownership. As shown in Table 1, a total of 668 firm-year observations are lost over the 10 years of data due to missing Compustat data.¹³ The remaining sample for analysis consists of 1,524 firm-year observations on 189 firms. Our data are distributed relatively evenly over the years, and this is especially true in the Compustat sample relative to the original sample. This suggests that we are less successful in matching earlier firm observations to Compustat. However, the distribution of observations by industry is similar in the original sample and the Compustat sample, so firms in specific sectors are not noticeably more likely to be dropped from the sample.

The dynamics of D&O insurance purchase among firms in our sample are illustrated in several figures. Figure 1 shows the percentage of firms that purchase D&O insurance by industry and year. The figure shows that purchase rates vary by industry, and that these differences are persistent over the sample period.

Figure 2 shows the percentage of firm-year observations in the sample for which D&O insurance is purchased by year. The figure shows some slight upward trending over time in D&O insurance purchase, but the percent in each year does not differ dramatically from the overall sample mean of 74 percent. Figure 3 summarizes the D&O insurance purchase behaviors for each firm during the sample period. Of the 189 firms in Compustat analysis sample, 103 (55 percent) purchase D&O insurance in every year that they appear in our database and 31 (16 percent) never purchase D&O

¹²The legislation change in question (Bill 198) was introduced in 2003, but became effective only at the end of 2005. It changed radically the responsibilities of corporate managers. It also introduced the concept of class action security derivative lawsuits (see Emerson and Clarke, 2003) until then almost completely absent from courts in Canada. LaCroix (2012) writes: "The growth in securities lawsuit filings in Canada is largely a result of the growth in new filings under Bill 198, the Ontario legislation that amended the Ontario securities laws with regard to issuer's continuous disclosure obligations. . . . The Bill 198 cases account for more than two-thirds of all of the suits filed between 2008 and 2011." Of the 56 class action lawsuits filed in Canada since 2006, 35 are related to Bill 198 (see Heys and Berenblut, 2012). For comparison, between 2006 and 2011, a total of 1,265 class action lawsuits were filed in a federal court of the United States.

¹³Because our regression models use lagged values of Compustat variables as controls, we actually impose the restriction that the firm appears in Compustat and we have 2 years of data for the firm. Imposing only the restriction that the firm appears in Compustat leaves 1,551 firm-year observations. The increase in the coverage by Compustat of Canadian firms (51 percent in 1996 and 85 percent in 2005) is the result of many small firms being coded in the early years rather than any Compustat-related factor.

TABLE 1
Sample of Firms

Year	Total	Biotech & Pharma	Paper Products	Industrial Products	High Tech	Consumer Products	Merchandising	Media
Original sample								
1996	309	20	36	91	34	59	40	29
1997	300	21	33	88	40	55	39	24
1998	278	21	30	83	40	48	33	23
1999	255	19	26	78	38	43	31	20
2000	214	18	19	66	31	36	27	17
2001	194	17	17	60	27	35	22	16
2002	177	14	17	56	23	33	20	14
2003	163	14	17	47	22	30	19	14
2004	144	14	12	40	19	27	18	14
2005	128	11	11	37	15	24	17	13
Total	2,162	169	218	646	289	390	266	184
Sample with Compustat data								
1996	160	9	16	50	19	26	25	15
1997	181	12	17	59	26	27	25	15
1998	179	12	17	58	27	27	23	15
1999	179	11	17	57	26	30	23	15
2000	163	12	13	52	24	30	20	12
2001	153	13	12	51	21	29	15	12
2002	142	12	12	49	18	26	13	12
2003	134	12	13	41	18	25	13	12
2004	122	12	11	37	15	22	13	12
2005	111	9	10	35	13	19	13	12
Total	1,524	114	138	489	207	261	183	132

FIGURE 1
Percent of Observations by Year and Industry With D&O Insurance

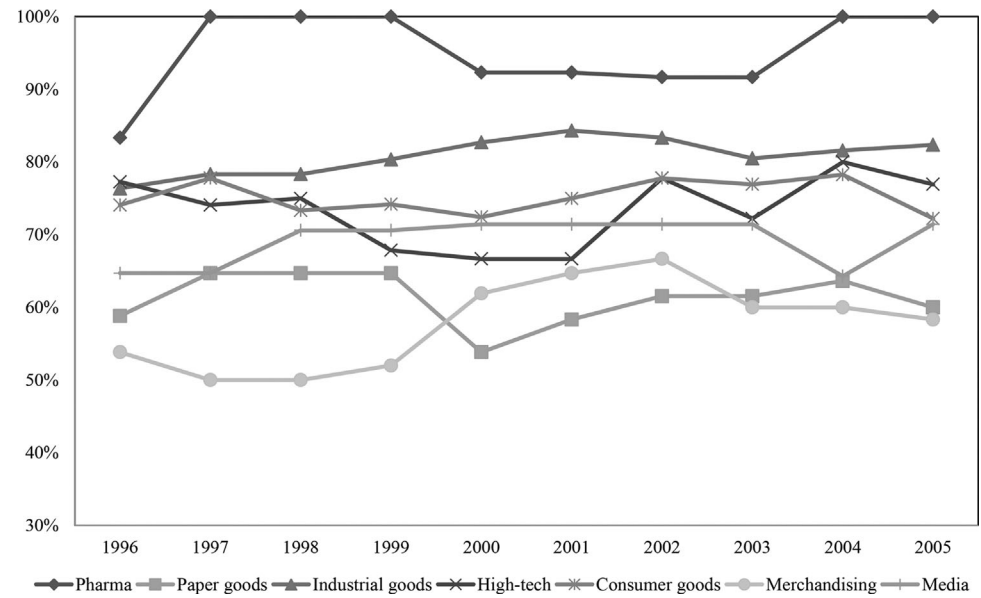


FIGURE 2
Percent of Observations by Year With D&O Insurance

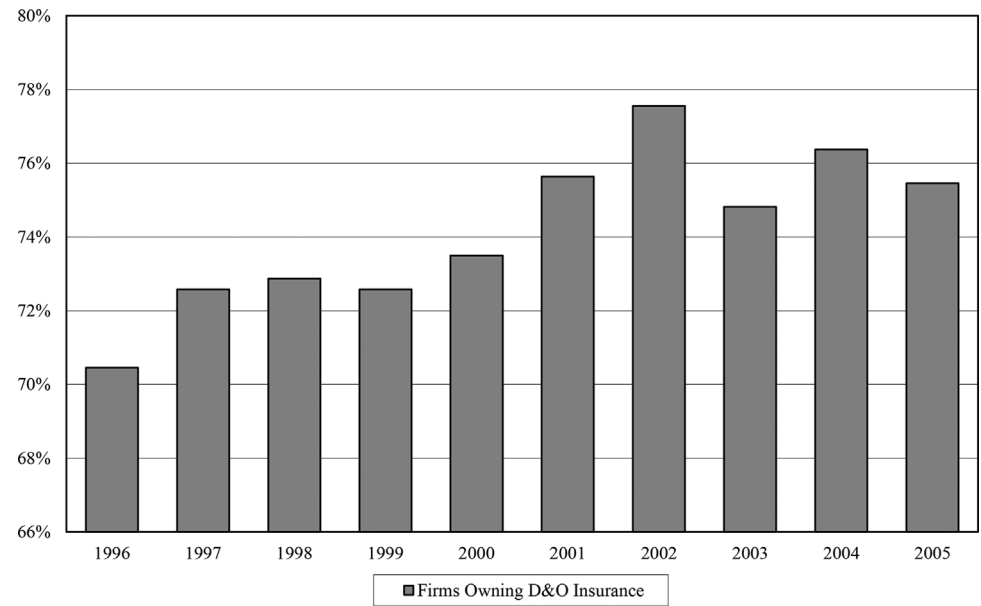
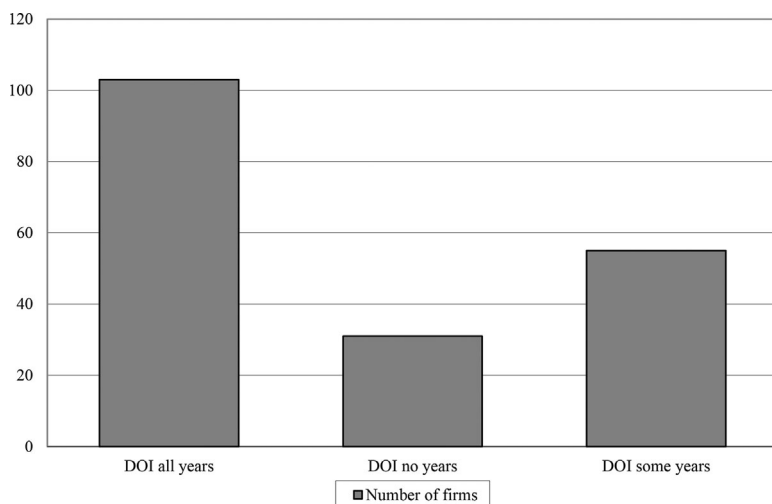


