Corporate Governance and Firm-Specific Stock Price Crashes

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June 2013

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1. Introduction

In the absence of optimal contracts, managers can exploit their informational advantage and engage in short-sighted, opportunistic behaviour at the expense of long-run shareholders. Broadly, such behaviour may take two forms: undertaking investment decisions that aim to temporarily boost valuations, or engaging in earnings management to preserve an inflated stock price. These practices, however, are unsustainable and will eventually lead to significant stock price crashes when the true fundamentals are revealed.

A considerable body of literature suggests that effective corporate governance mechanisms can curb such sub-optimal managerial decision-making [Shleifer and Vishny (1997), Healy et al. (1999)]. This is achieved, for instance, by disciplining investments [Masulis et al. (2007)], preventing earnings management [Xie et al. (2003)], and improving the information environment [Armstrong et al. (2012), Karamanou and Vafeas (2005)]. These findings suggest that since effective corporate governance mechanisms help to reduce opportunistic managerial behaviour, they should also be associated with lower firm-specific stock price crashes.

In this study we examine whether firm-specific stock price crashes can be predicted from the firm's corporate governance system. To highlight which aspects of the governance system predict stock price crashes we use the framework developed by Standard and Poor's (2002) and the OECD Steering Group of Corporate Governance (2009) and jointly consider four dimensions of governance in our tests: ownership structure, accounting opacity, board structure and processes, and CEO incentives and power. Based on prior literature [Chen et al. (2001), Hutton et al. (2009), Kim et al. (2011a), and Bradshaw et al. (2011)], we focus the bulk of our analysis on two measures of firm-specific stock price crashes derived from a

basic market model, namely, (i) the negative conditional skewness of firm-specific weekly returns as a portion of standard deviation, and (ii) the negative of the worst deviation of firm-specific weekly return as a portion of standard deviation. However, our results are robust to different specifications and methodologies to estimate crashes, and we discuss these in later sections of the paper.

Using a dataset during the period 2002-2009, and controlling for other variables that have been shown to be associated with stock price crashes, we find that future stock price crashes are positively related to institutional ownership and the percentage of directors that hold stocks consistent with the view that institutions and directors with stock ownership pressurize management to deliver short-run performance. Moreover, crashes are positively related to the opacity of the financial reports, suggesting that suboptimal decision making mainly occurs in less transparent environments. We also find that the percentage of independent directors on the audit committee and auditor industry expertise, are negatively related to crashes, highlighting that both may improve the transparency and reliability of the financial reports. Finally, the presence of a formal, clearly defined corporate governance policy in a firm's mandate relates negatively with crashes. More broadly, these results suggest that ownership structure, accounting opacity, as well as board structure and processes influence future crashes. This influence is economically important since, depending on the crash risk measure, a change in the corporate governance measures from the 25^{th} to 75^{th} percentile explains between 23.01% - 29.48% of the standard deviation of the crash risk measure.

We also use a changes-based model to examine whether increases or decreases in the governance variables predict crashes asymmetrically. Changes to the governance systems

reflect ex-ante cost-benefit analysis by the managers and/or shareholders, and it is possible that increases or decreases in governance may not be the opposite sides of the same coin. As shown by Chen (2008), there is a trade-off between advising and monitoring management, and more advising leads to lower monitoring and greater agency costs. So, for example, a company that has fallen on hard times may find it ex-ante optimal to focus more on the advisory, rather than the monitoring capacity of the board, and will thus adapt its governance system accordingly. Adjusting governance policy in this way, however, will, on average, be associated with higher future crashes because the board is less focused on monitoring. Conversely, more stable firms that are unlikely to experience crashes can afford better monitoring, and will thus employ the opposite changes to their governance system to this effect. In this example, the relationship between these opposite changes to governance with crashes will be stronger in the former, rather than the latter case.

Our findings indeed show that several of the relationships we document are asymmetric. Positive changes in the institutional ownership, the percentage of directors with stock ownership, opacity of financial reports and CEO bonuses are associated with an increase in crashes, whereas negative changes to these variables have no material effect. Similarly, positive changes in the number of blockholders and board independence are associated with a decrease in crash risk, with negative changes having no effect. In addition, negative changes in the percentage of independent directors on the audit committee increase crashes. No such effect exists for positive changes. This evidence suggests that investors should consider these asymmetries when forecasting crashes using corporate governance measures.

Finally, we also examine whether industry or company characteristics that theoretically can affect the importance of corporate governance systems influence the aforementioned relationships. Our findings show that the impact of governance on future crashes is stronger when the company operates in a low competition industry, where the market is less able to punish suboptimal managerial behaviour, and is solely concentrated in companies with higher information uncertainty, where it is easier for managers to mask short-run price maximization as long-run value maximisation.

This study contributes to the literature that investigates the determinants of firm-specific stock price crashes. This issue receives considerable attention in the media, especially after the recent corporate scandals such as the collapse of Enron and the financial crisis of 2008-2009. Chen et al. (2001) find that firms with high past returns and more volatile firms are more pronounced to crashes. Hong and Stein (2003) provide evidence that investor heterogeneity is positively associated with crashes. Finally, Kim et al. (2011b) find that corporate tax avoidance leads to more crashes. None of these studies examines the impact of corporate governance on crashes.

Previous studies that examine the relationship between governance and crashes restrict their analysis to a limited set of governance variables. For example, Hutton et al. (2009), Kim et al. (2011a) and Callen and Fang (2013) show that stock price crashes increase with opacity in financial reports, executive equity incentives and institutional ownership, respectively. Our analysis contributes to this literature in two important ways: firstly we jointly consider a broad set of governance variables in our models and thus control for the interrelationships between the various corporate measures [as is common in the governance literature, i.e., Ashbaugh-Skaife et al. (2006), Chung and Zhang (2011)]. Our results show

that, in addition to the effects shown by these studies, several other governance attributes predict crashes. Secondly, in further analyses, we go beyond these studies and show that the predictability of crashes from the various governance measures is not symmetric for increases and decreases in the governance measures and is mainly concentrated in firms with greater agency problems.

Our results on the predictability of firm-specific stock price crashes are important, especially to individual investors who have been shown by previous studies to be under-diversified [Barber and Odean (2000), Curcuru et al. (2007)]. For these investors idiosyncratic stock price crashes imply significant reductions to the value of their portfolios, and as suggested by decision theory, will be associated to disproportionate disutility due to loss aversion [Kahneman and Tversky (1979)]. The survey studies by Koonce et al. (2005) and Olsen (1997) show that investors rank the probability of a large loss as the *primary* source of investment risk, thus confirm the notion that crashes are a first order concern for investors. Our analysis shows that individual investors can screen firms on the basis of their corporate governance systems and reduce the likelihood of experiencing stock price crashes.

The study proceeds as follows: Section 2 discusses the background and develops the motivation, section 3 describes research design, section 4 discusses empirical results, section 5 presents additional analyses and section 6 concludes the study.

2. Background and motivation

Self-interested managers may pursue short-term myopic practices that are not optimal for their long-run shareholders. For example, as explained by Bebchuk and Stole (1993) and Baker et al. (2004) managers may have the incentive to "cater" to prevailing sentiment and

invest in projects that are overvalued by the market.[1] This catering hypothesis is supported by prior evidence that managers overinvest in fixed assets during periods of inflated performance [McNichols and Stubben (2008)], that firms hire and invest excessively when earnings are overstated [Kedia and Philippon (2009)], and that discretionary accruals and firm investment are positively related [Polk and Sapienza (2009)]. Overall, such suboptimal investment policies project strong investment opportunities in the short-term, leading however to undercapitalization and stock price crashes when the actual growth rate is revealed [Benmelech et al. (2010)].

To support the pretense of strong growth opportunities, managers can also manipulate financial information, engaging in the well-known practice of earnings management. Kothari et al. (2009) argue that managers have incentives to stockpile negative information from the market for financial reasons, such as career and compensation concerns. Similarly, Ball (2001) suggests that non-financial reasons, such as empire building and maintenance of self-esteem may also provide managers with incentives to withhold bad news. Hoarding bad news for an extended period of time, however, is unsustainable [Bleck and Liu (2007), Kothari et al. (2009)]. At some point all the hitherto negative information is revealed in the market, which results to a stock price crash [Jin and Myers (2006), Hutton et al. (2009)].

Such opportunistic managerial behaviors are made possible by the inherent information asymmetries that exist between managers and the market. Indeed various financial scandals suggest that the consequences of such agency problems can be severe (e.g. Enron). A considerable body of academic literature, however, suggests that sound corporate governance systems help to alleviate such agency risk problems by bridging the informational

[1] For example during the stock market boom in the late nineties the number of tech IPO's surged. This is because the market was overly optimistic about the capacity of the internet to generate growth, and viewed these projects favourably. Therefore, managers catered to this demand.

gap between shareholders and managers [Shleifer and Vishny (1997), Healy et al. (1999)]. For instance Armstrong et al. (2012) find that information asymmetry and private information gathering decreased following the passage of state antitakeover laws. Similarly, Karamanou and Vafeas (2005) provide evidence that corporate boards and audit committees relate to the quality of voluntary financial disclosure practices. In addition, corporate governance systems also limit suboptimal investment decisions. For instance, Masulis et al. (2007) find that antitakeover provisions limit the disciplinary power of the market for corporate control leading to inefficient mergers and acquisitions that destroy shareholder value. Finally, some studies find that corporate governance reduces earnings management practices [Xie et al. (2003); Klein (2002)] whilst others find rather mixed results or no association [Larcker et al. (2007)].

