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Abstract

We investigate whether ownership structure, accounting opacity, board structure & processes and managerial incentives attributes relate to future stock price crash risk. Principal component analysis on the 21 attributes that comprise these four corporate governance dimensions reveals that they can explain between 13.1% and 23.0% of a one standard deviation in crash risk. Transient institutional ownership, CEO stock option incentives and the proportion of directors that hold equity increase crashes, whilst insiders' ownership, accounting conservatism, board size and the presence of a corporate governance policy mitigate crash risk. Overall these relations are more pronounced in environments that accentuate agency risk.

Keywords: Crash risk, corporate governance, agency risk, information environment.

JEL: G38, G34, M48.

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1. Introduction

The great breadth and depth of corporate governance literature, as shaped by a growing empirical and theoretical research in the past few decades, is indicative of the significant role that corporate governance systems play in protecting shareholders' welfare. This study investigates which corporate governance attributes, amongst the many that firms employ, are the most prominent ones in explaining the link between governance and future stock price crashes.

Stock price crashes are likely to occur among firms with high agency risk [Callen and Fang (2013); Kim and Zhang (2015)]. Managers, in such firms, due to career concerns and incentives arising from compensation contracts, may exploit information asymmetries to conceal negative information and engage in short-sighted price maximisation to better serve their own interests [Stein (1989)]; either through earnings management [Kothari et al. (2009)] or suboptimal investment decisions that cater to prevail market sentiment [Bebchuk and Stole (1993)]. However, withholding, delaying or accumulating the disclosure of bad news is unsustainable for long periods and will eventually lead to significant stock price crashes when the true fundamentals unexpectedly reveal an enormous amount of negative information in the market [Bleck and Liu (2007); Callen and Fang (2013); Kim and Zhang (2015)].

A large body of literature finds that corporate governance systems can alleviate agency risk, curbing such opportunistic managerial behaviour that could be harmful to shareholders [Xie et al. (2003); Klein (2002); Karamanou and Vafeas (2005); Masulis et al. (2007)]. Prior research on the effect of corporate governance on various organizational outcomes typically focuses on individual governance mechanisms or constructs one-dimensional governance metrics by summing up individual variables [Gompers et al. (2003)]. Similarly, the crash risk literature has only focused upon a single governance mechanism [Hutton et al. (2009); Kim et

al. (2011); Callen and Fang (2013); Kim et al. (2015)].[1] In contrast, we undertake a comprehensive investigation using a broad set of governance attributes which provides a more appealing and credible approach [Ashbaugh-Skaife et al. (2006); Bhagat et al. (2008); Bebchuk et al. (2009)] and enables us to measure the overall quality of a firm's governance system and ascertain which are the most relevant in limiting crash risk.

Drawing motivation from all these studies we examine which corporate governance attributes mitigate the 1-year-ahead firm-specific stock price crashes.[2] We jointly consider four central dimensions of governance mechanisms (i) *ownership structure,* (ii) *accounting opacity,* (iii) *board structure & processes,* and (iv) *managerial incentives,* which comprise a broad set of 21 attributes. Each of these corporate governance dimensions are designed to increase or enhance the monitoring of management's actions to promote effective decision-making, limit their opportunistic behavior and reduce the information asymmetry between the firm and its external stakeholders [Ashbaugh-Skaife et al. (2006)]. Although we motivate the use of each of the corporate governance attributes employed, we do not expect that all 21 would equally affect a firm's propensity to stock price crashes since some attributes might have little or no relevance to the phenomenon under scrutiny. Hence, in this study, we rely on various regression model specifications from principal component analysis (PCA) to a horse-race approach to identify which of these dimensions and attributes are responsible for explaining future firm-specific stock price crashes and under what circumstances.

Our regression approach is carefully implemented to tackle econometric problems previously identified in the corporate governance literature and which often cloud the interpretation of results, for example simultaneous causality and dynamic endogeneity issues [Bhagat and Bolton (2008); Cremers and Ferrell (2014); Callen and Fang (2013); Kim and

[1] Kim and Zhang (2014) also examine the relation between financial reporting opacity and ex ante (or perceived) crash risk, as reflected in the steepness of implied volatility smirks.

[2] We use the terms *firm-specific stock price crash* and *crash risk* interchangeably to refer to 1-year-ahead crash risk that results from sharp stock price declines.

Zhang (2015)] and the limiting interpretation of a single or composite corporate governance index [Ashbaugh-Skaife et al. (2006); Cremers and Ferrell (2014)].

Overall, our results are consistent with the notion that a firm's governance system can be setup to mitigate the occurrence of future stock price crashes. Specifically, the principal component analysis reveals that, depending on the regression estimation setting, the statistical significant factors that emerge from the governance attributes can explain overall between 13.1% and 23.0% of a one standard deviation of future crash risk. Thus, the effect of corporate governance on crash risk is not just statistically significant but also important in economic terms. Further detailed analysis, reveals that the governance attributes pertaining to both *ownership structure* and *accounting opacity* provide a first-order effect in mitigating the occurrence of future crash risk, and can explain on their own approximately 9.0% and 3.4% of a one standard deviation of future crash risk, respectively. Whilst the remaining dimensions, namely *board structure & processes* and *managerial incentives* add very little, if any, on their own, to the explanatory power of the model that links the governance factors to crash risk.

Analysis of the 21 governance attributes employed, reveal seven which appear to be the most prominent ones to explain the occurrence of future stock price crashes. Specifically we find that crash risk increases with transient institutional ownership, CEO stock option incentives and the proportion of outside directors that hold equity in the company. Furthermore, despite the widespread claim that directors' share-ownership aligns managerial and shareholders incentives, our results with respect to outside directors suggest that this incentive mechanism may not reduce crash risk, but rather increase it instead, consistent with Song and Windram (2004). We also find that crash risk decreases with insiders' ownership, the level of conditional accounting conservatism in the financial reports, board size and the presence of corporate governance policy in a firm's mandate. In this respect, firms with larger

boards and a clear defined corporate governance policy are also more likely to reduce the agency conflicts that induce crash risk.

Interestingly, unlike prior research, we do not find that the opacity of the financial reports increases stock crashes [Hutton et al. (2009)]. Further analysis reveals that this lack of a positive relationship is driven by the financial crisis, an economic downturn period in which managers had limited opportunities and fewer incentives to stockpile negative information through earning management practices [Jenkins et al. (2009); Ahmad-Zaluki et al. (2011); Chia et al. (2007); Filip and Raffournier (2014); Bertomeu and Magee (2011)], a precursor situation to stock price crashes.

Finally, we examine whether industry or firm characteristics, which are known to affect the effectiveness of corporate governance systems [Giroud and Mueller (2010)], moderate the aforementioned relations. We find that the impact of governance on future crash risk is stronger when the company: (i) operates in a low competition industry, (ii) operates in environments with high information asymmetry, and (iii) experiences higher earnings or cash-flow uncertainty. These findings bring additional evidence to the extant literature that sheds light on market conditions and firm-specific environment that fuel managerialism behaviour, which could foster suboptimal decision making that subsequently leads to stock price crashes.

Our study contributes to the literature that investigates the determinants of firm-specific stock price crashes. Chen et al. (2001) find that firms with high past returns and more volatile firms are more pronounced to crashes while Hong and Stein (2003) provide evidence that investor heterogeneity is positively associated with crashes. Our analysis shows that controlling for these effects, governance also strongly and economically meaningful relates to crash risk. In this respect, we contribute to the empirical research that investigates how corporate governance systems affect shareholders' welfare.

We also contribute to studies that look at specific governance attributes that may affect stock price crashes. For example, Hutton et al. (2009), Kim et al. (2011), Kim and Zhang (2015) and Callen and Fang (2013) find stock price crashes increase with opacity in financial reports, executive equity incentives, non-conservative accounting practices and transient institutional ownership, respectively. Our study extends this work by providing the first comprehensive comparison of a large array of corporate governance attributes that may mitigate (or increase) future crash risk. We are therefore able to identify which of these corporate governance attributes are the most powerful in explaining the occurrence (or not) of crash risk.

In addition, whilst we confirm a number of the prior findings with respect to institutional ownership and accounting conservatism, we also shed light on other salient governance attributes that affect crash risk, namely, director equity ownership, board size and presence of a clearly defined corporate policy. To our knowledge, this is the first study to report new firm-level evidence pertaining to the economic and welfare consequences of the abovementioned set of governance attributes in the realm of crash risk studies.

At the same time, our study bases its empirical inference on the period 2002-2013 which starts on the onset of the Sarbanes-Oxley Act and extends well beyond the recent financial crisis. This allows us to demonstrate that the breakdown of the positive relation between accounting opacity and crash risk, is driven by the years during and following the crisis, which reflects, in part, the increased demand for conservative earnings during this period. We therefore provide complementary evidence to prior studies that find that the business cycle or dramatic changes in the economic climate have an impact on the firm's propensity to manipulate earnings [Filip and Raffournier (2014); Bertomeu and Magee (2011); Jenkins et al. (2009)]. Our findings also show that accounting conservatism is resilient to the prevailing economic conditions since its impact on crash risk is strong

throughout the whole period of our investigation and is unaffected by the crisis period. These findings highlight the need for more conservative accounting practices, given its moderating effect on crash risk.

The study proceeds as follows: Section 2 describes the research design and the corporate governance attributes investigated, section 3 describes the data, section 4 discusses empirical results, section 5 presents additional analyses and section 6 concludes the study.

2. Research design

2.1. 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:

$$CRASH_t = \alpha_0 + \sum_{m=1}^{M} \alpha_m GOVERNANCE_{t-1} + \sum_{n=M+1}^{N} \alpha_n CONTROL_{t-1} + \varepsilon_t , \qquad (1)$$

GOVERNANCE includes up to 21 corporate governance attributes and *CONTROL* includes control variable according to prior crash risk literature.

To treat any simultaneous causality effects, the baseline model specification regresses corporate governance attributes on crash risk with a lag of one-period [see, for instance, Ashbaugh-Skaife et al. (2006); Bhagat and Bolton (2008); Callen and Fang (2013); Kim and Zhang (2015)]. We also include three lags of the dependent variable to allow current governance attributes to be influenced by realizations and/or shocks of past firm-specific stock price crashes taking into account any dynamic endogeneity that may exist in the panel of data. Estimating in this manner provides a dynamic OLS model of governance and crash risk.

All regression models include 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)]. All continuous variables are standardized to have a mean value of zero and variance of one to put all variables on a common scale.

Finally, by employing a broad set of corporate governance attributes and a large number of control variables, we handle endogeneity that could be the result of unobserved heterogeneity without the need to reside on fixed effect estimation. However, despite this we also include firm fixed effect specifications to control for the possibility that corporate governance and stock price crash risk are simultaneously determined by other exogenous variables. However, since there is great risk that the fixed effects estimators may not detect an effect of corporate governance attributes on crash risk, even if it exists [Zhou (2001); Wintoki et al. (2012)], we focus our inferences mostly on the results that emerge in the cross-sectional analysis and provide the firm fixed effects as a complimentary (robustness) analysis.

2.1.1. Measurement of firm-specific stock price crashes

We first estimate firm-specific weekly returns using the following expanded index model regression:

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

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. Since residuals from the expanded index model may be skewed, we define the firm-specific weekly return for firm *j* in week *t* as the natural logarithm of one plus the residual (i.e., $W_{j,t} = \ln[1+\varepsilon_{j,t}]$). Following Chen et al. (2001) and Hutton et al. (2009) we employ two primary measures of crashes, namely the negative conditional skewness (*NCSKEW*) and the down-to-up volatility (*DUVOL*). Larger values of *NCSKEW* and *DUVOL* signify greater crash risk. In particular, *NCSKEW* in year *t* for stock *j* is calculated as follows:

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

where *n* counts the number of days in a fiscal year. *DUVOL* in year *t* is calculated as follows:

$$DUVOL_{j,t} = \log[(n_u - 1)\sum_{down} W_{j,t}^2 / [(n_d - 1)\sum_{up} W_{j,t}^2]] \quad (4)$$

where n_u and n_d are the number of up and down days over the fiscal year, respectively. In detail, for each stock *j* over a fiscal year *t*, we separate all the weeks with firm-specific returns below the annual mean from those firm-specific returns that are above the annual mean and categorize them as "down weeks" and "up weeks", respectively. We then compute the standard deviation for the two predefined subsamples. *DUVOL* is the log of the ratio of the standard deviation of the "down weeks" over the standard deviation of the "up weeks".

2.1.2. Corporate governance attributes

A corporate governance structure combines controls, policies and guidelines that drive the organization toward its objectives while also satisfying stakeholders' needs. A corporate governance structure is often a combination of various mechanisms. Therefore we consider a large set of individual governance variables and rely on a variety of traditional measures of governance used by regulators.

Ownership structure

Investors have emerged as an important force in corporate monitoring. Shleifer and Vishny (1997) argue that institutional shareholders, by virtue of their large shareholdings have incentives to collect information and monitor management since they reap greater benefits [Shivdasani (1993)]. However, a competing view, is that large outside shareholders may also act as speculators than as stable investors, thus pressurizing management to deliver short run performance and providing a weak monitoring system [Graves and Waddock 1990; Porter (1992); Bushee (1998)]. Consistent with both the monitoring and expropriation view,

Callen and Fang (2013) find that stable institutional investors act as monitors in influencing managerial behaviour and are negatively associated with crash risk, whilst unstable (or transient) institutions appear to focus on short-term increases and are positively associated with crashes.

We use six variables to proxy *ownership structure*. The first three measures replicate those employed by Callen and Fang (2013) to distinguish between stable and unstable institutional investors. Specifically, we measure institutional stability by dedicated institutional ownership *(%INST_DED*), transient institutional ownership (*%INST_TRANS*) and institutional holdings volatility *(INST_STD*). We also measure the number of outside blockholders that own at least 5% of a firm (*BLOCK*) since previous research suggests that major investors also influence corporate policy in a similar way to institutional shareholders [see Barclay and Holderness (1991); Bethel et al. (1998)]. Prior literature also suggests that insider ownership reduces agency costs since inside ownership helps align insider-owner's interest with those of outside shareholders [Fama and Jensen (1983); Jensen and Meckling (1976)]. As insider ownership rises, insiders have incentives to protect shareholders' interest and thus would need less supervision, albeit in a non-linear fashion [Morck et al. (1988); McConnell and Servaes (1990); Bhagat et al. (1999)]. We measure insider ownership *(%INSIDER*) as the percentage of equity held by insiders (officers, managers and directors).