FIGURE 3

D&O Insurance Status by Firm



insurance. The remaining 55 firms change their purchase behavior during the sample years. This includes 17 firms that drop D&O insurance during the period.

ESTIMATING D&O INSURANCE DEMAND

Determinants of D&O Insurance Demand

The cornerstone of our empirical analysis is development and estimation of models of D&O insurance demand. Corporate insurance purchase decisions are determined by a wide variety of factors including the financial position of the firm in relation to the potential loss severity and probability distribution of loss, risk tolerance of the board (if directors are risk averse), insurance service benefits demanded by the firm (including monitoring of the board), and opportunism by an entrenched board. The price of insurance will also matter, but the price at which insurance is offered will be affected by many of these same firm characteristics. Care must be taken in choosing explanatory variables to capture all of these determinants without creating problems of multicollinearity or endogeneity bias.

Litigation Risk. Measuring differences in firms' litigation risk exposure is challenging, but one can proxy for risk by making use of legal and institutional characteristics of D&O liability. Survey evidence shows that shareholders represent the most important group of possible plaintiffs (Towers-Watson, various years). Yet it is important to realize that not all shareholders have the right to sue directors and officers for negligent behavior. Shareholders need to show the damages they suffered by providing evidence of the difference between the price at which the stock was purchased and the estimated market price of the stock in the absence of mismanagement.

For example, suppose that managers reported misleading accounting results on June 1 (on which day the share price increased from P_0 to P_1) and that these false results are acknowledged on June 30 (on which day the share price falls from P_1 to P_2). The shareholders who may have a chance of obtaining reparation are not those who purchased the stock prior to June 1 (they were buying on correct information), nor those who purchased and sold prior to June 30 (their information set is the same). The shareholders who can claim to have lost money because of the misinformation are those who purchased on or after June 1 (after the false news) and held on to the shares until June 30 (after the correction). Their loss, per share, is $P_1 - P_2$.¹⁴ With N shares of stock on the market and a proportion ρ of shareholders that can claim a loss, the potential damages from a lawsuit are $S = \rho N(P_1 - P_2) = \rho NP_1(1 + r_2)$, with $r_2 = -P_2/P_1 < 0$.

We therefore see that the potential severity of loss (S) to the firm is a function of the proportion (ρ) of shareholders who purchased on wrong information and held on to the stock, the current market value of equity of the company (NP_1), and some measure of the return that will befall the stock when mismanagement is revealed ($1 + r_2$). A firm's purchase of insurance and the insurance policy limit should be positively related to S , implying that insurance purchase and policy limits will depend positively on the firm's market value of equity, the fraction of shares that trade, and the expected downward return on the stock in the event of managerial wrongdoing. Taking logarithms yields a linear relationship between the firm's potential future loss severity and these variables, shown in Equation (1). This summarizes the foundation of our empirical specifications.

$$[\ln(S)] = [\ln(NP_1)] + [\ln(\rho)] + [\ln(1 + r_2)]. \quad (1)$$

The log of a firm's market value of equity at time $t = 1$ can be directly measured using stock market data. The proportion of shareholders that have a claim (ρ) depends on the number of new shareholders who purchase stock on date $t = 1$ and keep it until date $t = 2$. As a proxy for ρ , we shall use the percent of shares that traded in the previous calendar year. More frequent trades will increase the percent of shareholders with standing in a suit, and should therefore be positively related to the firm's demand for insurance. We may also expect that ρ is a function of the importance of minority shareholders, or an inverse function of the presence of important blockholders. Thus, our empirical models control for the percentage of the firm's shares held by board insiders. As a proxy for the presence of large blockholders distinct from board insiders, we use the shareholding of large financial institutions (calculated as the percentage of the shares held by financial institutions that own more than 10 percent of the stock). We expect more concentrated ownership to negatively impact the demand for D&O insurance.

The expected downside risk of managerial wrongdoing, $[\ln(1 + r_2)]$, should be positively related to D&O insurance ownership and may be related to several

¹⁴If we assume continuously compounded returns, the loss per share between date $t = 1$ and date $t = 2$ becomes $P_1 - P_1 e^{r(t_2 - t_1)} = P_1(1 - e^{r(t_2 - t_1)})$.

observable variables. The first is the stock's annual volatility of compounded daily returns. The more volatile the stock price is to any type of information, the greater should be price changes following the revelation of managerial wrongdoing. We also expect a positive relationship between financial leverage and/or the risk of financial distress and the expected downside return, as leverage increases financial risk and a firm in financial distress is more likely to observe a very bad return (bankruptcy represents a return of -100 percent) than a firm that is financially healthy. Finally, the firm's overall return on assets (ROA) measures the solidity of the firm's earnings, with ROA negatively related to the expected downside return of the stock. Thus, stock volatility and risk of financial distress should be positively related to D&O insurance demand, whereas ROA should be negatively related to demand. Because higher leverage indicates greater financial risk but may also be associated with more active monitoring by creditors, the predicted sign of the leverage variable is ambiguous.¹⁵

Firm Size and Growth. The shareholder protection hypothesis (Holderness, 1990; O'Sullivan, 1997) implies that the D&O insurance purchase decision should be positively related to firms' market capitalization (MVE). It is also true that stakeholders other than shareholders are allowed to sue a firm's directors and officers. These lawsuits are usually related to the firm's operations (employees, clients, and suppliers) so that directors in larger firms are more likely to be sued. For these reasons, larger firms should have a stronger demand for D&O insurance and our models include the MVE to account for this.

Corporate insurance theory predicts that firms with higher growth opportunities should be more likely to demand insurance, due to the higher opportunity costs of financial losses. Our empirical models include the market-to-book value of the firm as a measure of growth opportunities to account for this effect (Park and Shin, 2004; Boyer and Hanon, 2012). Baker and Griffith (2010) provide another reason for growth to matter, as rapid growth may signal risky behaviors or aggressive accounting. These authors note that D&O insurance underwriters view recent rapid growth with suspicion, and as a potential risk factor for claims. This view implies that growth increases the demand for insurance, but may also lead to underwriting rejection or higher price. The models of demand for insurance ownership include an indicator of unusually high recent growth as a control variable to account for this effect.

Board Structure and Governance. Board structure and governance may affect both the demand for D&O insurance and D&O insurance prices, and previous empirical literature has found some support for these effects (O'Sullivan, 1997; Core, 2000; Boyer and Stern, 2014). Our empirical models consider board characteristics that affect the likelihood of board opportunism in purchasing insurance. The variables included in our estimates are an indicator of whether both the CEO and COB roles are

¹⁵Monitoring by creditors may substitute for insurer monitoring achieved through D&O purchase (Holderness, 1990).

held by one person, the percent of voting shares controlled by the board, the number of board members, the percentage of outsiders on the board, and an indicator of board compensation in the form of stock options.

