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Accounting and litigation risk: evidence from Directors' and Officers' insurance pricing

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Abstract We study whether and how financial reporting concerns are priced by insurers that sell Directors' and Officers' (D&O) insurance to public firms. As D&O insurers typically assume the liabilities arising from shareholder litigation, the premiums they charge for D&O coverage reflect their assessment of a company's litigation risk. Using a sample of public firms in the 2001–2004 Tillinghast D&O insurance surveys, we document that firms with lower earnings quality or prior accounting restatements pay higher premiums after controlling for other factors impacting litigation risk. In addition, insurers' concerns about financial reporting are most evident for firms with restatements that are not revenue or expense related, are greater in the period following the passage of the Sarbanes–Oxley Act of 2002, and are greater for firms with financial reporting problems that linger. Our results are consistent with past restatements being viewed as evidence of chronic problems with a firm's financial statements. By analyzing archival data, we can also quantify the effects of other determinants of D&O premiums (such as business risk, corporate governance, etc.) identified by Baker and Griffith (Univ Chic Law Rev 74(2):487–544, 2007a) through interviews regarding the D&O underwriting process.

Keywords Financial reporting quality · Accounting restatements · Directors' and Officers' insurance · Litigation risk · D&O · Corporate governance

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1 Introduction

We examine the effect of financial reporting concerns on litigation risk that is proxied by Directors' and Officers' (D&O) liability insurance premiums. Legal liability has long been viewed as a major deterrent of irresponsible financial reporting. Palmrose and Scholz (2004) argue that accounting restatements provide a unique setting for examining the legal consequences of irresponsible financial reporting, since they represent an acknowledgement by the company that the original publicly disseminated financial statements were not in accordance with Generally Accepted Accounting Principles. Restatements have served as one of the important triggers leading to the Securities and Exchange Commission's (SEC's) initiating an investigation of financial misconduct and misstatements (Karpoff et al. 2008) through the use of programs such as the Accounting and Auditing Enforcement Releases. Concern over restatements has also motivated the creation of the Public Oversight Board Panel on Audit Effectiveness. Since restatements appear to be central to the public policy debate over the quality of financial reporting (Palmrose and Scholz 2004) and since there is widespread concern about the deterrence role of civil liability, it is essential first to understand the extent to which financial reporting quality affects litigation risk. Therefore the primary research question in this study is whether accounting quality, in general, and restatements, in particular, affect litigation risk. If past restatements indicate chronic problems in the financial reporting process and these problems increase a firm's risk of being sued, we would expect a positive association between past restatements and litigation risk. However, theoretically, it is by no means an obvious consequence. Wilson (2008) finds that the stock market's financial reporting concerns following restatements appear to be transitory and that companies quickly recover investor confidence.[1] Ettredge et al. (2011) show that, following restatements, companies' earnings forecasts tend to be more conservative, which should likely lower their litigation risk. Additionally, recent studies provide evidence that firms take actions to improve monitoring mechanisms and reporting quality following adverse accounting related events such as restatements, financial reporting violations, and internal control weakness reports (Farber 2005; Srinivasan 2005; Desai et al. 2006; Ashbaugh-Skaife et al. 2008). Thus, if a restatement represents a cleanup of past accounting-related problems and indicate added oversight over the financial reporting process, it would not necessarily raise (and may even decrease) litigation risk.

Besides the importance of the research question, a noteworthy feature of this study is our measure of ex ante litigation risk. Prior studies (e.g., Rogers and Stocken 2005; Brown et al. 2005) typically use the fitted value of a static regression of ex post lawsuit incidence on economic predictors of a firm's risk of being sued as

[1] Chen et al. (2012) appear to challenge this finding by showing that firms with accounting irregularities do experience a significant decrease in earnings response coefficients for up to 3 years after restatement announcements.

a proxy for ex ante litigation risk.[2] Since a lawsuit is a relatively low probability event, such an approach, derived from a dichotomous measure of litigation incidence (i.e., being sued or not), can only distinguish between "extreme" outcomes and "non-extreme" outcomes. Even these classifications are likely to be problematic. Among the firms that had lawsuits, those with frivolous lawsuits are treated the same as those with serious ones.[3] Similarly, among the firms that had no lawsuits, firms with low ex ante litigation risk are treated the same as firms with high ex ante litigation risk but for whom the risk pays off and a lawsuit is avoided ex post. To bypass these problems, we use a market-based measure of ex ante litigation risk, that is, the D&O liability insurance premiums. In the U.S., public firms routinely purchase D&O insurance coverage for their directors and officers for reimbursement of defense costs and settlements arising from shareholder litigation. Most shareholder litigation is settled within policy limits, with the D&O insurers primarily footing the bill (Baker and Griffith 2007a). Therefore we would expect the pricing of D&O liability insurance to reflect the D&O insurers' assessments of the impact of financial reporting concerns on firms' litigation risk.[4] In other words, the insurers should have ample incentive to price financial reporting risk efficiently in order to compensate for their expected payout obligations in the case of financial-reporting-related lawsuits.

Using a sample of 152 U.S. public firms in the Tillinghast D&O insurance surveys conducted between 2001 and 2004, we show that firms with restatements of accounting numbers prior to the effective date of D&O coverage pay higher insurance premiums after controlling for other economic factors that shape a firm's litigation environment. This evidence suggests that D&O insurers view the restatements as indicating chronic problems in the financial reporting process rather than as a corrective action that signals better accounting quality (and, in turn, lower litigation risk) in the future. Our results thus extend the findings in prior research (Kinney and McDaniel 1989; Palmrose and Scholz 2004), which only documents that certain types of restatements can lead to an increased likelihood of a lawsuit for accounting misdeeds related to those specific restatements. This is because current D&O insurance premiums do not reflect the risk of lawsuits pertaining to specific past restatements (that occurred before the current D&O policy became effective), as the payouts for these lawsuits would typically be covered by prior D&O insurance contracts effective at the time of the restatement

[2] Such static regression models have been the subject of recent criticism in the finance literature. They have been shown to be econometrically unreliable in contexts such as merger and acquisition prediction and bankruptcy prediction (Shumway 2001).

[3] Field et al. (2005) document that results of their study change significantly when frivolous lawsuits are dropped from the lawsuit sample.

[4] The study is framed as an assessment of whether financial reporting concerns affect litigation risk. However, we acknowledge that what we actually test is whether these concerns impact D&O insurers' perception of litigation risk. To the extent that the D&O insurance market does not exhibit accurate pricing of litigation risk, the original assessment may not be valid. However, the recent legal literature has recognized the promise of D&O insurance premiums as a litigation risk proxy. For example, Baker and Griffith (2007a) state that "D&O premiums are the only place to look" if one wants to find "the annualized present value of shareholder litigation risk for any particular corporation."

announcement.[5] They reflect, instead, insurers' concerns about financial reporting going forward.

In addition, insurers' concerns about financial reporting appear to be most evident for firms with "non-core" restatements not involving revenue or expense recognition issues rather than for firms with "core" restatements. This finding indicates that core restatements likely lead to an effective disciplining of a firm's accounting practices and hence do not raise future litigation risk. In contrast, non-core restatements, which typically involve reclassification issues, appear to signal chronic financial reporting problems that increase litigation risk. We also show that the D&O premiums have increased for restatement firms following the passage of the Sarbanes–Oxley Act of 2002 (SOX), which suggests that SOX increased the D&O liability exposure due to accounting issues. Finally, we consider the "tower" of insurance coverage spanning multiple layers of insurers and test whether the pricing of financial reporting risk depends on an insurer's position in the hierarchy. The excess insurers, who are responsible for payouts beyond what is covered by the primary D&O policy, only get involved in the less frequent but larger claims. Consistent with accounting concerns typically leading to such claims, we find that the excess insurers are more sensitive (than primary insurers) to financial reporting quality issues indicated by restatements when pricing D&O insurance.

Since accounting researchers have argued that there is no single proxy for financial reporting quality that encompasses every decision-making context (Dechow et al. 2010), we do not focus on restatements only. We analyze two additional proxies for financial reporting quality, namely, performance matched abnormal accruals (Kothari et al. 2005) and the discretionary component of the Dechow and Dichev (2002) accrual quality measure attributable to management's reporting decisions (Francis et al. 2005). Neither of these two proxies has a high correlation with accounting restatements, indicating that they proxy for accounting risk of a kind different from restatements. Nevertheless, they both appear to affect litigation risk significantly. More importantly, all three accounting risk measures are shown to have pricing effects on D&O insurance premiums that are incremental to the others, suggesting that D&O insurers consider different dimensions of financial reporting concerns in their pricing. Our results also demonstrate that the effect of these financial reporting concerns on litigation risk is robust even after controlling for business and corporate governance risk factors that help to shape a firm's financial reporting quality.

Besides documenting a positive association between financial reporting quality and litigation risk, our study also contributes to the understanding of the determinants of litigation risk by examining the impact of corporate governance and litigation environment variables. There is limited prior research on the determinants of litigation risk proxied by D&O insurance premiums in the U.S.,

[5] Though D&O insurance policies are typically written on a "claims made" basis (excluding claims made and reported after the policy expires), claims related to restatements are typically protected by other provisions. For example, the "notice of circumstances" provision allows the insured to give notice to the insurer to lock in insurance coverage under the current policy for restatements that may not ripen into an actual claim for months or even years. As a result, future D&O policies need not cover these restatements even if claims are made in future periods.

largely due to the lack of D&O insurance data in the public domain. The only study that systematically examines D&O insurance pricing in the U.S. is Baker and Griffith (2007a), who conducted extensive interviews with D&O insurance industry participants (e.g., underwriters, brokers, lawyers, etc.) about the underwriting process to identify factors that determine D&O pricing. While providing a setting for corroboration of the identified factors with hard data, our study is the first to quantify the effects of these factors–something an interview-based approach cannot do. Additionally, because the factors contributing to a firm's litigation risk could be correlated with one another, the archival approach employed in this study can discern whether these factors have impacts that are incremental to one another.

Core (2000) examines publicly disclosed Canadian data on D&O insurance premiums for 110 Canadian firms and finds that certain business risk and corporate governance factors are priced by the D&O insurers. While Core (2000) does not consider financial reporting concerns at all, given the litigation environment differences between the U.S. and Canada and the different time periods studied, our results for how business risk and corporate governance risk affect D&O insurance pricing also differ from those of Core (2000). For example, we find that D&O premiums decrease with the percentage of independent directors appointed by the CEO, a result opposite to the findings in Core (2000). Overall, after including financial reporting and business risk variables, the complete set of all corporate governance variables contributes little additional explanatory power in the litigation risk models. While this result is at odds with Core (2000), it is consistent with Baker and Griffith (2007a), who surprisingly report the lack of importance given to "structural" governance characteristics by insurance industry professionals.

The time period differences between Core (2000) and our study are also important because the Private Securities Litigation Reform Act of 1995 (PSLRA), which mainly aims at creating disincentives for frivolous and unsubstantiated lawsuits against companies and their innocent directors and officers, has significantly altered the litigation environment, especially since 1999 (Bailey 2005). Johnson et al. (2007), for a sample of high technology firms, find a shift from litigation based on forward-looking earnings disclosures in the pre-PSLRA period to lawsuits based on earnings restatements and abnormal insider selling[6] in the post-PSLRA period. Our results, which are based solely on data from the post-PSLRA period, suggest that D&O insurers view restatements and other indicators of (lack of) accounting quality as important risk factors for future litigation even after controlling for corporate governance and business risks. Such knowledge is critical for a better understanding of current legal regulation in the U.S., as the deterrence goals of corporate and securities liability appear to be viewed in the legal literature as being achieved indirectly through the insurance intermediary (Baker and Griffith 2007a).

Finally, the findings in this study have implications for risk management in public firms. The association between D&O insurance premiums and accounting irregularity measures documented in the study provides empirical guidance as to

[6] Claims pertaining to insider trading are normally excluded from D&O insurance coverage.

whether and how financial reporting choices can affect a firm's cost of D&O insurance coverage. More importantly, a broader understanding of the determinants of litigation risk can offer additional insights into managerial behavior, as prior research has documented significant differences in managerial behavior in the face of litigation risk (Francis et al. 1994; Johnson et al. 2001; Baginksi et al. 2002; Rogers and Stocken 2005; Brown et al. 2005; Cao and Narayanamoorthy 2011).

The rest of the paper is organized as follows. Section 2 describes D&O insurance and summarizes the related literature. Section 3 develops the hypotheses and presents the econometric model. Section 4 discusses the data. Section 5 presents the empirical results, and Sect. 6 concludes.