Based on the current evidence, in this study we investigate the link between corporate governance systems and future stock price crashes.

3. Research design

3.1 Model specification

To implement our analysis we model the relation between corporate governance and future stock price crashes using variants of the following regression model specification:[2,3]

$$CRASH_t = \alpha_0 + \alpha_1 \sum_{m=2}^{M} \alpha_m GOVERNANCE_{t-1} + \sum_{n=m+1}^{N} \alpha_n CONTROL_{t-1} + \varepsilon_t$$

[2] All the regressions include year and industry dummies to control for unobserved time-invariant year and industry factors. Industry indicator variables are based on Fama and French (1997) 48 industry categories. In addition, standard errors are adjusted for clustering at the firm level to control for potential bias in the estimates when the residuals of a firm are correlated across firms [Petersen (2009)].

[3] The appendix provides definitions of all the variables.

Where:

Crash Variables

$NCSKEW_t$ is the negative of the third moment of firm-specific weekly returns for each firm and year divided by the standard deviation of firm-specific weekly returns raised to the third power.
$EXTR_SIGMA_t$ is the negative of the worst deviation of firm-specific weekly returns from the average firm-specific weekly return divided by the standard deviation of firm-specific weekly returns.

Governance Variables

Ownership structure:

$BLOCK_{t-1}$ is the number of outside blockholders that own at least 5% of a firm.
$INST_{t-1}$ is the percentage of shares held by institutional investors.
$INSIDER_{t-1}$, is the percentage of shares held by officers or directors.
BRD_STOCK_{t-1} is the percentage of directors that hold stock in the firm.

Accounting opacity:

$OPAQUE_{t-1}$ is the three-year moving sum of the absolute discretionary accruals.
AUD_IND_{t-1} is the the percentage of outside independent directors in the audit committee.
AUD_EXP_{t-1}, is a dummy variable that equals one when the audit firm of a particular firm has more than a third of market share of total sales within an industry.

Board structure and processes:

BRD_IND_{t-1} is the percentage of outside directors serving the board.
BRD_COMP_{t-1} is the percentage of directors that also serve on boards of other firms.
$GPOL_{t-1}$ is an indicator variable showing whether a company has a formal, clearly defined corporate governance policy in its mandate.

CEO incentives and power:

$BONUS_{t-1}$ is the CEOs bonus scaled by salary.
INC_OPT_{t-1} is the option holdings incentives ratio as in Bergstresser and Phillippon (2006).
INC_STC_{t-1} is the stock holdings incentives ratio as in Bergstresser and Phillippon (2006).
$DUALITY_{t-1}$ is a dummy variable that equal 1 when the positions of the CEO and the chairman of the board are held by the same person.

Control Variables

$DTURN_{t-1}$ is the detrended average weekly stock trading volume.
RET_{t-1} is the average firm-specific weekly returns.

STD_{t-1} is the volatility of firm-specific weekly returns.
$SIZE_{t-1}$ is the natural logarithm of market value of equity.
MB_{t-1} is the market value of equity to book value of equity.
LEV_{t-1} is the financial leverage defined as the total liabilities to total assets.
ROE_{t-1} is the return on equity defined as income before extraordinary items to equity.
$CRASH_{t-1}$ is the lag 1 stock price crash measure.
$CRASH_{t-2}$ is the lag 2 stock price crash measure.
$CRASH_{t-3}$ is the lag 3 stock price crash measure.

3.2 Model justification

3.2.1 Measurement of firm-specific stock price crashes

Given we are investigating the association of firm-specific governance on firm-specific crashes we estimate firm-specific weekly returns using the following expanded index model regression:

$$r_{j,t} = \alpha_j + \beta_{1,j} r_{m,t-2} + \beta_{2,j} r_{m,t-1} + \beta_{3,j} r_{m,t} + \beta_{4,j} r_{m,t+1} + \beta_{5,j} r_{m,t+2} + \varepsilon_{j,t}$$

where $r_{j,t}$ is the return on stock j in week t and $r_{m,t}$ is the CRSP value-weighted market index in week t. To allow for non-synchronous trading we include lead and lag variables for the market index (Dimson, 1979). This regression removes market-wide return movements from firm returns, and thus residuals capture weekly firm-specific returns. Since residuals from equation (1) are skewed, we define firm-specific weekly return for firm j in week t ($W_{j,t}$) as the natural logarithm of one plus the residual (i.e., $W_{j,t} = \ln[1 + \varepsilon_{j,t}]$). Then, following the literature on crashes such as Chen et al. (2001), Hutton et al. (2009), Kim et al. (2011a) and Bradshaw et al. (2011) we employ two primary measures of crashes. The first measure is the negative conditional skewness measured in year t ($NCSKEW_t$). $NCSKEW_t$ is the negative of the third moment of firm-specific weekly returns for each firm and year divided by the standard deviation of firm-specific weekly returns raised to the third power. Specifically, for a given firm j in a fiscal year t we calculate $NCSKEW_{j,t}$ as follows:

$$NCSKEW_{j,t} = -[n(n-1)^{\frac{3}{2}} \sum W_{j,t}^3 / [(n-1_(n-2)(\sum W_{j,t}^2)^{\frac{3}{2}}$$

The second measure is the extreme sigma measured in year t ($EXTR_SIGMA_t$). $EXTR_SIGMA_t$ is the negative of the worst deviation of firm-specific weekly returns from the average firm-specific weekly return divided by the standard deviation of firm-specific weekly returns. Particularly, for a given firm j in a fiscal year t we compute $EXTR_SIGMA_{j,t}$ as follows:

$$EXTR_SIGMA_{j,t} = -Min[\frac{W_{j,t} - \overline{W}_{j,t}}{\sigma_{W,j,t}}],$$

where $\overline{W}_{j,t}$ is the mean of the firm-specific weekly return and $\sigma_{W,j,t}$ is the standard deviation of the firm-specific weekly return. Larger values of $NCSKEW_{j,t}$ and $EXTR_SIGMA_{j,t}$ signify greater crashes.

3.2.2 Measurement of corporate governance

Our study examines how a comprehensive set of variables that capture different aspects of the governance relates to crashes. Prior studies often focus on one aspect of governance, such as opacity in financial reports [Hutton et al., (2009)], or equity incentives [Kim et al. (2011a)] or institutional ownership [Callen and Fang, (2013)], as opposed to a comprehensive set of governance features. A disadvantage of this approach is that governance features may serve as either *substitutes* or *complements*, in protecting shareholder's claims to firm's resources. Therefore inferences from studying certain governance attributes may suffer from omitted variable biases. Instead, in order to highlight the exact avenue by which governance predicts stock prices crashes, we focus on a broad set of governance features that comprehensively capture the monitoring of managerial decision making. In particular, based on the four different attributes of the governance system developed by Standard and Poor's (2002) and the OECD Steering Group of Corporate Governance (2009) we use variables to measure: (i)

ownership structure, (ii) accounting opacity, (iii) board structure and processes, and (iv) CEO incentives and power.

Ownership structure

A considerable body of literature investigates the role of shareholders with significant firm ownership in protecting all shareholders' interest from self-serving managerial behaviour. Shleifer and Vishny (1997) argue that shareholders with significant ownership positions have the financial interest and ability to evaluate investment decisions and corporate policies. Therefore, when necessary, they can exert pressure using their voting power to avoid suboptimal investment decisions. Edmans (2009) highlights that the presence of institutional investors, who have the ability to trade on information about long-run value, shields managers from temporary earnings disappointments allowing them to maintain a long-run perspective. This is known as the monitoring function of institutional investors. Consistent with this notion of monitoring, Shivdasani (1993) reports that in the presence of outside blockholders, the likelihood of a hostile takeover increases. Similarly, Cornett et al. (2008) find that institutional investors obstruct earnings management. According to this monitoring view, the relationship between institutional ownership and future stock crashes should be negative.

A competing view, however, is that large outside shareholders may also act as speculators as opposed to investors, being overly concerned with earnings disappointments, thus pressurizing management to meet or beat earnings expectations [Graves and Waddock 1990; Porter (1992), Bushee (1998), (2001)]. Such pressure, however, encourages short-run price maximization, and hence should increase future stock crashes. Consistent with this

expropriation view, Callen and Fang (2013) find that institutional ownership increases crashes, especially when the institutions have shorter horizons.