A combined CEO/COB role increases insider power since the board is headed by the same person who heads up management. A board with more voting control will also give insiders more power to the possible detriment of the shareholders' wealth. In contrast, a larger board or a board with a large fraction of outsiders will be less likely to be under the influence of firm insiders. Compensating board members via stock options rather than cash has the effect of increasing the board's interest alignment with shareholders, reducing the influence of management. Applying this reasoning, the first two measures of board structure should increase the likelihood of D&O insurance purchase and the latter three measures should decrease it. However, Priest (1987) suggests that having D&O insurance is a necessary condition for outsiders to sit on boards, and D&O defense costs and compensation costs may rise with the number of board members. Also, some studies suggest that smaller boards are more effective in monitoring management (see Guest, 2009). These considerations suggest that a larger board and a higher percentage of outsiders on the board may be associated with higher insurance demand, resulting in an ambiguous net relationship between these variables and D&O insurance.

More generally, the hypothesis that D&O insurers impose good-governance characteristics on boards leads to ambiguity in the predicted relationship between board characteristics and D&O insurance. If D&O insurers act as a monitor on behalf of shareholders (Holderness, 1990), companies with weak governance characteristics—which lead to high monitoring costs—will be more likely to purchase D&O insurance. An alternative hypothesis is that good corporate governance practices are a condition for insurers providing D&O coverage (O'Sullivan, 1997; Baker and Griffith, 2010). If this form of the monitoring hypothesis is correct, we should expect to observe stronger governance characteristics when the firm's managers are protected under a D&O insurance policy. This latter view also suggests that board characteristics will be jointly determined with D&O insurance ownership. For this reason we investigate the predictive power of the theory in our sample of firms before estimating models of D&O insurance demand.

Price. The price of insurance should be an important determinant of the D&O insurance purchase decision and of the coverage limit chosen. Unfortunately, we cannot observe the price of insurance for firms that do not purchase it. We can, however, test for the expected relationship between price and insurance coverage limits for firms that purchase insurance. Demand theory tells us that the amount of coverage chosen will depend negatively upon the price of insurance, where the price is defined per unit of coverage rather than the total premium amount for the policy. The unit price of insurance is the price per dollar of expected loss but we do not have data that permit us to construct estimates of expected loss; therefore, we define the unit price of insurance as the total premium divided by the aggregate policy limits (the rate on line). We hypothesize a negative relationship between unit price and insurance coverage limits.

Demand Model Specification

Our estimated models examine two aspects of the demand for D&O insurance: ownership of insurance and the choice of insurance policy limits among owners. We model these demand measures as depending on the firm characteristics discussed above. To reflect the timing of the insurance purchase decision, lagged values of financial variables are used in the models. All monetary values are converted to U.S. 2006 constant dollars. The construction of regression variables is described in Appendix Table A1, which also reports summary statistics for the Compustat sample of firms. Appendix Tables A3.1 and A3.2 report the correlation matrix for the regression variables. The estimated model of the likelihood that a firm purchases D&O insurance takes the following form:¹⁶

$$\text{Ownership}_{it} = \beta' R_{it} + \delta' G_{it} + \gamma' B_{it} + e_i + u_t + w_{it}, \quad (2)$$

where β , δ , and γ are vectors of parameters to be estimated and

R_{it} = measures of litigation risk measures for firm i in year t ,

G_{it} = measures of firm size and growth opportunities of firm i in year t ,

B_{it} = measures of recent growth and board characteristics of firm i in year t .

The terms e_i and u_t are unobservable firm-specific and year-specific effects and w_{it} is a random error term.

The determinants of insurance coverage limits (for firms observed purchasing insurance) include the same measures of litigation risk, firm size, and growth opportunities used in the models of D&O insurance ownership, along with the price per dollar of coverage. Because theory predicts that recent growth trends and board characteristics should be reflected in the unit price of insurance, these variables are not included in the estimated model. However, some board characteristics may increase desired coverage limits and an expanded model explores the effect of these variables. These include the number of board members and the percent of outsiders on the board. The basic model of demand for coverage limits takes the following basic form:

$$\text{Ln}(\text{Limits}_{it}) = \beta' R_{it} + \delta' G_{it} + aP_{it} + e_i + u_t + v_{it}, \quad (3)$$

where P_{it} is the unit price (premium per dollar of coverage) for firm i in year t ; β , δ , and a are vectors of parameters to be estimated; R_{it} and G_{it} are defined as above; e_i and u_t are unobservable firm-specific and year-specific effects; and w_{it} is a random error term.

¹⁶ Although our estimates use lagged variables as proxy variables, the general structure of the empirical model remains that the demand for insurance ownership and coverage limits depends on current expectations of litigation risk, firm size, and growth. Thus, the general form of the model is written with all contemporaneous right-hand-side variables.

Because demand theory implies that the firm's chosen insurance coverage limits will vary inversely with the price of insurance, the unit price of insurance may not be predetermined in the estimates of Equation (3). For this reason, the models of coverage limits are estimated using instrumental variables (IV) methods, which treat the unit price as jointly determined with the coverage limit. The excluded instruments in the IV estimates are the average unit price of D&O insurance in other industries, and the average unit price of D&O insurance for other firms in the same industry, with the latter variable included only for those firms listed on another exchange in addition to Toronto.

Additional approaches to estimation account for other econometric concerns. The biasing effects of potential spurious correlation over time in the choice of insurance coverage limits are explored through the use of first-differenced panel estimates. First differenced models are estimated using the change in all variables from year $t-1$ to year t . The biasing effects of potentially endogenous selection into insurance purchase are examined through the use of Heckman selection corrections. In a first-stage estimate the propensity for a firm to purchase D&O insurance is estimated via a version of (2). The inverse Mills' ratios calculated from the first-stage estimates are then included as regressors in the estimation of Equation (3), to control for the case where the error term in Equation (2) is correlated with the error term in Equation (3) (see Heckman, 1979; Puhani, 2000).

Identification is achieved by including additional regressors in this first stage that do not appear in the second stage. The key variables included in the first-stage estimates of D&O insurance purchase that are not included in the second-stage estimates of insurance coverage limits in the Heckman model are based on the industry sector of each firm. Figure 1 shows the persistent variation in the percentage of firms purchasing D&O insurance across industries in our sample, which we interpret as indicating unobserved differences in litigation risk at the industry level. Our first-stage estimates of the purchase decision include simple industry indicators in some versions, and in other versions include the percentage of firms in each industry and year that purchase D&O insurance. Measures of large asset size changes and board characteristics are also assumed to be determinants of insurance purchase but not of insurance coverage limits, and these also function as instruments in the first stage of the model.¹⁷

¹⁷We acknowledge that these variables are not intuitively obvious candidates for omitting from the coverage limits models. However, our identification strategy is supported in the existing literature on D&O insurance: prior research has found that board characteristics are related to insurance purchase decisions (O'Sullivan 1997, 2002), but not to insurance limits (Kaltchev, 2006), and has found the price of D&O insurance to be related to board characteristics (Core, 2000). Moreover, as a theoretical matter Heckman estimation does not require excluded instruments in the first stage of the model (although in this case normality of errors is relied upon for identification). Furthermore, the industry variables serve as additional excluded instruments. Finally, we note that our results do not rest solely on the Heckman estimates: as seen in Table 5, the first-differenced estimates produce extremely similar results.