Our last ownership variable captures whether the outside directors that sit on the various committees own shares in the company. Currently, there is mixed evidence as to whether directors that own stocks have the incentive to engage in the companies' operations more diligently [Yermack (2004)] or not [Core et al. (1997); Brick et al. (2006)]. We use the percentage of directors that hold stock in the firm (*%BRD_STOCK*) to capture outside director's monitoring incentives [see Core et al. (1997); Yermack (2004)].

We expect that *%INST_DED*, *BLOCK* and *%INSIDER* to be negatively related to future

crash risk, while both *INST_STD, %INST_TRANS* to be positively related. Given the mixed evidence as described above, we make no predictions on the sign of the relation between outside-directors' stock ownership (*%BRD_STOCK*) and future crashes.

Accounting opacity

Accounting transparency is crucial to mitigating the information asymmetry between managers and shareholders that fuels agency risks. Although the quality of the accounting in a firm is a function of the efficacy of both the internal and external corporate governance mechanisms it is also in-itself a governance mechanism [Watts (2003); Ball and Shavakumar (2005); Guay and Verrecchia (2006); Jankensgard (2014); Lara et al. (2009)]. We therefore include accounting quality as a corporate governance mechanism and use two measures previously used in the crash risk literature: opaqueness (*OPAQUE*) in the spirit of Hutton et al. (2009), and Khan and Watt's (2009) accounting conservatism (*C_SCORE*). We include both measures as they capture different aspects of accounting quality [Kim and Zhang (2013)]. Following prior literature, we expect high *C_SCORE* (*OPAQUE*) to decrease (increase) crash risk.

The independent assessment of the audit committee is also crucial to the effective monitoring of a firms' financial reporting process. Klein (2002), for instance, finds a negative relation between audit committee independence and earnings management practices [see also Agrawal and Chadha (2005)]. To proxy for the quality of the audit process, we measure the proportion of outside independent directors in the audit committee (*%AUD_IND*). Finally, as part of their overall disclosure strategy, firms may select audit firms who are industry-experts. As Dunn and Mayhew (2004) posit auditor expertise signals a firm's intention to provide enhanced disclosures. Therefore we also include auditor industry expertise (*AUD_EXP*) to be 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, and zero otherwise. We expect both of these audit attributes to be negatively associated with crash risk.

Board structure & processes

We use five measures to capture the different aspects of the board structure & processes identified in the corporate governance literature. We measure the composition of the board as the percentage of outside directors on the board (*%BRD_IND*). Typically a board with more outside directors is considered to be more effective in monitoring management which will protect shareholders from self-serving managerial behavior [see also Agrawal and Chadha (2005); Xie et al. (2003); for an opposing view see Hermalin and Weisbach (1991)].

Smaller boards are also considered to be more effective in attaining higher monitoring [Lipton and Lorsch (1992); Jensen (1993); Yermack, 1996]. However, recent papers suggest that the board size effect depends very much on the organizations form [Coles et al. (2008); Ni and Purda (2012)]. To capture the effectiveness of the board based on its size we include the measure, namely *BRD_SIZE*, defined as the number of members sitting in the board.

The impact of busy boards on corporate governance is rather mixed. Firms with very busy board members have been found to be associated with weak corporate governance [Fich and Shivdasani (2006)], while more competent directors enhance the firm's corporate governance [Klein (1998); Ashbaugh-Skaife et al. (2006)]. We include a measure to capture outside director busyness/competence (*%BRD_COMP*) defined as the percentage of directors that also serve on boards of other firms.

Several studies examine and find that the separation of the CEO and chairman positions is associated with the boards monitoring efficacy [Fama and Jensen (1983) Yermack (1996)]. We therefore include a dummy variable (*CEO_DUALITY*) that equals 1 when the two positions, CEO and chairman, are held by the same person, and zero otherwise.

Finally, the last attribute identifies using a dummy binary variable whether a company has a formal, clearly defined corporate governance policy in its mandate (*GPOL*). Such a 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.

We expect that *%BRD_IND* and *GPOL* to be negatively related to future crash risk, while *CEO_DUALITY* to be positively related. Given the mixed evidence we make no predictions on the sign of the relation between board sizes (*BRD_SIZE*), directors' busyness/competence (*%BRD_COMP*) and future crashes.

Managerial incentives

The early literature argues that increasing the use of equity-based compensation is a more effective way of aligning the interest of managers and shareholders by exposing managers' wealth to their firms' stock price and reducing the agency costs. However recent evidence suggests and finds that both CEOs and CFOs compensation structure may induce self-serving behavior [Healy (1985); Bergstresser and Phillippon (2006); Benmelech et al. (2010); Kim et al. (2011)] and thereby reduce corporate governance efficacy [Bebchuk et al. (2009)]. This incentive is argued to be more powerful for their option holdings relative to their stock holdings [Burns and Kedia (2006); Benmelech et al. (2010)]. Moreover, Kim et al. (2011) finds that CFO equity incentives are more important than CEO incentives in determining crash risk. We include two different measures to capture equity-based compensation incentives for both CEOs and CFOs. Specifically, we measure the option holdings incentives ratio (*INC_OPT*) and stock holdings incentives ratio (*INC_STC*) (as in Bergstresser and Phillippon (2006) and Kim et al. (2011)) for both the CEO and the CFO. We expect, consistent with the findings of Kim et al. (2011), that these measures will be

positively related to future crash risk for both managerial positions. As option-holdings provide more powerful incentives for managers to inflate short-term share prices [Burns and Kedia (2006); Kim et al. (2011)], we expect the link between option-based compensation and future crashes to be more important than the stock-based one.

Annual pay of managers also includes a cash-based compensation such as bonus. Benmelech et al. (2010) demonstrates that bonus compensation induces truth-telling when combined with a stock-based component implying a negative link of bonus with sharp stock price declines. At the same time, prior research argues that managers' bonus plans can also induce short-termism behavior [Healy (1985)] which may induce a positive link of bonus to future crashes. Therefore, the link of bonus to future crashes is an empirical question. We measure the cash-based compensation for both the CEO and CFO using the level of bonuses paid (*BONUS)* scaled by salary and we make no predictions on the sign of the relation of *BONUS* and future crash risk.

2.1.3. Control variables

The model of Hong and Stein (2003) 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 ($RETURN_{t-1}$) and past volatility of firm-specific weekly returns (STD_{t-1}) over the fiscal year period *t-1* [Chen et al. (2001)]. Finally, based on the analysis of Hutton, et al. (2009), we include (one-period lagged values of): firm size defined as the natural logarithm of market value of equity ($SIZE_{t-1}$), market value of equity to book value of equity (MB_{t-1}), financial leverage defined as the total liabilities to total assets (LEV_{t-1}), and return on equity defined as income before extraordinary items to equity (ROE_{t-1}). Most of our control variables also capture the tradeoff between the monitoring costs and private benefits of

control the firm faces [Wintoki et al. (2012)], and therefore are suitable time-varying variables that may jointly affect both stock price crashes and governance.

3. Dataset

We collect weekly returns from CRSP to estimate stock crash risk measures, the corporate governance attributes are constructed using information from the Corporate Library and firm-specific financial information are from Compustat. Information for CEO duality and managerial incentives are obtained from ExecuComp. To construct the institutional ownership variables we use data from the Thompson-Reuters Institutional Holdings Database.[3]

Our sample covers the period 2002-2013. 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 continuous variables at the 1st and 99th percentiles to mitigate possible data errors and influential extreme observations. The final sample with full information on all variables consists of 1552 firms with 8119 firm-year observations.

[Insert Table 1]

Table 1 presents the descriptive statistics. The mean (median) values of *NCSKEW* and *DUVOL* are 0.101 (0.046) and -0.000 (-0.011) respectively and are comparable with prior studies [e.g., Kim et al. (2011)]. Within the *ownership structure* component of governance, the mean (median) stock holdings are 3.6% (0.0%) for dedicated (*%INST_DED*) and 17.3% (15.8%) for transient (*%INST_TRA*) institutional investors while institutional volatility in stock holdings (*%INST_STD*) is 0.2% (0.0%). Moreover, the number of blockholders

[3] We thank Brian Bushee for providing the data to classify institutional investors into transient and dedicated groups.

(*BLOCK*) is 2.677 (3.000), and insiders' stock holdings (*%INSIDER*) are 10.5% (4.9%) while 87.7% (100%) of the outside directors hold stocks in the firm (*%BRD_STOCK*).

Regarding the *accounting opacity* element of governance, the mean (median) values of opacity (*OPAQUE*) in financial reports are 0.363 (0.208) while accounting conservatism values (*C_SCORE*) are 0.040 (0.035). Not surprisingly, 93.8% (100%) of the directors on the audit committee are independent (*%AUD_IND*). Finally, 22.6% of the firms appoint industry-specialist audit firms (*AUD_EXPERT*).

For the *board structure & processes* dimension of governance, the mean (median) percentage of independent directors (*%BRD_IND*) serving the board is 73.5% (75%) and the mean of board size (*BRD_SIZE*) is 8.173. The mean (median) of the board members who also serve on other boards (*%BRD_COMP*) is 37.2% (35.7%), about 57% of the CEOs also serve as chairman to the board (*CEO_DUALITY*) and approximately 73.7% of the firms have a formal corporate governance policy (*GPOL*) in their mandate.

Concerning *managerial incentives* components of governance, the mean (median) incentive ratios for CEOs are 17.9% (14.0%) for options (*CEO_INC_OPT*) and 16.0% (8.1%) for stocks (*CEO_INC_STC*). The corresponding figures for CFOs are 10.4% (7.7%) for options (*CFO_INC_OPT*) and 4.8% (2.8%) for stocks (*CFO_INC_STC*). Moreover, CEOs receive bonuses (*CEO_BONUS*) of about 50% of their salary, while for CFOs (*CFO_BONUS*) this figure is about 37.5% of their salary.

Our sample consists of large profitable firms, the mean (median) market capitalization is about $1,737 million ($1,525) while return on equity is 10.9% (11.4%). The average firm exhibits moderate growth opportunities with average market to book ratio of 3.143 and employ leverage of 48.3%. In summary, our sample is fairly representative of studies that utilize data from the same sources, certainly in terms of firm size, market to book and

leverage [Callen and Fang (2013)]; as well as board characteristics such as board size and percentage of independent directors on the board [Larcker et al. (2007)].

Table 2 shows Pearson (Spearman) correlation coefficients above (below) the diagonal among the crashes and corporate governance variables. As expected, the two crash risk measures are significantly related to one another with a positive correlation of approximately 0.96. Among the governance attributes, various correlations are significant but not to a degree to raise collinearity concerns. Untabulated results of the variance inflation factor (VIF) indicate that our regression model specifications are unlikely suffer from the collinearity problem.[4] We also find that many of the corporate governance attributes exhibit statistical significant association with the two measures of crash risk.

[Insert Table 2]

4. Multivariate analysis results

4.1. Governance factors and crash risk

We rely on exploratory principal component analysis (PCA) to reduce the large number of governance attributes we use into a few governance factors that account for most of the variance in the observed variables. Our objective is to assess through the factor analysis: (i) the overall impact of the governance attributes, and (ii) the impact of each of the four corporate governance dimensions, to explain the variability in future crashes. This analysis can reveal the overall economic impact of the whole governance system as formed by the 21 attributes; specifically we can determine how much of one standard deviation of the crash risk measures is explained by each of the governance factors because these factors are orthogonal by construction.

We follow similar PCA procedures to those used in the prior literature. As in Larcker et al. (2007), we retain all factors with an eigenvalue greater than unity. We also employ the

[4] The highest correlations appear between the CEO and CFO compensation components; to guard against erroneous inferences our baseline regression analysis (Table 4) considers specifications where CEO and CFO incentives are included separately.

scree test [Jolliffe (2002)] to affirm that this approach delivers the same number of factors as with the eigenvalue approach. To serve the purpose of our PCA investigation, the retained factors are rotated using an orthogonal rotation as in Dey (2008). To safeguard the efficacy of PCA, we examine the variables' factor loadings and verify that the retained factors capture distinct governance aspects since there are no significant cross-loadings or situations where the same governance attribute is significantly associated with more than one factor.

We rely on the PCA to generate different sets of governance factors. First, PCA is applied to the whole set of 21 attributes to create seven significant factors (namely *PC1* to *PC7*) that retain 57.3% of the total variance in the original data. Second, PCA is applied to the attributes of each of the four governance dimensions we consider in this study. Out of the *ownership structure* dimension we retain two factors (*PC_OWN1* and *PC_OWN2*), which retain 41.4% of the total variance of the six attributes that characterize this dimension. Out of the *accounting opaqueness* dimension we retain two factors (*PC_OPAQ1* and *PC_OPAQ2*), which retain 53.6% of the total variance of the four attributes that characterize this dimension. Out of the *board structure & processes* dimension we again retain two factors, (*PC_BOARD1* and *PC_BOARD2*), which retain 50.0% of the total variance of the five attributes that characterize this dimension. Finally, out of the *managerial incentives* dimension we retain three factors, (*PC_INC1* to *PC_INC3*), which retain 78.9% of the total variance of the six attributes that characterize this dimension.

Table 3 provides coefficient estimates of various specifications of the governance factors on *NCSKEW* (Panel A) and *DUVOL* (Panel B), controlling for other known determinants of crash risk. Column (1) in Panel A (Panel B) reports the cross-sectional coefficients with the seven factors, namely *PC1* to *PC7*, estimated from all 21 governance attributes when regressed on *NCSKEW* (*DUVOL*). We find that three (five) factors are significant at conventional statistical levels (p-values < 0.10 or better). Column (2) in panels

A and B which includes firm fixed effects, shows three factors that strongly relate to future crashes (p-values < 0.05 or better). More importantly, however, the impact of the overall governance system is economically meanigful. In particular, column (1), in panels A and B, demonstrates that the accumulated absolute coefficient values of the statistical significant factors that emerge from the governance attributes can explain overall between 13.1% to 19.3% of a one standard deviation of crash risk. A similar picture emerges when we include the firm fixed effects (see column (2) in panels A and B) in this case the statistical significant factors can explain overall between 18.4% to 23.0% of a one standard deviation of crash risk. This analysis lends credence to the notion that the 21 governance attributes we consider offer an economic meaningful practice in mitigating crash risk.