Given the evidence in Callen and Fang (2013) we expect that the latter effect dominates and therefore the relationship between crashes and institutional ownership is positive. However, we do note that this positive association in our framework may not hold given we include a number of other corporate governance variables in our model, and these variables are to some extent interrelated. We use two variables to measure institutional ownership at year t-1: $BLOCK_{t-1}$ is the number of outside blockholders that own at least 5% of a firm. $INST_{t-1}$ is the percentage of shares held by institutional investors.

We also consider the extent of insider ownership. As insider ownership rises, insiders have incentives to protect their interests and would be potentially more involved in monitoring managerial decisions [Morck et al. (1988), McConnell and Servaes (1990)], possibly leading to a negative relation with future crashes. $INSIDER_{t-1}$, is the percentage of shares held by officers or directors at year t-1.

Our last ownership variable measures the percentage of directors that hold shares of the firm. The traditional view is that directors that own stocks have the incentive to engage in the companies' operations more diligently [Hambrick and Jackson (2000)], which improves monitoring and thus would reduce crashes. Consistent with this view, Yermack (2004) finds that outside director's option incentives bear a positive relationship with future firm performance. However, there is also evidence to the contrary; Core et al. (1997) find no evidence that directors with directors that own stocks are more attentive. It is also possible that directors' compensation packages align their interests with managers, as shown for

example by Brick et al. (2006). Given the mixed evidence, we make no prediction regarding the sign of the relationship between director ownership incentives and crashes. We use the percentage of directors that hold stock in the firm at year t-1, BRD_STOCK_{t-1}, to capture outside director's monitoring incentives.

Accounting opacity

Accounting opacity is crucial to mitigating the information asymmetry between managers and shareholders. Better opacity facilitates the monitoring of managerial actions and thereby reduces the likelihood that managers would exhibit self-serving behavior. For example, Sengupta (1998) argues that firms with more informative disclosures are less likely to withhold negative information. Following Hutton et al. (2009) we use the three-year moving sum of the absolute discretionary accruals at year t-1 ($OPAQUE_{t-1}$) as a measure of opacity in financial reports. We obtain discretionary accruals as the residuals of a modified Jones (1991) model. Particularly, for each year and industry membership based on Fama and French (1997) 48-industry groups we estimate the following model:

$$\frac{TA_{i,t}}{Assets_{i,t-1}} = \alpha_1 \frac{1}{Assets_{i,t-1}} + \alpha_2 \frac{\Delta Sales_{i,t} - \Delta AR_{i,t}}{Assets_{i,t-1}} + \alpha_3 \frac{PPE_{i,t}}{Assets_{i,t-1}} + \alpha_4 \frac{CFO_{i,t}}{Assets_{i,t-1}} + \varepsilon_{i,t}$$

where total accruals $TA_{i,t}$ is the change in current assets plus the change in debt in current liabilities and the change in income tax payable, and minus the change in cash, the change in current liabilities and depreciation amortization expenses. $\Delta Sales_{i,t}$ is the change in sales. $\Delta AR_{i,t}$ is the change in accounts receivables. $PPE_{i,t}$ is the property plant and equipment. $CFO_{i,t}$ is the cash flow from operations minus the extraordinary items.[4] Given the discussion above and the evidence in Hutton et al. (2009) we expect a positive relationship between opacity and future stock price crashes.

[4] The inclusion of cash flows controls for extreme operating performance [Cohen et al. (2005)].

The reliability of a firm's financial information is a responsibility of audit committee. Klein (2002), for instance, finds a negative relation between audit committee and earnings management practices. Similarly, Agrawal and Chadha (2005) find a negative relation between earnings restatements and board committees that comprise of independent outside directors who have an accounting or finance backgrounds. To proxy for the quality of the audit process, we use AUD_IND_{t-1} defined as the percentage of outside independent directors in the audit committee in year t-1. Overall, to the extent that audit committees carry out their duties effectively, managers should be less likely to exhibit self-serving behavior. Accordingly, there should be a negative relation between audit committee functioning and crashes.

Finally, as part of their overall disclosure strategy, firms may select industry-specialist audit firms. In that respect, Dunn and Mayhew (2004) posit that auditor expertise signals a firm's intention to provide enhanced disclosures. Thus, we use a measure of auditor expertise, AUD_EXP_{t-1}, using a dummy variable that equals one when the audit firm of a particular firm has more than a third of market share of total sales within an industry during year t-1. We expect a negative relation between AUD_EXP_{t-1} and crashes.

Board structure and processes

Prior literature suggests that different facets of board structure are determinants of managerial action's monitoring. As argued by Fama and Jensen (1983), outside directors who are independent on management's influence are useful to protect shareholders from self-serving managerial behavior [see also Agrawal and Chadha, (2005); Xie et al. (2003)]. Largely the literature posits that board independence is positively related to firm performance [DeFond et al. (2005)]. Better firm performance should reflect better investment decisions and less

information asymmetry between managers and shareholders [Beasley (1996), Klein (2002)], leading to lower crashes. A different stream of literature, however, finds no relation between board independence and measures of firm performance [Hermalin and Weisbach (1991)]. Nevertheless, we tentatively expect that a firm's board independence, measured as the percentage of outside directors serving the board at year t-1, BRD_IND_{t-1}, is negatively related to crashes.

Among outside independent directors, more competent directors should be able to limit self-serving managerial behavior, leading to lower crashes. Similarly to Klein (1998) and Ashbaugh-Skaife et al. (2006), we measure board competence by the percentage of directors that also serve on boards of other firms at year t-1, BRD_COMP_{t-1}, expecting a negative relation between BRD_COMP_{t-1} and crashes.

Finally, the last measure is an indicator variable showing whether a company has a formal, clearly defined corporate governance policy in its mandate. Such policy, among others, includes guidelines regarding board and committee nomination, composition, and independence. In addition, it provides directions concerning board meetings, director attendance, compensation and more importantly evaluation of the Chairman, CEO and board/committees performance. This information takes the form of a dummy variable $GPOL_{t-1}$, that equals 1 if such a policy exists at year t-1 and 0 otherwise. We expect that this variable is negatively related to crashes, because in the presence of such a policy it will be more difficult for the manager to engage in opportunistic behavior.

CEO incentives and power

Recent evidence suggests that CEOs/CFOs compensation structure may induce self-serving behavior. Healy (1985) and Bergstresser and Phillippon (2006), for instance, find that bonus plans and the sensitivity of CEOs option portfolio value to stock prices is positively related to earnings management behavior, leading to greater crashes [Kim et al. (2011a)]. Thus, we use year t-1 CEOs bonus scaled by salary, $BONUS_{t-1}$, [as in Fahlenbrach and Stulz (2011)], option holdings incentives ratio (INC_OPT_{t-1}) and stock holdings incentives ratio (INC_STC_{t-1}) measured at year t-1 [as in Bergstresser and Phillippon (2006) and Kim et al. (2011a)] to measure compensation incentives.[5]

A CEO's influence on the board is another element of "CEO incentives and power" since it can reduce the board's effectiveness in monitoring managers. The greater the CEO's influence on the board, the less likely the board to suspect irregularities such as suboptimal investment decisions or earnings management. Imhoff (2003) suggest that CEO's that also serve as chairman of the board are more powerful since the chairman of the board set board's agenda. As measure of CEO power, we use CEO $DUALITY_{t-1}$, defined as a dummy variable that equal 1 when the positions of the CEO and the chairman of the board are held by the same person at year t-1, and zero otherwise. If $DUALITY_{t-1}$ enhances self-serving managerial behavior, we would expect a positive relation with future crashes.

[5] Kim et al. (2011a) find strong evidence that the sensitivity of a chief financial officer (CFO) option portfolio value to stock price is positively related to crashes. We also investigate the robustness of our findings after including CFO stock and option holdings incentives. Untabulated results show that our main findings remain unaltered after including CFO incentives. In addition, we find no relation between CFO incentives and crashes. We choose to report our main analysis using only CEO incentives because including CFO incentives reduces substantially the number of firm-year observations.

3.2.3 Control variables

In accord with prior literature we include several control variables in our analysis. First, Hong and Stein (2003) model predicts that investor heterogeneity causes greater crashes. Thus, we control for investor heterogeneity using the detrended average weekly stock trading volume in year t-1 ($DTURN_{t-1}$). We also include past average firm-specific weekly returns (RET_{t-1}) and past volatility of firm-specific weekly returns (STD_{t-1}) over the fiscal year period t-1 because Chen et al. (2001) provide evidence that firms with high past returns and more volatile firms are more pronounced to crashes. Finally, based on the analysis of Hutton, et al (2009), we include past firm size defined as the natural logarithm of market value of equity in year t-1 ($SIZE_{t-1}$), past market value of equity to book value of equity in year t-1 (MB_{t-1}), past financial leverage defined as the total liabilities to total assets in year t-1 (LEV_{t-1}), and past return on equity defined as income before extraordinary items to equity at year t-1 (ROE_{t-1}).

To address concerns for endogeneity between past crashes experiences and corporate governance, i.e., firms which have experienced stock price crashes in the past improve their governance systems to prevent such events from reoccurring, following Klein (1998) and Harford, Mansi and Maxwell (2008) we use lagged values of the dependent variable up to three years in our regressions.