ESTIMATING EFFECTS OF D&O INSURANCE

D&O Insurance and Board Characteristics

As noted previously, corporate insurance theory implies a link between governance characteristics and the demand for D&O insurance. The direction of the effects is made ambiguous by the insurer monitoring hypothesis, which implies that board characteristics may be affected by the purchase of D&O insurance rather than the other way around. To explore these relationships, we compare a variety of board characteristics across firms with D&O insurance and those without D&O insurance. The board characteristics examined are: whether the CEO is also the chairman of the board, the overall size of the board, the percentage of outsiders on the board, the percentage of voting shares owned by insiders, and whether any board compensation is in the form of stock options. Because this analysis does not use Compustat data, these comparisons may be undertaken using the original sample of firms. We first conduct the analysis using the full sample of firms, comparing all firm-years in which D&O insurance is present with all firms-years in which it is not. We then restrict the analysis to firms that changed D&O insurance status during our sample period, comparing firm-years in which D&O insurance is owned with those in which it is not. Comparisons of mean values are supplemented by coefficient estimates from regressions of each governance variable on the D&O insurance indicator, industry dummies, and year dummies. The regression approach accounts for the fact that D&O insurance purchase rates differ across industries and increase over time. If board characteristics also vary across industry and time, comparison of means may mistakenly ascribe these differences to D&O insurance ownership.

D&O Insurance and Abnormal Accruals

According to surveys by Towers-Watson (various years), the majority of D&O lawsuits result from accounting misbehavior by firms. One such misbehavior is aggressive earnings management. An early example from the earnings management literature is Healy (1985), who examines accounting tools linked to accruals (defined as accounting adjustments to cash flows authorized by accounting standards) to assess a company's deliberate management of earnings reports. Using discretionary accruals, Jones (1991) shows that a firm's officers can take advantage of accounting items to manipulate reported earnings (also see Dechow, Sloan, and Hutton, 1995; McNichols, 2000). DuCharme, Malatesta, and Sefcik (2004) find that abnormal accruals are particularly high prior to new share issues, which suggests that firms manipulate earnings results when issuing shares. It follows that a firm's earnings management should lead to a higher probability of shareholder suits (Chung and Park-Wynn, 2008).

We use abnormal accruals as a measure of risk taking to examine whether firms that have more D&O insurance protection manage their earnings more aggressively (also see Cao and Narayanamoorthy, 2011). We follow the method of Jones (1991) (also see Dechow, Sloan, and Hutton, 1995; Kothari, Leone, and Weasley, 2005) to construct the abnormal accruals measure. The first step is to calculate a firm's accruals for a given year:

$$TA_{i,t} = \frac{\Delta STA_{i,t} - \Delta STL_{i,t} - \Delta Cash_{i,t} + \Delta STD_{i,t} - Dep_{i,t}}{A_{i,t-1}}. \quad (4)$$

In this equation, $\Delta STA_{i,t}$ is the change in the firm's short-term assets (Compustat item 4), $\Delta STL_{i,t}$ is the change in the firm's short-term liabilities (item 5), $\Delta Cash_{i,t}$ is the change in the firm's cash and short-term investment positions (item 1), $\Delta STD_{i,t}$ is the change in the firm's short-term debt (item 34), $Dep_{i,t}$ is the firm's current annual amortization and depreciation account (item 14), and $A_{i,t-1}$ is the firm's total assets in the previous year (item 6).

We regress this total accrual measure on a set of variables that have been shown or hypothesized to have a significant impact on a firm's total accruals in a given year (see Jones, 1991; Dechow, Sloan, and Hutton, 1995). We define the nondiscretionary accruals as the predicted value of such a regression. The residual of the estimated equation is used as the measure of each firm's discretionary accruals. Including the current year's return on asset as argued by Kothari, Leone, and Weasley (2005), the econometric model estimated is shown in the equation below, where $\Delta Sales_{i,t}$ is the change in the firm's sales (Compustat item 12), $PPE_{i,t}$ is the firm's gross investment in property plan and equipment (Compustat item 7), and $ROA_{i,t}$ is the firm's current return on assets (Compustat item 18 divided by item 6).

$$TA_{i,t} = \alpha_0 + \alpha_1 \frac{1}{A_{i,t-1}} + \alpha_2 \frac{\Delta Sales_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{A_{i,t-1}} + \alpha_4 ROA_{i,t} + \varepsilon_{i,t}. \quad (5)$$

We then concentrate on the absolute value of these residual accruals (Abs Value Resid) to measure how large the deviation is from the expected value of zero, as larger deviations are suggestive of manipulation. Our expectation is that firms whose directors and officers are better protected should be more aggressive in their use of discretionary accruals; that is, we hypothesize a positive relationship between D&O insurance limits and abnormal discretionary accruals. The empirical model used to test this hypothesis takes the following form:

$$\text{Abnormal Accruals}_{it} = \beta(\text{Limits/MVE})_{it} + \delta' M_{it} + e_i + u_t + \varepsilon_{it}, \quad (6)$$

where β and δ are parameters to be estimated, e_i and u_t are unobservable firm-specific and year-specific effects, and ε_{it} is a random error term. Limits/MVE is the measure of D&O insurance coverage amount, normalized to the firm's size as in Lin, Officer, and Zou (2011). The vector M_{it} includes firm-specific characteristics other than insurance protection, which may affect the propensity for earnings management—measures of the firm's incentive and opportunity to manage earnings.

Following Park and Shin (2004), incentives to aggressively manage earnings are captured by the firm's risk of financial distress, growth opportunities, and the importance of bonuses to executives (also see DeFond and Park, 2001; Francis et al., 2005). Higher risk of financial distress raises incentives to manage earnings to avoid

reporting negative news, higher growth opportunities yield incentives to invest in current assets that may (as a byproduct) increase abnormal accruals, and earnings management may occur due to the desire to raise or protect bonuses. The measures of financial distress and growth opportunities have been defined previously. The importance of executive bonuses is captured by an indicator of any bonus compensation for the highest paid employees in the previous year. A firm's opportunities to manage earnings are captured by the extent of concentrated ownership (insider ownership and ownership shares of financial blockholders) and firm size, both of which are expected to decrease abnormal accruals. Closely held firms are less concerned with managing earnings announcements since the impact of announcements on shareholder trades will be less, due to owners' greater awareness of the true financial health of the firm. The blockholder variables are defined previously; firm size is measured by sales volume (lagged 1 year). For sake of completeness, the same board characteristics that were considered in the models of insurance demand are included in some versions of these estimates.

Because the impact of D&O insurance coverage on earnings management is conditioned on the purchase of insurance, the models of abnormal accruals are estimated using OLS and additionally using the Heckman selection techniques to control for endogenous selection into D&O insurance ownership. The selection-corrected estimates are applied in the same manner as in the estimates of coverage limits—by including in the estimates of (6) the inverse Mills' ratios obtained from first-stage estimates of (2). The variables in (2) determine D&O purchase status, but not abnormal accruals are the industry indicators (or industry-by-year D&O purchase propensity) and other variables that appear only in the empirical models of insurance purchase.

ESTIMATION RESULTS

Results: D&O Insurance and Board Structure

Table 2 report means and *t*-test statistics for the comparisons of board characteristics of firms that purchase D&O insurance and those that do not. The table also reports the signs and statistical significance of the coefficient estimates for D&O insurance ownership obtained from regressing each variable on the D&O insurance indicator, industry dummies, and year dummies. For ease of interpretation, the table also presents the predicted relationships between board characteristics and D&O insurance under the hypothesis that D&O insurance strengthens the governance characteristics of boards.