Column (3) in Panel A (Panel B) reveals that the governance dimension *ownership structure* provides the most prominent governance dimension since both factors are strongly statistically significant (p-values < 0.01) and offer a first-order effect in mitigating the occurrence of future crashes since this dimension can explain on its own about 8.6% (9.3%) of a one standard deviation of crash risk. *Accounting opacity* is the second most important governance dimension with one statistical significant factor (p-value < 0.05) and can explain on its own overall about 3.4% of a one standard deviation of crash risk, see column (4). The other two dimensions, namely *board structure & processes* and *managerial incentives* (columns 5 and 6 respectively) add very little on their own, if any, to the explanatory power of the model. Columns (7) and (8) include all governance dimension factors pooled together in the same regression and confirm our previous conjectures. These results provide an indication on how governance dimensions differ and by how much, which may help shareholders to fortify their firms' corporate governance systems in ways that could mitigate future crashes.

[Insert Table 3]

In terms of control variables, consistent with Chen et al. (2001) we find that future crashes are positively related to the firm-specific returns (*RETURN*) and the volatility of firm-specific returns (*DTURN).* Future crashes are also positively related to return on equity (*ROE*) and, similar to Hutton et al. (2009), negatively related to firm leverage (*LEV*). 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.

4.2 Governance attributes and crash risk: A horserace approach

In this section we take a horserace approach to examine the relation between corporate governance and future stock price crashes using the 21 corporate governance attributes. Table 4 reports only the coefficients of the governance attributes, for brevity the control variables are unreported. In Panel A (Panel B) the dependent variable is *NCSKEW* (*DUVOL*). Columns (1) to (5) report the relations between each governance dimension to future crashes. Since some of the CEO and CFO incentives are highly correlated with one another, we have two estimations for the fourth governance dimension (namely, *managerial incentives*) to avoid erroneous inferences that may emerge from the collinearity problem; in this respect, column (4) reports the relation between CEO incentives and future crashes, while column (5) reports the same but for the CFO. Column (6) reports the results for all 21 attributes; columns (7) and (8) report separately the effect of CEO and CFO incentives when included with all other governance attributes in the presence of firm fixed firm effects whereas column (9) includes the firm fixed effects equivalent of column (6).

[Insert Table 4]

The results in Table 4 column (1) indicate a strong positive relationship between transient institutional ownership (*%INST_TRA*) and future crash either when using *NCSKEW* (Panel A) or *DUVOL* (Panel B). This relationship continues to hold when including firm

fixed firm effects (see column (6)). Columns (1) and (6) in Panel B also show a positive relation of institutional ownership stock-holdings volatility (*INST_STD*) and *DUVOL*. These results support the expropriation hypothesis, whereby institutions pressurize management to deliver short-run performance [Graves and Waddock (1990); Porter (1992); Bushee (1998)]. Interestingly, the percentage of outside directors that hold equity in the firm (*%BRD_STOCK*) is also positively related to future crashes. This result suggests that outside directors with equity ownership may encourage myopic behavior [see for example Brick et al. (2006)]. Both of these empirical inferences continue to hold true when we include all other corporate governance variables and firm fixed effects (column (9) Panels A and B). Column (1) and (6) attest that there is also strong evidence that insider ownership (*%INSIDER*) is negatively related to future crashes, consistent with the view that insider ownership aligns shareholders' and managers' interests [Morck et al. (1988); McConnel and Servaes (1990], although it loses significance when firm fixed effects are included (column (9)); which is consistent with the findings that insider ownership typically change slowly overtime within a firm [Hermalin and Weisbach (1991); Zhou (2001)].[5] All other variables within this dimension (column (1)) have the expected sign, with the exception of *BLOCK*, but none are found to be statistically significant.

Investigating the *accounting opacity* dimension, the results in column (2) show that accounting conservatism (*C_SCORE*) is negatively related to future crashes (p-values < 0.01). This relation remains robust under all specifications (columns (6) to (9)), and is consistent with Kim and Zhang (2015) that accounting conservatism reduces managers' incentives to manipulate earnings and reduces the agency problems between managers and outside investors [Watts (2003); LaFond and Watts (2008); among others]. Regarding the other three accounting opacity attributes, namely *OPAQUE*, *%AUD_IND* and

[5] Following Morck et al. (1988) and McConnell and Servaes (1990) 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.

AUD_EXPERT, although we observe their predicted signs, none of them is statistically significant. The lack of significance on accounting opacity (*OPAQUE*) challenges the results reported in Hutton et al. (2009), which we investigate further (see section 4.4.), and find that the link of accounting opacity to crash risk is conditional on the economic cycle. In terms of *board structure & processes* both board size (*BRD_SIZE*) and the presence of a governance policy (*GPOL*) show a negative relation to future crashes (column (3) panels A and B). *BRD_SIZE* is statically significant under the majority of specifications; however *GPOL* is only statistically significant when the dependent variable is *NCSKEW*. *BRD_SIZE* results are robust when including firm fixed effects although *GPOL* no longer loads under the firm fixed effect model (column (9)).[6] All other remaining variables are not found to be statistically significant. Overall, there is empirical evidence to suggest that larger boards and the presence of a formal clearly defined governance policy limits managers ability to engage in suboptimal behavior. This finding is consistent with recent papers that suggest that the board size effect depends very much on the organizations form [Coles et al. (2008); Ni and Purda (2012)].

Column (4) in both panels, show a positive statistical significant relation (p-values < 0.05) between CEO option incentives (*CEO_INC_OPT*) with future crashes. This relation continues to hold under most of the specifications, with the exception of column (6). Interestingly, we do not however observe any significant relations for the CFO case. Overall, there is no compelling evidence from columns (6) and (9) to suggest that managerial incentives can curb the incentive to hide bad news to avoid crash risk.[7] These findings are inconsistent with Kim et al. (2011), which may be due to the different sample periods being investigated. Unlike Kim et al. (2011) our sample period captures the period post the Sarbanes-Oxley (SOX) Act of 2002 which Cohen et al. (2005) finds is a period that managers

[6] It is reasonable to observe that *GPOL* is not statistically significant in the firm fixed effects estimation due to the stickiness of this governance attribute that results in extremely low within-firm variation.

[7] Investigation of columns (4) and (5) in comparison to (6), as well as (7) and (8) in comparison to (9) reveal that some high correlations between the CEO and CFO managerial compensation attributes does not lead to any co-linearity issues.

behave less opportunistically compared to the pre-Sox period. Overall, compared to Kim et al. (2011), our findings suggest that in the post-SOX period, equity-based compensation is less likely to induce bad news hoarding, and thus future crashes.

Finally, because all continuous variables have been standardized to have a zero mean value and standard deviation of one, we can use coefficient estimates to assess each attribute's economic importance. Depending on the crash risk measure a change in the continuous corporate governance attributes by one standard deviation can explain up to 6.6% of one standard deviation of the crash risk measure (see, for instance, *C_SCORE* coefficient in column 6, Table 4, Panel B). This value is extremely high once we consider the economic impact of well-founded determinants of crash risk like market-to-book (*MB*), leverage (*LEV*) and return-on-equity (*ROE*), whose standardized coefficient values are about 3.0%, 5.0% and 7.0%, respectively. Therefore, some of the governance attributes are especially important in mitigating the crash risk, especially those that relate to ownership (*%INST_TRA*, *%INSIDER*, *%BRD_STOCK*), accounting conservatism (*C_SCORE*), board size (*BRD_SIZE*) and the presence of a well-defined governance policy (*GPOL*) that maintain the highest coefficient values.

Taken all together, the results lend support to our expectations that a number of corporate governance practices play an important role in mitigating the occurrence of future stock price crashes.

4.3 When does corporate governance really matter?

The demand for better governance depends on the severity of agency problems since the industry or environment in which the company operates in accentuates agency risk. In that respect, either the market is less able to punish opportunistic managerial behaviour or it is easier for managers to mask short-run price maximization as being a long-run value maximisation business strategy. We test this hypothesis using two proxies that capture

information asymmetry problems, namely industry competition and the volatility of stock returns, as well as two measures that capture higher earnings/cash-flow uncertainty in which agency risk may be more pronounced.

Giroud and Mueller (2010) argue 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, and 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:

$$HHI_{j,t} = \sum_{i=1}^{N_j} S_{i,j,t}^2 \qquad (5)$$

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. Higher values of HHI indicate weaker industry competition.

We also consider whether the uncertainty that surrounds the firms' operations plays a role. Since corporate governance helps bridge the information gap between shareholders and managers, it is expected to be more important in environments of high uncertainty where this asymmetry is likely to be more pronounced [Dey (2008); Jankensgard (2014)]. We measure uncertainty using the standard deviation of daily stock returns in the last 12 months [Baker and Wurgler (2006)].

Additionally, we investigate how corporate governance impacts firms with higher (or lower) earnings/cash-flow uncertainty. These firms are expected to be more reliant on internal funds and to pay low dividends [Chay and Suh (2009)], which may force managers to put greater emphasis on short-term price maximization and engage significantly more in practices to conceal bad news regarding the firm's operating performance. In this respect,

corporate governance should be more effective to mitigate crash risk in firms that face high earnings/cash-flow uncertainty. We measure this type of uncertainty with two variables:[8] (i) a simple measure of operating profits volatility computed using the last 5-years' standard deviation of sales and (ii) a sophisticated measure of cash flow volatility following Garfinkel and Hankings (2011) computed as the quarterly volatility of operating profits using the prior 20 periods.[9]

We break our sample in two groups based on the magnitude of the segregation variables in year *t-1* (high or low splitting at the median for continuous variables), and we re-run the baseline analysis from Table 4 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 where the main regression specifications are broken down by the degree of agency risk (LOW vs. HIGH). Columns (1) and (2) 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 as captured by *NCSKEW* are positively related to transient institutional ownership (*%INST_TRANS*) and the percentage of outside directors that hold stock in the firm (*%BRD_STOCK*). The results also show a negative relation between *NCSKEW* and accounting conservatism (*C_SCORE*), board size (*BRD_SIZE*) and the presence of a clear corporate governance policy (*GPOL*). In summary, consistent with Giroud and Mueller (2010), the effects of governance on future crashes are more important in the less competitive industries since we observe greater statistical significance for the governance attributes for this group.

[8] All items are scaled by total assets to remove any undue influence from larger firms.

[9] Given cash flow volatilities, we create a dummy variable to capture when a firm's cash flow uncertainty has recently spiked. Following, Garfinkel and Hankings (2011) we employ the "rolling increase" measure and assign the value of 1 if three or four of the last four quarterly values of cash flow uncertainty were increasing relative to the prior quarter and zero otherwise.

A similar picture emerges in the other cases where we either consider the relation between governance attributes and crashes depending on either the level of firm stock return volatility in columns (3) and (4) or firm profits/cash-flow volatility as depicted by the two measures we employ in columns (5)-(8). In general, we observe that the overall effects of governance are more pronounced when stock return volatility (column (4)), operating profits volatility (column (6)) and cash flow volatility (column (8)) is high. In particular, consistent with our previous findings, future crashes are positively related to transient institutional ownership and the percentage of directors that hold stock in the firm. Interestingly, consistent with Kim et al. (2011) in columns (4) and (6) there is also a positive relation between CEO option incentives ratio and future crashes. Future crashes are also negatively related to insider ownership, to accounting conservatism practices, board size, and the presence of formal government policy. [10]

Finally, despite the fact that some of the governance attributes also load significantly on the low agency risk cases resulting in similar coefficients (using an *F*-test for comparison) between the two groups, overall, the findings indicate that the effects of the governance variables on future crashes are mostly driven from firms facing higher market or idiosyncratic uncertainty.

4.4. The role of accounting opacity in economic downturn periods

Our results in Table 4 show that accounting opacity is not significantly related to future crash risk which is inconsistent with Hutton et al. (2009), but partially consistent with the Hutton et al.'s assertions that the relationship diminishes post-SOX era. Given our sample begins post SOX and extends beyond the financial crisis, it provides us with the opportunity to investigate whether the lack of association we observe is due to the new regulatory environment which may limit managers' ability to hide information or alternatively that the

[10] We obtain similar results when we use analyst forecast dispersion as a proxy for information uncertainty.

adverse economic conditions limits a firm's propensity to engage in income-increasing practices, and thus their ability to hoard bad news [Jenkins et al. (2009); Ball and Shivakumar (2005)] a necessary condition for the occurrence of crashes.

To investigate this issue, we use the model specification in column (6) reported in Table 4, but now include interaction variables to identify whether the crisis and post-crisis period limits the firm's ability to manipulate earnings and thus moderates *OPAQUE's* association with crash risk. Since *OPAQUE* is the rolling-sum of a firm's prior three years of discretionary accruals we create a *CRISIS_POST* dummy variable that reflects both the crisis and post-crisis period (2007-2012) in terms of a firm's discretionary accruals. Accordingly, *CRISIS_POST* takes the value of one for all years after 2009, and zero otherwise, thus capturing the firms reported discretionary accruals during the crisis and post-crisis period.[11] In this sense, the interaction term $OPAQUE_{t-1}$* *CRISIS_POST* captures the incremental changes in the relation between earnings management and future crashes during and following the financial crisis period, while $OPAQUE_{t-1}$ mainly captures the relation between earnings management and future crashes during the pre-crisis period.

[Insert Table 6]

Table 6 presents the results of the above model specification in column (1) for *NCSKEW* and in column (3) for *DUVOL*.[12] We find that *OPAQUE* is now positive and statistically significant (p-value < 0.05), suggesting that the association between opacity and future crashes has not dissipated following SOX, as suggested by Hutton et al. (2009). We do, however, find that the coefficient on $OPAQUE_{t-1}$*CRISIS_POST* is negative and statistically significant, which indicates that the relation between opacity and crash risk is

[11] Following recent literature [Kuppuswamy and Villalonga (2010)], we define the financial crisis period from 2007 to 2009. We find however that our results are not sensitive to different cut-off years surrounding the crisis period. For example, redefining the crisis period to 2008-2009 rather than 2007-2009 does not change our inferences.