3.3 Dataset

We collect weekly returns from CRSP to estimate stock crash measures, corporate governance measures from Corporate Library, and firm-specific financial information from Compustat. Our sample covers the period 2002-2009. Similar to prior literature, we exclude financial services firms (SIC 6000-6999), utilities (SIC 4900-4999), firm-years with price at the fiscal year-end less than $2.5, and firm-years with less than 26 weeks of stock returns

during a fiscal year. Further, we exclude observations with missing information and we winsorize the variables at the 1st and 99th percentiles to mitigate possible data errors and influential extreme observations. The final sample consists of 1451 firms with 6620 firm-year observations.

[Insert Table 1]

Table 1 presents the descriptive statistics. The mean (median) values of *NCSKEW* and *EXTR_SIGMA* are 0.115 (0.060) and 2.674 (2.505) respectively and are comparable with those reported in Kim et al. (2011a) and Bradshaw et al. (2011). Within the ownership structure component of governance, the mean (median) number of blockholders is 2.524 (2.000), while institutional investors and insiders hold 79.6% (81.6%) and 11.2% (5.4%), respectively. Finally, 85.9% (91.7%) of the directors hold stocks in the firm, which is similar to the value reported in Ashbaugh-Skaife et al. (2006) of 87% (92%).

Regarding the accounting opacity element of governance, the mean (median) values of opacity in financial reports is 0.298 (0.209). Not surprisingly, 93.5% (100%) of the directors on the audit committee are independent. . Finally, about 24% of the firms appoint industry-specialist firms to audit financial reports.

For the board structure and processes dimension of governance, the mean (median) percentage of independent directors serving the board is 72% (75%). About 53.5% of the board members also serve on other boards. Finally, 68.6% of the sample the firm has a formal corporate governance policy in its mandate.

Concerning CEO incentives and power components of governance, the option and stock incentives ratio are 17.9% (14.3%) and 15.5% (6.7%), respectively. CEOs receive bonuses about 66.6% (38.9%) of their salary, lower than the figure reported in Kim et al. (2011a) of 81.8% (55%). Finally, 58.6% (100%) of the CEOs also serve as Chairman of the board.

As far as the control variables are concerned, results show that the sample consist of large profitable firms. Specifically, the mean (median) market capitalization is $1711.285 million ($1506.175) while return on equity is 9.6% (11.3%). As expected, the firms exhibit only moderate growth opportunities as indicated by the market to book ratio of 2.924 (2.330) and rely less heavily on leverage as captured by the ratio of total liabilities to total assets of 49.5% (50.4%). In summary, the descriptive statistics in Table 1 show that our sample is fairly representative of studies that utilize data from the same sources.

[Insert Table 2]

Table 2 shows Pearson (Spearman) correlation coefficients above (below) the diagonal among the crashes and corporate governance variables. Crashes are positively correlated with the percentage of institutional ownership, the financial report opacity, and the CEO option holdings incentives ratio. Also, crashes are negatively correlated with auditor industry expertise and with the presence of a clearly defined corporate governance policy. Notably, accounting opacity is generally positively related to board structure and processes, and thus complements in bridging the information gap between shareholders and managers. In addition, ownership structure is negatively related to CEO incentives and power, and therefore they are substitute mechanisms in reducing the information asymmetry problem

between shareholders and managers. Finally, the correlations are not high to raise concerns of multicollinearity.

4. Multivariate analysis results

4.1 Corporate governance and crashes

In this section we examine the relation between corporate governance and stock price crashes. Table 3 reports the results. In the first column the dependent variable is $NCSKEW_t$ and in the second column the dependent variable is $EXTR_SIGMA_t$.

[Insert Table 3]

The results provide evidence that ownership structure, accounting opacity and board structure are associated to future crashes. Specifically, there is a positive relationship between institutional ownership and crashes. This result supports the expropriation hypothesis, whereby institutions pressurize management to deliver short-run performance [Graves and Waddock 1990; Porter (1992), Bushee (1998), (2001)]. Interestingly, the percentage of directors that hold stock in the firm is also positively related to future crashes. This result casts doubt on the view that director stock ownership automatically reduces agency problems [Hambrick and Jackson (2000)]. Rather, it suggests that directors with stock ownership may encourage myopic behavior [see for example Brick et al. (2006)]. Finally, there is also weak evidence that insider ownership is negatively related to future crashes, consistent with the view that insider ownership aligns shareholders and manager's interests [Morck et al. (1988); McConnel and Servaes (1990].[6]

[6] Morck et al. (1988) and McConnell and Servaes (1990) argue that the relation between insider ownership and shareholders' wealth, may be non-linear. Therefore, to investigate whether there is a non-linear relation between insider ownership and crashes, we also include the squared term of insider ownership in the regression analysis. Untabulated results reveal no relation between the squared term of insider ownership and crashes.

As predicted, consistent with Hutton et al. (2009), opacity in financial reports is positively related to future crashes. In addition, the percentage of independent directors serving on the audit committee is negatively related to future crashes. This implies that the functioning of audit committees is more effective in the presence of independent directors [Klein (2002), Agrawal and Chadha (2005)]. Finally, firms that appoint industry-specialist audit firms display lower future crashes. This finding is consistent with Dunn and Mayhew (2004), who posit that auditor expertise signals a firm's intention to provide enhanced disclosures.

In terms of board structure there is a negative relation between the presence of a governance policy and future crashes. This finding suggests that in the presence of a formal, clearly defined governance policy, the manager is less able to engage in suboptimal behavior.

Contrary to the notion that equity-based compensation increases future crashes [Kim et al. (2011a)] results show no relation between CEO option and stock holdings incentives ratio with future crashes. Further untabulated investigation of this finding reveals that when excluding corporate governance measures from the regression analysis, CEO option holdings ratio becomes positive and significant at the 10% level (one-sided test). This relation becomes substantially weaker after including institutional ownership in the analysis, suggesting that Kim et al. (2011a) findings may suffer from omitted variable bias. Another explanation for the absence of this relationship may be the fact that the period of investigation in this study is after the passage of Sarbanes-Oxley Act of 2002. Cohen et al. (2005) find that opportunistic behavior of managers, related to equity-based compensation is associated with earnings management only during the period preceding SOX. Overall,

compared to Kim et al. (2011a), our findings suggest that after SOX, equity-based compensation in itself is less likely to induce bad news hoarding, and thus future crashes. [7]

In terms of control variables, consistent with Chen et al. (2001) results show that future crashes are positively related to the firm-specific returns and the volatility of firm-specific returns. Future crashes are also positively related to return on assets and, similar to Hutton et al. (2009), negatively related to firm leverage. It is interesting to note that the lagged values of the dependent variable are generally insignificant, which indicates that it is unlikely for the same firm to experience multiple crashes over the years. This suggests that the patterns we document are less likely to reflect reverse-causality, i.e., firms who have experienced crashes in the past have responded by adjusting their corporate governance systems, which in turn affects their propensity to experience future crashes.[8]

Overall, the results in this section provide evidence that different attributes of corporate governance influence stock price crashes. To provide an indication of the aggregate economic importance of the corporate governance measures we calculate for a hypothetical firm the increase in crash risk due to an improvement of corporate governance as a percentage of standard deviation of the crash risk variable. Specifically, the increase in crash risk measure is calculated as the sum of the coefficient estimates of each of the governance attributes that are statistically significant multiplied by the difference between the 25th and

[7] In an alternative specification of the model in Table 3 we have examined whether the GIM index of shareholder rights proposed by Gombers, Ishii and Metrick (2003) affects crashes, in addition to the other governance variables. We find that the GIM index is insignificant in this smaller sample (the inclusion of the GIM index reduces our sample by roughly 20%). These results are available upon request.

[8] In general such endogeneity effects are more worrisome when one models two firm-specific outcomes, such as executive compensation and governance, contemporaneously. We model one firm specific outcome (governance) and a *future* market outcome (stock price crashes), so endogeneity is less likely to arise.

75th percentile of each governance attribute.[9] Depending on the crash risk measure, a change in the corporate governance measures from the 25th to 75th percentile explains 23.01% to 29.48% of the standard deviation of the crash risk measure.

4.2 Is the effect of corporate governance on crashes asymmetric?

The results in the previous section capture a static relationship between the level of the governance measure and the stock price crashes, which implicitly assumes that increases or decreases to the corporate governance variables exert a symmetric effect of crashes. However, this may not hold in practice since changes to a firm's corporate governance structure may involves a cost-benefit analysis by the managers/shareholders and is therefore a function of several individual and organizational contingencies which will vary overtime [Westphal and Zajac (1994), Hutton et al. (2009); Crutchley et al. (2002)].