2 Institutional background and related literature

2.1 D&O liability insurance

In its 2002 annual executive summary on the state of the D&O insurance market, Tillinghast reports that "approximately 19 % of U.S. survey respondents reported one or more claims against their directors or officers over a 10-year experience period." Most companies like to reimburse their directors and senior officers for defense costs and settlements arising from successful claims that target their actions (or inactions) with respect to the company. Typically, they do so by purchasing D&O liability insurance, which provides coverage if a claim is settled with no admission of bad faith by the director/officer or there is no finding of bad faith by the court. Tillinghast (2005) suggests that 100 % of the U.S. public company respondents purchased D&O insurance. Besides protecting the directors and officers for decisions they make in good faith *ex post*, from an *ex ante* perspective, the D&O policies are useful in attracting talented directors and officers to the companies.

A typical D&O insurance policy combines up to three types of insurance coverage[7]:

1. personal coverage, which provides direct payment to directors and officers when a firm is unable or unwilling to indemnify them[8];
2. corporate reimbursement coverage, which reimburses the company when it indemnifies directors and officers for the costs of defending the lawsuits; and
3. entity coverage, available for many years to nonprofits and in recent years to for-profit companies, encompassing at least some claims against the organization directly, including those that name no individual insured.

Entity coverage carries a separate premium and retention. In this study, we focus on the aggregate insurance coverage of the first two types. The personal and

[7] This description of a typical D&O insurance policy draws heavily on Tillinghast (2002), Core (2000), and Baker and Griffith (2007a).

[8] U.S. law allows indemnification against most claims. However, defense costs in certain shareholder derivative lawsuits where the D&Os are sued by shareholders on behalf of the firm are not indemnifiable. Additionally, firms may be unable to bear the costs due to financial distress.

corporate coverage limits are usually the same, with the personal coverage deductible being zero and the corporate coverage deductible being two percent of the limit. The annual insurance premium paid by a company for a D&O policy covers claims filed in the year of coverage up to the annual policy limit and subject to any deductible/retention. Such premium is an *ex ante* litigation risk measure that incorporates information about both the expected magnitude of loss or damage recovery amount (through the choice of a D&O insurance limit) and the expected likelihood of such losses for the policy period (through the pricing of the chosen limit).

There is reason to believe that, in the U.S., D&O insurance companies and insureds have symmetric information when structuring a contract.[9] Knepper and Bailey (1998) report that, besides a written application detailing past and future business activities, litigation experience and biographical data on directors and officers, the D&O insurance premium decision is made only after the insurer conducts background checks on the directors and officers. If the firm has withheld information at this stage, the insurance company can use the omission to deny coverage if there is a claim. These features indicate that the insurer and the insured share similar beliefs about the firm's litigation risk when the premiums are decided. When one of the D&Os intentionally misrepresents a known risk of a suit while applying for the policy, the insurer can refuse coverage to the director or officer who made the misrepresentation. However, per the severability provisions in place, under U.S. law, the insurer usually must continue to extend coverage to the innocent directors and officers.

Unlike during the 1980s, the current market for D&O insurance is very liquid and has several underwriters. Tillinghast (2002) identifies five underwriters with at least 8 % of the D&O insurance market by premiums and ten underwriters with at least 2 % of the market. In 2002, Arthur J. Gallagher, a leading D&O insurance broker, estimated that there were at least 47 underwriters competing in the marketplace.[10] These statistics point to the D&O insurance pricing being reasonably efficient. Since the expected loss to an insurance company depends on both the litigation frequency as well as the damages (maximum limit) for which they can be held liable, the D&O insurance premium likely depends on the coverage limit chosen by the company. There is substantial cross-sectional variation in the D&O coverage limits companies choose to buy. Therefore, in order to draw inferences regarding litigation risk from the D&O premium data, it is essential to control for any excessive under- or over-coverage purchases. In our empirical design, we explicitly distinguish between the expected level of D&O insurance coverage justified by a firm's litigation environment and the abnormal coverage that is above and beyond the expected level.

[9] Core (2000) argues that the insurance application is structured to enable the insurer to obtain full information about the applicant's risk factors at negligible cost.

[10] "The buyer's perception of D&O realities and latest trends," speech by Philip Norton, Arthur J. Gallagher & Co., Tillinghast Executive Seminar, 2004.

2.2 Related literature

Two prior studies have examined the litigation outcome for firms with accounting restatements. Kinney and McDaniel (1989) study characteristics of firms restating quarterly earnings reports between 1976 and 1985 and document litigation incidence for 14 % of the restating firms. Palmrose and Scholz (2004) investigate firms with accounting restatements between 1995 and 1999 and find a significant likelihood of companies being sued only for certain kinds of restatements. Besides a "thorough descriptive documentation of the accounting characteristics of a large sample of restatements," Wahlen (2004) views the primary contribution of Palmrose and Scholz (2004) to be an "estimation of the incremental effects of different types of restatements on the incidence of lawsuits." In contrast, while examining the relationship between litigation risk and financial reporting quality, we do not restrict ourselves to a "restatement only" sample. We investigate whether a firm with a financial restatement has significantly higher litigation risk than a firm without a restatement. Prior research has shown that restatement companies tend to differ from non-restatement companies in size, profitability, growth, and audit committee characteristics (Kinney and McDaniel 1989; DeFond and Jiambalvo 1991; Sennetti and Turner 1999; Abbott et al. 2003; Agrawal and Chadha 2005; Carcello et al. 2011). Thus the likelihood of accounting restatements is associated with business and corporate governance characteristics. We seek to determine whether accounting problems have implications for ex ante litigation risk even *after* controlling for business and governance risk factors, which differs from the focus in the two prior studies, where the empirical analyses do not allow for the interplay between these factors and accounting quality. Moreover, both studies quoted above (Kinney and McDaniel 1989; Palmrose and Scholz 2004) track the incidence of restatement leading to lawsuits pertaining to *that* particular restatement. This study, in contrast, examines the consequences of restatements for *future* litigation risk. Lawsuits pertaining to past restatements are typically covered by the insurance policy effective *at the time of* the announcement of the accounting misstatement rather than the current insurance policy. Therefore our study can shed light on whether past accounting restatements are viewed by insurance underwriters as indicating chronic accounting-related problems within the firm.

Besides the above studies, the earlier literature does not appear to consistently find a link between financial reporting concerns and litigation risk. Francis et al. (1994) document that, in lawsuits, plaintiffs typically argue that their losses were caused by adverse earnings news that triggered a sharp decline in stock prices. Jones (1998), however, finds no significant association between litigation risk and discretionary accruals, a measure of earnings quality. Lys and Watts (1994) also find no significant association between lawsuits against auditors and financial reporting for a post-1982 period. Johnson et al. (2007), focusing on the high technology sector for the period between 1991 and 2000, investigate a sample of lawsuit firms and their matched non-lawsuit industry peers with similar largest 1-day stock price declines. They report that firms restating class period earnings are more likely to be sued.

Other than using an ex ante litigation risk proxy and a more recent period, our research differs significantly from Johnson et al. (2007) in the following ways. First, the sample used in Johnson et al. (2007), by construction, contains firms/industries with high ex post litigation risk (i.e., sued firms and non-sued matching firms that could potentially be sued due to large stock price declines). This limits the generalizability of their results to other settings. In contrast, we study a broad spectrum of industries and firms without imposing *a prior* constraint in regard to their litigation risk. Second, we include two additional accounting quality measures in the empirical analysis to obtain a better understanding of the role financial reporting concerns play in shaping a firm's litigation risk. Furthermore, as mentioned earlier, our litigation risk measure, which is based on D&O insurance premiums, only contains the risk related to possible future accounting misdeeds and excludes lawsuits pertaining to past restatements.

There is scant literature on the determinants of D&O insurance pricing and, in particular, the relationship between financial reporting concerns and such pricing using U.S. data.[11] This is largely due to the unavailability of data, as U.S. firms are not required to disclose any information related to D&O insurance purchases.[12] Core (2000) studies 110 publicly traded Canadian firms with fiscal year-ends in 1993–1994 and finds business risk and corporate governance variables to be significantly associated with D&O insurance premiums. However, there is reason to believe that the D&O insurance pricing is different in the U.S. Canadian firms must disclose D&O insurance information in their proxy statements, making their purchases transparent. The significant institutional differences between the litigation environment in Canada and that in the U.S. (Baginski et al. 2002) also warrant further investigation using U.S. data. In addition, the litigation environment and, consequently, the D&O insurance market have undergone significant changes over the years, especially in the U.S. Specifically, accounting irregularities have recently appeared at the forefront of litigation concerns. Johnson et al. (2007) find a shift from litigation based on forward-looking earnings disclosures in the pre-PSLRA period to lawsuits based on earnings restatements and abnormal insider selling in the post-PSLRA period. Baker and Griffith (2007a) draw upon in-depth interviews about the D&O underwriting process with underwriters, actuaries, brokers, lawyers and corporate risk managers and indicate that underwriters consider corporate governance, financial reporting practices, and many other risk factors in pricing their D&O insurance products. Given these findings, further research on the relationship between financial reporting risk (along with other economic determinants) and D&O insurance premiums for

[11] A few studies have examined the demand for D&O coverage using non-U.S. data (O'Sullivan 1997; Core 1997; Boyer 2004, 2005) and U.S. data (Kaltchev 2006). Chung and Wynn (2008) report that greater D&O insurance coverage is associated with lower earnings conservatism. Chung et al. (2008) use excess D&O liability insurance coverage for Canadian firms as a proxy for managerial opportunism and find a positive association between excess D&O coverage and audit fees for local firms but no significant relation between the two for firms cross-listed in the U.S. None of the above studies focuses on D&O pricing.

[12] Chalmers et al. (2002) is the only study that we are aware of examining the D&O insurance premium using proprietary U.S. data. However, their sample consists of only 72 IPO firms, and the focus of the study is whether the insurance coverage chosen reflects managerial opportunism and is related to post-IPO performance. They do not consider financial reporting in their analysis of D&O premiums.

publicly traded firms in the U.S. appears warranted. Our research attempts to fill this void.

3 Determinants of D&O insurance premiums

In this section, we first discuss how various litigation-risk-related factors can affect the pricing of D&O insurance and the proxies we use for measuring these factors, with the main focus being financial reporting risk. We then discuss the econometric design for testing the pricing of financial reporting risk.

3.1 Proxies for litigation risk factors

3.1.1 Financial reporting risk

There has been increased public and regulatory scrutiny of financial reporting in recent years, especially following the collapse of large corporations such as Enron and WorldCom and the bankruptcy of one of the biggest accounting firms, Arthur Andersen. Based on the finding that disclosure related litigation was responsible for 46.4 % of all claims filed against U.S. participants in 2002, Tillinghast (2002) states that "disclosures of publicly traded companies are an area of increased underwriting concern" of D&O insurers. Additionally, according to the Tillinghast report, claims pertaining to inadequate or inaccurate disclosure (such as claims related to securities trading decisions that led to financial loss) typically have a higher cost than other claims. In 2002, the settlement value of cases settling for between $5 million and $50 million averaged $5.9 million for non-accounting cases but averaged $12.4 million for accounting cases (PricewaterhouseCoopers 2002), and such costs continued to rise.[13] Early and Kastelic (2004) cite revenue recognition as a common cause of underwriting concern. Bailey (2005) also states that a larger percentage of the lawsuits focus on allegations of accounting fraud, with revenue recognition issues emerging as a significant cause of litigation risk. Bailey (2002) specifically attributes the rise in D&O insurers' liability to increasing financial reporting concerns by pointing out that these concerns were the alleged cause in ten of the thirteen largest litigation settlements (all in excess of $100 million).

Given the above anecdotal evidence, one would expect measures of financial reporting quality to be associated with a firm's litigation risk. Interestingly, prior studies only provide mixed evidence on the association between the two. As discussed earlier, while there is some evidence that accounting restatements are associated with higher litigation risk for firms in the high technology industry (Johnson et al. 2007), such a relation is not documented for other firms (Jones 1998; Lys and Watts 1994). The lack of a significant association between accounting quality and litigation risk in these studies is somewhat puzzling, given the findings in the accounting literature that accounting quality metrics exhibit significant associations with cost of capital and realized returns (Francis et al. 2004, 2005;

[13] PricewaterhouseCoopers (2003) reports that the settlement costs rose another 53 % in 2003.