[12] For brevity, Table 6 reports only the results relating to *OPAQUE* and *C_SCORE*. Regression results regarding all other corporate governance variables are qualitatively similar to the ones presented in Table 4.

considerably less pronounced during and post the crisis period. In columns (2) and (4) we segment the financial crisis years into the crisis period itself (*CRISIS*) and the post-crisis period (*POST_CRISIS*) to ascertain whether the driver of these results is the crisis period specifically or the post-crisis period instead.[13] The results indicate that the coefficients on both $OPAQUE_{t-1}$*CRISIS* and $OPAQUE_{t-1}$* POST_CRISIS* are negative and significant, in almost all cases, consistent with our prior findings; it appears however that the crisis period (2007-2009) has the greatest moderating effect on the association between accounting opacity and crash risk.

These finding are consistent with the prior literature that earnings management reduces both during and following economic downturn periods. This may be due to the increased uncertainty about future outcomes and the heightened focus on the downside risk which should motivate market forces to demand more conservative earnings, and dissuade firms from hoarding bad news [Jenkins et al. (2009)]. Or alternatively, that surrounding an economic downturn period the market is more inclined to tolerate poor performance [Ahmad-Zaluki et al. (2011)] and as a consequence managers have fewer incentives to engage in earnings management to mask any bad news. Moreover during a recession period firms may also be subject to increased monitoring from auditors, creditors and other stakeholders which should also result in managers having less discretion to alter their earnings [Chia et al. (2007); Bertomeu and Magee (2011); Filip and Raffournier (2014)]. Finally, litigation risk will also be higher during periods of economic decline and therefore managers may respond to this risk by limiting or even reverting income-smoothing [Jenkins et al. (2009)]. All other corporate governance variables continue to hold their signs and significance as previously reported in Table 4.

[13] *CRISIS* takes the value of one for the fiscal year 2010, and zero otherwise. Therefore, the interaction term $OPAQUE_{t-1}$*CRISIS* captures the incremental changes in the relation between discretionary accruals during the crisis period (i.e. 2007-2009), and crash risk. While, *POST_CRISIS* now takes the value of one for all years after 2010, and zero otherwise. Again our results are not sensitive to alternative cut-off periods for the crisis and post crisis.

Overall, the relation of opacity to crashes appears to depend on the economic conditions, unlike accounting conservatism which we find maintains its strong negative relation to crashes irrespective of the consequences of the crisis period. These findings highlight that accounting conservatism is a strong innate corporate governance attribute that mitigates the presence of crash risk regardless of the economic cycle climate, making it more important for firms (and policymakers) to put in place practices that would prevent firms from stockpiling negative information.

5. Additional analyses

To assess the robustness of our results we carry out additional checks that consider deriving the overall effect from alternative measures of stock price crashes and other corporate governance variables.

5.1 Alternative measures of stock price crashes

We re-estimate all models of Table 4 using two alternative measures of crashes. The first is an indicator variable (*CRASH*) that equals one when a firm experiences at least one crash week during the fiscal year, and zero otherwise. 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 measure is the extreme sigma (*EXTR_SIGMA*). *EXTR_SIGMA* 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 in a fiscal year we compute *EXTR_SIGMA* as follows:

$$EXTR\_SIGMA = -Min[\frac{W - \overline{W}}{\sigma_W}] \quad (6)$$

where the firm-specific weekly return for firm j in week $t, W_{j,t}$, is similar to the one used for the estimation of *NCSKEW* and σ_W is the standard deviation of this return.

Untabulated results reveal that our previous findings remain unchanged to the definition of the crash risk measure.

5.2. Other variables: Additional governance attributes and CEO traits

There is a vast array of corporate governance variables that have been used in the prior literature to capture the different characteristics of a board [Larcker et al. (2007); Dey (2008)]. Drawing on these prior studies we investigate whether any of these additional attributes are associated to crash risk: number of board meetings; percentage of directors with tenure above 15 years; percentage of directors below the age of 70; percentage of directors that are CEOs in other companies; whether the firm has a staggered board, and if the firm founder is a board member. Moreover, following the findings of Giroud and Mueller (2010) we include the HHI index (as computed for the needs of Table 5) as an additional control variable. In untabulated results we find the inclusion of these additional corporate governance variables, without and with firm fixed effects, are not statistically significant, nor do they change in any way prior inferences.

In addition, we also investigate whether CEO's traits influence their behaviour and firm outcomes [Hambrick and Mason (1984)]. If CEOs' actions fail to deliver, which affects their personal wealth; this may incentivize CEOs to conceal adverse operating outcomes from shareholders which subsequently can lead to crashes. CEOs sensitivities about firm performance, however, vary across CEOs' career horizon [Buchholtz and Ribbens (1994); Prendergast and Stole (1996); Boschen et al. (2003); Yim (2013)], and gender [Khan and Vieito (2013)]. To capture these aspects of CEOs personal traits we investigate their age (*CEO_AGE*), tenure (*CEO_TENURE*) and gender (*CEO_GENDER*). In untabulated results we find that the inclusion of these additional control variables does not change prior inferences.

6. Conclusion

In this study we investigate which corporate governance attributes, amongst the many that firms employ, are the most prominent ones in explaining the link between governance and stock price crashes. We find that collectively the 21 corporate governance attributes we use can explain overall between 13.1% and 23.0% of a one standard deviation of future crash risk. Further analysis reveals that seven attributes are significantly related to the occurrence of future crash risk. Specifically, we find future crashes increase with transient institutional ownership, CEO stock option incentives and the percentage of outside directors that hold shares, and decrease with percentage of stocks held by insiders, the level of accounting conservatism, board size and the existence of a formal governance policy in the companies' mandate. Unlike prior research we do not find opacity of financial reports increase stock crashes, yet further analysis reveals that this finding is conditional on the economic cycle. Finally, our findings are stronger in less competitive industries and in companies with higher uncertainty (where governance as a monitoring mechanism is expected to be 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.

References

Agrawal, A., Chadha, S., 2005. Corporate governance and accounting scandals. Journal of Law and Economics 48, 371-406.

Agrawal, A., Knoeber, C.R., 1996. Firm performance and mechanisms to control agency problems between managers and shareholders. Journal of Financial and Quantitative Analysis 31, 377-397.

Ahmad-Zaluki, N.A., Campbell, K., Goodacre, A., 2011. Earnings management in Malaysian IPOs: The East Asian crisis, ownership control, and post-IPO performance. The International Journal of Accounting 46, 111-137.

Ashbaugh-Skaife, H., Collins, D., LaFond, R., 2006. The effects of corporate governance on firms' credit ratings. Journal of Accounting and Economics 4, 203–243.

Baker, M., Wurgler, J., 2006. Investor Sentiment and the Cross-Section of Stock Returns. The Journal of Finance 61, 1645-1680.

Ball, R., Shivakumar, L., 2005. Earnings quality in UK private firms: comparative loss recognition timeliness. Journal of Accounting and Economics 39, 83-128.

Barclay, M.J., Holderness, C.G., 1991. Negotiated block trades and corporate control. Journal of Finance 46, 861-878.

Bebchuk, L., Cohen, A., Ferrell, A., 2009. What matters in corporate governance?. Review of Financial Studies 22, 783-827.

Bebchuk, L.A, Stole, L., 1993. Do short-term managerial objectives lead to under- or over-investment in long-term projects? Journal of Finance 48, 719-729.

Benmelech, E., Kandel, E., Veronesi, P., 2010. Stock-based compensation and CEO (dis) incentives. Quarterly Journal of Economics 125, 1769–1820.

Bergstresser, D., Philippon, T., 2006. CEO incentives and earnings management. Journal of Financial Economics 80, 511–529.

Bertomeu, J., Magee, R.P., 2011. From low-quality reporting to financial crises: Politics of disclosure regulation along the economic cycle. Journal of Accounting and Economics 52, 209-227.

Bethel, J.E., Liebeskind, J.P., Opler, T., 1998. Block share purchases and corporate performance. Journal of Finance 53, 605-634.

Bhagat, S., Bolton, B., Romano, R., 2008. The promise and peril of corporate governance indices. Columbia Law Review, 1803-1882.

Bhagat, S., Bolton, S., 2008. Corporate governance and firm performance, Journal of Corporate Finance 14, 257–273.

Bhagat, S., Carey, D.G., Elson, C.M., 1999. Director ownership, corporate performance, and management turnover. The Business. Lawyer, 885-919.

Bleck A., Liu, X., 2007. Market Transparency and the Accounting Regime. Journal of Accounting Research 45, 229–256.

Boschen, J.F., Duru, A., Gordon, L.A., Smith, K.J., 2003. Accounting and stock price performance in dynamic CEO compensation arrangements. The Accounting Review 78, 143-168.

Brick, I.E., Palmon, O., Wald, K.J, 2006. CEO compensation, director and firm performance: Evidence of cronyism? Journal of Corporate Finance 12, 403–423.

Buchholtz, A.K., Ribbens, B.A., 1994. Role of chief executive officers in takeover resistance: effects of CEO incentives and individual characteristics. The Academy of Management Journal 37, 554-579.

Burns, N., Kedia, S., 2006. The impact of performance-based compensation on misreporting. Journal of Financial Economics 79, 35-67.

Bushee, B., 1998. The Influence of Institutional Investors on Myopic R&D Investment Behaviour. The Accounting Review 73, 305-333.

Callen, J.L., Fang, X., 2013. Institutional Investors and Crashes: Monitoring or Expropriation? Journal of Banking and Finance 43, 1-13.

Chay, J.B., Suh, J., 2009. Payout policy and cash-flow uncertainty. Journal of Financial Economics 93, 88-107.

Chen, J., Hong, H., Stein, J. 2001. Forecasting Crashes: Trading Volume, Past Returns, and Conditional Skewness in Stock Prices. Journal of Financial Economics 61, 345–381.

Chia, M.Y., Lapsley, I., Lee, H.W., 2007. Choice of auditors and earnings management during the Asian financial crisis. Managerial Auditing Journal 22, 177-196.

Cohen, D.A., Dey, A., Lys, T.Z., 2005. Trends in earnings management and informativeness of earnings announcements in the pre- and post-Sarbanes Oxley periods. Unpublished working paper. University of Texas, University of Minnesota, Northwestern University.

Coles, J.L., Daniel, N.D., Naveen, L., 2008. Boards: Does one size fit all?. Journal of Financial Economics 87, 329-356.

Core, J. W., Holthausen, R. W., Larcker, D. F., 1997. Corporate governance, CEO compensation and firm performance. Mimeograph, the Wharton School, Philadelphia.

Cremers, M., Ferrell, A., 2014. Thirty years of shareholder rights and firm valuation. Journal of Finance 69, 1167–1196.

Dey, A., 2008. Corporate governance and agency conflicts. Journal of Accounting Research 46, 1143-1181.Dunn, K. A., Mayhew, B. W. 2004. Audit firm industry specialization and client disclosure quality. Review of Accounting Studies 9, 35–58.

Fama, E.F, Jensen, M.C, 1983. Separation of ownership and control. Journal of Law and Economics 26, 301–325.

Fama, E.F., French, K.R., 1997. Industry cost of equity. Journal of Financial Economics 43, 153-193.

Fich, E. M., Shivdasani, A., 2006. Are busy boards effective monitors? The Journal of Finance 61, 689-724.

Filip, A., Raffournier, B., 2014. Financial crisis and earnings management: The European evidence. The International Journal of Accounting 49, 455-478.

Garfinkel, J.A., Hankins, K.W., 2011. The role of risk management in mergers and merger waves. Journal of Financial Economics 101, 515-532.

Giroud, X., Mueller, H.M., 2010. Does corporate governance matter in competitive industries? Journal of Financial Economics 95, 312–331.

Gompers, P., Ishii, J., Metrick, A., 2003. Corporate governance and equity prices. Quarterly Journal of Economics 118, 107-156.

Graves, S., Waddock S., 1990. Institutional ownership and control: implications for long-term corporate performance. Academy of Management Executive 37, 1034-1046.

Guay, W., Verrecchia, R., 2006. Discussion of an economic framework for conservative accounting and Bushman and Piotroski (2006). Journal of Accounting and Economics 42, 149-165.

Hambrick, D.C., Mason, P.A., 1984. Upper echelons: The organization as a reflection of its top managers. Academy of Management Review 9, 193-206.

Harford, J., Mansi, S.A., Maxwell, W.F., 2008. Corporate governance and firm cash holdings in the US. Journal of Financial Economics 87, 535-555.

Healy, P., 1985. The effect of bonus schemes on accounting decisions. Journal of Accounting & Economics 7, 85-107.

Hermalin, B., Weisbach M., 1991. The Effects of Board Composition and Direct Incentives on Firm Performance. Financial Management 4, 101-112.

Hong, H, Stein, J.C., 2003. Differences of opinion, short-sales constraints and market crashes. Review of Financial Studies 16, 487-525.

Hutton, A., Marcus, A., Tehranian, H., 2009. Opaque financial reports, R2, and crash risk. Journal of Financial Economics 94, 67-86.

Jankensgard, H., 2014. A tale of beauties and beasts: Testing the optimal disclosure hypothesis. Multinational Finance Journal 18, 139-167.

Jenkins, D.S., Kane, G.D., Velury, U., 2009. Earnings conservatism and value relevance across the business cycle. Journal of Business Finance and Accounting 36,1041-1058.

Jensen, M. C., Meckling W. H., 1976. Theory of the firm: managerial behaviour, agency costs and ownership structure. Journal of Financial Economics 3, 305-360.

Jensen, M.C., 1993. The modern industrial revolution, exit, and the failure of internal control systems. The Journal of Finance 48, 831-880.

Jolliffe, I., 2002. Principal Components Analysis. Springer Series in Statistics, Second edition. New York: Springer.

Karamanou, I., Vafeas, N., 2005. The Association Between Corporate Boards, Audit Committees, and Management Earnings Forecasts: An Empirical Analysis. Journal of Accounting Research 43, 453-486.