In this section we estimate a dynamic version of the baseline model that captures whether positive or negative changes in the corporate governance measures exert an asymmetric effect on stock price crashes. Specifically, we decompose the year t-1 levels of governance variables into its previous year levels (e.g. t-2) and year t-1 annual changes [e.g. Hillegeist et al. (2004)], allowing for different coefficients on positive and negative changes.[10] Specifically we include three variables for each corporate governance measure in our regression, the level of the corporate governance variable in t-2, and two variables that capture the nature of the change in the measure from t-2 to t-1 as follows: we define the variable *P_D_Measure* as the value of the positive change in each corporate governance measure (and 0 otherwise), and *N_D_Measure* as the value of the negative change in each

[9] Note that we treat governance attributes that relate positively (negatively) to crashes by assigning governance differences in values from the 25th (75th) percentile to 75th (25th) percentile. For indicator governance attributes we assign governance differences in value from zero (one) to one (zero).
[10] Note that we use this treatment only for continuous corporate governance variables.

corporate governance measure (and 0 otherwise). To ease interpretation, we take the absolute value of *N_D_Measure* so that a positive coefficient signifies a negative relationship between decreases in corporate governance and crashes. The Appendix provides more details about the definitions of these variables.

The results are shown in Table 4. In terms of ownership structure, an increase in block ownership leads to significant reductions to stock price crashes, whereas decreases have no material effect. Similar to Shivdasani (1993) and Cornett et al. (2008), this finding is consistent with the view that blockholders increasing their position in firms also increases the level of scrutiny. With regard to institutional ownership the results indicate that largely prior year's levels, rather than changes, drive the relation with crashes, a finding consistent with Callen and Fang (2013). Finally, there is also weak evidence that increases in director stock ownership is positively related to crashes.

In regards to accounting opacity, the results show that the relation between opacity in financial reports and crashes is not symmetric, as suggested by the analysis of Hutton et al. (2009). In particular, increases in opacity of financial reports lead to a significant increase in crashes, whilst decreases in opacity do not have a material effect. Interestingly, neither the level of opacity in financial reports at t-2 relates to crashes. This finding indicates that deterioration in opacity of financial reports, rather than past levels, is better capturing managerial proclivity to hide information from the market. Finally, there is some weak evidence that reductions in the amount of independent directors on the audit committee lead to increases in stock price crashes. Consistent with Klein (2002), this finding suggests that a reduction in audit committee independence reduce the reliability of financial information.

In terms of board structure and processes, we observe that increases in the board's independence also leads to significant reductions to stock price crashes, whereas decreases have no material effect. This finding, consistent with Fama and Jensen (1983) and Agrawal and Chadha (2005), indicate that increases in outside directors serving the board could protect shareholders from self-serving managerial behaviour.

Finally the analysis in this section highlights that increases in CEO bonus in year t-1 are positively related to crashes in period t, suggesting that when a CEO receives an increase in performance-related pay he is likely to engage in short-run price maximization, which however ultimately leads to stock price crashes. This finding corroborates the views of Healy (1985) and Bergstresser and Phillippon (2006) that performance-related pay may result in suboptimal behavior.

Overall the analysis in this section highlights that the effect of corporate governance on stock price crashes is in many cases asymmetric. Accordingly, investors should consider these asymmetries when forecasting crashes.

[Insert Table 4]

4.3 When does corporate governance really matter?

Agency theory suggests that corporate governance helps to alleviate opportunistic behavior by managers because it bridges the information asymmetry gap between shareholders and managers [Jensen and Meckling, (1976)]. It follows that the demand for better governance is likely to depend on the severity of the information asymmetry problems, which vary across firms. We test this hypothesis using two proxies that capture information asymmetry problems between shareholders and managers: (i) industry competition and (ii) the volatility of stock returns.

Giroud and Mueller (2010) explain that the effect of corporate governance on agency problems depends on the competitiveness of the industry. When competition is high managerial slack is punished by the market, therefore the importance of corporate governance as a monitoring mechanism is reduced. We measure industry competition using the Herfindahl-Hirschman Index (HHI). The HHI is computed as the sum of squared market shares as follow:

$$HHI_{j,t} = \sum_{i=1}^{N_j} S_{i,j,t}^2$$

where $S_{i,j,t}$ is the market share of firm i in industry j in year t. Market share is calculated using firm sales. We estimate industry competition for each of the Fama and French 48 industry classifications. High values of HHI indicate weaker industry competition.

Our second test examines whether the uncertainty that surrounds the firms' operations plays a role. Since corporate governance helps bridge the information gap between shareholders and managers, it will be more important in environments of high uncertainty where this asymmetry is likely to be more pronounced [Dey, (2008)]. We measure uncertainty using the standard deviation of daily stock returns [Zhang (2006), Baker and Wurgler, (2006)].

We break our sample in two groups based on the magnitude of the two variables at year t-1 (high or low cutting at the median), and we re-run the baseline analysis analysis from Table 3 for the two subsamples separately. This approach reveals the impact of corporate governance on crashes in these different regimes.

[Insert Table 5]

The results are shown in Table 5. The first and second columns show the effects of industry competition. As expected, the effects of corporate governance on future crashes are stronger in industries with *low* competition. Specifically, consistent with our previous findings, in less competitive industries future crashes are positively related to the institutional ownership, the percentage of directors that hold stock in the firm and the opacity of financial reports. Interestingly, consistent with Kim et al. (2011a) there is also a positive relation between CEO option incentives ratio and future crashes. The results also show a negative relation between future crashes and auditor industry expertise. Within more competitive industries, future crashes are positively (negatively) related to institutional ownership and the presence of formal governance policy. There is also a weaker negative relation between future crashes and insider ownership and bonuses. In summary, consistent with Giroud and Mueller (2010), the effects of governance on future crashes are more important in less competitive industries.

The third and fourth column of Table 5 shows the effect of firm uncertainty. Again as expected we find that the effects of governance on future crashes are only significant in the *high* uncertainty environments. In particular, consistent with our previous findings, future crashes are positively related to institutional ownership, the percentage of directors that hold stock in the firm, and opacity of financial reports. Future crashes are also negatively related to the number of blockholders, insider ownership, audit independence, auditor industry expertise and the presence of formal government policy. None of these relationships is significant among low firms with low uncertainty. Overall, the results indicate that the effects

of the governance variables on future crashes are solely concentrated in firms with higher uncertainty. [11]

5. Additional analyses

To assess the robustness of our results, in this section, we carry out several robustness checks that consider deriving the overall effect from annual regressions, alternative measures of stock price crashes, and additional sensitivity analysis. All the results reported in this section are based on our baseline analysis of Table 3, but our main findings are qualitatively similar when re-running the analysis of Table 4 (available upon request).

5.1 Overall effects from annual regressions

We test whether the relationship between governance and stock price crashes is robust when derived from annual regressions. Particularly, using the methodology in Aboody and Lev (1998), and Clarkson et al. (2004), we re-estimate the baseline model annually, aggregate the annual coefficients into an overall effect and then test whether this overall effect is significantly different from zero.

[Insert Table 6]

Table 6 reports the results. The overall effect for each variable is the same as that derived in the baseline model, whereby stock price crashes increase with institutional ownership, director stock ownership, and opacity of financial reports and decrease with insider ownership, audit independence, auditor industry expertise and the presence of formal governance policy. The two test statistics for the overall effect (Z_1 and Z_2) show that these

[11] We obtain similar results when we use analyst forecast dispersion as a proxy for information uncertainty. In addition, we obtain similar findings when we conduct the analysis in Table 4 conditional on industry competitiveness and information uncertainty. These results are available from the authors upon request.

relationships are highly significant. Overall the relationships we show in Table 3 are robust to this alternative methodology.

5.2 Alternative measures of stock price crashes

In this section we estimate our baseline model using two alternative measures of crashes. The first is an indicator variable ($CRASH_{j,t}$) that equals one when a firm experiences at least one crash week during the fiscal year *t*, and zero otherwise [Hutton et al. (2009)]. A crash week is when a firm experiences firm-specific weekly returns 3.09 standard deviations (3.09 is chosen to generate a frequency of 0.1% in the normal distribution) below the mean firm-specific weekly returns for the entire fiscal year. The second is the down-to-up volatility measured in year t $(DUVOL_{j,t})$ used by Chen et al. (2001).

[Insert Table 7]

The results are shown in Table 7. Our inferences remain qualitatively similar when we use these alternative measures of crashes. In addition, our results are robust to crash risk measure estimates using firm-specific weekly returns that arise from the Fama and French (1993) three-factor model. The estimation of firm-specific weekly returns is analogous to that of the index model. These results are available from the authors upon request.

6. Conclusion

In this study, we investigate whether corporate governance can predict future firm specific stock price crashes. Since governance mitigates managerial opportunistic behaviour geared toward short-run price maximization, such as earnings management or overinvestment, we

hypothesize that there will be a significant relationship between governance and future crashes.

In our analysis we take a broad view of governance, studying how its different facets predict stock price crashes. Specifically, we use variables that capture the ownership structure of the company, its accounting opacity, its board structure processes, and CEO incentives and power. In our analyses we find that a number of variables are important: future crashes increase with institutional ownership, the percentage of directors that hold shares and opacity in financial reports, and decrease with audit expertise, audit independence and the existence of a formal governance governance policy in the companies' mandate. In additional analysis we find that these effects are asymmetric, and that they are stronger in less competitive industries and in companies with higher uncertainty (where governance as a monitoring mechanism is more important).