The top panel of Table 2 presents results for the full sample of observations. Both the comparison of means and the regression estimates reveal substantial differences in governance structures among firms with D&O insurance and those without. Firms with D&O insurance are more likely to separate the CEO and COB roles, have larger boards, and have a higher fraction of outsiders on the board. Firms with D&O insurance also have less concentrated voting rights among the board. Each of these differences is statistically significant at the 5 percent

TABLE 2
D&O Insurance and Board Characteristics

	Effect if Insurance Strengthens Monitoring	Mean for Firms Without D&O Insurance	Mean for Firms With D&O Insurance	T-stat	Sig.	Effect of D&O in Regression (Sig.)
Full sample of firms						
CEO-COB	-	0.443	0.350	-3.957	***	— (**)
Number of board members	+/-	8.234	8.746	3.609	***	+ (***)
Voting share of board	-	0.260	0.242	-0.881	n/s	— (**)
Pct Outsiders on board	+	0.619	0.639	2.464	***	+ (**)
Options compensation	+	0.141	0.153	0.496	n/s	— (n/s)
Firms that change insured status						
CEO-COB	-	0.369	0.315	-1.346	n/s	— (n/s)
Number of board members	+/-	8.183	8.854	2.553	***	+ (*)
Voting share of board	-	0.239	0.292	1.304	n/s	— (n/s)
Pct outsiders on board	+	0.648	0.615	-2.319	**	— (*)
Options compensation	+	0.126	0.164	0.223	n/s	+ (n/s)

confidence level or better in the regression context. Firms that own D&O insurance are more likely to compensate board members via stock options, but this difference is not statistically significant. The directions of differences are all consistent with the hypothesis that D&O insurance acts to strengthen monitoring by imposing good-governance characteristics on boards as a precondition for insurance (Baker and Griffith, 2010).

The bottom panel of Table 2 reports the comparisons of board structures across the insurance and no-insurance regimes for firms that change insurance status during the sample period. This comparison provides a stronger test of whether board differences are likely to be a consequence of D&O insurance purchase. In contrast to results for the full sample, we observe few statistically significant differences in board structure and no differences in board structure that remain statistically significant at the 5 percent confidence level in the regression context. In this sample of firms ownership of D&O insurance is associated with larger board size and the effect is statistically significant at the 10 percent confidence level in the regression context; ownership of D&O insurance is associated with a lower fraction of outsiders on the board, statistically significant at 10 percent confidence level in regressions. Overall, the weak relationships between insurance ownership and board structure for firms that change D&O ownership status are most clearly in line with the findings of Baker and Griffith (2010) that the D&O insurance underwriting process does not induce changes in board governance structures. Thus, we treat board characteristics as exogenous.

Results: D&O Insurance Ownership

Table 3 presents estimation results for the models of firms' D&O insurance purchase decisions. The table reports linear probability estimates and probit estimates that include year fixed effects and firm-specific effects. In the linear models firm fixed effects are employed and in the probit models firm random effects are employed, since in nonlinear estimates with observation-level fixed effects only those firms that change D&O status during the sample period could be included in the sample (Wooldridge, 2002). For comparison purposes, probit estimates that include industry-level fixed effects or the percent of firms that purchase D&O insurance in each industry and year instead of firm random effects are also reported.

Although the linear models overall are statistically significant and many coefficient estimates have the predicted sign, few individual covariates are significantly related to D&O insurance ownership. In the estimates without board characteristics, firm size (MVE) is positively related to D&O insurance purchase and is statistically significant, consistent with the prediction that large firms will have greater demand for D&O insurance. However, firm size loses statistical significance when board characteristics are included in the model. Many variables indicative of litigation risk—the ownership share of financial blockholders, stock price volatility, and the risk of financial distress—have the expected signs but are not statistically significant. Other measures—including insider ownership shares, the percent of shares recently traded, growth opportunities and recent growth, and accounting

TABLE 3
Estimates of D&O Insurance Ownership

Variables	Linear Probability	Probit (Firm Effects)	Probit (Industry Effects)	Probit (Industry D&O Pct)				
Size								
Lagged MVE	0.018** 2.014	0.012 1.455	0.170* 1.764	0.110** 2.214	0.065 1.177	0.030** 2.020	0.074** 2.340	
Proxy for rho								
Financial blockholders' share	0.000 0.298	0.000 -0.075	-0.018* -1.669	-0.024** -2.120	0.004 0.875	0.003 0.671	0.001 0.760	0.002 0.880
Inside ownership share	0.002 1.457	0.001 0.909	0.016** 2.453	0.012* 1.709	0.001 0.154	0.002 0.636	0.0010 -0.100	0.002 0.950
Percent shares traded	-0.030 -1.061	-0.031 -1.084	-0.646* -1.694	-0.465 -1.175	0.015 0.077	-0.084 -0.429	0.016 0.260	0.054 0.440
Measure for downside risk								
Stock volatility	0.008 1.513	0.009 1.755	0.060* 1.730	0.067* 1.879	-0.003 -0.142	-0.002 -0.091	-0.002 -0.380	-0.016 -1.040
Risk of financial distress	0.001 1.021	0.001 0.805	0.011 1.476	0.009 1.183	0.002 0.508	0.002 0.613	0.001 0.680	0.005* 1.950
Lagged ROA	0.064*** 3.805	0.086*** 3.004	0.377 1.447	0.598* 1.844	0.180* 1.677	0.183* 1.687	0.045 1.270	0.127 0.940
Debt ratio	-0.079 -1.160	-0.049 -0.952	-2.044*** -2.878	-2.127*** -2.672	0.172 0.447	0.088 0.222	0.017 0.150	0.002 0.010
Growth								
Market-to-book value	0.000 -0.096	-0.001 -0.481	-0.008 -0.356	-0.014 -0.627	0.008 1.054	0.006 0.773	0.002 0.910	0.007 0.660
Large positive asset change	0.029 1.340	0.032 1.533	0.564* 1.905	0.678** 2.118	0.170 1.626	0.122 1.052	0.058** 1.960	0.202 1.410
Board characteristics								
CEO/COB role combined		0.012 0.373		-0.085 -0.247		-0.120 -0.694		-0.076 -0.830

(Continued)

TABLE 3
Continued

Variables	Linear Probability	Probit (Firm Effects)	Probit (Industry Effects)	Probit (Industry D&O Pct)
Options compensation	-0.013	-0.580	-0.454*	-0.411***
	-0.310	-1.632	-1.912	-3.440
Number on board	0.008	0.067	0.022	0.002
	0.918	1.039	0.560	0.120
Percent outsiders on board	-0.057	0.168	1.530***	1.681***
	-0.483	0.211	3.398	6.420
Board share of voting stock	0.036	0.634		0.004
	1.202	1.442	-0.458	0.040
Pct of industry with D&O				4.491***
				1.216***
				4.370
Firm effects	Yes	Yes	No	No
Year effects	Yes	Yes	Yes	Yes
Industry effects	No	No	Yes	No
Observations	1,351	1,351	1,351	1,351
Adjusted R ²	0.793	—	—	1,338
Wald χ^2	—	52.46***	55.14***	38.63***
		61.23	63.48	65.61***

Note: The *t*-statistics are reported below coefficient estimates. *** indicates $p < .01$; ** indicates $p < .05$; * indicates $p < .10$ using two-sided tests. Linear probability models include firm and year fixed effects; the first set of probit models include firm random effects and year fixed effects; the second set of probit models include industry fixed effects and year fixed effects; the third set of probit models includes the percent of firms purchasing D&O insurance in each industry and year.

profitability (lagged ROA)—have unexpected signs, and among these variables ROA is statistically significant. None of the board characteristics are statistically significant, and an *F*-test confirms that they are also not jointly significant ($F_{5,187} = 0.63$, $p = 0.67$).

The signs of the estimated coefficients using probit models with firm-level random effects are similar, but more statistically significant results are achieved. As in the linear models, firm size is positive and statistically significant in the models that exclude board characteristics. The ownership share of financial blockholders is negative and statistically significant, as predicted. Stock price volatility is positively related to D&O insurance demand, as predicted, and is marginally statistically significant. There is no significant relationship between firm growth opportunities (market-to-book value) and insurance demand. There is, however, a positive and statistically significant relationship between the indicator of recent large asset growth and demand for D&O insurance. As in the linear probability models, all board characteristics are statistically insignificant although the indicator of options compensation is nearly significant at the 10 percent confidence level. A test of joint significance indicates that board characteristics are not statistically significant overall ($\chi^2_5 = 6.56$, $p = 0.26$).