Aboody et al. 2005). A possible reason is the choice of the litigation risk proxy. Cao and Narayanamoorthy (2011) show that the use of a D&O-premium-based ex ante litigation measure instead of the typical ex post measure leads to different inferences when investigating the effect of litigation risk on management earnings forecasts. Since a lawsuit is a low probability event, a dummy variable that indicates whether a firm is eventually sued ex post can only distinguish between "extreme" outcomes (being sued) and "non-extreme" outcomes (not being sued). This allows for a limited degree of freedom in capturing a firm's litigation risk and hence its relationship with a continuous measure of accounting quality. The dichotomous classification also has other problems, including not being able to differentiate between (1) frivolous and serious lawsuits, among lawsuit firms, and (2) firms with low ex ante litigation risk and those with high ex ante litigation risk but for whom the risk pays off and lawsuits are avoided, among non-lawsuit firms. The D&O insurance premium, which incorporates D&O insurance underwriters' forward-looking assessment of a company's litigation likelihood and damage magnitude, can be viewed as a continuous, *ex ante* measure of litigation risk and likely bypasses the problems discussed before. Studying whether high-quality and responsible financial reporting practices can effectively reduce D&O premiums thus helps to shed light on the association between financial reporting quality and litigation risk.[14]

We assume that financial reporting risk will generally decrease with financial reporting quality and use financial reporting risk and lack of financial reporting quality interchangeably. We follow the recent literature (Palmrose et al. 2004; Palmrose and Scholz 2004) and primarily use accounting restatements to proxy for the lack of quality of financial reporting. We define *restate* as an indicator for whether a firm has any restatements of financial numbers in the year immediately preceding the effective date of the D&O insurance contract. The main benefits of using restatements to proxy for poor earnings quality is a lower Type I error in the identification of misstatements and a reasonably large sample size compared to, for example, a sample based on SEC enforcement actions (Dechow et al. 2010). On the other hand, the use of a restatement sample also comes at a cost. To the extent that these restatements do not contain intentional errors, they are less likely to reflect high litigation risk. This potential error in measuring financial reporting quality biases against finding a significant association between restatements and litigation risk. In general, if a previous restatement implies low accounting quality in the future, we expect it to be positively associated with D&O insurance premium. However, if it indicates corrective actions to improve financial reporting quality and additional oversight over the financial reporting process, a previous restatement can be associated with lower D&O insurance premium.

[14] D&O insurance policies typically include a "fraud exclusion" that relates to claims involving intentional fraudulent acts or personal enrichment. This can appear to reduce the effect of financial reporting concerns on D&O insurance pricing. However, in practice, such exclusion has not had such an impact for three reasons. First, proving fraud is a challenge as the plaintiff must establish intent. Second, there is a presumption of innocence on the part of the directors and officers until fraud is proved under the "final adjudication" condition. Meanwhile, the insurance company has to continue to indemnify the directors and officers. Finally, most shareholder litigation ends in settlement without any admissions of fraud or guilt, with D&O insurers being the ones footing the bill. See Baker and Griffith (2007b) and Mathias et al. (2000) for detailed discussions on the issue.

Accounting researchers have argued that there is no single proxy for financial reporting quality that encompasses every decision-making context (Dechow et al. 2010). Consistent with this argument, we analyze two additional proxies for financial reporting quality. First, we use discretionary accruals (*dacc*), defined as the level of accruals above and beyond what can be justified by a firm's underlying performance, to measure the lack of earnings quality. We follow Kothari et al. (2005) and estimate *dacc* using an extension of the Jones model augmented with lagged performance (measured by lagged return on assets) in the regression. The detailed estimation is presented in Appendix 1. Second, we follow Francis et al. (2005) and construct a measure of the discretionary component of a firm's accrual quality (*aq_resid*) based on the mapping of accruals to past, present, and future cash flows. Such a measure teases out the part of the fluctuation in the mapping function that stems from a firm's inherent business risk and thus can capture the part that comes from management's financial reporting decisions. The *aq_resid* measure relies on the use of a two-step estimation model, which is presented in Appendix 2.

Finally, while this study focuses on financial reporting, we recognize that financial disclosure is broader than that. Skinner (1997) finds that timelier voluntary disclosures are associated with lower litigation settlements. However, Field et al. (2005) argue that voluntary disclosures tend to be "sticky," in the sense that some firms consistently offer management guidance while other firms do not. They state that past disclosures are unlikely to influence a firm's current lawsuit probability. We control for the frequency and nature of voluntary disclosure by including three variables relating to management earnings forecasts. First, we measure forecast frequency as the natural logarithm of one plus the number of management earnings forecasts made in the year immediately preceding the effective date of an annual D&O contract (*log_fc*). Second, we capture the disclosure risk by including an indicator for whether there is at least one management forecast that contains bad news about a company's financial performance (*dbnews*) made in the year preceding the effective date of a D&O contract. If there is a negative abnormal stock return in a short window around the forecast date, the forecast is viewed as containing bad news. Finally, in our empirical specification, we also interact the two variables (*log_fc * dbnews*) to capture any effect of disclosure risk that is conditional on the nature/frequency of the voluntary disclosure.

3.1.2 Corporate governance risk

Several of the recent, well-publicized corporate scandals involved corporate governance failures, including those that were accounting related. In studying the effect of financial reporting quality on D&O insurance pricing, it is necessary to control for the impact of corporate governance on D&O premiums for two reasons. First, poor governance itself can contribute to irresponsible accounting practices as manifested by the recent accounting scandals and documented by prior studies (e.g., Dechow et al. 1996; Carcello et al. 2011). Hence omitting governance variables from the analysis can lead to spurious results if corporate governance drives D&O pricing mainly through its effect on financial reporting choices. Second, whether litigation risk should be positively or negatively associated with corporate

governance is theoretically an open question, given that both litigation risk and corporate governance are elements of a broad system of control mechanisms. Romano (1991) argues that certain "good" corporate governance mechanisms make litigation easier. Imposing personal liability on corporate officers and directors for breach of duties of care (negligence) and loyalty (conflict of interest) facilitates litigation and can help align the interests of the managers with those of the shareholders. This suggests a positive association between good governance and litigation risk. However, poor corporate governance that leads to ineffective disciplining of managers can imply higher litigation risk, which indicates a negative relation between corporate governance and litigation risk. Core (2000) documents that the D&O premium decreases with the quality of a firm's governance structure.[15] Baker and Griffith (2007a), however, suggest that "structural" corporate governance variables typically employed in academic research do not play a critical role in the D&O underwriting process in the U.S. Instead, insurers tend to emphasize corporate "culture" by investigating carefully the formal rules and informal norms that shape a firm's incentive system and internal constraints.

We use the following variables to measure a firm's corporate governance. First, we use two variables to proxy for board independence. We include the percentage of independent directors (i.e., those who are not employees of the firm and have no business affiliations with the firm) on the board (*pct_ind*). Dechow et al. (1996) find that firms accused of fraudulent reporting by the SEC are more likely to have fewer outside directors (i.e., lower board independence). This suggests that board independence is an indicator of strong governance that can reduce the likelihood of accounting irregularities and, consequently, D&O premiums. However, from our discussions with D&O insurance industry participants, it appears that, while they market D&O insurance as a prerequisite to attract outside talent to the board, at the same time, they view outsiders as riskier in that outsiders are not likely to act in bad faith, a case typically excluded by D&O insurance coverage. This assertion is also corroborated by the Black et al. (2003) survey, which shows that almost no cases of actual out-of-pocket liability have ever occurred for outside directors, indicating that they are very unlikely to be found to have acted in bad faith, which means that the insurance company almost always foots the bill in their cases. Since prior research (Core 2000) has also found a negative relation between the percentage of outside directors appointed by the CEO and governance quality, we include such a variable as well in the study (*app_ceo_pct_ind*). Second, similar to Core (2000), we measure equity incentives of inside directors (*pct_shares_inside*) by the percentage of share values owned by directors who are also employees of the firm.[16] Since this variable captures both incentive alignment with shareholders and potential

[15] As Core (2000) argues, weak corporate governance is not necessarily bad for shareholders. As a counter-example, shareholders can maximize share value by imposing loose constraints on a talented manager and sue her if she makes bad choices.

[16] Core (2000) uses another variable, the percentage of share votes controlled by inside directors for his sample of Canadian companies. He finds support for a negative (positive) relation between premiums and percentage of shareholdings (percentage of voting power) due to incentive alignment (entrenchment). In our sample of U.S. companies, we do not find a significant difference between these two variables since, unlike Canadian firms, our sample firms typically have only one class of shares.

managerial entrenchment, it is an open question as to which direction the empirical relation will go. Third, we use two proxies for CEO power on the board. Corporate governance is expected to be stronger when the board is independent of the CEO (Jensen 1993). The variable *log_ceo_exp* is defined as the natural logarithm of one plus the number of years the CEO has been on the board. We also include an indicator for whether a CEO also doubles as the board chair (*duality*). Finally, we include a control for board size (*board_size*), defined as the number of directors on the board.

Additionally, we include several governance characteristics of a firm's audit committee, which is explicitly tasked with overseeing financial reporting and can play an important role in reducing the likelihood of restatements (Abbott et al. 2003; Agrawal and Chadha 2005; Carcello et al. 2011). First, *pct_ind_audit* is defined as the percentage of independent directors on the audit committee. Second, *pct_shares_audit* captures the equity incentives of audit committee members and is defined as the percentage shareholdings owned by audit committee members. Third, we include *absence_audit*, defined as the percentage of directors on the audit committee who attend fewer than 75 % of the board and committee meetings they are supposed to attend, to indicate how actively the audit committee members oversee the financial reporting and audit process.

We consider two auditor characteristics that can be associated with a firm's accounting quality and litigation risk. First, auditor switching has been shown to be associated with a higher incidence of restatements (Lazer et al. 2004). Thus a restatement company that switches auditors can be perceived as being at higher risk of subsequent poor financial reporting. We include the variable *auditor_chg*, which is an indicator variable taking the value of one if the firm has changed its auditor in the past year and zero otherwise. We note that the inclusion of this variable along with the three primary financial reporting variables in the same regression estimation will only bias against finding significance for the primary variables. Second, we include the variable *Big5*, which equals one if the firm has employed a Big 5 auditor in the year prior to the effective date of the D&O policy and zero otherwise. Prior studies have argued that Big 5 auditors provide higher quality audit services (e.g., Dopuch and Simunic 1980; DeAngelo 1981), which indicates lower litigation risk. However, the impact of this variable on litigation risk is not straightforward, as the deep pockets of Big 5 auditors can, by themselves, also attract lawsuits (Palmrose 1988; Dye 1993).

We also consider the effect of large stakeholders on D&O insurance pricing. Outside blockholders simultaneously increase governance quality and litigation risk since they use lawsuits as a substitute monitoring device (Romano 1991). Meanwhile, recent evidence (Romano 2001) seems to conclude that institutional investor activism does not really improve corporate performance, indicating a lack of monitoring effectiveness of these investors. We include an indicator variable (*inst_block5*) that equals one if there exists an institutional shareholder holding at least 5 % of the stock of the firm and zero otherwise. The other stakeholders who can have an incentive to monitor the firm are the debt holders. We include leverage (*lev*), defined as a firm's total debt as a percentage of total assets, to proxy for monitoring by the debt holders.

3.1.3 PSLRA risk

The Private Securities Litigation Reform Act was passed in 1995, with the main objective being to discourage frivolous and unsubstantiated lawsuits against companies and their innocent directors and officers. Although the legislation was successful in achieving *litigation* reform (by changing various procedures relating to how securities lawsuits are prosecuted), the legislation did not accomplish *liability* reform (Bailey 2005). We highlight two specific provisions of the PSLRA.

Prior to the passage of the PSLRA, a plaintiff lawyer needed only a symbolic plaintiff to proceed with the case. To correct the situation where the main gainers were the plaintiff lawyers, this Act required the court to appoint a lead plaintiff and a lead counsel. The presumption was that the shareholder who lost the maximum amount of money would be the lead plaintiff and the PSLRA was an attempt to get the institutional shareholders involved in securities litigation. However, the involvement of institutional investors has significant implications for the D&O insurance market. While prior to PSLRA there was a glass ceiling in terms of lawsuit settlements (which was roughly equal to adequate compensation for the plaintiff lawyer), now institutional investors want to recoup as much of their "loss" as they can. Hence the size of the settlements has skyrocketed.[17] While the use of lawsuits as a substitute monitoring device by blockholders has already been documented (Romano 1991), the active involvement of institutional blockholders in lawsuits against large companies appears to have received a boost from PSLRA.

Another clause in PSLRA has also had a large impact on the settlement of lawsuits. Previously, all parties (e.g., directors, officers, lenders, etc.) responsible for the alleged wrongdoing were jointly and severally liable. The PSLRA changed the responsibility to a proportionate liability. While lenders have the deeper pockets, it is hard to argue that they are more responsible than the directors and officers. This means that plaintiffs are unwilling to settle with the directors and officers for a smaller amount, since such settlement will create a glass ceiling and reduce compensation from the lenders. Thus the presence of debt can incentivize lawsuits against the company since the debt holders can also be sued. Additionally, settlement costs are much higher if there are debt holders with deep pockets involved.

For the reasons outlined above, we identify two variables as proxies for PSLRA risk. The variable *inst_block5* is an indicator for the existence of an institutional blockholder holding at least 5 % of a firm's outstanding shares, and the variable *lev* is defined as total debt (debt in current liabilities plus long-term debt) as a percentage of total assets. Note that both these variables also measure governance risk as discussed earlier. Hence, if the two variables proxy for good governance, we expect them to be negatively associated with the D&O insurance premium.