Khan, M., Watts, R.L., 2009. Estimation and empirical properties of a firm-year measure of accounting conservatism. Journal of Accounting and Economics 48, 132-150.

Khan, W. A., Vieito, J. P., 2013. Ceo Gender and Firm Performance. Journal of Economics and Business 67, 55-66.

Kim, J.B., Li, Y., Zhang, L., 2011. CFOs Versus CEOs: Equity Incentives and Crashes. Journal of Financial Economics 101, 713-730.

Kim, J.B., Zhang, L., 2014. Financial reporting opacity and expected crash risk: Evidence from implied volatility smirks. Contemporary Accounting Research 31, 851-875.

Kim, J.B., Zhang, L., 2015. Accounting Conservatism and Stock Price Crash Risk: Firm-level Evidence. Contemporary Accounting Research, *forthcoming*.

Klein, A., 1998. Firm performance and board committee structure. Journal of Law and Economics 41, 275- 303.

Klein, A., 2002. Audit committee, board characteristics and earnings management. Journal of Accounting and Economics 33, 375-400.

Kothari, S.P., Shu S., Wysocki, P., 2009. Do Managers Withhold Bad News? Journal of Accounting Research 47, 241–276.

Kuppuswamy V., Villalonga, B., 2010. Does Diversification Create Value in the Presence of External Financing Constraints? Evidence from the 2007–2009 Financial Crisis. Working Paper.

LaFond, R., Watts, R.L., 2008. The information role of conservatism. The Accounting Review 83, 447-478.

Lara, J. M. G., Osma, B. G., Penalva, F., 2009. Accounting conservatism and corporate governance. Review of Accounting Studies 14, 161-201.

Larcker, D., Richardson, S., Tuna, I., 2007. Corporate governance, accounting outcomes, and organizational performance. The Accounting Review 82, 963-1008.

Lipton, M., Lorsch, J.W., 1992. A modest proposal for improved corporate governance. The Business Lawyer 48, 59-77.

Masulis, R., Wang, C., Xie, F., 2007. Corporate governance and acquirer returns. Journal of Finance 62, 1851–1889.

McConnell, J.J., Servaes, H., 1990. Additional evidence on equity ownership and corporate value. Journal of Financial Economics 27, 595–612.

Morck, R., Shleifer, A., Vishny, R., 1988. Management ownership and market valuation: An empirical analysis. Journal of Financial Economics 20, 293–315.

Ni, Y., Purda, L.D., 2012. Does Monitoring by Independent Directors Reduce Firm Risk?. Available at SSRN 1986289.

OECD., 2009. Corporate governance and the financial crisis: Key findings and main messages. http://www.oecd.org/corporate/ca/corporategovernanceprinciples/43056196.pdf.

Petersen, M., 2009. Estimating standard errors in finance panel data sets: comparing approaches. Review of Financial Studies 22, pp. 435–480.

Porter, M.E., 1992. Capital choice: changing the way America invests in industry. Journal of Applied Corporate Finance 5, 4–16.

Prendergast, C., Stole, L., 1996. Impetuous youngsters and jaded old-timers: acquiring a reputation for learning. Journal of Political Economy 104, 1105-1134.

Shivdasani, A., 1993. Board composition, ownership structure and hostile takeovers. Journal of Accounting and Economics 16, 167–198.

Shleifer, A., Vishny, R., 1997. A survey on corporate finance. Journal of Finance 52, 737–783.

Song, J., Windram, B., 2004. Benchmarking audit committee effectiveness in financial reporting. International Journal of Auditing 8, 195-205.

Standard & Poor's., 2002. Standard & Poor's corporate governance scores: Criteria, methodology and definitions. McGraw-Hill Companies, Inc., New York.

Stein, J., 1989. Efficient capital markets, inefficient firms: A model of myopic corporate behavor. Quarterly Journal of Economics 104, 655-669.

Watts, R.L., 2003. Conservatism in accounting part I: Explanations and implications. Accounting horizons 17, 207-221.

Wintoki, M. B., Linck, J. S., Netter, J. M., 2012. Endogeneity and the dynamics of internal corporate governance. Journal of Financial Economics 105, 581-606.

Xie, B., Davidson III, W.N, DaDalt, P.J., 2003. Earnings Management and Corporate Governance: The Roles of the Board and the Audit Committee. Journal of Corporate Finance 9, 295-316.

Yermack, D., 1996. Higher market valuation of companies with a small board of directors. Journal of Financial Economics 40, 185-211.

Yermack, D., 2004. Remuneration, retention, and reputation incentives for outside directors. Journal of Finance 59, 2281–2308.

Yim, S., 2013. The acquisitiveness of youth: CEO age and acquisition behavior. Journal of Financial Economics 108, 250-273.

Zhou, X., 2001. Understanding the determinants of managerial ownership and the link between ownership and performance: comment. Journal of Financial Economics 62, 559-571.

Table 1. Descriptive statistics.

This table presents descriptive statistics for 8119 firm-year observations during the period 2002-2013. NCSKEW is the negative conditional skewness and DUVOL is the down-to-up volatility. %INST_DED (%INST_TRA) is the percentage of equity ownership in the firm by dedicated (transient) institutional investors and INST_STD is the average standard deviation of institutional equity holding proportions across all investors in the firm over a 5-year period. BLOCK is the number of outside investors who hold 5% or more of equity, %INSIDER is the percentage of equity held by insiders and %BRD_STOCK is the percentage of outside directors that hold equity in the firm. OPAQUE is the three-year moving sum of the absolute discretionary accruals, C_SCORE is accounting conservatism, %AUD_IND is the percentage of outside independent directors in the audit committee and AUD_EXPERT is a dummy variable that equals one when the auditors' firm has more than a third of market share of total turnover within an industry. %BRD_IND is the percentage of outside directors serving on the board, BRD_SIZE is the number of directors sitting in the board, %BRD_COMP is the percentage of directors that also serve on boards of other firms, CEO_DUALITY is a dummy variable that equals one when the positions of the CEO and the chairman of the board are held by the same person, and GPOL is a dummy variable that equals one when the company has a formal and clearly defined corporate governance policy in its mandate. CEO_INC_OPT (CFO_INC_OPT) is the CEO (CFO) option holding incentives, CEO_INC_STC (CFO_INC_STC) is the CEO (CFO) stock holding incentives and CEO_BONUS (CFO_BONUS) is the CEO (CFO) bonus scaled by salary. DTURN is the de-trended average weekly stock trading volume, RETURN is the average firm-specific weekly returns, STD is the volatility of firm-specific weekly returns, SIZE is the natural logarithm of market value of equity, MB is the market value of equity to book value of equity, LEV is the financial leverage defined as the total liabilities to total assets and ROE is the return on equity defined as income before extraordinary items to equity.

Variables	Mean	Median	Standard Deviation	25th Percentile	75th Percentile
Dependent Variables					
$NCSKEW_t$	0.101	0.046	0.811	-0.360	0.498
$DUVOL_t$	-0.000	-0.011	0.364	-0.243	0.227
Ownership Structure					
$\%INST\_DED_{t-1}$	0.036	0.000	0.066	0.000	0.052
$\%INST\_TRA_{t-1}$	0.173	0.158	0.120	0.089	0.244
$INST\_STD_{t-1}$	0.002	0.000	0.002	0.000	0.001
$BLOCK_{t-1}$	2.677	3.000	1.602	1.000	4.000
$\%INSIDER_{t-1}$	0.105	0.049	0.140	0.023	0.120
$\%BRD\_STOCK_{t-1}$	0.877	1.000	0.180	0.818	1.000
Accounting Opacity					
$OPAQUE_{t-1}$	0.363	0.208	0.468	0.118	0.399
C_SCORE_{t-1}	0.040	0.035	0.139	-0.038	0.108
$\%AUD\_IND_{t-1}$	0.938	1.000	0.128	1.000	1.000
AUD_EXPERT_{t-1}	0.226	0.000	0.418	0.000	0.000
Board Structure & Processes					
$\%BRD\_IND_{t-1}$	0.735	0.750	0.140	0.667	0.857
BRD_SIZE_{t-1}	8.173	9.000	1.546	7.000	10.000
$\%BRD\_COMP_{t-1}$	0.372	0.357	0.321	0.000	0.636
$CEO\_DUALITY_{t-1}$	0.570	1.000	0.495	0.000	1.000
$GPOL_{t-1}$	0.737	1.000	0.440	0.000	1.000
Managerial Incentives					
$CEO\_INC\_OPT_{t-1}$	0.179	0.140	0.150	0.062	0.261
$CEO\_INC\_STC_{t-1}$	0.160	0.081	0.200	0.032	0.195
CEO_BONUS_{t-1}	0.500	0.000	0.748	0.000	0.845
$CFO\_INC\_OPT_{t-1}$	0.104	0.077	0.100	0.031	0.146
$CFO\_INC\_STC_{t-1}$	0.048	0.028	0.060	0.009	0.064
CFO_BONUS_{t-1}	0.375	0.051	0.568	0.000	0.600

Control Variables					
$DTURN_{t-1}$	0.863	0.860	19.840	-7.533	9.213
$RETURN_{t-1}$	-0.114	-0.077	0.157	-0.140	-0.043
STD_{t-1}	0.045	0.041	0.020	0.029	0.053
$SIZE_{t-1}$	7.460	7.330	1.450	6.375	8.398
MB_{t-1}	3.143	2.273	8.325	1.553	3.547
LEV_{t-1}	0.483	0.494	0.193	0.339	0.618
ROE_{t-1}	0.109	0.114	0.637	0.047	0.180

Table 2: Correlation coefficients between corporate governance variables and crash risk.

This table presents the Pearson (Spearman) correlations above (below) the diagonal for 8119 firm-year observations during the period 2002-2013. NCSKEW is the negative conditional skewness and DUVOL is the down-to-up volatility. %INST_DED (%INST_TRA) is the percentage of equity ownership in the firm by dedicated (transient) institutional investors and INST_STD is the average standard deviation of institutional equity holding proportions across all investors in the firm over a 5-year period. BLOCK is the number of outside investors who hold 5% or more of equity, %INSIDER is the percentage of equity held by insiders and %BRD_STOCK is the percentage of outside directors that hold equity in the firm. OPAQUE is the three-year moving sum of the absolute discretionary accruals, C_SCORE is accounting conservatism, %AUD_IND is the percentage of outside independent directors in the audit committee and AUD_EXPERT is a dummy variable that equals one when the auditors' firm has more than a third of market share of total turnover within an industry. %BRD_IND is the percentage of outside directors serving on the board, BRD_SIZE is the number of directors sitting in the board, %BRD_COMP is the percentage of directors that also serve on boards of other firms, CEO_DUALITY is a dummy variable that equals one when the positions of the CEO and the chairman of the board are held by the same person, and GPOL is a dummy variable that equals one when the company has a formal and clearly defined corporate governance policy in its mandate. CEO_INC_OPT (CFO_INC_OPT) is the CEO (CFO) option holding incentives, CEO_INC_STC (CFO_INC_STC) is the CEO (CFO) stock holding incentives and CEO_BONUS (CFO_BONUS) is the CEO (CFO) bonus scaled by salary. Boldface numbers indicate statistical significance at 10% or better.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Dependent Variables																							
1.NCSKEW$_t$		**0.96**	0.01	0.00	**0.06**	**0.02**	0.00	0.01	0.02	0.00	0.00	-0.02	0.00	0.01	**-0.02**	-0.01	**-0.05**	**0.03**	0.01	-0.01	**0.02**	0.01	-0.02
2.DUVOL$_t$	**0.98**		0.00	0.00	**0.06**	**0.02**	0.00	**0.02**	0.01	-0.02	0.00	-0.01	0.01	0.01	-0.01	-0.00	**-0.04**	**0.04**	**0.02**	0.00	**0.04**	**0.03**	-0.01
Ownership Structure																							
3.BLOCK$_{t-1}$	0.00	-0.01		**0.05**	**0.05**	**0.07**	**-0.05**	**-0.02**	**0.04**	**0.21**	**0.05**	**-0.04**	**0.10**	**-0.16**	**-0.12**	**-0.10**	**0.04**	**-0.17**	**-0.15**	**-0.18**	**-0.18**	**-0.10**	**-0.16**
4.%INST_DED$_{t-1}$	0.00	0.01	**-0.07**		**0.18**	**0.03**	**0.07**	**-0.05**	**-0.05**	**0.18**	**-0.06**	**0.04**	**-0.08**	**0.24**	**-0.02**	**0.06**	**-0.15**	0.01	**-0.05**	**0.13**	**0.04**	**-0.07**	**0.13**
5.%INST_TRA$_{t-1}$	**0.05**	**0.05**	**0.05**	**0.19**		**0.25**	0.01	-0.01	**0.10**	**0.21**	-0.02	0.00	**0.04**	**-0.17**	**-0.09**	**0.03**	**-0.20**	0.00	**-0.03**	**-0.05**	-0.01	0.01	**-0.06**
6.INST_STD$_{t-1}$	**0.02**	**0.02**	**0.10**	**0.10**	**0.37**		**0.04**	0.00	**0.05**	**0.12**	0.00	**-0.05**	**-0.03**	**-0.12**	**-0.12**	0.00	**-0.10**	**-0.12**	-0.01	**-0.05**	**-0.12**	**-0.06**	**-0.05**
7.%INSIDER$_{t-1}$	0.00	-0.01	**0.05**	**-0.05**	0.00	**0.05**		**-0.11**	0.00	**0.24**	**-0.05**	**-0.04**	**-0.36**	**-0.03**	**-0.09**	**-0.04**	**-0.25**	**-0.11**	**0.29**	-0.01	**-0.11**	**-0.08**	0.00
8.%BRD_STOCK$_{t-1}$	**0.02**	**0.03**	-0.01	-0.01	**0.03**	**0.03**	**-0.16**		**-0.02**	**-0.13**	**0.03**	**0.04**	**0.13**	**-0.07**	**0.18**	**0.08**	**0.16**	0.00	**-0.03**	**-0.03**	-0.01	**0.17**	**-0.03**
Accounting Opacity																							
9.OPAQUE$_{t-1}$	**0.02**	0.01	**0.02**	-0.01	**0.09**	**0.06**	**0.02**	**-0.09**		**-0.03**	**-0.02**	**-0.10**	0.01	**-0.18**	**-0.05**	**-0.04**	**-0.03**	**0.04**	**0.05**	**-0.09**	0.00	**0.03**	**-0.07**
10.C_SCORE$_{t-1}$	-0.01	**-0.02**	**0.23**	**0.04**	**0.19**	**0.11**	**0.40**	**-0.12**	**0.03**		-0.01	**-0.08**	**-0.13**	**0.04**	**-0.26**	**-0.09**	**-0.36**	**-0.34**	**-0.13**	**-0.12**	**-0.30**	**-0.25**	**-0.12**
11.%AUD_IND$_{t-1}$	0.00	0.00	**0.05**	0.00	**-0.02**	0.00	**-0.05**	**0.03**	**-0.03**	0.00		-0.01	**0.51**	**-0.02**	0.00	0.01	**0.03**	**0.03**	**-0.03**	**-0.03**	0.01	0.01	**-0.03**
12.AUD_EXPERT$_{t-1}$	-0.01	-0.01	**-0.04**	**0.07**	0.00	**-0.04**	**-0.09**	**0.04**	**-0.13**	**-0.09**	-0.01		**0.03**	**0.02**	**0.10**	**0.03**	**0.07**	**0.05**	0.00	**0.04**	**0.06**	**0.06**	**0.03**
Board Structure & Processes																							
13.%BRD_IND$_{t-1}$	-0.01	0.00	**0.07**	-0.01	**0.05**	0.01	**-0.43**	**0.16**	**-0.03**	**-0.15**	**0.40**	**0.04**		**-0.02**		**0.13**	**0.21**	**0.12**	**-0.14**	**-0.07**	**0.04**	**0.08**	**-0.08**
14.%BRD_COMP$_{t-1}$	0.01	0.01	**-0.16**	**0.31**	**-0.24**	**-0.17**	**-0.02**	**-0.08**	**-0.06**	0.02	0.02	**0.03**	**-0.02**			**0.08**	**-0.03**	**0.09**	**-0.09**	**0.36**	**0.14**	**-0.07**	**0.34**
15.BRD_SIZE$_{t-1}$	**-0.02**	-0.02	**-0.22**	**0.12**	**-0.13**	**-0.15**	**-0.26**	**0.21**	**-0.17**	**-0.33**	**-0.04**	**0.15**	**0.17**	**0.14**		**0.06**	**0.23**	**0.13**	**-0.05**	**0.03**	**0.11**	**0.12**	**0.03**