Overall our analysis shows that corporate governance systems have a significant impact on the propensity of the firm to experience a stock price crash. Our results can be used by investors to screen firms reducing the likelihood of experiencing stock price crashes.

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Table 1
Descriptive statistics

This table reports descriptive statistics for the dependent variables, explanatory variables and control variables. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix.

Variables	Mean	Median	Standard Deviation	25th Percentile	75th Percentile
Dependent Variables					
$NCSKEW_t$	0.115	0.060	0.805	-0.348	0.499
$EXTR_SIGMA_t$	2.674	2.505	0.768	2.122	3.069
Ownership Structure					
$BLOCK_{t-1}$	2.524	2.000	1.541	1.000	4.000
$\%INST_{t-1}$	0.796	0.816	0.174	0.687	0.921
$\%INSIDER_{t-1}$	0.112	0.054	0.136	0.025	0.138
$\%BRD_STOCK_{t-1}$	0.859	0.917	0.191	0.778	1.000
Accounting Opacity					
$OPAQUE_{t-1}$	0.298	0.209	0.256	0.121	0.379
$\%AUD_IND_{t-1}$	0.935	1.000	0.137	1.000	1.000
AUD_EXPERT_{t-1}	0.240	0.000	0.427	0.000	0.000
Board Structure and Processes					
$\%BRD_IND_{t-1}$	0.720	0.750	0.146	0.625	0.833
BRD_COMP_{t-1}	0.535	0.533	0.267	0.333	0.750
$GPOL_{t-1}$	0.686	1.000	0.464	0.000	1.000
CEO Incentives and Power					
INC_OPT_{t-1}	0.179	0.143	0.145	0.068	0.257
INC_STC_{t-1}	0.155	0.067	0.204	0.025	0.186
$BONUS_{t-1}$	0.666	0.389	0.781	0.000	1.110
$DUALITY_{t-1}$	0.586	1.000	0.493	0.000	1.000
Control Variables					
$DTURN_{t-1}$	3.313	2.415	15.146	-3.939	10.578
$RETURN_{t-1}$	-0.111	-0.077	0.098	-0.142	-0.044
STD_{t-1}	0.044	0.040	0.019	0.030	0.054
$SIZE_{t-1}$	7.445	7.316	1.419	6.369	8.388
MB_{t-1}	2.924	2.330	1.953	1.583	3.657
LEV_{t-1}	0.495	0.504	0.197	0.349	0.631
ROE_{t-1}	0.096	0.113	0.177	0.045	0.182
$NCSKEW_{t-1}$	0.123	0.077	0.678	-0.321	0.513
$NCSKEW_{t-2}$	0.133	0.085	0.687	-0.313	0.513
$NCSKEW_{t-3}$	0.143	0.091	0.670	-0.295	0.516

Table 2

Pearson (Spearman) correlations above (below) the diagonal among crashes and corporate governance variables

This table reports Pearson/Spearman correlations among crashes, corporate governance and control variables. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent Variables																
1.NCSKEW$_t$	1.00	0.84***	0.01	0.05***	0.01	0.01	0.04***	-0.02	-0.03***	0.00	-0.01	-0.05***	0.03**	-0.01	-0.01	-0.02
2.EXTR_SIGMA$_t$	0.79***	1.00	0.02	0.04***	0.00	0.00	0.05***	-0.01	-0.03***	0.00	0.00	-0.03***	0.02*	-0.01	-0.02	-0.03**
Ownership Structure																
3.BLOCK$_{t-1}$	0.00	0.02	1.00	0.55***	-0.04***	-0.04***	0.05***	0.06***	-0.04***	0.11***	-0.14***	0.05***	-0.13***	-0.13***	-0.19***	-0.07***
4.%INST$_{t-1}$	0.04***	0.04***	0.55***	1.00	-0.27***	-0.02*	0.06***	0.08***	-0.01	0.21***	-0.07***	0.20***	0.11***	-0.13***	-0.07***	-0.02
5.%INSIDER$_{t-1}$	0.01	0.02	0.04***	-0.20***	1.00	-0.09***	-0.01	-0.05***	-0.04***	-0.33***	-0.10***	-0.30***	-0.12***	0.30***	-0.06***	-0.04***
6.%BRD_STOCK$_{t-1}$	0.02	0.01	-0.04***	-0.02*	-0.16***	1.00	-0.09***	0.02	0.07***	0.11***	0.07***	0.15***	-0.01	-0.05***	0.04***	0.09***
Accounting Opacity																
7.OPAQUE$_{t-1}$	0.03***	0.05***	0.05***	0.06***	0.01	-0.12***	1.00	-0.02	-0.08***	-0.01	-0.09***	-0.03***	0.04***	0.03***	-0.08***	-0.06***
8.%AUD_IND$_{t-1}$	-0.02	0.00	0.06***	0.07***	-0.06***	0.03**	-0.01	1.00	-0.01	0.52***	0.00	0.04***	0.00	-0.05***	-0.03**	0.02
9.AUD_EXPERT$_{t-1}$	-0.03***	-0.03***	-0.04***	-0.02	-0.09***	0.05***	-0.11***	-0.01	1.00	0.06***	0.07***	0.08***	0.05***	-0.02*	0.05***	0.03**
Board Structure and Processes																
10.%BRD_IND$_{t-1}$	-0.01	0.01	0.09***	0.18***	-0.39***	0.15***	-0.02*	0.44***	0.07***	1.00	0.12***	0.20***	0.10***	-0.17***	-0.02**	0.12***
11.BRD_COMP$_{t-1}$	-0.01	0.00	-0.14***	-0.09***	-0.15***	0.07***	-0.09***	0.01	0.06***	0.12***	1.00	0.11***	0.14***	-0.09***	0.27***	0.12***
12.GPOL$_{t-1}$	-0.05***	-0.03**	0.04***	0.19***	-0.34***	0.16***	-0.06***	0.03**	0.08***	0.19***	0.10***	1.00	0.12***	-0.08***	0.06***	0.03**
CEO Incentives and Power																
13.INC_OPT$_{t-1}$	0.03***	0.03***	-0.12***	0.12***	-0.14***	-0.01	0.02*	0.01	0.06***	0.12***	0.17***	0.12***	1.00	0.18***	-0.10***	0.10***
14.INC_STC$_{t-1}$	0.00	-0.01	-0.11***	-0.03**	0.16***	0.04***	0.01	-0.03**	0.00	-0.08***	-0.08***	0.01	0.2***	1.00	-0.14***	0.17***
15.BONUS$_{t-1}$	-0.01	-0.02	-0.18***	-0.09***	-0.05***	0.02	-0.07***	-0.02*	0.05***	-0.04***	0.30***	0.01	-0.09***	-0.18***	1.00	0.12***
16.DUALITY$_{t-1}$	-0.01	-0.02*	-0.07***	-0.03***	-0.09***	0.11***	-0.07***	0.02*	0.03***	0.14***	0.12***	0.03**	0.10***	0.19***	0.10***	1.00

Table 3
Corporate governance and crashes

This table reports ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. t-statistic is in parenthesis below the coefficient. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

Variables	Predicted Sign	NCSKEW	EXTR_SIGMA
Ownership Structure			
$BLOCK_{t-1}$	?	-0.011	-0.012
		(-1.24)	(-1.47)
$\%INST_{t-1}$	?	0.323***	0.259***
		(4.17)	(3.44)
$\%INSIDER_{t-1}$	-	-0.104	-0.143*
		(-1.20)	(-1.66)
$\%BRD_STOCK_{t-1}$	+	0.096*	0.130**
		(1.87)	(2.55)
Accounting Opacity			
$OPAQUE_{t-1}$	+	0.122**	0.099**
		(2.45)	(2.10)
$\%AUD_IND_{t-1}$	-	-0.172**	-0.111
		(-2.02)	(-1.32)
AUD_EXPERT_{t-1}	-	-0.056**	-0.047*
		(-2.23)	(-1.95)
Board Structure and Processes			
$\%BRD_IND_{t-1}$	-	0.053	0.046
		(0.57)	(0.52)
BRD_COMP_{t-1}	-	0.015	0.029
		(0.32)	(0.63)
$GPOL_{t-1}$	-	-0.053*	-0.052*
		(-1.84)	(-1.90)
CEO Incentives and Power			
INC_OPT_{t-1}	+	0.069	0.058
		(0.82)	(0.71)
INC_STC_{t-1}	-	-0.039	-0.010
		(-0.73)	(-0.21)
$BONUS_{t-1}$	+	-0.010	-0.011
		(-0.65)	(-0.72)
$DUALITY_{t-1}$	+	-0.018	-0.022
		(-0.83)	(-1.07)
Control Variables			
$DTURN_{t-1}$	+	0.001	0.001
		(1.20)	(1.55)
$RETURN_{t-1}$	+	0.949*	0.315
		(1.79)	(0.61)
STD_{t-1}	+	5.631*	1.644
		(1.92)	(0.57)
$SIZE_{t-1}$	-	-0.005	-0.025**
		(-0.44)	(-2.36)
MB_{t-1}	+	0.004	-0.001
		(0.54)	(-0.21)
LEV_{t-1}	-	-0.183***	-0.074
		(-2.60)	(-1.17)
ROE_{t-1}	-	0.143**	0.125*
		(2.01)	(1.94)
$DEPENDENT_{t-1}$	?	-0.002	0.007
		(-0.11)	(0.56)
$DEPENDENT_{t-2}$	?	0.020	0.028**
		(1.31)	(2.08)
$DEPENDENT_{t-3}$	?	0.008	0.016
		(0.51)	(1.25)
Intercept		Yes	Yes
Year fixed effects		Yes	Yes
Industry fixed effects		Yes	Yes
Adj. R^2		0.021	0.023