In contrast, in the probit estimates with industry-level effects—whether industry fixed effects or percent of industry purchasing D&O insurance in a year—none of the measures of firm size, growth, litigation risk, or expected downside consequences of managerial wrongdoing are statistically significant with the exception of lagged ROA, which is marginally so. Two board characteristics are statistically significant: the percent of outsiders on the board is associated with a higher likelihood of insurance, and board compensation in the form of stock options is associated with a lower likelihood of insurance. A test of joint statistical significance confirms that board characteristics overall are significantly related to insurance purchase ($\chi^2_5 = 14.91$, $p = 0.011$). These findings with regard to board characteristics are in line with those from previous studies using cross-sectional data (Core 1997; O'Sullivan 1997, 2002). The lack of significant relationships in the estimates using true panel data methods suggests that these previously identified relationships may be overstated.¹⁸

Results: D&O Insurance Limits

Table 4 reports estimation results for the models of D&O insurance coverage limits for firms that purchase insurance. OLS estimates are reported in the left-hand columns of the table and IV estimates are reported in the right-hand columns. All estimated models include firm-specific fixed effects and year fixed effects, and standard errors are clustered at the firm level. Several general findings are notable from these estimates. First, the estimated coefficients on the regression variables are generally consistent with theoretical predictions, with fewer unexpected relationships than in

¹⁸Kaltchev (2006) also finds no relationship between governance characteristics and D&O insurance demand in estimates using panel data methods.

TABLE 4
OLS and IV Estimates of Coverage Limits

Variables	Price Exogenous		Price Endogenous	
Price				
Unit price of insurance	-0.363***	-0.366***	-0.167	-0.163
	-5.403	-5.470	-0.515	-0.500
Size				
Lagged MVE	0.099***	0.094***	0.088***	0.083***
	4.647	4.536	3.234	3.216
Proxy for rho				
Financial blockholders' share	-0.002	-0.003	-0.002	-0.002
	-1.077	-1.155	-1.115	-1.170
Inside ownership share	-0.003	-0.003	-0.002	-0.002
	-1.542	-1.651	-1.031	-1.071
Percent of shares traded	0.133*	0.136*	0.075	0.067
	1.866	1.837	0.733	0.579
Measure of downside risk				
Stock volatility	0.009	0.009	0.010	0.010
	1.390	1.374	1.418	1.450
Risk of financial distress	0.000	0.000	0.000	0.000
	0.184	0.184	0.236	0.220
Lagged ROA	-0.165*	-0.176**	-0.139	-0.151
	-1.907	-1.960	-1.488	-1.605
Debt ratio	0.269	0.287*	0.122	0.126
	1.612	1.735	0.422	0.415
Growth				
Market-to-book value	0.004***	0.004**	0.005***	0.004***
	3.150	2.449	3.592	2.778
Board characteristics				
Number on board		0.024		0.022
		1.145		1.089
Percent outsiders on board		0.071		0.056
		0.353		0.301
Firm effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Observations	914	909	914	910
R ²	0.883	0.884	0.897	0.897
First-stage partial F-test (weak IV)	—	—	16.011**	15.228**
Overid test (exogenous IV)			0.660	0.619
Wu-Hausman test (unit price exogenous)	—	—	0.397	0.417

Note: The *t*-statistics are reported below coefficient estimates. *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.10$ using two-sided tests. The excluded instruments in first stage of IV estimates are average unit price of insurance in other industries and average unit price for other firms in the same industry, included only for those firms listed on another exchange. The first-stage partial *F*-statistic shows that these instruments are relevant and the test of overidentifying restrictions shows that these instruments are exogenous. However, the Wu-Hausman test fails to reject the null hypothesis that price is exogenous.

the estimates of insurance ownership. Second, despite the strong relevance and validity of the excluded instruments, seen in the test statistics at the bottom of the table and in the first-stage estimates reported in Appendix Table A2, the null hypothesis that the unit price is exogenous is not rejected. This accounts for the third general finding, that the IV estimates are similar to the OLS estimates although with less statistical significance.

Among the statistically significant variables in the OLS estimates are the unit price of insurance, which is negatively related to coverage limits, and firm market valuation, which is positively related to coverage limits, both of which are consistent with expectations. The expected negative sign is observed on lagged ROA, which is statistically significant in all models. Importantly, the expected positive sign on the percent of firm shares traded (a key measure of litigation risk) is observed and is statistically significant at the 10 percent confidence level. Growth opportunities are also positive and statistically significant. The estimated coefficients on all other variables have the predicted signs but do not rise to statistical significance.

The first-differenced and Heckman selection-corrected estimates of the choice of insurance coverage limits are reported in Table 5. The table presents the results of estimating both the baseline and expanded model specifications, and all versions of the models include both firm-specific and year-specific fixed effects. Because the IV estimates in Table 4 indicate that the unit price of insurance is not strongly endogenous, price is treated as exogenous in these estimates.

Both the first-differenced and Heckman estimates are similar in sign and significance to the OLS estimates. Virtually all of the explanatory variables have the expected sign, and many key variables—including unit price, percent of shares traded, firm size, and return on assets—are statistically significant in all estimated models. In the selection-corrected estimates, insider ownership shares are statistically significant and negatively related to coverage limits. Firm leverage, growth opportunities, and board size are statistically significant and positively related to coverage limits in these models. The inverse Mills' ratio is not statistically significant in the Heckman models, suggesting that selection into D&O insurance purchase is not systematically related to insurance coverage limits.

Results: Earnings Management

OLS and Heckman selection-corrected estimates of discretionary accruals on the level of D&O insurance protection are shown in Table 6. The dependent variable in these models, the measure of discretionary accruals for each firm-year, is measured as the absolute value of the residuals from a regression of total accruals on the set of explanatory variables described in the methods section. Coefficient estimates for all explanatory variables in this model were statistically significant, and the adjusted R^2 of the model was 0.281. Summary statistics for the absolute value of residuals from this regression are reported in Appendix Table A1 along with those of the other regression variables. Although not reported in the table, we note further that the distribution of discretionary accruals for firms that purchase D&O insurance is very similar to that of the nonpurchasing firms. A simple t -test confirms that there is no

TABLE 5

First-Differenced and Selection-Corrected Estimates of Coverage Limits

Variables	First-Differenced		Selection-Corrected I		Selection-Corrected II	
Price						
Unit price of insurance	-0.366*** -16.770	-0.365*** -16.640	-0.365*** -15.140	-0.368*** -15.070	-0.364*** -15.080	-0.366*** -15.150
Size						
Lagged MVE	0.045*** 3.369	0.043*** 3.197	0.100*** 7.180	0.101*** 6.850	0.097*** 7.150	0.094*** 6.870
Proxy for rho						
Financial blockholders' share	-0.001 -1.060	-0.002 -1.091	-0.002* -1.790	0.000 -0.410	-0.002* -1.900	-0.003** -1.970
Inside ownership share	-0.003* -1.887	-0.003* -1.887	-0.003*** -2.620	-0.003*** -2.620	-0.003*** -2.770	-0.003*** -2.880
Percent shares traded	0.092*** 2.668	0.097*** 2.701	0.133*** 2.920	0.134*** 2.860	0.133*** -2.940	0.136*** 3.000
Measure of downside risk						
Stock volatility	0.003 0.783	0.004 0.800	0.009* 1.680	0.008 0.006	0.009* 1.750	0.009* 1.740
Risk of financial distress	0.000 -0.310	0.000 -0.371	0.000 0.7300	0.001 0.1300	0.000 0.130	0.000 0.240
Lagged ROA	-0.082** -2.051	-0.089** -2.192	-0.159** -2.900	-0.160*** -2.830	-0.169*** -3.130	-0.176*** -3.260
Debt ratio	-0.015 -0.161	-0.004 -0.042	0.288*** 2.870	0.301*** 2.940	0.282*** 2.830	0.287*** 2.890
Growth						
Market-to-book value	0.003 1.322	0.003 1.288	0.005** 2.030	0.004* 1.750	0.004 1.890	0.004 1.600
Board characteristics						
Number on board		-0.002 -0.187		0.024** 2.150		0.024** 2.130
Percent outsiders on board		0.064 0.525		0.222 1.360		0.081 0.570
Firm effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	768	762	1,239	1,239	1,239	1,239
R ²			—	—		
Censored observations	—	—	330	330	330	330
Uncensored observations	—	—	909	909	909	909
Chi-sq (model signif)	—	—	8,260.06**	7,728.78***	8,229.90**	8,281.05***
Inverse Mills' ratio	—	—	0.101	0.256	-0.024	0.016

Note: The *t*-statistics are reported below coefficient estimates. *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.10$ using two-sided tests. The two selection-corrected estimates differ only in the first-stage variables, with version I including the covariates in Table 3 and industry fixed effects and version II including Table 3 covariates and the percent of firms in each industry and year that purchase D&O insurance.