16.CEO_DUALITY$_{t-1}$	-0.01	0.00	**-0.10**	**0.10**	**0.02**	0.00	**-0.10**	**0.09**	**-0.05**	**-0.10**	0.02	**0.03**	**0.15**	**0.08**	**0.10**		**0.04**	**0.11**	**0.20**	**0.10**	**0.06**	**0.07**	**0.09**
17.GPOL$_{t-1}$	**-0.04**	**-0.04**	**0.04**	**-0.11**	**-0.16**	**-0.06**	**-0.32**	**0.17**	**-0.07**	**-0.38**	0.00	**0.07**	**0.21**	**-0.03**	**0.27**	**0.04**		**0.12**	**-0.08**	-0.00	**0.06**	**0.11**	-0.01
Managerial Incentives																							
18.CEO_INC_OPT$_{t-1}$	**0.03**	**0.04**	**-0.16**	**0.12**	0.01	**-0.08**	**-0.12**	-0.02	0.01	**-0.34**	**0.03**	**0.05**	**0.14**	**0.13**	**0.17**	**0.11**	**0.12**		**0.18**	**-0.11**	**0.68**	**0.17**	**-0.08**
19.CEO_INC_STC$_{t-1}$	**0.02**	**0.03**	**-0.12**	**-0.05**	**0.02**	0.01	**0.14**	**0.07**	**0.03**	**-0.23**	-0.01	0.01	**-0.05**	**-0.17**	-0.00	**0.21**	**0.02**	**0.19**		**-0.13**	**0.11**	**0.26**	**-0.07**
20.CEO_BONUS$_{t-1}$	-0.01	0.00	**-0.17**	**0.21**	**-0.08**	**-0.07**	**0.03**	**-0.06**	**-0.04**	-0.01	0.00	**0.03**	**-0.10**	**0.42**	**0.04**	**0.08**	**-0.08**	**-0.11**	**-0.22**		0.00	**-0.06**	**0.78**
21.CFO_INC_OPT$_{t-1}$	**0.03**	**0.04**	**-0.17**	**0.15**	0.00	**-0.08**	**-0.09**	**-0.03**	-0.01	**-0.29**	0.02	**0.05**	**0.05**	**0.18**	**0.14**	**0.08**	**0.05**	**0.69**	**0.10**	**0.03**		**0.27**	**-0.05**
22._CFO_INC_STC$_{t-1}$	0.01	0.02	**-0.08**	**-0.02**	**0.07**	**-0.03**	**-0.22**	**0.27**	**-0.04**	**-0.33**	0.01	**0.06**	**0.16**	**-0.11**	**0.21**	**0.07**	**0.19**	**0.17**	**0.39**	**-0.14**	**0.24**		**-0.09**
23.CFO_BONUS$_{t-1}$	-0.01	-0.01	**-0.17**	**0.23**	**-0.09**	**-0.07**	**0.04**	**-0.07**	**-0.03**	0.00	-0.01	**0.02**	**-0.10**	**0.42**	**0.04**	**0.08**	**-0.09**	**-0.08**	**-0.18**	**0.86**	-0.01	**-0.19**	

Table 3. Corporate governance factors and crash risk.

This table presents ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level between corporate governance factors and crash risk. The sample consists of 8119 firm-year observations during the period 2002-2013. Principal Components Analysis (PCA) and the extracted factors are explained in Section 4.1. NCSKEW in Panel A is the negative conditional skewness and DUVOL in Panel B is the down-to-up volatility. DTURN is the de-trended average weekly stock trading volume, RETURN is the average firm-specific weekly returns, STD is the volatility of firm-specific weekly returns, SIZE is the natural logarithm of market value of equity, MB is the market value of equity to book value of equity, LEV is the financial leverage defined as the total liabilities to total assets and ROE is the return on equity defined as income before extraordinary items to equity. $DEPENDENT_{t-1}$, $DEPENDENT_{t-2}$ and $DEPENDENT_{t-3}$ represent lagged values of the NCSKEW in Panel A and DUVOL in Panel B. *t*-statistics are reported in the parenthesis below each coefficient. All specifications include a constant, year and industry fixed effects. The term F.F.E. is used to indicate the inclusion of firm fixed effects. ***, ** and *, indicate significance at the 0.01, 0.05 and 0.10 level or better, respectively.

Panel A: Corporate governance factors and NCSKEW

Principal components are extracted using 21 corporate governance attributes			**Principal components are extracted separately using attributes within the four corporate governance dimensions**						
	(1)	**(2)**		**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
PC1	-0.035**	0.007	**PC_OWN1**	0.049*				0.050***	0.042**
	(-2.32)	(0.30)		(3.56)				(3.63)	(2.22)
PC2	0.023	0.056**	**PC_OWN2**	-				-0.043***	-0.050**
	(1.60)	(2.22)		(-3.15)				(-3.51)	(-2.17)
PC3	0.018	0.082***	**PC_OPAQ1**		0.010			0.010	0.052**
	(1.12)	(2.99)			(0.65)			(0.62)	(2.05)
PC4	0.005	-0.013	**PC_OPAQ2**		0.034**			0.031**	0.043**
	(0.49)	(-0.64)			(2.44)			(2.22)	(2.29)
PC5	-0.007	0.020	**PC_BOARD1**			-0.013		-0.021	0.011
	(-0.62)	(0.85)				(-0.87)		(-1.39)	(0.45)
PC6	0.059***	0.046**	**PC_BOARD2**			-0.055		-0.012	0.007
	(3.94)	(2.10)				(-0.36)		(-0.77)	(0.28)
PC7	-0.037**	-0.019	**PC_INC1**				-0.017	-0.019	0.007
	(-2.45)	(-0.84)					(-1.33)	(-1.54)	(0.36)
			PC_INC2				0.022*	0.019	0.048**
							(1.72)	(1.44)	(2.09)
			PC_INC3				-0.008	0.014	0.019
							(-0.71)	(1.20)	(0.94)
Control									
$DTURN_{t-1}$	0.033***	0.032**		0.033*	0.035***	0.035***	0.035***	0.033***	0.033**
	(2.82)	(2.50)		(2.81)	(3.02)	(2.99)	(3.00)	(2.87)	(2.57)
$RETURN_{t-1}$	-0.005	-0.051**		-0.005	-0.000	-0.003	-0.001	-0.003	-0.049*
	(-0.40)	(-2.01)		(-0.38)	(-0.03)	(-0.21)	(-0.05)	(-0.25)	(-1.95)
STD_{t-1}	0.001	-0.086**		0.001	0.007	0.002	0.008	0.004	-0.084**
	(0.03)	(-2.51)		(0.05)	(0.31)	(0.09)	(0.36)	(0.20)	(-2.44)
$SIZE_{t-1}$	-0.001	0.299***		0.005	-0.016	0.003	-0.010	-0.004	0.300***
	(-0.07)	(4.70)		(0.33)	(-0.96)	(0.20)	(-0.63)	(-0.24)	(4.66)
MB_{t-1}	-0.025	-0.010		-0.023	-0.025	-0.027	-0.030	-0.024	-0.008
	(-1.40)	(-0.47)		(-1.29)	(-1.35)	(-1.44)	(-1.53)	(-1.33)	(-0.38)
LEV_{t-1}	-0.042***	-0.045		-	-0.035**	-0.040***	-0.038**	-0.038***	-0.040
	(-2.93)	(-1.54)		(-3.73)	(-2.55)	(-2.92)	(-2.76)	(-2.65)	(-1.34)
ROE_{t-1}	0.063***	0.065***		0.063*	0.066***	0.066***	0.068***	0.063***	0.065***
	(3.91)	(3.16)		(4.14)	(3.99)	(4.09)	(3.96)	(3.84)	(3.17)
$DEPENDENT_{t-1}$	0.004	-0.169***		0.004	0.005	0.005	0.004	0.004	-0.170***
	(0.36)	(-13.51)		(0.35)	(0.44)	(0.42)	(0.35)	(0.30)	(-13.54)
$DEPENDENT_{t-2}$	0.011	-0.125***		0.009	0.012	0.011	0.012	0.010	-0.125***
	(0.95)	(-10.04)		(0.83)	(1.02)	(1.01)	(1.04)	(0.89)	(-9.99)
$DEPENDENT_{t-3}$	0.002	-0.098***		0.001	0.002	0.002	0.003	0.001	-0.099***
	(0.19)	(-8.00)		(0.09)	(0.14)	(0.17)	(0.21)	(0.11)	(-8.05)
F.F.E.	NO	YES		NO	NO	NO	NO	NO	YES
Adj. R^2	0.019	0.254		0.019	0.016	0.016	0.016	0.020	0.254

Panel B: Corporate governance factors and DUVOL

Principal components are extracted using 21 corporate governance attributes			Principal components are extracted separately using attributes within the four corporate governance dimensions						
	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)
PC1	-0.028*	0.022	**PC_OWN1**	0.050***				0.051***	0.044**
	(-1.80)	(1.02)		(3.63)				(3.73)	(2.32)
PC2	0.031**	0.079***	**PC_OWN1**	-0.043***				-0.050***	-0.053**
	(2.16)	(3.16)		(-3.62)				(-3.98)	(-2.33)
PC3	0.035**	0.108***	**PC_OPAQ1**		0.017			0.016	0.060**
	(2.09)	(3.95)			(1.11)			(1.01)	(2.35)
PC4	0.010	-0.005	**PC_OPAQ2**		0.034**			0.031**	0.040**
	(0.85)	(-0.27)			(2.53)			(2.27)	(2.16)
PC5	-0.001	0.032	**PC_BOARD1**			-0.005		-0.013	0.024
	(-0.05)	(1.38)				(-0.30)		(-0.84)	(1.02)
PC6	0.058***	0.043**	**PC_BOARD2**			-0.001		-0.010	0.019
	(3.89)	(2.02)				(-0.08)		(-0.64)	(0.08)
PC7	-0.041***	-0.025	**PC_INC1**				-0.011	-0.013	0.018
	(-2.69)	(-1.09)					(-0.83)	(-1.04)	(1.00)
			PC_INC2				0.027**	0.022*	0.062***
							(2.03)	(1.67)	(2.69)
			PC_INC3				0.016	0.023**	0.037*
							(1.37)	(1.96)	(1.87)
Control									
$DTURN_{t-1}$	0.034***	0.032***		0.035***	0.037***	0.037***	0.037***	0.035***	0.034***
	(3.02)	(2.57)		(3.04)	(3.26)	(3.23)	(3.23)	(3.09)	(2.66)
$RETURN_{t-1}$	-0.025*	-0.057**		-0.027**	-0.022*	-0.024*	-0.022*	-0.023*	-0.056**
	(-1.96)	(-2.23)		(-2.13)	(-1.68)	(-1.90)	(-1.70)	(-1.88)	(-2.19)
STD_{t-1}	-0.039*	-0.098***		-0.043**	-0.036*	-0.040*	-0.035	-0.036*	-0.096***
	(-1.81)	(-2.86)		(-2.03)	(-1.70)	(-1.93)	(-1.01)	(-1.67)	(-2.83)
$SIZE_{t-1}$	-0.004	0.310***		0.015	-0.008	0.010	-0.003	-0.004	0.316***
	(-0.19)	(4.88)		(1.08)	(-0.51)	(0.70)	(-0.21)	(-0.23)	(4.96)
MB_{t-1}	-0.031**	-0.019		-0.029*	-0.031*	-0.033**	-0.036**	-0.031**	-0.017
	(-2.08)	(-0.86)		(-1.94)	(-1.96)	(-2.08)	(-2.20)	(-1.99)	(-0.81)
LEV_{t-1}	-0.052***	-0.060**		-0.063***	-0.046***	-0.054***	-0.049***	-0.050***	-0.058**
	(3.67)	(-2.07)		(-4.71)	(-3.39)	(-3.96)	(-3.55)	(3.47)	(-1.98)
ROE_{t-1}	0.065***	0.063***		0.064***	0.068***	0.068***	0.070***	0.065***	0.063***
	(5.18)	(3.07)		(5.50)	(5.18)	(5.26)	(4.95)	(5.09)	(3.08)
$DEPENDENT_{t-1}$	0.005	-0.171***		0.004	0.057	0.005	0.005	0.004	-0.172***
	(0.42)	(-13.84)		(0.33)	(0.47)	(0.41)	(0.40)	(0.34)	(-13.90)
$DEPENDENT_{t-2}$	0.018	-0.123***		0.015	0.018*	0.018	0.019*	0.016	-0.123***
	(1.61)	(-9.90)		(1.41)	(1.68)	(1.62)	(1.68)	(1.51)	(9.87)
$DEPENDENT_{t-3}$	-0.002	-0.107***		-0.004	-0.003	-0.003	-0.003	-0.004	-0.108***
	(-0.22)	(-8.71)		(-0.37)	(-0.30)	(-0.28)	(-0.23)	(-0.32)	(-8.79)
F.F.E.	NO	YES		NO	NO	NO	NO	NO	YES
Adj. R^2	0.027	0.262		0.022	0.019	0.018	0.019	0.023	0.261

Table 4: Corporate governance attributes and crash risk.