[17] Bailey (2005), who was the lead counsel for the D&O insurance companies in the various Enron related lawsuits, states that prior to 2000 it was difficult to identify a settlement of more than $100 million. However, he lists at least 27 settlements larger than this amount since then. Settlements of securities cases are about 20 % higher in cases involving large companies where the lead plaintiff is an institutional investor (Early and Kastelic 2004).

However, if they mainly proxy for increased PSLRA-related risk, we expect to see a positive relation with the premium.

3.1.4 Business risk

A firm's underlying business risk can also affect its litigation risk and hence the pricing of D&O insurance. Since many shareholder lawsuits are trigged by firms' poor performance, we use cumulative abnormal returns (based on the CRSP value-weighted index returns) for the year immediately preceding the effective date of the D&O contract (*cumret*) as a proxy for past stock market performance. We expect *cumret* to be negatively related to D&O insurance premiums. To capture financial performance, we include an indicator for loss (*loss*), which equals one if a firm's net income is negative in the previous year and zero otherwise. This variable is expected to be positively associated with D&O premiums. Larger firms are more likely to be sued due to their deeper pockets (Core 2000; Tillinghast 2002; Johnson et al. 2007). We use the natural logarithm of total market value of equity (*log_mv*) as a size proxy. Romano (1991) reports that companies with disclosure of prior litigation are expected to have higher litigation risk because of a negative reputational effect. The variable *priorclaim*, defined as an indicator for whether a firm has had D&O claims during the past 9 years, captures the risk due to prior litigation. To the industry participants we spoke to, a significant source of litigation risk is the stock price volatility of the company. We include standard deviation of daily stock returns (*vol*) in the prior year as a measure of stock price volatility. We expect a positive relation between stock volatility and insurance premiums. We note that financial leverage (*lev*), which we defined before, can proxy for closeness to bankruptcy and would be relevant as a risk factor in the business risk category. We also include an indicator (*risk_ind*) that takes the value of one for risky industries, which comprise biotechnology (SIC 2833–2836), computer hardware (SIC 3570–3577), electronics (SIC 3600–3674), retailing (SIC 5200–5961) and computer software (SIC 7371–7379). Prior research has documented that share turnover is significantly associated with ex post litigation incidence (Francis et al. 1994; Skinner 1996). Hence we also control for *turnover,* the average daily volume of shares traded as a percentage of total shares outstanding for the previous year. Finally, we include year dummies, defined as the year of the Tilllinghast survey from which the D&O insurance data were obtained, to control for macroeconomic conditions.

3.2 Econometric model

We follow prior studies (Core 2000; Chalmers et al. 2002; Cao and Narayanamoorthy 2011) and assume that the logarithm of the D&O premium is linear in the logarithm of a firm's litigation-risk-related factors and the logarithm of the D&O limit. Thus the following equation can be estimated (we suppress the "log" sign on *litigation risk factors* to be consistent with the notation used in prior studies):

$$\text{Log}(premium) = a_0 + a_1 litigation\ risk\ factors + a_2 \text{Log}(limit) + err, \quad (1)$$

where *premium* = the amount of D&O insurance premium a firm pays for a chosen limit (and deductible); *litigation risk factors* = the factors contributing to a firm's litigation risk; *limit* = the amount of D&O insurance coverage chosen by a firm.

When purchasing D&O insurance, firms typically first choose the limit amount based on the litigation risk they face and then pay the corresponding premium agreed upon with the insurance company.[18] Rewriting *limit* as a linear function of litigation-risk-related factors, we can estimate the logarithm of *limit* as follows (with the log sign on *litigation risk factors* suppressed):

$$\text{Log}(limit) = b_0 + b_1\ litigation\ risk\ factors + xlimit, \quad (2)$$

where *xlimit* = the residual term in (2), or the "abnormal limit," which captures the limit taken over and above the amount that can be explained by litigation-risk-related factors.

Substituting (2) in (1) yields:

$$\text{Log}(premium) = a_0 + b_0 a_2 + (a_1 + b_1 a_2) litigation\ risk\ factors + a_2 x\ limit + err, \quad (3)$$

which is estimated in its reduced form as follows:

$$\text{Log}(premium) = c_0 + c_1 litigation\ risk\ factors + c_2 x\ limit + err. \quad (4)$$

Decomposing "*litigation risk factors*" in (4) into the four categories of risk factors discussed earlier, we have the following equation:

$$\begin{aligned}\text{Log}(premium) = {} & d_0 + d_1 financial\ reporting\ risk + d_2 corporate\ governance\ risk \\ & + d_3 PSLRA\ risk + d_4 business\ risk + d_5 xlimit + err. \end{aligned} \quad (5)$$

From (4) and (5), we can see that in order to analyze the effect of financial reporting risk and other litigation-risk-related factors on D&O insurance premiums, we need to include *xlimit* to control for the effect of abnormal limit on the total premium. In our empirical specification, when using (2) to arrive at an estimate for *xlimit*, we include the same sets of litigation-risk-related factors as independent variables: financial reporting risk, corporate governance risk, PSLRA risk, and business risk. While the coefficients of interest in this study would be the ones on financial reporting risk, we will also discuss the findings relating to other litigation-risk-related factors to facilitate comparison with prior studies.

The above two-stage model yields consistent estimates only under the assumption that there is no information asymmetry between insurers and managers. As discussed earlier, given the extensive scrutiny of the company and its directors and officers at every insurance renewal, it is not unreasonable to assume limited asymmetry between the company and the insurance carrier. There are some obvious

[18] While the D&O coverage purchased might seem to be affected by cost (i.e., the D&O premiums charged), Core (2000) argues that the premium does not affect the firm's choice of the limit, which depends instead on marginal costs and benefits of coverage. We have followed the prior literature on D&O insurance (Core 2000; Chalmers et al. 2002) and not modeled it as a simultaneous equations system.

exceptions to this assumption, though. For example, Chalmers et al. (2002) report that there are large increases in insurance limits (or coverage is initiated) and premiums around the time a company makes an IPO. In these circumstances, there can be some information asymmetry, which in turn suggests that we exercise caution in eliminating such firms from our study.

4 Data

We obtain the data on D&O insurance limits and premiums from Tillinghast–Towers Perrin.[19] The RiskMetrics Directors database is our main source of corporate governance data. We obtain stock return data from CRSP, institutional shareholding data from Thomson Financial, management earnings forecasts data from First Call's CIG (Company Issued Guidelines) database, restatement data from the Government Accountability Office (GAO), and accounting data from Compustat, respectively. Table 1 summarizes the variable definitions and data sources.

In accordance with our data license agreement with Tillinghast, we acknowledge that they have not furnished the names of the respondents to their survey. However, since we were furnished with survey data on revenues, assets, number of employees, states of domicile, and 2-digit SIC codes, we were able to devise a matching algorithm to identify respondents by searching in the Compustat annual database. The 2001, 2002, 2003, and 2004 Tillinghast D&O insurance surveys cover a great variety of firms with different corporate forms and countries of domicile. Since this study focuses on U.S. firms, we first extract the subset of survey respondents that are publicly traded on a U.S. stock exchange and obtain an initial sample of 783 unique firms (Table 2, Panel A).[20] We then perform a multi-step matching algorithm to identify these firms (Table 2, Panel B), starting with a stringent matching process (Step 1) that requires a perfect match for assets, revenue, number of employees, 2-digit SIC, and state code in the Compustat annual database for the year of interest. Since the dates of the Tillinghast surveys do not necessarily correspond to a respondent's fiscal year-end, it is likely that when a respondent filled out the survey questions, the actual values of total assets, revenues, and other items deviated from those reported at the fiscal year-end. Hence, in the subsequent steps, we vary the matching criteria by relaxing certain groups of constraints. For example, in the second step, holding other constraints unchanged, we allow the difference between the number of employees reported by Compustat and Tillinghast to fall within ± 1 % of the value reported by Tillinghast. In the later steps, the constraints on revenue, assets, and number of employees are relaxed by up to ± 5, ± 5 and ± 10 %, respectively. For any repeat survey respondents, we also verify the validity of the

[19] The other studies (Chalmers et al. 2002; Kaltchev 2006; Kim 2006) based on U.S. D&O insurance data do not disclose the source of the proprietary databases they use.

[20] We require the firms to be repeat respondents included in both the 2001 and 2002 (or 2003 and 2004) Tillinghast surveys. This is because the data on "prior claims" is only available for 2002 and 2004, and we can reconstruct such data for the 2001 and 2003 observations only for firms included in the two consecutive years mentioned above.

Table 1 Variable definitions

Variable	Definition	Data source
D&O insurance variables		
totlim	Total annual D&O insurance limit ($Millions)	Tillinghast
totprem	Total annual D&O insurance premium ($Millions)	Tillinghast
log_limit	The natural logarithm of D&O insurance limit	Tillinghast
log_premium	The natural logarithm of D&O insurance premium	Tillinghast
log_primprem	The natural logarithm of primary D&O insurance premium	Tillinghast
log_exprem	The natural logarithm of excess D&O insurance premium	Tillinghast
primlim_totlim	Primary insurance limit as a percentage of total limit	Tillinghast
exlim_totlim	Excess insurance limit as a percentage of total limit	Tillinghast
xlimit	"Abnormal limit" or the residual term calculated from a regression of *log_limit* on its determinants	–
Corporate governance variables		
inst_block5	Indicator for whether there is at least one institutional investor with shareholdings greater than 5 %; = 1 if yes, = 0 otherwise	Thomson Financial
board_size	Number of directors on the board	Risk Metrics
pct_shares_inside	Percentage shareholdings owned by inside directors	RiskMetrics
pct_ind	Number of independent directors as a percentage of total number of directors	RiskMetrics
app_ceo_pct_ind	Percentage of outside directors that started board service after the CEO joined the board	RiskMetrics
duality	Indicator for whether the CEO is also the chairman of the board; = 1 if yes, = 0 otherwise	RiskMetrics
log_ceo_exp	The natural logarithm of (1 + number of years the CEO has served on the board)	RiskMetrics
pct_ind_audit	Percentage of independent directors on the audit committee	RiskMetrics
pct_shares_audit	Percentage shareholdings owned by audit committee members	RiskMetrics
absence_audit	Percentage of directors on the audit committee who attend fewer than 75 % of the board and committee meetings they are supposed to attend	RiskMetrics
Business risk, PLSRA risk, and other control variables		
log_mv	The natural logarithm of the market value of a firm's equity	Compustat
vol	Standard deviation of daily stock returns for the previous year	CRSP
priorclaim	Indicator for whether a firm had D&O claims during the past 9 years; = 1 if yes, = 0 otherwise	Tillinghast
cumret	Cumulative abnormal returns (adjusted for CRSP value-weighted index) for the previous year	CRSP
turnover	Average daily trading volume (in share percentage) for the previous year	CRSP
lev	Total debt (debt in current liabilities plus long-term debt) as a percentage of total assets	Compustat
loss	Indicator for whether a firm had a loss (net income <0) in the previous year, = 1 if yes, = 0 otherwise	Compustat

Table 1 continued

Variable	Definition	Data source
risk_ind	Indicator for whether a firm is in risky industries, including the biotechnology industry (SIC 2833–2836), computer hardware industry (SIC 3570–3577), electronics industry (SIC 3600–3674), retailing industry (SIC 5200–5961), and computer software industry (SIC 7371–7379); = 1 if yes, = 0 otherwise	Compustat
big5	Indicator for whether a firm's auditor is among the Big 5 (now Big 4) accounting firms; = 1 if yes, = 0 otherwise	Compustat
auditor_chg	Indicator for whether a firm changed its auditor in the previous year; = 1 if yes, = 0 otherwise	Compustat
sox	Indicator for whether a D&O contract has an effective date later than the enactment date of the Sarbanes–Oxley Act of 2002; = 1 if yes, = 0 otherwise	Tillinghast
Accounting quality and disclosure variables		
restate	Indicator for whether there is at least one restatement in the year prior to the effective date of a D&O policy; = 1 if yes, = 0 otherwise	GAO
restate_core	Indicator for whether there is at least one restatement involving revenue or cost/expense recognition issues in the year prior to the effective date of a D&O policy; = 1 if yes, = 0 otherwise	GAO
restate_ncore	Indicator for whether there is at least one restatement not involving revenue or cost/expense recognition issues in the year prior to the effective date of a D&O policy; = 1 if yes, = 0 otherwise	GAO
restate_3yr	Indicator for whether there is at least one restatement in the 3 years prior to the effective date of a D&O policy; = 1 if yes, = 0 otherwise	GAO
dacc	Performance-matched discretionary accrual computed based on Kothari et al. (2005) (Appendix 1)	Compustat
aq_resid	Francis et al.'s (2005) measure of discretionary component of a firm's accrual quality (Appendix 2)	Compustat
log_fc	The natural logarithm of (1 + number of voluntary earnings forecasts made by the management) for a given year	First Call
dbnews	Indicator for whether a firm made at least one bad-news (with negative abnormal return during days [−2, 0] around the forecast date) earnings forecast for a given year; = 1 if yes, = 0 otherwise	First Call, CRSP

matching results by comparing our firm identifications from multiple years. The matching algorithm altogether yields a matched sample of 457 unique firms.[21]

Table 3 describes our final sample. Starting from the 457 firms that can be successfully identified by our matching process, we exclude firms that offered IPOs shortly before their insurance contracts took effect. This screen is used to reduce the incidence of any information asymmetry between the insurance carrier and the company as documented by Chalmers et al. (2002). Data constraints (i.e., CRSP, Compustat, RiskMetrics Directors database, I/B/E/S, First Call, and Thomson

[21] While the validity of our results hinges on the accuracy of our matching algorithm, we believe that any matching error would not lead to systematic bias in the results and would only introduce noise that biases against finding a significant association between accounting and litigation risk.