TABLE 6
Continued

Variables	OLS		Selection-Corrected I		Selection-Corrected II	
Firm effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,270	1,244	1,205	1,205	1,215	1,205
R ²	0.341	0.157	—	—	—	—
Censored observations	—	—	330	330	330	330
Uncensored observations	—	—	885	875	885	875
Chi-sq (model signif)	—	—	522.14***	397.56***	526.69***	413.15*
Inverse Mills' ratio	—	—	-0.050**	-0.060**	-0.036*	-0.027

Note: The *t*-statistics are reported below coefficient estimates. *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.10$ using two-sided tests. The first stage of Heckman selected corrected estimates includes the covariates in Table 3 and industry fixed effects (version I) or yearly percent of industry observations with D&O insurance (version II).

statistically significant difference in the mean value of this variable across the two sets of firms.¹⁹

The OLS estimates in Table 6 are reported for the full Compustat sample of firms (setting D&O coverage limit equal to 0 for firms that do not purchase insurance). The Heckman models report the second-stage estimates of abnormal accruals for firms that purchase D&O insurance, after accounting for the purchase decision in the first stage. All estimated models include firm-specific fixed effects and year fixed effects in the abnormal accruals equation. First-stage estimates of D&O insurance ownership are estimated as in previous tables. We report three versions of estimation results—models including only the insurance limits variable (along with firm and year fixed effects), models that also include firm financial characteristics, and models that also include firm financial and governance characteristics.

Consistent with hypothesized effects, all estimates show a positive and statistically significant relationship between D&O insurance protection and larger discretionary accruals. Relationships remain statistically significant and coefficient estimates are similar when the additional control variables are added to the models, and few of the control variables are themselves significant. The measure of growth opportunities (market-to-book value of assets) is positive and statistically significant in all versions of the estimates, consistent with hypothesized effects. In the Heckman estimates, the measures of concentrated ownership (financial blockholders' and insiders' ownership shares) are associated with lower values of discretionary accruals, as hypothesized.

These results strongly favor the hypothesis that D&O insurance leads to more aggressive earnings management, suggesting moral hazard effects of insurance. Interestingly, however, the inverse Mills' ratios indicate a negative selection effect that is generally statistically significant. This implies that firms that purchase D&O insurance are intrinsically less likely to experience high values of abnormal accruals than other firms, suggesting that firms with stronger governance select into purchasing D&O insurance.

CONCLUSIONS

This article uses a hand-constructed panel data set of publicly traded Canadian corporations listed on the Toronto Stock Exchange for 1996 through 2005 to test hypotheses regarding the role and consequences of D&O insurance for corporate risk and risk taking. We examine a wide range of relationships: the determinants of insurance ownership, the choice of policy limits, the effects of insurance purchase on board structure, and the impact of higher insurance limits on earnings management. Although the findings of this study are not wildly different from results of previous studies, the use of a panel data set that includes both insurance purchasers and non-

¹⁹For firm-year observations in which insurance is purchased ($n = 316$) the mean value is 0.0548 and the standard deviation is 0.0649; for those in which insurance is not purchased ($n = 956$) the mean is 0.0558 and the standard deviation is 0.0689. The t -test statistic is -0.2307 .

purchasers and panel data estimation methods sharpens results and permits more robust inference.

We find that variables used to represent the potential cost of shareholder lawsuits are significantly associated with firms' D&O insurance ownership decisions and coverage limits. These include the firm's market value of equity, the proportion of shareholders that could file a claim, and the expected downside risk for the firm's stock. In contrast, board characteristics have little impact on D&O insurance demand in our estimates. These results are robust to allowing a firm's decision to purchase insurance, and the price of insurance if it is purchased, to be endogenously determined.

Our panel data set yields strong evidence regarding the role of D&O insurers in monitoring corporate boards. One version of this hypothesis posits that firms with weaker governance structures will have a stronger demand for D&O insurance, in order to shift monitoring to the insurer (Holderness, 1990). A second version of the hypothesis posits that firms observed purchasing D&O insurance may have stronger governance structures due to the need for D&O insurance to complement other monitoring efforts (O'Sullivan, 1997), or due to effects of insurers' underwriting and pricing of D&O insurance (Baker and Griffith, 2010). Results of our panel data analysis provide little direct support for either version of the hypothesis, as we find that board characteristics are not significantly associated with D&O insurance ownership or coverage limits. However, Heckman estimates show that D&O insurance ownership and abnormal returns are significantly related, and the (negative) direction of the relationship suggests that firms with stronger governance are more likely to purchase insurance.

Our estimates also show that purchase of larger amounts of D&O insurance is associated with more aggressive earnings management, providing evidence that insurance ownership leads to moral hazard. This is somewhat surprising given that our data come from an environment in which D&O insurance information must be disclosed to shareholders. Disclosure of D&O insurance information to capital markets should control the moral hazard effects, since otherwise it could be used by traders as a measure of the propensity of a firm's management to find itself in a situation where it is at risk of being sued. Such a *managerial character score* would be similar to credit score and ratings that are attributed to individuals and companies as a signal of their probability of default. Mandating disclosure of D&O insurance by U.S. corporations has been suggested by Griffith (2006) as an antidote for the failure of boards in general and the failure of D&O insurers in particular to monitor properly managerial behavior.²⁰ If results from Canada generalize to the United States, such disclosure may not be sufficient to control moral hazard. Of course, as noted by Baker and Griffith (2010), the results from Canada may not generalize to the U.S. setting: as the litigation environment in Canada is weaker (see Clarkson and Simunic, 1994; Emerson and Clarke, 2003; Heys and Berenblut, 2012), this means that market discipline is also arguably weaker.

²⁰Also see Boyer and Stern (2014) for another call for disclosure based on a different rationale.