Table 4
Asymmetric relations between corporate governance and crashes

This table reports ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level. The sample consists of 1306 firms with 5024 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

Variables	Predicted Sign	NCSKEW	EXTR_SIGMA
Ownership Structure			
$BLOCK_{t-2}$	?	-0.018	-0.014
$P_D_BLOCK_{t-1}$	?	-0.029*	-0.024*
$N_D_BLOCK_{t-1}$	?	0.017	0.015
$\%INST_{t-2}$	?	0.305***	0.230**
$P_D_\%INST_{t-1}$	?	0.321*	0.127
$N_D_\%INST_{t-1}$	?	0.139	0.040
$\%INSIDER_{t-2}$	-	-0.051	-0.128
$P_D_\%INSIDER_{t-1}$	-	0.436	0.285
$N_D_\%INSIDER_{t-1}$	+	0.154	0.200
$\%BRD_STOCK_{t-2}$	+	0.083	0.104
$P_D_\%BRD_STOCK_{t-1}$	+	0.201*	0.152
$N_D_\%BRD_STOCK_{t-1}$	-	-0.106	-0.087
Accounting Opacity			
$OPAQUE_{t-2}$	+	0.036	-0.001
$P_D_OPAQUE_{t-1}$	+	0.077***	0.095***
$N_D_OPAQUE_{t-1}$	-	-0.014	-0.006
$\%AUD_IND_{t-2}$	-	-0.025	-0.026
$P_D_\%AUD_IND_{t-1}$	-	0.159	0.095
$N_D_\%AUD_IND_{t-1}$	+	0.385*	0.277
AUD_EXPERT_{t-1}	-	-0.048*	-0.044
Board Structure and Processes			
$\%BRD_IND_{t-2}$	-	-0.005	-0.002
$P_D_\%BRD_IND_{t-1}$	-	-0.387*	-0.444**
$N_D_\%BRD_IND_{t-1}$	+	-0.259	-0.350
BRD_COMP_{t-2}	-	-0.019	0.025
$P_D_BRD_COMP_{t-1}$	-	-0.007	-0.032
$N_D_BRD_COMP_{t-1}$	+	0.076	0.062
$GPOL_{t-1}$	-	-0.058*	-0.046
CEO Incentives and Power			
INC_OPT_{t-2}	+	0.031	0.021
$P_D_INC_OPT_{t-1}$	+	-0.037	0.068
$N_D_INC_OPT_{t-1}$	-	-0.073	-0.116
INC_STC_{t-2}	-	-0.105	-0.021
$P_D_INC_STC_{t-1}$	-	-0.138	-0.212
$N_D_INC_STC_{t-1}$	+	-0.066	-0.060
$BONUS_{t-2}$	+	-0.003	-0.002
$P_D_BONUS_{t-1}$	+	0.000**	0.000***
$N_D_BONUS_{t-1}$	-	0.002	0.002
$DUALITY_{t-1}$	+	-0.031	-0.038
Intercept		Yes	Yes
Control Variables		Yes	Yes
Year fixed effects		Yes	Yes
Industry fixed effects		Yes	Yes
Adj. R^2		0.014	0.019

Table 5
Corporate governance and crashes: the effect of industry competition and firm uncertainty

This table reports ordinary least squares coefficient estimates of yearly regressions with standard errors adjusted for clustering at the firm level. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. The top value in each cell refers to NCSKEW and the bottom value to EXTR_SIGMA. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

Variables	Predicted Sign	Industry Competition		Return Volatility	
		High	Low	High	Low
Degree of Information Asymmetry		**Low**	**High**	**High**	**Low**
Ownership Structure					
$BLOCK_{t-1}$	?	-0.005	-0.016	-0.024*	-0.006
		-0.012	-0.011	-0.024**	-0.008
$\%INST_{t-1}$	?	0.256**	0.390***	0.400***	0.119
		0.245**	0.270***	0.308***	0.101
$\%INSIDER_{t-1}$	-	-0.231*	0.021	-0.312**	0.020
		-0.210*	-0.101	-0.349**	-0.024
$\%BRD_STOCK_{t-1}$	+	0.053	0.154**	0.162**	0.060
		0.100	0.161**	0.191***	0.095
Accounting Opacity					
$OPAQUE_{t-1}$	+	0.072	0.227***	0.138**	0.029
		0.061	0.205**	0.133**	0.021
$\%AUD_IND_{t-1}$	-	-0.174	-0.166	-0.366***	-0.027
		-0.067	-0.179	-0.304**	0.050
AUD_EXPERT_{t-1}	-	-0.030	-0.078**	-0.091**	-0.011
		-0.026	-0.067**	-0.109***	0.017
Board Structure and					
$\%BRD_IND_{t-1}$	-	0.067	0.024	0.078	0.023
		0.080	0.023	0.079	-0.012
BRD_COMP_{t-1}	-	0.071	-0.056	0.008	-0.004
		0.014	0.045	0.038	-0.020
$GPOL_{t-1}$	-	-0.073*	-0.017	-0.091**	0.014
		-0.084**	0.001	-0.087**	0.006
CEO Incentives and Power					
INC_OPT_{t-1}	+	-0.086	0.270**	0.207	-0.051
		-0.119	0.294***	0.168	-0.044
INC_STC_{t-1}	-	-0.032	-0.051	-0.034	-0.078
		-0.006	-0.015	0.003	-0.053
$BONUS_{t-1}$	+	-0.033	0.017	0.014	-0.032
		-0.049**	0.033	0.022	-0.037*
$DUALITY_{t-1}$	+	-0.018	-0.024	-0.018	-0.030
		-0.021	-0.032	-0.029	-0.017
Intercept		Yes	Yes	Yes	Yes
Control Variables		Yes	Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes	Yes
Industry fixed effects		Yes	Yes	Yes	Yes
No of obs.		3309	3311	3029	3028
		3309	3311	3029	3028
Adj. R^2		0.022	0.020	0.038	0.003
		0.021	0.029	0.042	0.009

Table 6
Overall effects of annual regressions

This table reports ordinary least squares coefficient estimates of yearly regressions with standard errors adjusted for clustering at the firm level. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. The top value in each cell refers to NCSKEW and the bottom value to EXTR_SIGMA. The Z1 and Z2 tests examine the overall effect of each variable.

$$Z1 = (1/\sqrt{T})\sum_{j=1}^{T}(t_j/\sqrt{k_j/(k_j-2)}), \quad Z2 = \text{average t - statistic / (standard deviation of t - statistic / } \sqrt{T-1}$$

where, t_j is the t-statistic for year j, k_j is the degrees of freedom, and T is the number of years. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