Table 2 Firm identification process using the matching algorithm

	Number of firms
Panel A: initial sample for matching	
Firms included in the 2001, 2002, 2003, and 2004 Tillinghast surveys	4,677
Repeat respondents included in both 2001 and 2002, or 2003 and 2004 Tillinghast surveys	1,881
Firms publicly traded on a major stock exchange	833
U.S. firms publicly traded on a major stock exchange	783
	Number of matched firms
Panel B: CUSIP matching results for the initial sample of 783 publicly traded U.S. firms identified in Panel A	
Step 1: within ±0 % assets, ±0 % revenue, and ±0 % #employees; matching 2-digit SIC and state code	302
Step 2: within ±0 % assets, ±0 % revenue, and ±1 % #employees; matching 2-digit SIC and state code	29
Step 3: within ±0 % assets, ±0 % revenue, and ±2 % #employees; matching 2-digit SIC and state code	39
Step 4: within ±0 % assets, ±0 % revenue, and ±3 % #employees; matching 2-digit SIC and state code	23
Step 5: within ±0 % assets, ±0 % revenue, and ±4 % #employees; matching 2-digit SIC and state code	20
Step 6: within ±0 % assets, ±0 % revenue, and ±5 % #employees; matching 2-digit SIC code and state code	27
Step 7: within ±0 % assets, ±0 % revenue, and ±10 % #employees; matching 2-digit SIC code and state code	54
Step 8: within ±1 % assets, ±1 % revenue, and ±1 % #employees; matching 2-digit SIC and state code	6
Step 9: within ±2 % assets, ±2 % revenue, and ±2 % #employees; matching 2-digit SIC and state code	5
Step 10: within ±3 % assets, ±3 % revenue, and ±3 % #employees; matching 2-digit SIC code and state code	4
Step 11: within ±4 % assets, ±4 % revenue, and ±4 % #employees; matching 2-digit SIC code and state code	7
Step 12: within ±5 % assets, ±5 % revenue, and ±5 % #employees; matching 2-digit SIC and state code	7
Step 13: remove firms with inconsistent matched identification derived from different years of data	(66)
Final number of matched firms	457

Panel A reports the selection process that yields an initial sample of 783 publicly traded U.S. firms for matching. Panel B presents the matching process using firm attributes (e.g., total assets, revenue, number of employees, industry classifications, and state code) reported by the Tillinghast surveys. Step 1 requires a perfect match for assets, revenue, number of employees, 2-digit SIC, and state code in Compustat. In Steps 2–12, we vary the matching criteria by relaxing certain groups of constraints. For example, in Step 8, we allow the difference between the total assets reported by Compustat and Tillinghast to fall within ±1 % of the value reported by Tillinghast. Similarly, constraints on revenue and number of employees are relaxed by ±1 and ±1 %, respectively. In the last step, we verify the validity of the matching results by comparing firm identification derived from different years of data

Table 3 Sample selection

	# of firms
Initial sample	
Number of unique publicly traded U.S. firms included in the 2001–2004 Tillinghast Survey (see Table 2, Panel A)	783
Matched sample	
Number of firms matched with SIC, assets, revenue, number of employees, and state code (see Table 2, Panel B)	457
Data availability constraints	
Less: firms with IPOs or without financial data available on Compustat	(24)
Less: firms without stock return data available on CRSP	(73)
Less: firms without institutional holding data available on Thomson Financial	(20)
Less: firms without corporate governance data available on RiskMetrics director database	(188)
Final sample	
Final sample I (firms with data available to compute the restatement variable)	152
Final sample II (non-financial firms with data available to compute all three f inancial reporting quality variables)	110

Financial) further reduce the sample to 152 firms (351 firm-year observations), for which we have data to compute our first measure of financial reporting quality, *restate*. Of this final sample, we have data for a subset of 110 non-financial firms (232 firm-year observations)[22] to compute performance-matched discretionary accruals (*dacc*) as well as the Francis et al. (2005) discretionary component of accrual quality based on mapping of working capitals with cash flows (*aq_resid*).

Panel A of Table 4 presents the summary statistics based on 152 firms (351 firm-year observations) in the final sample. (Note that the statistics on *dacc* and *aq_resid* are based on smaller samples due to data availability constraints.) The mean (median) insurance coverage limit for the sample, *totlim*, is $63.84 million ($50.00 million). This is much higher than the coverage amounts reported in Core (2000), where the mean (median) limit was 26.43 million (20 million) Canadian dollars. The mean (median) premiums, *totprem*, are $1.26 million ($0.78 million) for the sample. In the Core (2000) sample, the corresponding value is 167,780 (103,477) Canadian dollars. The summary statistics on our measures of financial reporting quality suggest that 4 % of the firm-year observations have restatements (*restate*) in the year immediately preceding the effective date of the D&O policy. The median number of earnings forecasts made during such period is two ($log_fc = 1.099$), while 56 % of the firm-year observations have at least one bad-news forecast. In addition, the median levels of performance matched discretionary accruals (*dacc*) and discretionary accrual quality (*aq_resid*) are both negative. The summary statistics on *dacc* and *aq_resid* are comparable to those reported in previous studies. Among the 351 firm-year observations, about 20 % have had prior claims (*priorclaim*) against directors, officers or both in the preceding 9 years. The

[22] We exclude the financial firms in computing the accrual-based accounting quality measures, to be consistent with prior literature.

median board size (*board_size*) is nine directors, and on average, 66 % of the directors on the board are independent (*pct_ind*). In terms of audit committee characteristics, on average, 87.6 % of the committee members are independent (*pct_ind_audit*). The mean (median) percentage shareholdings of the audit committee members (*pct_shares_audit*) is 2 % (0.2 %). On average, 3 % of the committee members attend fewer than 75 % of the board and committee meetings they are supposed to attend (*absence_audit*). The averages of leverage (*lev*), cumulative abnormal return (*cumret*) and stock return volatility (*vol*) are 19.4, 10, and 3.8 %, respectively. About 26.5 % of the firm-year observations had a loss (*loss*) during the year immediately preceding the effective date of the D&O contract.

Panel B of Table 4 shows the D&O insurance characteristics by industry. Firms in the utilities industry carry the highest amount of total D&O limits (mean = $114.2 million, median = $100.0 million), while firms in the financial industries pay the highest amount of D&O premiums (mean = $2.09 million, median = $1.77 million). D&O insurance is the most costly for the service industries, with an average price of $0.04 for each dollar of D&O coverage purchased. For most firms, the D&O coverage consists of primary insurance and one or more layers of excess (i.e., secondary and beyond) insurance. The median ratio of primary limit to total limit for each of the twelve industry groups ranges from 0.23 to 0.45. Since the primary coverage would be exhausted first before payment from the excess coverage incurs, such coverage is more expensive than the excess coverage (Baker and Griffith 2007a). This is supported by our data, as the price per dollar of primary limit is consistently higher than the price per dollar of total limit for each industry.

5 Empirical results

5.1 Computing the "abnormal limit" (xlimit): regression of D&O limit on its determinants

Table 5 reports the derivation of *xlimit* from estimation of two regressions of D&O limit (*log_limit*) on litigation risk factors, including financial reporting quality, corporate governance risk, PSLRA risk, and business risk. Model 1 only includes *restate*, while Model 2 includes all three measures of financial reporting quality (*restate*, *dacc*, and *aq_resid*). The pair-wise Pearson (Spearman Rank) correlations of these variables are 0.08 (0.07) for *restate* and *dacc*, 0.09 (−0.13) for *restate* and *aq_resid*, and 0.06 (0.04) for *dacc* and *aq_resid*. Except for the Spearman Rank correlation of *restate* and *aq_resid*, which is significant at the 5 % level, none of the above correlations is statistically significant. These correlations are consistent with Dechow et al.'s (2010) argument that no single measure captures financial reporting quality in every context. The regressions use pooled data for the period between 2001 and 2004. All the independent variables take values immediately preceding the effective date of the D&O insurance contracts. The *t* statistics are computed using Huber-White standard errors adjusting for firm-level clustering.

Table 5 shows that the coefficients on *log_mv* and *lev* are significantly positive in both models, suggesting that firms purchase higher D&O insurance coverage if they

Table 4 Descriptive statistics

Variable	N	Q1	Median	Q3	Mean	SD
Panel A: all firm-year observations						
totlim (in $Million)	351	20.500	50.000	100.000	63.843	59.228
totprem (in $Million)	351	0.441	0.777	1.268	1.263	1.973
log_mv	351	20.416	21.309	22.427	21.455	1.445
vol	351	0.021	0.031	0.052	0.038	0.022
turnover	351	0.004	0.007	0.016	0.011	0.011
cumret	351	−0.151	0.144	0.359	0.102	0.618
lev	351	0.002	0.159	0.297	0.194	0.216
loss	351	0.000	0.000	1.000	0.265	0.442
priorclaim	351	0.000	0.000	0.000	0.197	0.398
risk_ind	351	0.000	0.000	1.000	0.390	0.489
big5	351	0.000	1.000	1.000	0.524	0.500
auditor_chg	351	0.000	0.000	0.000	0.054	0.227
board_size	351	7.000	9.000	11.000	8.997	2.858
pct_ind	351	0.571	0.692	0.800	0.660	0.172
duality	351	0.000	1.000	1.000	0.664	0.473
app_ceo_pct_ind	351	0.000	0.143	0.571	0.287	0.335
pct_shares_inside	351	0.005	0.017	0.062	0.071	0.174
log_ceo_exp	351	1.386	2.079	2.565	2.005	0.831
inst_block5	351	1.000	1.000	1.000	0.806	0.396
pct_ind_audit	351	0.800	1.000	1.000	0.876	0.223
pct_shares_audit	351	0.001	0.002	0.007	0.021	0.138
absence_audit	351	0.000	0.000	0.000	0.029	0.091
log_fc	351	0.000	1.099	1.792	1.077	0.854

Table 4 continued

Variable	N	Q1	Median	Q3	Mean	SD
dbnews	351	0.000	1.000	1.000	0.558	0.497
restate	351	0.000	0.000	0.000	0.043	0.203
dacc	320	−0.041	−0.005	0.024	−0.008	0.104
aq_resid	232	−0.034	−0.011	0.005	0.002	0.114

Industry index	Industry name (2-digit SICs)	Number of observations		Total limit ($Millions)	Total premium ($Millions)	Price per dollar of limit ($)	Ratio of primary limit to total limit	Price per dollar of primary limit ($)
Panel B: D&O insurance characteristics by industry								
1	Petroleum (13, 29)	13	Mean	90.385	0.816	0.008	0.410	0.012
			Median	100.000	0.738	0.008	0.250	0.010
2	Finance/Real estate (60–69)	14	Mean	90.000	2.086	0.021	0.482	0.035
			Median	100.000	1.772	0.018	0.250	0.027
3	Consumer Durables (25, 30, 36–37, 39, 50, 55, 57)	68	Mean	62.353	1.599	0.030	0.331	0.042
			Median	50.000	0.999	0.024	0.286	0.035
4	Basic Industry (10, 12, 14, 24, 26, 28, 33)	47	Mean	59.096	1.202	0.024	0.327	0.037
			Median	50.000	0.707	0.018	0.267	0.022
5	Food/Tobacco (1, 20, 21, 54)	16	Mean	94.375	0.916	0.009	0.398	0.015
			Median	67.500	0.646	0.006	0.279	0.011
6	Construction (15–17,32,52)	5	Mean	71.000	0.487	0.007	0.386	0.012
			Median	50.000	0.413	0.006	0.417	0.012
7	Capital goods (34–35, 38)	36	Mean	51.667	0.885	0.026	0.341	0.036
			Median	35.000	0.704	0.019	0.250	0.038
8	Transportation (40–42, 44–45, 47)	5	Mean	84.000	0.601	0.008	0.234	0.013