This table presents ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level between crash risk measures and corporate governance attributes. The sample consists of 8119 firm-year observations during the period 2002-2013. NCSKEW in Panel A is the negative conditional skewness and DUVOL in Panel B is the down-to-up volatility. %INST_DED (%INST_TRA) is the percentage of equity ownership in the firm by dedicated (transient) institutional investors and INST_STD is the average standard deviation of institutional equity holding proportions across all investors in the firm over a 5-year period. BLOCK is the number of outside investors who hold 5% or more of equity, %INSIDER is the percentage of equity held by insiders and %BRD_STOCK is the percentage of outside directors that hold equity in the firm. OPAQUE is the three-year moving sum of the absolute discretionary accruals, C_SCORE is accounting conservatism, %AUD_IND is the percentage of outside independent directors in the audit committee and AUD_EXPERT is a dummy variable that equals one when the auditors' firm has more than a third of market share of total turnover within an industry. %BRD_IND is the percentage of outside directors serving on the board, BRD_SIZE is the natural logarithm number of directors sitting in the board, %BRD_COMP is the percentage of directors that also serve on boards of other firms, CEO_DUALITY is a dummy variable that equals one when the positions of the CEO and the chairman of the board are held by the same person, and GPOL is a dummy variable that equals one when the company has a formal and clearly defined corporate governance policy in its mandate. CEO_INC_OPT (CFO_INC_OPT) is the CEO (CFO) option holding incentives, CEO_INC_STC (CFO_INC_STC) is the CEO (CFO) stock holding incentives and CEO_BONUS (CFO_BONUS) is the CEO (CFO) bonus scaled by salary. *t*-statistics are reported in the parenthesis below each coefficient. All specifications include a constant, control variables, year and industry fixed effects. The term F.F.E. is used to indicate the inclusion of firm fixed effects. ***, ** and *, indicate significance at the 0.01, 0.05 and 0.10 level or better, respectively.

Panel A: Corporate governance attributes and NCSKEW

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ownership Structure										
$\%INST\_DED_{t-1}$	-	-0.015					-0.014	-0.008	-0.007	-0.008
		(-1.04)					(-0.97)	(-0.43)	(-0.38)	(-0.42)
$\%INST\_TRA_{t-1}$	+	0.060***					0.057***	0.041*	0.043**	0.041*
		(4.02)					(3.81)	(1.87)	(1.97)	(1.85)
$INST\_STD_{t-1}$	+	0.016					0.016	0.023*	0.023*	0.023*
		(1.37)					(1.39)	(1.67)	(1.69)	(1.68)
$BLOCK_{t-1}$	-	0.001					0.016	-0.007	-0.009	-0.007
		(0.71)					(1.22)	(-0.41)	(-0.49)	(-0.40)
$\%INSIDER_{t-1}$	-	-0.023**					-0.026**	0.013	0.016	0.013
		(-1.97)					(-1.96)	(0.46)	(0.57)	(0.45)
$\%BRD\_STOCK_{t-1}$	?	0.024**					0.027**	0.058***	0.058***	0.058***
		(2.10)					(2.35)	(3.24)	(3.25)	(3.26)
Accounting Opacity										
$OPAQUE_{t-1}$	+		0.014				0.011	0.017	0.017	0.017
			(1.09)				(0.83)	(1.03)	(1.05)	(1.03)
C_SCORE_{t-1}	-		-0.061***				-0.057***	-0.051**	-0.056**	-0.051*
			(3.01)				(-2.70)	(-1.95)	(-2.18)	(-1.95)
$\%AUD\_IND_{t-1}$	-		-0.016				-0.056	-0.213	-0.216	-0.218
			(-0.19)				(-0.54)	(-1.42)	(-1.44)	(-1.45)
AUD_EXPERT_{t-1}	-		-0.033				-0.030	0.033	0.035	0.032
			(-1.21)				(-1.09)	(0.58)	(0.62)	(0.57)

Board Structure and Processes										
$\%BRD\_IND_{t-1}$	-			0.016			0.004	0.006	0.006	0.006
				(1.32)			(0.31)	(0.22)	(0.25)	(0.24)
BRD_SIZE_{t-1}	?			-0.050**			-0.037	-0.079*	-0.083*	-0.079*
				(-2.00)			(-1.43)	(-1.66)	(-1.75)	(-1.67)
$\%BRD\_COMP_{t-1}$	?			0.001			-0.003	0.011	0.011	0.011
				(0.06)			(-0.14)	(0.41)	(0.38)	(0.42)
$CEO\_DUALITY_{t-1}$	+			-0.027			-0.037	-0.014	0.006	-0.013
				(-1.15)			(-1.49)	(-0.35)	(0.15)	(-0.34)
$GPOL_{t-1}$	-			-0.052*			-0.060**	0.004	0.006	0.006
				(-1.70)			(-1.96)	(0.08)	(0.11)	(0.10)
Managerial Incentives										
$CEO\_INC\_OPT_{t-1}$	+				0.023*		0.015	0.051**		0.045*
					(1.79)		(0.93)	(2.18)		(1.72)
$CEO\_INC\_STC_{t-1}$	+				-0.000		0.010	0.021		0.022
					(-0.01)		(0.76)	(0.89)		(0.89)
CEO_BONUS_{t-1}	?				-0.010		0.000	0.017		0.027
					(-0.78)		(0.05)	(0.92)		(1.12)
$CFO\_INC\_OPT_{t-1}$	+					0.013	-0.004		0.030	0.013
						(0.99)	(-0.25)		(1.44)	(0.58)
$CFO\_INC\_STC_{t-1}$	+					0.007	-0.001		0.000	-0.032
						(0.63)	(-0.06)		(0.01)	(-0.17)
CFO_BONUS_{t-1}	?					-0.020*	-0.024		-0.004	-0.014
						(-1.64)	(-1.57)		(-0.24)	(-0.62)
F.F.E.		NO	NO	NO	NO	NO	NO	YES	YES	YES
Adj. R^2		0.019	0.017	0.016	0.016	0.016	0.020	0.256	0.256	0.256

Panel B: Corporate governance attributes and DUVOL

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ownership Structure										
%INST_DED$_{t-1}$	-	-0.020					-0.018	-0.011	-0.009	-0.010
		(-1.46)					(-1.35)	(-0.57)	(-0.50)	(-0.55)
%INST_TRA$_{t-1}$	+	0.064***					0.060***	0.048**	0.051**	0.047**
		(4.36)					(4.03)	(2.18)	(2.33)	(2.14)
INST_STD$_{t-1}$	+	0.019*					0.020*	0.027**	0.027**	0.027**
		(1.65)					(1.70)	(1.96)	(1.99)	(1.98)
BLOCK$_{t-1}$	-	0.003					0.010	-0.024	-0.026	-0.024
		(0.24)					(0.82)	(-1.36)	(-1.47)	(-1.35)
%INSIDER$_{t-1}$	-	-0.028**					-0.031**	0.007	0.012	0.007
		(-2.38)					(-2.38)	(0.23)	(0.41)	(0.26)
%BRD_STOCK$_{t-1}$	?	0.027**					0.030**	0.062***	0.061***	0.061***
		(2.31)					(2.51)	(3.50)	(3.47)	(3.49)
Accounting Opacity										
OPAQUE$_{t-1}$	+		0.010				0.006	0.009	0.009	0.008
			(0.82)				(0.50)	(0.55)	(0.55)	(0.52)
C_SCORE$_{t-1}$	-		-0.075***				-0.066***	-0.064**	-0.071***	-0.063**
			(-3.70)				(-3.09)	(-2.47)	(-2.76)	(-2.43)
%AUD_IND$_{t-1}$	-		-0.019				-0.087	-0.243*	-0.241	-0.246*
			(-0.22)				(-0.83)	(-1.65)	(-1.61)	(-1.65)
AUD_EXPERT$_{t-1}$	-		-0.031				-0.027	0.014	0.017	0.012
			(-1.12)				(-0.97)	(0.25)	(0.29)	(0.21)
Board Structure and Processes										
%BRD_IND$_{t-1}$	-			0.020*			0.011	0.017	0.018	0.017
				(1.68)			(0.74)	(0.69)	(0.73)	(0.70)
BRD_SIZE$_{t-1}$	?			-0.057**			-0.043*	-0.078*	-0.083*	-0.078*
				(2.30)			(-1.69)	(-1.66)	(-1.77)	(-1.67)
%BRD_COMP$_{t-1}$	?			0.002			-0.002	0.013	0.011	0.011
				(0.11)			(-0.10)	(0.47)	(0.39)	(0.44)
CEO_DUALITY$_{t-1}$	+			-0.019			-0.033*	-0.024	0.004	-0.022
				(-0.80)			(-1.35)	(-0.60)	(0.12)	(-0.55)
GPOL$_{t-1}$	-			-0.041			-0.047	0.022	0.026	0.025
				(1.35)			(-1.56)	(0.40)	(0.47)	(0.45)
Managerial Incentives										
CEO_INC_OPT$_{t-1}$	+				0.026**		0.015	0.070***		0.066**
					(1.99)		(0.87)	(2.97)		(2.54)
CEO_INC_STC$_{t-1}$	+				0.007		0.018	0.032		0.027
					(0.56)		(1.33)	(1.35)		(1.11)
CEO_BONUS$_{t-1}$	?				-0.002		0.011	0.033*		0.046*
					(-0.13)		(0.67)	(1.73)		(1.91)
CFO_INC_OPT$_{t-1}$	+					0.016	-0.002		0.030	0.006
						(1.24)	(-0.10)		(1.45)	(0.27)

$CFO\_INC\_STC_{t-1}$	+					0.013	0.002		0.016	0.013
						(1.08)	(0.16)		(0.89)	(0.65)
CFO_BONUS_{t-1}	?					-0.016	-0.028*		-0.000	-0.018
						(-1.32)	(-1.78)		(-0.00)	(-0.83)
F.F.E.		NO	NO	NO	NO	NO	NO	YES	YES	YES
Adj. R^2		0.023	0.020	0.019	0.019	0.019	0.025	0.264	0.263	0.264

Table 5. Corporate governance attributes and crash risk: The impact of agency risk.

This table presents ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level between crash risk measures and corporate governance attributes for the period 2002-2013. Model estimations are done separately for low and high levels of agency risk using four agency risk proxies: (i) Industry Completion is measured using the Herfindahl-Hirschman Index, (ii) Return Volatility is measured using the standard deviation of daily stock returns in the last 12 months, (iii) Operating Profits Volatility is measured with operating profits volatility computed using the last 5-years' standard deviation of sales and (iv) Cash Flow Volatility is measured following Garfinkel and Hankings (2011) computed as the quarterly volatility of operating profits using the prior 20 periods. NCSKEW in Panel A is the negative conditional skewness and DUVOL in Panel B is the down-to-up volatility. %INST_DED (%INST_TRA) is the percentage of equity ownership in the firm by dedicated (transient) institutional investors and INST_STD is the average standard deviation of institutional equity holding proportions across all investors in the firm over a 5-year period. BLOCK is the number of outside investors who hold 5% or more of equity, %INSIDER is the percentage of equity held by insiders and %BRD_STOCK is the percentage of outside directors that hold equity in the firm. OPAQUE is the three-year moving sum of the absolute discretionary accruals, C_SCORE is accounting conservatism, %AUD_IND is the percentage of outside independent directors in the audit committee and AUD_EXPERT is a dummy variable that equals one when the auditors' firm has more than a third of market share of total turnover within an industry. %BRD_IND is the percentage of outside directors serving on the board, BRD_SIZE is the natural logarithm number of directors sitting in the board, %BRD_COMP is the percentage of directors that also serve on boards of other firms, CEO_DUALITY is a dummy variable that equals one when the positions of the CEO and the chairman of the board are held by the same person, and GPOL is a dummy variable that equals one when the company has a formal and clearly defined corporate governance policy in its mandate. CEO_INC_OPT (CFO_INC_OPT) is the CEO (CFO) option holding incentives, CEO_INC_STC (CFO_INC_STC) is the CEO (CFO) stock holding incentives and CEO_BONUS (CFO_BONUS) is the CEO (CFO) bonus scaled by salary. *t*-statistics are reported in the parenthesis below each coefficient. All specifications include a constant, control variables, year and industry fixed effects. The term F.F.E. is used to indicate the inclusion of firm fixed effects. *F*-statistics for comparison of the key coefficients are depicted with the symbol "+" indicating significance at the 0.10 level or better. ***, ** and *, indicate significance at the 0.01, 0.05 and 0.10 level or better, respectively.