Variables	Predicted Sign	2002	2003	2004	2005	2006	2007	2008	2009	Average	Z1	Z2
Ownership Structure												
$BLOCK_{t-1}$	?	0.044	-0.024	-0.01	-0.026	-0.018	-0.012	0.015	-0.035	-0.008	-0.982	-1.106
		0.038	-0.033	-0.028	-0.02	-0.018	-0.002	0.021	-0.040*	-0.010	-1.330	-1.184
$\%INST_{t-1}$	?	0.549*	0.428	0.007	0.364*	0.439**	0.138	0.276	0.566**	0.346	3.955***	6.040***
		0.441	0.124	0.284	0.31	0.375*	0.032	0.054	0.435*	0.257	3.231***	5.574***
$\%INSIDER_{t-1}$	-	-0.275	-0.123	-0.142	0.209	-0.122	-0.302	-0.306	-0.121	-0.148	-1.675*	-3.525***
		-0.263	-0.311	-0.223	0.054	-0.021	-0.254	-0.343	-0.516**	-0.235	-2.510**	-4.884***
$\%BRD_STOCK_{t-1}$	+	0.139	0.342*	0.058	0.168*	-0.148	0.102	0.227	0.054	0.118	1.807*	2.622**
		0.291	0.185	0.144	0.223*	0.047	-0.025	0.245	0.113	0.153	2.649**	6.286***
Accounting Opacity												
$OPAQUE_{t-1}$	+	0.195	-0.047	0.08	0.301	-0.117	0.028	0.124	0.162	0.091	1.396	2.373**
		0.233	-0.158	0.008	0.299*	0.035	0.021	0.065	0.114	0.077	1.295	2.098**
$\%AUD_IND_{t-1}$	-	0.218	-0.224	-0.101	-0.18	-0.305	0.104	-0.274	-0.658**	-0.178	-1.908*	-2.047**
		0.122	-0.299	-0.151	-0.046	-0.171	0.09	-0.116	-0.409	-0.123	-1.396	-2.833***
AUD_EXPERT_{t-1}	-	-0.133	-0.002	-0.107	-0.059	-0.073	-0.007	0.017	-0.042	-0.051	-1.873*	-3.797***
		-0.014	0.026	-0.099	-0.051	-0.062	-0.045	-0.035	-0.046	-0.041	-1.716*	-5.491***
Board Structure and Processes												
$\%BRD_IND_{t-1}$	-	0.058	0.321	-0.011	0.127	0.072	-0.328	-0.196	0.354	0.050	0.505	0.711
		0.297	0.429*	0.101	0.052	0.037	-0.298	-0.373	0.194	0.055	0.672	0.606
BRD_COMP_{t-1}	-	-0.112	0.019	-0.022	-0.116	0.036	0.333*	-0.098	0.055	0.012	0.122	0.112
		-0.039	0.137	-0.073	-0.063	-0.033	0.249*	0.033	0.144	0.044	0.808	0.941
$GPOL_{t-1}$	-	0.048	-0.103	-0.017	-0.033	-0.093	0.028	-0.052	-0.155	-0.047	-1.574	-2.812***
		0.074	-0.11	-0.034	-0.043	-0.016	0.001	-0.077	-0.122	-0.041	-1.521	-3.189***
CEO Incentives and Power												
INC_OPT_{t-1}	+	0.237	0.291	0.068	0.099	0.1	-0.277	0.297	-0.073	0.093	0.881	1.194
		0.318	0.244	-0.084	0.027	0.128	-0.320*	0.32	0.156	0.099	0.877	0.875
INC_STC_{t-1}	-	0.334*	0.162	-0.043	-0.243*	-0.166	-0.013	-0.061	0.042	0.001	-0.223	-0.176
		0.462**	0.212	0.138	-0.253*	-0.027	-0.085	-0.062	0.121	0.063	0.870	0.473
$BONUS_{t-1}$	+	-0.076	0.006	-0.049	-0.081*	0.013	-0.039	0.071	0.008	-0.018	-1.093	-0.811

		-0.078	0.003	-0.023	-0.071*	-0.005	-0.024	0.090*	0.024	-0.010	-0.655	-0.508
$DUALITY_{t-1}$	+	0.061	0.002	-0.022	-0.104*	-0.113*	0.037	0.113*	-0.018	-0.005	-0.331	-0.211
		-0.025	-0.008	-0.029	-0.058	-0.121**	0.035	0.111*	-0.072	-0.021	-1.003	-0.686
Intercept		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Control Variables		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Industry fixed effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			

Table 7
Corporate governance and crashes: Alternative measures of crashes

This table reports ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level. The sample consists of 1451 firms with 6620 firm-year observations during the period 2002-2009. All the variables are defined in the appendix. t-statistic is in parenthesis below the coefficient. ***, ** and *, indicate significance (two-tailed) at the 0.01, 0.05 and 0.10 level or better, respectively.

Variables	Predicted Sign	CRASH	DUVOL
Ownership Structure			
$BLOCK_{t-1}$	?	-0.064**	-0.006
		(-2.52)	(-1.59)
$\%INST_{t-1}$	?	0.762***	0.157***
		(3.15)	(4.47)
$\%INSIDER_{t-1}$	-	-0.233	-0.059
		(-0.77)	(-1.48)
$\%BRD_STOCK_{t-1}$	+	0.433***	0.048**
		(2.63)	(2.07)
Accounting Opacity			
$OPAQUE_{t-1}$	+	0.397***	0.054**
		(2.77)	(2.45)
$\%AUD_IND_{t-1}$	-	-0.234	-0.089**
		(-0.90)	(-2.61)
AUD_EXPERT_{t-1}	-	-0.181**	-0.029***
		(-2.26)	(-2.61)
Board Structure and Processes			
$\%BRD_IND_{t-1}$	-	0.127	0.042
		(0.45)	(1.02)
BRD_COMP_{t-1}	-	-0.045	0.007
		(-0.34)	(0.34)
$GPOL_{t-1}$	-	-0.103	-0.021*
		(-1.25)	(-1.68)
CEO Incentives and Power			
INC_OPT_{t-1}	+	0.136	0.032
		(0.53)	(0.82)
INC_STC_{t-1}	-	0.098	-0.011
		(0.59)	(-0.45)
$BONUS_{t-1}$	+	-0.065	0.000
		(-1.32)	(0.07)
$DUALITY_{t-1}$	+	-0.077	-0.008
		(-1.20)	(-0.78)
Intercept		Yes	Yes
Control Variables		Yes	Yes
Year fixed effects		Yes	Yes
Industry fixed effects		Yes	Yes
QIC/Adj R^2		7296.68	0.026

Appendix: Definition of Variables

Variables	Definitions
Dependent Variables:	
NCSKEW	Negative of the third moment of firm-specific weekly returns for each firm and year divided by the standard deviation of firm-specific weekly returns raised to the third power
EXTR_SIGMA	Negative of the worst deviation of firm-specific weekly returns from the average firm-specific weekly return divided by the standard deviation of firm-specific weekly returns
CRASH	An indicator variable that equals one when a firm experiences at least one crash week during the fiscal year, and zero otherwise
DUVOL	Log of the ratio of the standard deviation of the "down weeks" over the standard deviation of the "up weeks"
Ownership Structure:	
BLOCK	Number of outside blockholders that owned at least 5% of a firm
P_D_BLOCK	The positive change in BLOCK and zero otherwise
N_D_BLOCK	The absolute of negative or zero change in BLOCK and zero otherwise
%INST	Percentage of shares held by institutional investors
P_D_%INST	The positive change in %INST and zero otherwise
N_D_%INST	The absolute of negative or zero change in %INST and zero otherwise
%INSIDER	Percentage of shares held by officers or directors
P_D_%INSIDER	The positive change in %INSIDER and zero otherwise
N_D_%INSIDER	The absolute of negative or zero change in %INSIDER and zero otherwise
%BRD_STOCK	Percentage of directors hold stock in the firm
P_D_%BRD_STOCK	The positive change in %BRD_STOCK and zero otherwise

N_D_%BRD_STOCK	The absolute of negative or zero change in %BRD_STOCK and zero otherwise

Accounting Opacity:

OPAQUE	Three-year moving sum of the absolute discretionary accruals estimated from a modified Jones (1991) model
P_D_ OPAQUE	The positive change in OPAQUE and zero otherwise
N_D_ OPAQUE	The absolute of negative or zero change in OPAQUE and zero otherwise
%AUD_IND	Percentage of outside independent directors in the audit committee
P_D_%AUD_IND	The positive change in %AUD_IND and zero otherwise
N_D_%AUD_IND	The absolute of negative or zero change in %AUD_IND and zero otherwise
AUD_EXPERT	Dummy variable that equals one when the audit firm of a particular firm has more than one third of market share of total sales within an industry, and zero otherwise

Board Structure and Processes:

%BRD_IND	Percentage of outside directors serving the board
P_D_%BRD_IND	The positive change in %BRD_IND and zero otherwise
N_D_%BRD_IND	The absolute of negative or zero change in %BRD_IND and zero otherwise
BRD_COMP	Percentage of directors that also serve on boards of other firms
P_D_ BRD_COMP	The positive change in BRD_COMP and zero otherwise
N_D_ BRD_COMP	The absolute of negative or zero change in BRD_COMP and zero otherwise
GPOL	Dummy variable that equals one if corporate governance policy exists, and zero otherwise

CEO Incentives and Power:

INC_OPT	Option holdings incentives ratio estimated as in Bergstresser and Philippon (2006)

P_D_INC_OPT	The positive change in INC_OPT and zero otherwise
N_D_INC_OPT	The absolute of negative or zero change in INC_OPT and zero otherwise
INC_STC	Stock holdings incentives ratio estimated as in Bergstresser and Philippon (2006)
P_D_INC_STC	The positive change in INC_STC and zero otherwise
N_D_INC_STC	The absolute of negative or zero change in INC_STC and zero otherwise
BONUS	CEOs bonus scaled by salary
P_D_BONUS	The positive change in BONUS and zero otherwise
N_D_BONUS	The absolute of negative or zero change in BONUS and zero otherwise
DUALITY	Dummy variable that equals one when the positions of the CEO and the chairman of the board are held by the same person, and zero otherwise

Control Variables:

DTURN	Detrended average weekly stock trading volume
RETURN	Past average firm-specific weekly returns
STD	Past volatility of firm-specific weekly returns
SIZE	Natural logarithm of market value of equity
MB	Market value of equity to book value of equity
LEV	Total liabilities to total assets
ROE	Income before extraordinary items to equity