**APPENDIX
TABLE A1**
REGRESSION VARIABLE DEFINITIONS AND SUMMARY STATISTICS

Variable Name or Label	Source	Construction	Mean	Std Dev	25th	Median	75th	N
D&O insurance ownership	SEDAR	Equals 1 if firm reports a positive D&O coverage limit	0.751	0.432	1.000	1.000	1.000	1,524
D&O coverage limits	SEDAR	Ln (D&O aggregate policy limit)	15.71	3.99	15.89	16.50	17.24	1,145
D&O insurance unit price	SEDAR (constructed)	D&O premium/D&O coverage limit	0.006	0.009	0.002	0.004	0.006	1,049
D&O coverage limit/assets	SEDAR, Compustat	D&O limit/market value of equity	0.180	0.716	0.016	0.041	0.120	1,128
Number on board	SEDAR (constructed)	Total number on the board	8.827	2.913	7.000	8.000	11.000	1,511
Board receives stock options	SEDAR	Equals 1 if board members receive any compensation as stock options	0.142	0.349	0.000	0.000	0.000	1,524
Percent outsiders on board	SEDAR (constructed)	Percent of board members who are not insiders	0.621	0.164	0.500	0.636	0.750	1,508
CEO/COB role combined	SEDAR (constructed)	Equals 1 if the CEO is also the COB	0.353	0.478	0.000	0.000	1.000	1,524
Board's share of voting stock	SEDAR (constructed)	Percent of A shares owned by directors	0.253	0.450	0.007	0.074	0.359	1,524
Financial blockholders' share	SEDAR (constructed)	Percent of shares owned by financial institution blockholders with $\geq 10\%$	8.834	17.343	0.000	0.000	12.400	1,524
Insiders' ownership share	SEDAR (constructed)	Percent of shares owned by board insiders	24.34	229.457	10.920	47.505	85.150	1,524
Percent shares	Compustat	data28/data25 for previous year	0.379	0.368	0.128	0.280	0.528	1,499

(Continued)

TABLE A1
Continued

Variable Name or Label	Source	Construction	Mean	Std Dev	25th	Median	75th	N
traded	(constructed)							
Stock volatility	TSX (constructed)	Standard deviation of annual stock price over previous 3 years	2.626	3.113	0.661	1.570	3.394	1,505
Lagged ROA	Compustat (constructed)	Data1 72/data6 for previous year	-0.014	0.289	-0.006	0.040	0.074	1,506
MVE	Compustat (constructed)	Data199 × data25 (in millions)	203.13	1043.64	321.54	7.88	122.74	1,504
Lagged MVE	Compustat (constructed)	Ln (data199 × data25) for previous year	5.736	1.943	4.369	5.736	7.087	1,446
Risk of financial distress	Compustat (constructed)	-Ln [(data199 × data25/data6)/(10×stdev ROA over previous 3 years)]	-7.857	17.457	-8.303	-2.946	-0.526	1,431
Debt ratio	Compustat (constructed)	(data9 + data5)/(data9 + data5 + data199 × data25)	0.380	0.234	0.187	0.354	0.552	1,458
Assets	Compustat	data6 (in millions)	217.24	548.14	415.52	10.49	159.29	1,509
Lagged ROA	Compustat (constructed)	data1 72/data6 for previous year	-0.014	0.288	-0.006	0.040	0.074	1,521
Market/book value	Compustat (constructed)	Lagged market value of equity/lagged assets	0.961	4.116	0.296	0.527	0.963	1,524
Large positive asset change	Compustat (constructed)	Equals 1 if data6(<i>t</i>)/data6(<i>t</i> -1) > 1.25	0.104	0.305	0.000	0.000	0.000	1,497
Absolute value of resid from accruals regression	Estimated	Absolute value of abnormal accruals based on regression residuals	0.056	0.068	0.016	0.035	0.071	1,272
Sales	Compustat	Ln (data12) for previous year	562.20	212.80	433.00	573.60	704.20	1,492
Any bonus (previous year)	SEDAR (constructed)	Equals 1 if the 5 highest paid employees received any bonus compensation in previous year	0.806	0.396	0	1	1	1,524

TABLE A2

FIRST-STAGE ESTIMATES OF UNIT PRICE

Variables	OLS	
Lagged MVE	0.055***	0.052***
	2.800	2.630
Financial blockholders' share	0.001**	0.001
	0.460	0.300
Insiders' ownership share	-0.003	-0.004
	-1.960	-2.050
Percent shares traded	0.235***	0.273***
	3.690	4.410
Stock volatility	-0.005	-0.005
	-0.650	0.700
Risk of financial distress	0.000	0.000
	-0.210	-0.150
lagged ROA	-0.130*	-0.121
	-1.660	-1.540
Debt ratio	0.672***	0.706***
	4.730	4.920
Market-to-book value	-0.001	-0.001
	-0.240	-0.310
Number on board		0.011
		0.690
Percent outsiders on board		0.046
		0.260
Average D&O unit price other industries	-0.860***	-0.830***
	-3.180	-3.020
Average unit price for other firms in same industry (Interacted with cross-listing status)	0.560***	0.556***
	6.660	6.590
Firm effects	Yes	Yes
Year effects	Yes	Yes
Observations	915	910
R ²	0.510	0.512

Note: The *t*-statistics are reported below coefficient estimates. *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.10$ using two-sided tests.

TABLE A3.1
DEMAND REGRESSIONS CORRELATION MATRIX

	Lagged MVE	Unit Price	Block-holders' Share	Insiders' Share	Pct Stock Traded	Stock Volatility	Risk of Financial Distress	Lagged ROA	Debt Ratio	Market-to-Book Value	High Growth Indicator	CEOCOB Combined	Number on Board	Pct Board Outsider	Any Option	Share Voting Stock
Lagged MVE	1.000															
Unit price	0.097	1.000														
Blockholders' share	-0.001	-0.001	1.000													
Insiders' share	0.089	-0.064	-0.259	1.000												
Pct stock traded	0.254	0.334	-0.073	-0.245	1.000											
Stock volatility	0.464	0.020	-0.046	0.065	0.080	1.000										
Financial distress	-0.265	0.057	-0.026	-0.048	0.071	-0.164	1.000									
Lagged ROA	0.239	-0.212	0.029	0.085	-0.094	0.095	-0.127	1.000								
Debt ratio	-0.187	-0.080	-0.007	0.141	-0.084	-0.165	0.335	-0.009	1.000							
Market-to-book value	-0.005	0.010	-0.027	-0.044	0.051	0.033	-0.035	-0.038	-0.144	1.000						
High growth indicator	-0.009	-0.011	-0.043	-0.014	0.055	0.016	-0.020	-0.109	-0.110	0.140	1.000					
CEOCOB combined	-0.127	-0.051	-0.063	0.155	-0.165	-0.031	0.001	0.080	0.055	-0.037	-0.001	1.000				
Number on board	0.611	0.019	0.051	0.172	0.157	0.200	-0.149	0.137	0.065	0.030	-0.019	-0.227	1.000			
Pct board outsider	0.051	-0.073	0.107	-0.263	0.092	0.069	-0.041	-0.015	-0.094	0.002	0.022	-0.038	0.087	1.000		
Any options to board	-0.049	0.142	0.044	-0.132	0.014	-0.044	-0.008	-0.086	-0.174	0.028	0.024	0.038	-0.163	0.054	1.000	
Board share voting stock	0.047	-0.038	0.212	0.288	-0.183	-0.009	-0.002	0.055	0.096	-0.036	-0.006	0.013	0.086	-0.086	0.011	1.000

TABLE A3.2
ACCUALS REGRESSIONS CORRELATION MATRIX

	Market-to-Book Value	Risk of Financial Distress	Block-holders' Share	Insiders' Share	Lagged Sales	Any Bonus (Execs)	CEOCOB Combined	Options (Board)	Number on Board	Pct Board Outsider	Share Voting Stock
Market-to-book value	1.000										
Financial distress	-0.035	1.000									
Blockholders' share	-0.027	-0.026	1.000								
Insiders' share	-0.044	-0.048	-0.259	1.000							
Lagged sales	-0.034	-0.133	0.022	0.154	1.000						
Any bonus (execs)	0.029	-0.119	0.023	0.064	0.231	1.000					
CEOCOB combined	-0.037	0.001	-0.063	0.155	-0.097	-0.050	1.000				
Options comp (board)	0.028	-0.008	0.044	-0.132	-0.193	-0.010	0.038	1.000			
Number on board	0.030	-0.149	0.051	0.172	0.614	0.211	-0.227	-0.163	1.000		
Pct board outsider	0.002	-0.041	0.107	-0.263	-0.039	0.024	-0.038	0.054	0.087	1.000	
Board share voting stock	-0.036	-0.002	0.212	0.288	0.048	-0.025	0.013	0.011	0.086	-0.086	1.000

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