Table 4 continued

Industry index	Industry name (2-digit SICs)	Number of observations		Total limit ($Millions)	Total premium ($Millions)	Price per dollar of limit ($)	Ratio of primary limit to total limit	Price per dollar of primary limit ($)
			Median	65.000	0.373	0.008	0.231	0.015
9	Utilities	52	Mean	114.231	1.872	0.018	0.278	0.031
	(46, 48–49)		Median	100.000	1.128	0.011	0.264	0.018
10	Textiles/Trade (22–23, 31, 51, 53, 56, 59)	16	Mean	38.438	1.151	0.025	0.509	0.036
			Median	45.000	0.436	0.018	0.450	0.020
11	Services (43, 72–73, 75, 76, 80, 81, 82, 83, 87, 89)	72	Mean	26.438	0.901	0.039	0.446	0.050
			Median	20.000	0.765	0.038	0.333	0.048
12	Leisure (27, 58, 70, 78–79)	7	Mean	50.429	0.803	0.018	0.305	0.028
			Median	50.000	0.638	0.017	0.250	0.027
Total		351						

Table 5 Computing the "abnormal limit" (*xlimit*): regression of D&O insurance limits on financial reporting concerns and economic determinants

Variable	Model 1		Model 2	
	Coefficient	*t* stat	Coefficient	*t* stat
Intercept	12.595***	[16.405]	11.998***	[13.775]
restate	0.273**	[2.022]	0.393**	[2.186]
dacc			0.230	[0.464]
aq_resid			0.658**	[2.093]
log_mv	0.230***	[6.862]	0.239***	[6.133]
vol	−9.426***	[−3.776]	−14.41***	[−4.024]
turnover	2.396	[0.655]	1.487	[0.314]
cumret	−0.003	[−0.072]	0.007	[0.103]
lev	0.594***	[2.888]	0.515**	[2.525]
loss	0.087	[1.156]	0.259***	[3.349]
priorclaim	0.271***	[2.626]	0.193	[1.605]
risk_ind	−0.277**	[−2.376]	−0.092	[−0.801]
big5	0.117	[1.557]	0.223**	[2.530]
auditor_chg	0.167	[1.308]	0.317***	[2.692]
board_size	0.059***	[2.800]	0.068***	[3.195]
pct_ind	0.779**	[2.021]	1.042***	[3.231]
duality	0.026	[0.308]	0.051	[0.611]
app_ceo_pct_ind	−0.209	[−1.391]	−0.061	[−0.356]
pct_shares_inside	0.320	[1.173]	0.213	[0.422]
log_ceo_exp	−0.229***	[−3.725]	−0.142*	[−1.874]
inst_block5	−0.132	[−1.469]	−0.221**	[−2.293]
pct_ind_audit	−0.346	[−1.308]	−0.343	[−1.199]
pct_shares_audit	0.028	[0.120]	−3.046	[−1.515]
absence_audit	−0.116	[−0.331]	−0.302	[−0.844]
*log_fc * dbnews*	−0.042	[−0.396]	−0.102	[−0.818]
log_fc	0.086	[1.069]	0.217**	[2.165]
dbnews	0.079	[0.589]	−0.020	[−0.114]
Year dummies	Included		Included	
Adjusted R^2	0.659		0.716	
F test	26.033[a]		21.081[a]	
# of firms	152		110	
# of observations	351		232	

The residual term from the regression is called "abnormal limit" (*xlimit*) and captures the limit taken over and above the amount that can be explained by litigation risk proxies. It is used as a control variable in the subsequent empirical analysis. Variables are as defined in Table 1. The values of the independent variables are measured immediately before the effective date of the D&O insurance contract

***, **, and * Significance at the 1, 5, and 10 % levels of a two-tailed *t* test based on Huber-White standard errors adjusting for firm-level clustering, respectively

[a] Significance at the 1 % level for the *F* test

are larger and have higher financial leverage. The positive coefficients on *board_size* and *pct_ind* suggest that firms with more directors on the board and a higher percentage of outside directors purchase higher D&O limits, perhaps because D&O insurance protection serves as a prerequisite to attract and retain talent (especially outside talent) to the board. The negative coefficient on *log_ceo_exp* indicates that firms with more experienced CEOs demand less D&O coverage. The audit committee variables (*pct_ind_audit*, *pct_shares_audit* and *absence_audit*) do not have statistically significant associations with *log_limit*. Table 5 also shows that *log_limit* is negatively related to *vol*. This is an interesting result, as one would expect higher stock return volatility to be linked with greater litigation risk. One potential explanation is that *vol* only increases the likelihood of litigation (by affecting D&O pricing) but not necessarily the magnitude of the damage amount (by affecting the D&O coverage). Finally, two of the proxies for financial reporting quality, *restate* and *aq_resid*, have significantly positive associations with *log_limit*, suggesting the existence of managerial foresight regarding the likelihood of litigation from financial reporting concerns. Among the proxies for prior voluntary disclosure (*log_fc*, *dbnews*, and *log_fc * dbnews*), only *log_fc* is significantly associated with *log_limit* in Model 2, indicating that a greater amount of prior forecast activities may prompt higher demand for D&O coverage.

5.2 Determinants of D&O insurance premiums

Table 6 reports the regression results of D&O premiums (*log_premium*) on accounting restatements and other economic determinants. Model 1 is a base specification that only includes the restatement dummy (*restate*), the "abnormal limit" (*xlimit*) and the year dummies. Model 2 further includes business risk factors in the regression, while Model 3 includes a complete list of independent variables. The variable *xlimit* in Models 1–3 is derived from the regression of D&O insurance limit on accounting restatement and other economic determinants (i.e., Model 1 in Table 5). Across the three specifications, the coefficients on *xlimit* are all significantly positive, indicating that any abnormal limit (over and above that explained by litigation risk proxies) is priced by the insurance carriers. In all of the models, *restate* has significantly positive coefficients, suggesting that D&O insurers view the acknowledgment of prior accounting misstatements as an area of underwriting concern. Specifically, in Model 3, the coefficient is 0.496 (t stat $= 4.19$), suggesting that, holding everything else constant, having a restatement would drive up the D&O premium by 64 %. Finally, adding business risk factors to the base model increases the explanatory power of the model significantly (as reflected in the adjusted R^2), while further including governance variables only does so modestly. The modest impact of governance variables suggests that, collectively, the structural features of a firm's corporate governance (e.g., board composition, equity ownership, etc.) only have a limited effect on D&O pricing, a finding that is consistent with Baker and Griffith's (2007a) conclusion that the cultural aspects of a firm's governance (e.g., the internal constraints faced by the managers, efficacy of the internal incentive system, etc.) may be more relevant in D&O insurance pricing.

Table 6 Regressions of D&O insurance premiums on accounting restatements and other economic determinants

Variable	Model 1		Model 2		Model 3	
	Coefficient	*t* stat	Coefficient	*t* stat	Coefficient	*t* stat
Intercept	13.082***	[169.571]	5.774***	[12.031]	6.146***	[10.915]
restate	0.8***	[5.246]	0.523***	[4.659]	0.496***	[4.190]
log_mv			0.307***	[14.627]	0.261***	[11.961]
vol			5.169**	[1.99]	4.465*	[1.778]
turnover			3.015	[0.969]	4.819	[1.565]
cumret			−0.118**	[−2.423]	−0.088*	[−1.795]
lev			0.58***	[3.327]	0.564***	[3.188]
loss			0.247***	[2.937]	0.22***	[2.715]
priorclaim			0.474***	[5.034]	0.452***	[5.341]
risk_ind			0.071	[0.705]	0.164	[1.534]
big5			0.161**	[2.293]	0.150**	[2.261]
auditor_chg			0.198*	[1.809]	0.125	[1.239]
board_size					0.04**	[2.17]
pct_ind					0.673***	[2.735]
duality					0.089	[1.19]
app_ceo_pct_ind					−0.234	[−1.62]
pct_shares_inside					−0.028	[−0.096]
log_ceo_exp					−0.17***	[−3.076]
inst_block5					0.095	[1.268]
pct_ind_audit					0.021	[0.117]
pct_shares_audit					0.056	[0.204]
absence_audit					0.345	[1.069]
xlimit	0.776***	[6.824]	0.776***	[9.854]	0.776***	[11.173]
*log_fc * dbnews*					0.047	[0.530]
log_fc					−0.018	[−0.225]
dbnews					0.078	[0.688]
Year dummies	Included		Included		Included	
Adjusted R^2	0.351		0.686		0.719	
F test	38.886[a]		51.914[a]		33.014[a]	
# of firms	152		152		152	
# of observations	351		351		351	

Variables are as defined in Table 1. The values of the independent variables are measured immediately before the effective date of the D&O insurance contract. The "abnormal limit" (*xlimit*) in Models 1–3 is derived from the regression of D&O insurance limit on restatement and other economic determinants (i.e., Model 1 in Table 5)

***, **, and * significance at the 1, 5, and 10 % levels of a two-tailed *t* test based on Huber-White standard errors adjusting for firm-level clustering, respectively

[a] Significance at the 1 % level for the *F* test

Table 7 Regressions of D&O insurance premiums on accounting restatements and other economic determinants: alternative specifications

Variable	Model 1		Model 2		Model 3	
	Coefficient	*t* stat	Coefficient	*t* stat	Coefficient	*t* stat
Intercept	6.207***	[11.096]	6.417***	[11.194]	6.911***	[11.082]
restate_3yr	0.366***	[3.775]				
restate_core			0.118	[0.783]		
restate_ncore			0.836***	[7.733]		
restate					0.200	[1.281]
*sox * restate*					0.819***	[4.216]
sox					0.664***	[9.248]
log_mv	0.257***	[11.922]	0.251***	[11.261]	0.256***	[9.630]
vol	3.873*	[1.661]	3.446	[1.297]	0.234	[0.075]
turnover	4.869	[1.603]	6.809**	[2.054]	8.31***	[2.621]
cumret	−0.089*	[−1.852]	−0.094**	[−2.013]	−0.086	[−1.635]
lev	0.599***	[3.470]	0.577***	[3.277]	0.466**	[2.457]
loss	0.238***	[2.961]	0.227***	[2.79]	0.376***	[4.178]
priorclaim	0.439***	[5.224]	0.458***	[5.425]	0.352***	[3.803]
risk_ind	0.189*	[1.741]	0.167	[1.541]	0.196*	[1.741]
big5	0.163**	[2.468]	0.137**	[2.033]	0.116	[1.573]
auditor_chg	0.142	[1.368]	0.068	[0.667]	0.196	[1.345]
board_size	0.041**	[2.233]	0.043**	[2.329]	0.029	[1.506]
pct_ind	0.732***	[3.000]	0.668***	[2.704]	0.691**	[2.506]
duality	0.079	[1.065]	0.085	[1.117]	0.077	[1.018]
app_ceo_pct_ind	−0.217	[−1.494]	−0.276*	[−1.858]	−0.262*	[−1.691]
pct_shares_inside	−0.001	[−0.002]	0.011	[0.039]	0.281	[0.870]
log_ceo_exp	−0.175***	[−3.165]	−0.198***	[−3.466]	−0.214***	[−3.509]
inst_block5	0.096	[1.302]	0.100	[1.298]	0.075	[0.852]
pct_ind_audit	−0.012	[−0.070]	0.032	[0.181]	−0.016	[−0.082]
pct_shares_audit	0.031	[0.112]	0.009	[0.035]	−0.172	[−0.534]
absence_audit	0.401	[1.218]	0.347	[1.066]	0.544	[1.307]
xlimit	0.779***	[11.353]	0.771***	[11.002]	0.760***	[9.854]
*log_fc * dbnews*	0.049	[0.561]	0.04	[0.448]	0.167	[1.419]
log_fc	−0.016	[−0.201]	−0.019	[−0.241]	−0.035	[−0.365]
dbnews	0.071	[0.623]	0.083	[0.735]	−0.054	[−0.385]
Year dummies	Included		Included		No	
Adjusted R^2	0.721		0.721		0.628	
F test	33.268[a]		32.258[a]		22.849[a]	
# of firms	152		152		152	
# of observations	351		351		351	

Variables are as defined in Table 1. The values of the independent variables are measured immediately before the effective date of the D&O insurance contract. The "abnormal limit" (*xlimit*) in Model 1 (2 or 3) is derived from a regression of D&O insurance limit similar to Model 1 (2 or 3) except for the exclusion of *xlimit* as an independent variable

***, **, and * significance at the 1, 5, and 10 % levels of a two-tailed *t* test based on Huber-White standard errors adjusting for firm-level clustering, respectively