Panel A: Corporate governance variables and NCSKEW

		Industry Competition		**Return Volatility**		**Operating Profits Volatility**		**Cash Flow Volatility**	
		HIGH	**LOW**	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**
	Degree of agency risk:	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**
	Predicted Sign	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Ownership Structure									
$\%INST\_DED_{t-1}$	-	-0.014	-0.013	-0.040**,+	0.011	-0.021	-0.009	-0.013	-0.012
		(-0.81)	(-0.60)	(-2.20)	(0.55)	(-1.07)	(-0.44)	(-0.76)	(-1.05)
$\%INST\_TRA_{t-1}$	+	0.052***	0.059***	0.035	0.057***	0.085***	0.033*	0.067***	0.049**
		(2.39)	(2.88)	(1.43)	(3.03)	(3.68)	(1.69)	(3.41)	(2.06)
$INST\_STD_{t-1}$	+	0.001	0.028*	-0.016	0.035**,+	-0.001	0.028*	0.024	0.012
		(0.07)	(1.85)	(-0.85)	(2.46)	(-0.04)	(1.87)	(1.53)	(0.69)
$BLOCK_{t-1}$	-	0.007	0.023	0.008	0.025	0.024	0.011	0.023	0.006
		(0.37)	(1.27)	(0.40)	(1.42)	(1.37)	(0.60)	(1.26)	(0.29)
$\%INSIDER_{t-1}$	-	-0.019	-0.030*	-0.018	-0.035**	-0.017	-0.039**	0.005	-0.057***,+
		(-1.03)	(1.64)	(-0.89)	(-2.16)	(-0.90)	(-2.16)	(0.27)	(-3.03)
$\%BRD\_STOCK_{t-1}$	?	0.023	0.031**,+	0.014	0.041***	0.029	0.031*	0.016	0.028
		(1.32)	(2.03)	(0.82)	(2.75)	(1.62)	(1.91)	(1.03)	(1.55)
Accounting Opacity									
$OPAQUE_{t-1}$	+	0.015	0.007	0.015	0.003	0.023	0.004	0.011	0.011

		(0.69)	(0.40)	(0.77)	(0.18)	(1.18)	(0.25)	(0.63)	(0.54)
C_SCORE_{t-1}	-	-0.056*	-0.058*	0.026	-0.107***,+	-0.031	-0.091***,+	-0.060**	-0.071**
		(-1.88)	(-1.89)	(0.76)	(-3.86)	(-1.06)	(-2.98)	(-1.97)	(-2.39)
$\%AUD\_IND_{t-1}$	-	-0.064	-0.063	0.041	-0.136	-0.062	-0.059	-0.023	0.130
		(-0.41)	(-0.46)	(0.30)	(-0.92)	(-0.42)	(-0.41)	(-1.54)	(0.88)
AUD_EXPERT_{t-1}	-	-0.052	-0.009	-0.035	-0.025	-0.043	-0.013	-0.022	-0.027
		(-1.48)	(-0.20)	(-0.96)	(-0.63)	(-1.07)	(-0.34)	(-0.59)	(-0.68)
Board Structure and Processes									
$\%BRD\_IND_{t-1}$	-	-0.000	0.013	0.003	0.003	0.015	-0.006	0.005	0.007
		(-0.00)	(0.61)	(0.16)	(0.16)	(0.69)	(-0.30)	(0.28)	(0.30)
BRD_SIZE_{t-1}	?	-0.004	-0.074**,+	-0.058	-0.025	-0.020	-0.067*	-0.022	-0.044
		(-0.12)	(-2.03)	(-1.60)	(-0.74)	(-0.53)	(-1.92)	(-0.65)	(-1.13)
$\%BRD\_COMP_{t-1}$	?	-0.017	0.015	-0.013	0.008	0.014	-0.014	-0.018	0.006
		(-0.64)	(0.57)	(-0.46)	(0.30)	(0.50)	(-0.56)	(-0.65)	(0.24)
$CEO\_DUALITY_{t-1}$	+	-0.053	-0.027	-0.073**	-0.001	-0.023	-0.052	-0.065	-0.011
		(-1.51)	(-1.36)	(-2.03)	(-0.04)	(-0.64)	(-1.55)	(-0.97)	(-0.30)
$GPOL_{t-1}$	-	-0.026	-0.080*	-0.005	-0.086**	-0.037	-0.078*	-0.010	-0.117**,+
		(-0.55)	(-1.90)	(-0.12)	(-2.08)	(-0.74)	(-1.93)	(-0.22)	(-2.41)
Managerial Incentives									
$CEO\_INC\_OPT_{t-1}$	+	0.033	-0.003	-0.011	0.049**,+	-0.024	0.044**,+	0.033	-0.001
		(1.45)	(-0.12)	(-0.53)	(1.96)	(-0.94)	(2.06)	(1.42)	(-0.05)
$CEO\_INC\_STC_{t-1}$	+	0.014	0.006	0.005	0.015	0.018	0.010	0.015	0.000
		(0.65)	(0.34)	(0.31)	(0.77)	(0.97)	(0.50)	(0.84)	(0.05)
CEO_BONUS_{t-1}	?	0.008	-0.005	0.002	-0.008	-0.004	-0.002	-0.000	0.001
		(0.34)	(-0.22)	(0.09)	(-0.32)	(-0.17)	(-0.08)	(-0.00)	(0.05)
$CFO\_INC\_OPT_{t-1}$	+	0.000	-0.006	0.019	-0.037	0.012	-0.016	-0.017	0.010
		(0.21)	(-0.27)	(1.00)	(-1.40)	(0.52)	(-0.73)	(-0.81)	(0.38)
$CFO\_INC\_STC_{t-1}$	+	0.007	-0.012	0.003	-0.011	0.006	-0.014	-0.012	0.015
		(0.39)	(-0.72)	(0.22)	(-0.62)	(0.34)	(-0.83)	(-0.73)	(0.89)
CFO_BONUS_{t-1}	?	-0.035	-0.017	-0.035*	-0.009	-0.021	-0.026	-0.012	-0.032
		(-1.59)	(-0.79)	(-1.66)	(-0.40)	(-0.92)	(-1.21)	(-0.60)	(-1.31)
No. Obs.		4074	4045	4059	4060	3945	4174	4241	3694
Adj. R^2		0.014	0.024	0.017	0.042	0.018	0.025	0.016	0.029

Panel B: Corporate governance variables and DUVOL

		Industry Competition		Return Volatility		Operating Profits Volatility		Cash Flow Volatility	
		HIGH	LOW	LOW	HIGH	LOW	HIGH	LOW	HIGH
	Degree of agency risk:	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**	**LOW**	**HIGH**
	Predicted Sign	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Ownership Structure									
$\%INST\_DED_{t-1}$	-	-0.019	-0.016	-0.042**$^{,+}$	0.004	-0.025	-0.012	-0.015	-0.028
		(-1.07)	(-0.84)	(-2.30)	(0.20)	(-1.40)	(-0.60)	(-0.88)	(-1.34)
$\%INST\_TRA_{t-1}$	+	0.061***	0.059***	0.034	0.065***	0.088***	0.036*$^{,+}$	0.064***	0.060***
		(2.74)	(2.92)	(1.35)	(3.52)	(3.89)	(1.85)	(3.23)	(2.59)
$INST\_STD_{t-1}$	+	0.005	0.032**$^{,+}$	-0.009	0.037**$^{,+}$	-0.000	0.033**$^{,+}$	0.026	0.018
		(0.26)	(2.02)	(-0.48)	(2.54)	(-0.02)	(2.16)	(1.59)	(1.07)
$BLOCK_{t-1}$	-	-0.003	0.021	0.002	0.024	0.020	0.005	0.018	-0.001
		(-0.18)	(1.19)	(0.11)	(1.38)	(1.14)	(0.30)	(1.02)	(-0.05)
$\%INSIDER_{t-1}$	-	-0.022	-0.042**	-0.033	-0.035**	-0.019	-0.051***	-0.006	-0.064***$^{,+}$
		(-1.19)	(-2.22)	(-1.61)	(-2.05)	(-1.02)	(-2.78)	(-0.30)	(-3.36)
$\%BRD\_STOCK_{t-1}$	?	0.028	0.031**	0.017	0.042***	0.026	0.037**	0.019	0.030*
		(1.56)	(2.01)	(1.02)	(2.83)	(1.52)	(2.21)	(1.20)	(1.64)
Accounting Opacity									
$OPAQUE_{t-1}$	+	-0.003	0.005	0.011	-0.007	0.009	0.004	0.005	0.023
		(-0.13)	(0.30)	(0.61)	(-0.46)	(0.53)	(0.24)	(0.34)	(0.13)
C_SCORE_{t-1}	-	-0.066**	-0.062**	0.040	-0.122***$^{,+}$	-0.046	-0.091***	-0.067**	-0.082***
		(-2.19)	(-2.02)	(1.15)	(-4.45)	(-1.51)	(-3.03)	(-2.24)	(-2.69)
$\%AUD\_IND_{t-1}$	-	-0.088	-0.114	0.022	-0.92	-0.120	-0.066	-0.021	0.032
		(-0.56)	(-0.79)	(0.15)	(-1.34)	(-0.82)	(-0.45)	(-1.42)	(0.22)
AUD_EXPERT_{t-1}	-	-0.049	-0.001	-0.023	-0.036	-0.048	-0.000	-0.016	-0.027
		(-1.41)	(-0.02)	(-0.63)	(-0.91)	(-1.21)	(-0.00)	(-0.42)	(-0.70)
Board Structure and Processes									
$\%BRD\_IND_{t-1}$	-	0.008	0.019	0.008	0.010	0.020	0.001	0.007	0.002
		(0.40)	(0.87)	(0.41)	(0.51)	(0.95)	(0.03)	(0.37)	(0.91)
BRD_SIZE_{t-1}	?	-0.008	-0.082**$^{,+}$	-0.064*	-0.037	-0.018	-0.079**	-0.029	-0.051
		(-0.23)	(-2.23)	(-1.78)	(-1.07)	(-0.47)	(-2.21)	(-0.82)	(-1.32)
$\%BRD\_COMP_{t-1}$	?	-0.010	0.010	-0.013	0.009	0.009	-0.007	-0.015	0.006
		(-0.35)	(0.40)	(-0.49)	(0.35)	(0.32)	(-0.31)	(-0.54)	(0.21)
$CEO\_DUALITY_{t-1}$	+	-0.046	-0.033	-0.070*	-0.005	-0.019	-0.052	-0.069**	-0.006
		(-1.28)	(-0.92)	(-1.91)	(-0.16)	(-0.52)	(-1.54)	(-2.03)	(-0.15)
$GPOL_{t-1}$	-	-0.015	-0.070*	0.004	-0.073*	-0.015	-0.070*	-0.006	-0.108**$^{,+}$
		(-0.33)	(-1.66)	(0.10)	(-1.80)	(-0.32)	(-1.70)	(-0.14)	(-2.25)
Managerial Incentives									
$CEO\_INC\_OPT_{t-1}$	+	0.033	-0.003	-0.011	0.050**$^{,+}$	-0.023	0.046**$^{,+}$	0.033	-0.001
		(1.42)	(-0.14)	(-0.56)	(2.03)	(-0.90)	(2.08)	(1.41)	(-0.02)
$CEO\_INC\_STC_{t-1}$	+	0.021	0.014	0.010	0.025	0.025	0.018	0.016	0.016
		(0.96)	(0.78)	(0.58)	(1.29)	(1.39)	(0.86)	(0.83)	(0.84)
CEO_BONUS_{t-1}	?	0.026	-0.005	0.021	-0.007	0.004	0.010	-0.002	0.019
		(1.05)	(-0.23)	(0.86)	(-0.33)	(0.19)	(0.40)	(-0.09)	(0.74)
$CFO\_INC\_OPT_{t-1}$	+	0.002	-0.007	0.020	-0.041	0.014	-0.015	-0.011	0.006

		(0.08)	(-0.30)	(1.05)	(-1.58)	(0.63)	(-0.69)	(-0.52)	(0.23)
$CFO\_INC\_STC_{t-1}$	+	0.012	-0.010	0.012	-0.017	0.006	-0.007	-0.013	0.025
		(0.66)	(-0.60)	(0.77)	(-0.89)	(0.37)	(-0.35)	(-0.73)	(1.38)
CFO_BONUS_{t-1}	?	-0.041*	-0.015	-0.041*	-0.006	-0.023	-0.029	-0.002	-0.043*
		(-1.82)	(-0.68)	(-1.91)	(-0.26)	(-1.03)	(-1.31)	(-0.10)	(-1.77)
No. Obs.		4074	4045	4059	4060	3945	4174	4241	3694
Adj. R^2		0.019	0.027	0.014	0.050	0.023	0.028	0.020	0.033

Table 6. Corporate governance attributes and crash risk: The impact of crisis on accounting opacity.

This table presents ordinary least squares coefficient estimates with standard errors adjusted for clustering at the firm level between crash risk measures and corporate governance attributes with emphasis on the interplay between accounting opacity and the crisis period. The sample consists of 8119 firm-year observations during the period 2002-2013. NCSKEW is the negative conditional skewness and DUVOL is the down-to-up volatility. For brevity the table presents only the accounting opacity (OPAQUE) and accounting conservatism (C_SCORE) variables. CRISIS_POST takes the value of one for all years after 2009, CRISIS takes the value of one for the fiscal year 2010 and POST_CRISIS takes the value of one for all years after 2010. All specifications include a constant, all other corporate governance attributes, control variables, year and industry fixed effects. ***, ** and *, indicate significance at the 0.01, 0.05 and 0.10 level or better, respectively.

		NCSKEW		DUVOL	
Variables	**Predicted Sign**	**(1)**	**(2)**	**(3)**	**(4)**
Accounting Opacity					
$OPAQUE_{t-1}$	+	0.061**	0.061**	0.047*	0.047*
		(2.31)	(2.31)	(1.83)	(1.83)
$OPAQUE_{t-1}$ * CRISIS_POST	-	-0.063**		-0.052*	
		(-2.10)		(-1.79)	
$OPAQUE_{t-1}$ * CRISIS	-		-0.067**		-0.056*
			(-2.01)		(-1.81)
$OPAQUE_{t-1}$ * POST_CRISIS	-		-0.059*		-0.047
			(-1.73)		(-1.40)
C_SCORE_{t-1}	-	-0.056***	-0.056***	-0.064***	-0.064***
		(-2.62)	(-2.62)	(-3.02)	(-3.02)
Adj. R^2		0.021	0.021	0.025	0.025