[a] Significance at the 1 % level for the *F* test

In Table 7, we extend our main analysis on restatements and D&O insurance pricing in several ways. First, instead of only examining the effect of restatements in the year immediately preceding the effective date of a D&O policy, in Model 1, we follow Wilson (2008) in considering the implications of prior restatements for a longer term. We replace *restate* from Model 1 in Table 6 with the variable *restate_3yr*, which takes the value of one if a restatement occurred in any of the 3 years prior to the effective date of a D&O policy and zero otherwise. The results mirror those of Table 6, suggesting that the incidence of restatements could affect D&O premiums several years in the future. We repeat the analysis by defining the "restatement" variable alternatively as (1) the number of restatements in the previous 3 years, (2) the number of restatements in the previous 2 years, and (3) whether there has been at least one restatement in the previous 2 years, respectively. For all three alternative "restatement" variables, the results remain qualitatively similar.[23]

Second, we differentiate between restatements according to the nature of the accounting misstatements involved, as there is evidence that financial statement users view "core" restatements differently than "non-core" restatements (Palmrose et al. 2004; Scholz 2008; Burks 2011). In Model 2 of Table 7, consistent with the prior literature (e.g., Palmrose and Scholz 2004), we define *restate_core* as an indicator variable that equals one if there is at least one "core" restatement involving revenue or cost/expense recognition issues due to improper accounting in the year preceding the D&O policy effective date and zero otherwise.[24] Similarly, *restate_ncore* is an indicator variable that equals one if there is at least one "non-core" restatement in the previous year not involving any revenue or cost/expense recognition issues. Interestingly, only *restate_ncore* has a significantly positive coefficient (coeff. = 0.836, *t* stat = 7.733), suggesting that the non-core restatements are likely driving the positive association between D&O premium and litigation risk reported in Table 6. Specifically, holding everything else constant, having a non-core restatement would drive up the premium by 131 %. The results are in sharp contrast to those in Palmrose and Scholz (2004), who find that a "core" restatement leads to a higher frequency of litigation (which pertains to *that* particular restatement and is typically covered by *prior* D&O policies in effect at the time of the restatement announcement). Our finding suggests that, rather than the core restatements, the D&O insurers view the non-core restatements as being an important risk factor for future litigation. A likely explanation is that the higher frequency of litigation following core restatements (Palmrose and Scholz 2004) may lead to effective disciplining of the accounting practices due to capital market incentives and heightened regulatory

[23] In an alternative specification, we also examine the impact of prior-year restatements on D&O premium, conditional on the firm's history of restatements. Specifically, we add to Model 3 of Table 6 the following two variables: (1) $restatement\_{history}$, an indicator variable that equals one if a firm has at least one restatement in year -2 or year -3 (with the year prior to the D&O policy effective date being year -1) and zero otherwise, and (2) $restatement*restatement\_{history}$. Untabulated results show that the coefficient on $restatement*restatement\_{history}$ is significantly positive, suggesting that the D&O premium is even higher for firms with a history of repeat restatements.

[24] 46.7 % of the firm-year observations with prior restatements involve revenue or expense recognition issues.

scrutiny, while the lower frequency of litigation for non-core restatements leads to relatively insufficient in-house cleanup of financial reporting.

Finally, as the passage of the Sarbanes–Oxley Act of 2002 has significantly increased D&O accountability as well as personal legal liability, we test whether the effect of financial reporting concerns has increased in the post-SOX period. We define *sox* as an indicator variable that equals one if a D&O policy has an effective date later than the enactment date of SOX and zero otherwise. The percentage of firm-year observations in the post-SOX period is 31 %. In Model 3 of Table 7, we include both *sox* and its interaction with the restatement variable (*sox* * *restate*) to examine the effect of financial reporting quality in the pre- and post-SOX periods. In this specification, both *sox* and *sox* * *restate* load positively and significantly. However, the coefficient on *restate* becomes insignificant. Our results suggest that insurers placed greater weight on the financial reporting quality variables in the post-SOX period.

In Table 8, we contrast three different specifications employing the alternative measures of financial reporting concerns. Model 1 (Model 2) includes *dacc* (*aq_resid*) as the main measure of lack of financial reporting quality, while Model 3 includes all three measures in one regression. In all of the models, the measures of financial reporting concerns have significantly positive associations with D&O premiums. Consistent with the findings in Table 6, the results suggest that D&O underwriters do price (lack of) financial reporting quality by adjusting the D&O premiums and do not fixate on any one measure. Specifically, in Model 3, the coefficients on *restate*, *dacc*, and *aq_resid* are 0.698 (t stat = 4.19), 1.031 (t stat = 3.01), and 0.573 (t stat = 2.06), respectively. This finding also appears to support the notion that these three reporting quality measures represent different aspects of financial reporting risk, as each has a significant impact on D&O pricing incremental to the others. Finally, measures for prior voluntary disclosure (*log_fc*, *dbnews* and *log_fc* * *dbnews*) do not exhibit significant statistical associations with *log_prem*, a finding that is consistent with Field et al. (2005), who find no evidence that disclosure triggers litigation.

In terms of corporate governance variables, the most robust coefficients are on board size and board independence. Specifically, the coefficients on *board_size* and *pct_ind* are significantly positive in all the specifications presented in Table 6, Table 7, and Model 3 in Table 8. The association between board size and D&O premiums has not been documented by prior studies. The positive coefficient on percentage of outside directors (*pct_ind*) indicates that the risk of outsiders to insurance carriers outweighs possible governance benefits. This directly contrasts with the results in Core (2000) and Chalmers et al. (2002). Core (2000) finds that D&O premiums decrease with board independence for a group of public Canadian firms, while Chalmers et al. (2002) report an insignificant relationship between the two for a sample of U.S. IPO firms. The coefficients on CEO tenure on the board (*log_ceo_exp*) are negative and significant in Tables 6, 7, 8, a finding that is consistent with Core (2000) and does not support the hypothesis that CEO entrenchment increases D&O premium. Rather, it indicates that companies with more experienced CEOs are probably viewed by D&O underwriters to be less risky because the CEO can better steer the business through rough times. This result also

Table 8 Regressions of D&O insurance premiums on financial reporting concerns and other economic determinants

Variable	Model 1		Model 2		Model 3	
	Coefficient	*t* stat	Coefficient	*t* stat	Coefficient	*t* stat
Intercept	5.922***	[9.924]	5.66***	[7.608]	5.545***	[7.941]
restate					0.698***	[4.190]
dacc	0.587**	[2.407]			1.031***	[3.013]
aq_resid			0.755**	[2.390]	0.573**	[2.059]
log_mv	0.257***	[11.373]	0.286***	[8.658]	0.291***	[9.341]
vol	5.666**	[2.151]	−1.344	[−0.365]	−3.358	[−0.892]
turnover	8.174***	[2.661]	2.080	[0.315]	2.419	[0.374]
cumret	−0.061	[−1.272]	−0.148**	[−2.221]	−0.132**	[−2.080]
lev	0.553***	[3.022]	0.544**	[2.488]	0.417*	[1.850]
loss	0.218**	[2.556]	0.429***	[4.159]	0.360***	[3.334]
priorclaim	0.234***	[2.875]	0.400***	[4.056]	0.229**	[2.388]
risk_ind	0.183*	[1.746]	0.217*	[1.713]	0.364***	[2.886]
big5	0.180***	[2.624]	0.201**	[2.541]	0.172**	[2.201]
auditor_chg	0.204*	[1.940]	0.364***	[3.025]	0.351***	[3.124]
board_size	0.064***	[3.479]	0.033	[1.503]	0.039*	[1.929]
pct_ind	0.208	[0.807]	0.773**	[2.520]	0.574*	[1.786]
duality	0.173**	[2.429]	0.103	[1.181]	0.093	[1.151]
app_ceo_pct_ind	−0.302**	[−2.108]	−0.242	[−1.258]	−0.385**	[−2.065]
pct_shares_inside	−0.189	[−0.584]	−0.836	[−1.584]	−1.204*	[−1.927]
log_ceo_exp	−0.157***	[−2.810]	−0.136**	[−2.074]	−0.119*	[−1.874]
inst_block5	0.039	[0.528]	0.158*	[1.743]	0.149	[1.626]
pct_ind_audit	0.375**	[1.962]	−0.032	[−0.157]	0.245	[1.087]
pct_shares_audit	0.222	[0.714]	−2.856**	[−2.338]	−2.899***	[−2.627]
absence_audit	0.168	[0.539]	0.597	[1.228]	0.396	[0.817]
xlimit	0.734***	[9.736]	0.835***	[10.338]	0.773***	[9.681]
*log_fc * dbnews*	0.043	[0.462]	−0.012	[−0.122]	−0.091	[−0.891]
log_fc	−0.013	[−0.165]	−0.005	[−0.061]	0.066	[0.769]
dbnews	0.071	[0.587]	0.17	[1.191]	0.161	[1.109]
Year Dummies	Included		Included		Included	
Adjusted R^2	0.721		0.739		0.758	
F test	30.454[a]		26.789[a]		25.089[a]	
# of firms	139		121		110	
# of observations	320		256		232	

Variables are as defined in Table 1. The values of the independent variables are measured immediately before the effective date of the D&O insurance contract. The "abnormal limit" (*xlimit*) in Model 1 (2 or 3) is derived from a regression of D&O insurance limit similar to Model 1 (2 or 3) except for the exclusion of *xlimit* as an independent variable

***, **, and * significance at the 1, 5, and 10 % levels of a two-tailed *t* test based on Huber–White standard errors adjusting for firm-level clustering, respectively

[a] Significance at the 1 % level for the *F* test

contradicts Baker and Griffith's (2007a) contention that entrenched management is a concern to D&O insurers. For the auditor related variables, the coefficient on *auditor_chg* is significantly positive in Table 8. This indicates that auditor switching is perceived as a risk factor for subsequent poor reporting when considered in conjunction with accounting quality measures (i.e., *dacc* and *aq_resid*) other than restatements. The coefficient on *big5* is significantly positive for most of the models in Tables 6, 7, 8, consistent with the argument in Palmrose (1988) and Dye (1993) that having an accounting firm with deep pockets attracts lawsuits and raises litigation risk, when controlling for financial reporting quality. Finally, the audit committee variables, in general, do not have statistically significant associations with D&O insurance premiums. Greater equity incentives for the audit committee members (*pct_shares_audit*) appear to reduce D&O premiums when all three financial reporting quality variables are included in the regression (Table 8, Model 3).

Regarding the PSLRA risk measures, the coefficient on *inst_block5* is largely insignificant (except for Model 2 in Table 8), suggesting that the PSLRA risk introduced by the existence of a large institutional blockholder does not appear to dominate the effect of close monitoring by the blockholder. The coefficient on *lev* is significantly positive in Tables 6, 7, 8, supporting the posited relationship between the role of debt holders and D&O premiums because of PSLRA. However, higher leverage is often also a business risk variable, as the likelihood of bankruptcy goes up when a firm takes on more debt. Hence caution is needed in attributing the effect solely to PSLRA risk.

With respect to the business risk factors, most of the variables have coefficients with the predicted signs. Consistent with the discussion in Sect. 3 and the finding in Core (2000), the significant coefficients on *log_mv* in all models presented in Tables 6, 7, 8 indicate that larger companies are associated with higher litigation risk. The significant coefficients on *cumret*, *priorclaim*, and *loss* indicate that companies with poorer stock performance, prior claims against their directors and officers, and financial loss are viewed as being riskier. Stock return volatility (*vol*) has a positive coefficient, as suggested in the previous section, but the coefficient is insignificant in some of the models. Finally, *risk_ind* is positively associated with *log_prem* when all three financial reporting quality variables are included in the regression (Table 7, Model 3), indicating potential interplay between these variables and the underlying economics of the litigation-prone industries.

5.3 Additional analysis and robustness checks

5.3.1 Primary versus excess insurance

As discussed in Sect. 4, there is usually a hierarchy of insurers in D&O policies, with multiple layers of insurance policies coming in "towers" to reach the total amount of insurance limit desired by a firm. There is a primary insurer who has responsibility for claims up to a certain insurance limit (i.e., the primary limit). The excess insurers bear responsibility for claims beyond the primary limit up to the total insurance coverage limit. We argue in Sect. 2 that lawsuits regarding

Table 9 Regressions of D&O insurance premiums on accounting restatements and other economic determinants: primary versus excess insurance

Variable	Model 1 Dep = *log_primprem*		Model 2: Dep = *log_exprem*	
	Coefficient	*t* stat	Coefficient	*t* stat
Intercept	6.248***	[5.954]	4.396***	[6.601]
restate	−0.284	[−0.354]	0.524***	[3.436]
log_mv	0.203***	[5.282]	0.241***	[8.465]
vol	5.340	[1.494]	8.628***	[3.358]
turnover	−0.318	[−0.068]	0.621	[0.193]
cumret	−0.096*	[−1.782]	−0.024	[−0.494]
lev	0.618**	[2.252]	0.506***	[3.434]
loss	0.045	[0.246]	0.149*	[1.792]
priorclaim	0.409***	[3.778]	0.433***	[4.728]
risk_ind	0.358*	[1.825]	0.107	[1.077]
big5	0.058	[0.745]	0.117*	[1.722]
auditor_chg	0.307*	[1.678]	−0.043	[−0.394]
board_size	0.065	[1.545]	0.032*	[1.747]
pct_ind	0.688*	[1.952]	0.026	[0.097]
duality	0.245*	[1.741]	0.175**	[2.244]
app_ceo_pct_ind	−0.419	[−1.613]	−0.069	[−0.496]
pct_shares_inside	0.089	[0.290]	0.000	[−0.002]
log_ceo_exp	−0.225***	[−2.692]	−0.062	[−1.116]
inst_block5	0.074	[0.826]	0.139*	[1.872]
pct_ind_audit	−0.047	[−0.229]	0.311	[1.504]
pct_shares_audit	−0.050	[−0.165]	−0.256	[−1.161]
absence_audit	0.353	[0.951]	0.259	[0.693]
*log_fc * dbnews*	0.262	[1.346]	0.082	[0.847]
log_fc	−0.150	[−1.419]	−0.052	[−0.646]
dbnews	−0.106	[−0.415]	−0.075	[−0.583]
xlimit	0.814***	[3.653]	0.562***	[5.608]
primlim_totlim	1.146***	[2.969]		
exlim_totlim			2.145***	[6.214]
Year dummies	Included		Included	
Adjusted R^2	0.287		0.735	
# of firms	152		128	
# of observations	351		316	

Variables are as defined in Table 1. The values of the independent variables are measured immediately before the effective date of the D&O insurance contract. The "abnormal limit" (*xlimit*) in Models 1 and 2 is derived from a regression of total D&O insurance limit similar to Model 1 in Table 5

***, **, and * significance at the 1, 5, and 10 % levels of a two-tailed *t* test based on Huber-White standard errors adjusting for firm-level clustering, respectively

disclosure and financial reporting, while less frequent, tend to involve extremely large claims and thus are more likely to exhaust the relatively small primary policy limits and require large payouts from the excess insurers. Therefore we expect the

premiums charged by the excess insurers to be more sensitive to financial reporting concerns than those charged by the primary insurers. Model 1 of Table 9 reports the regression results for the determinants of the D&O premium charged by the primary insurers, while Model 2 reports the results for the premium charged by the excess insurers. In both models, we control for the percentage of total insurance coverage that the particular layer of insurance accounts for using *primlim_totlim* (primary limit as a percentage of total limit) in Model 1 and *exlim_totlim* (excess limit as a percentage of total limit) in Model 2.[25] While the coefficient on *restate* in Model 1 is insignificant, it is significantly positive in Model 2. This suggests that it is the excess insurers who appear to be pricing the litigation risk due to financial reporting concerns reflected in prior restatements.

5.3.2 Future financial reporting quality

As many companies restate repeatedly (Files et al. 2011), we link D&O pricing with D&O insurers' expectation of a firm's future financial reporting quality and test whether higher premiums primarily affect firms with lingering financial reporting problems such as additional restatements in the D&O policy year. We proxy for D&O insurers' expectation of a firm's future financial reporting quality with $restate_{policy\_yr}$, an indicator variable that equals one if there is at least one restatement announced in the 1-year period in which the D&O policy is effective and zero otherwise. We extend Model 3 of Table 6 by including two additional variables in the regression: $restate_{policy\_yr}$ and *restate* * $restate_{policy\_yr}$. Under this specification (results untabulated), the coefficient on $restate_{policy\_yr}$ itself is insignificant. However, the coefficients on *restate* (coeff. = 0.377, t stat = 2.88) and *restate* * $restate_{policy\_yr}$ (coeff. = 0.497, t stat = 2.518) are both significantly positive, suggesting that, while D&O premiums are higher for firms with prior restatements, the premiums increase even more when accounting problems persist. The significant coefficient on *restate* * $restate_{policy\_yr}$ also confirms that D&O insurers can identify chronic accounting problems and price them accordingly.

5.3.3 Alternative specifications

Our results survive several robustness checks. First, since the coefficients in Eq. (5) capture both the direct effect of various risk factors on D&O pricing and the indirect effect of these factors on the firm opting for increased D&O limits, we test Eq. (1), where *log_prem* is directly regressed on *log_limit* and all risk factors. Untabulated results suggest that *restate* continues to have a significantly positive coefficient in this specification, confirming its direct effect on D&O pricing. Second, we extend Model 3 of Table 8 by further including the innate component of accrual quality (i.e., the fitted value of Eq. (7) in Appendix 2) in the regression. As one would expect, this variable does not have a significant association with *log_prem* (coefficient = −0.062, t stat = −0.074), as it should be largely captured by the

[25] Model 2 is based on a slightly smaller sample, as some firms only have the primary insurance layer in their D&O policies.

business risk factors we control for. The coefficients on *restate*, *dacc*, and *aq_resid* remain significantly positive under this specification. For Model 3 of Table 8, we also use alternative definitions of performance-matched abnormal accruals suggested by Kothari et al. (2005). The alternative measures are derived from the Jones model matched with current-period *ROA* or lagged *ROA,* the Jones model augmented with current *ROA* in the regression, the modified Jones model matched with current-period *ROA* or lagged *ROA*, and the modified Jones model augmented with current-period *ROA* or lagged *ROA* in the regression. The results remain qualitatively similar. Third, the test results are unaffected by the inclusion of growth opportunity proxies such as sales growth or book-to-market ratio. Fourth, when we replace the loss dummy with return on assets (*ROA*, defined as earnings before extraordinary items scaled by lagged total assets), *ROA* has a significantly negative association with *log_prem*, confirming the inverse relation between firm performance and D&O premiums. The other coefficients remain qualitatively similar under this specification. Fifth, we define the existence of large institutional blockholders using a cutoff of 10 % instead of 5 %. The results remain unchanged. Sixth, we define audit committee independence as an indicator variable that takes the value of one if the audit committee consists of independent directors only and zero otherwise, consistent with Carcello et al. (2011). This variable is not significantly associated with D&O premium. Finally, we examine the effect of financial solvency on D&O premiums by including an indicator variable, *bkdf*, which equals one if there is a Chapter 7 filing, Chapter 11 filing, or default on debt obligations without bankruptcy filing in the 2-year period immediately prior to the D&O contract effective date and zero otherwise.[26] Less than 1 % of the firm-year observations have *bkdf* equal to one and adding this variable to the regression does not change the main results.

6 Conclusion

In this article, we document that variation in D&O insurance premiums is associated with financial reporting quality after controlling for a firm's corporate governance risk, PSLRA risk, and business risk. Our study makes three main contributions. First, we extend prior literature on the relation between accounting restatements and litigation by showing that restatements are perceived as indicative of chronic accounting problems. Second, we show that three different dimensions of accounting quality are all priced by D&O insurers, suggesting that no single measure, by itself, captures all the effects of financial reporting quality on litigation

[26] We obtain the bankruptcy and default information from multiple sources including *Bankruptcy Data Source, Bankruptcy Yearbook and Almanac, Moody's Corporate Default Risk Service,* and Lynn Lopucki's *Bankruptcy Research Database*. We supplement the collected bankruptcy data by Compustat and CRSP databases as follows. Footnote information (AFTNT33, AFTNT34, and AFTNT35) in Compustat provides the month, year, and reasons of deletion of a firm. Code 2 under AFTNT35 denotes bankruptcy under Chapter 11, while Code 3 indicates bankruptcy under Chapter 7. The delisting code in CRSP, a three-digit number that provides the reasons of delisting, denotes liquidation if it is a value between 400 and 499.

risk. Third, we present new empirical evidence regarding the effects of corporate governance and business risk on D&O insurance pricing.

There are several avenues for future research. First, the relation between audit fees and D&O insurance premiums is worth investigating in order to examine whether the information regarding litigation risk used by auditors overlaps with or differs from that used by D&O insurers. Second, our ex ante litigation risk measure, the D&O insurance premium, can be used in other settings such as a study examining the association between litigation risk and managerial behavior. Third, future research can also explore whether, following accounting irregularities, D&O insurers seek actions to improve a firm's corporate governance and financial reporting practices for loss-prevention purposes.

The findings in this study have implications for recently proposed institutional reforms that aim at enhancing the financial transparency and responsible financial reporting choices of publicly traded firms in the U.S. For example, Ronen (2002) suggests the use of a market mechanism called financial statement insurance (FSI). Under his plan, public companies would buy FSI, which covers investors against losses due to misrepresentation in financial reports. The insurance coverage obtained by the firms, along with the premiums paid for such coverage is disclosed to the public. The insurance carriers would be the ones appointing and paying the auditors who attest to the accuracy of the financial statements of the prospective insurance clients. The disclosure of FSI coverage and premiums can then be an indicator to the market about a firm's financial reporting quality. Understanding how D&O underwriters perceive and price financial reporting risk in the current regime can help design such a new insurance product.

7 Appendix 1: Computation of *dacc* based on the Kothari et al. (2005) model of performance-matched accruals

The performance-matched discretionary accruals (*dacc*) are measured using the Jones model augmented to include lagged return on assets (*ROA*) as follows:

$$TACC_{it}/ASSETS_{it-1} = a_0 + a_1(1/ASSETS_{it-1}) + a_2(\Delta SALES_{it}/ASSETS_{it-1}) + a_3(PPE_{it}/ASSETS_{it-1}) + ROA_{it-1} + \varepsilon_{it}, \quad (6)$$

where $TACC_{it}$ = total accruals for firm i in year t, defined as the change in non-cash current assets minus the change in current liabilities excluding the current portion of long-term debt, minus depreciation and amortization; $ASSETS_{it}$ = total assets for firm i in year t; $\Delta SALES_{it}$ = change in sales for firm i in year t; PPE_{it} = net value of property, plant, and equipment for firm i in year t; ROA_{it} = earnings before extraordinary items for firm i in year t scaled by lagged total assets.

The above regression is estimated cross-sectionally each year for each of the Fama and French's (1997) 48 industry groups with at least 20 observations in the industry. The residual from the regression is defined as the performance-matched discretionary accruals.

8 Appendix 2: Computation of *aq_resid* based on Francis et al.'s (2005) extension of the Dechow and Dichev (2002) model

First, we estimate the following regression for each of the Fama and French (1997) 48 industry groups with at least 20 firms in year t. We obtain a residual from the regression for each firm for six consecutive years and compute an "accrual quality" variable called aq, defined as the standard deviation of the six residual terms obtained from the regressions.

$$\Delta WC_t = a_0 + a_1 CFO_{t-1} + a_2 CFO_t + a_3 CFO_{t+1} + a_4 \Delta Rev_t + a_5 PPE_t + \varepsilon_t, \quad (7)$$

where ΔWC_t = change in working capital for year t, defined as change in accounts receivable + change in inventory − change in accounts payable + change in other operating assets (net), scaled by average of beginning-of-year and end-of-year total assets for year t; CFO_t = cash flow from operations scaled by average of beginning-of-year and end-of-year total assets for year t; ΔRev_t = change in revenues between year t and year $t-1$ scaled by average assets; PPE = gross value of property, plant, and equipment in year t scaled by average assets.

In the above regression, to avoid any hindsight bias, for year t, the aq measure is based on the financial information available up to year t only. For example, aq for 2001 is estimated using the residuals from an industry-specific regression linking ΔWC_{2000} with CFO_{1999}, CFO_{2000} and CFO_{2001}, ΔWC_{1999} with CFO_{1998}, CFO_{1999}, and CFO_{2000}, and four more similar regressions estimated for earlier years.

Next, we break down the accrual quality measure (aq) into a component that is determined by a firm's innate business factors and a component that is driven by management's discretionary financial reporting choices. We estimate the following annual regression, and the residual term μ_t from this regression is our measure of financial reporting quality, *aq_resid*:

$$aq_t = b_0 + b_1 Size_t + b_2 \sigma(CFO)_t + b_3 \sigma(Sales)_t + b_4 Log\_OperCycle_t + b_5 NegEarn_t + \mu_t, \quad (8)$$

where aq_t = accrual quality estimated using Eq. (7) for year t; $size_t$ = the natural logarithm of a firm's total assets in year t; $\sigma(CFO)_t$ = the standard deviation of a firm's cash flows from operations, calculated over the past 6 years; $\sigma(Sales)_t$ = the standard deviation of a firm's sales, calculated over the past 6 years; $Log\_OperCycle_t$ = the natural logarithm of a firm's operating cycle for year t; $NegEarn_t$ = the number of years out of the past six when a firm reported negative earnings before extraordinary items.

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