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# Corporate Governance and Stock Price Crash Risk: Evidence from UK Panel Data

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## Abstract

This study examines the relationship between corporate governance characteristics and risk of stock price crash in UK firms. We use CEO Pay Slice (CPS) – the fraction of maximum top-five executives' total compensation that goes to the CEO, and board 'busyness' – the proportion of board level directors who have three or more directorships , to evaluate the effect of these two important aspects of corporate governance on stock price crash risk. The CPS reflects relative importance of the CEO as well as the extent to which the CEO is able to extract rents and expropriate shareholders wealth (expropriation effect). Board busyness may create a serious agency problem because directors are "too busy to mind the business", allowing for executives' short-termism and bad news hoarding (busyness effect). Using a large sample of UK listed companies over the 1997 to 2010 period, we document evidence supporting a positive relationship between CPS, board busyness and stock price crash risk. In line with the expropriation and busyness effects, we find that companies with high CPS and high levels of board busyness are exposed to higher level of stock price crash risk. The fact that CPS positively impacts on stock price crash risk has a strong implication for the on-going debate on how to reform executive remuneration so that it provides the right incentives to directors. There is also a direct implication for the public debate on limitation of the number of directorships held by executives from our findings, as we argue that board effectiveness depends on the overall level of board business.

**JEL classification:** G32, G35, G38, J33, L29

**Key words:** CEO compensation, CEO pay slice, busy board, corporate governance, agency problem, stock price crash risk

## Introduction

The finance literature has long examined corporate governance characteristics. Within the rapidly developing research on corporate governance, a significant proportion of the relevant theoretical and empirical literature has concentrated on studying the relationship between governance characteristics and stock price crash risk that is of key importance to many managers, investors, and academics. Changes in regulations, asset expropriation, disruptive product innovations, market crashes can all provoke stock price crashes. Increases in stock price crash risk can result in the decline of expected cash flows and NPVs. When cash flows fall below investors' expectations, managers tend to hide the bad news in order to protect their own wealth, human capital, and jobs (Amihud and Lev, 1981; Holmstrom, 1999; Benmelegh et al., 2010; Gormley and Matsa, 2011). Once negative firm-specific information becomes generally realized, stock price drops dramatically (Jin and Myers, 2006), increasing stock price crash risk. A considerable body of literature suggests that corporate governance mechanisms can help to prevent suboptimal managerial behaviors and so significantly reduce the risk of the firm's stock price crashing. Still, evidence on the impact of corporate governance characteristics on stock price crash risk outside the US is limited.

In this study, we attempt to throw additional light on the links between corporate governance characteristics and stock price crashes in the UK. In particular, we investigate whether pay inequality between a company's CEO and the other top executives, as well as board 'busyness' affect stock price crash risk of British companies. We define pay inequality as the proportion of top executives' total compensation that goes to the CEO – which has been labeled the CEO Pay Slice (CPS); and we measure corporate board busyness by the

proportion of busy directors (directors with three or more directorships) represented at the board level. Our main hypothesis is that companies with high CPS and 'busy' boards (which are both characteristics of weak corporate governance) are more exposed to stock price crash risk, all else equal. Explanations of positive relationship between CPS, board busyness and stock price crash risk conform to one of the following theoretical frames. First, high CPS may be an indication of CEO centrality. Powerful CEO can influence decision making process within the board room according to his/her own managerial style and risk preferences. CEO managerial style (whether conservative or aggressive) has been shown to influence important corporate decisions (Malmendier et al., 2011). CPS, as a measure of CEO power connected directly to stock price crash risk emerging from the implementation of certain corporate policies. Second, high-powered compensation packages, combined with information asymmetry, in the situations where boards are busy, magnify agency problems, and can also incentivize CEO and top executives to take on decisions that may enhance short term performance and so increase exposure to the stock price crash risk. Third, due to information asymmetry, it is difficult for outsiders to differentiate between managerial actions that generate true positive returns from those that generate high returns in order to help managers to camouflage the real situation in their companies and protect their jobs, at least for some time. Therefore, carefully considered structures of CEO and top executives' compensation packages, coupled with low pay disparity between top executive team members and good quality monitoring from non-busy corporate board may be necessary to control stock price crash risk exposures.

The recent corporate scandals around "fat cats" compensation packages in Britain[1] are a timely reminder that this problem requires further attention. Executive pay has become a major issue in recent years in the UK, with shareholders questioning high salaries directors

[1] See BBC News-Business: "High Pay of UK executives corrosive, report says", 22 November 2011, http://www.bbc.co.uk/news/business-15827683

receive[2,3]. The British government has been very proactive in tackling compensation-related problems. Thus, in 2002, the UK became the first country to mandate an annual non-binding shareholder vote on directors' remuneration ("say on pay") to improve the "accountability, transparency, and performance linkage of executive pay" (Baird and Stowasser, 2003). In September 2013, the government went one step further and introduced mandatory 'say on pay'. Shortcomings in regulation of compensation-related issues have been also addressed by the UK Corporate Governance Code 2010 (The Code), with particular attention being paid to the importance of establishing a strong link between directors' remuneration and firm performance[4], as well as responsibilities of directors for risk oversight and management[5]. In our analysis we use a large sample of non-financial companies listed on the London Stock Exchange, comprising 692 firms over the 1997 to 2010 period. We control for important corporate governance characteristics, such as board composition, board size, CEO- Chairman duality, and CEO tenure; we also control for various firm-specific characteristics, which are company size, ratio of capital expenditures to total assets, and leverage. Our empirical methodology includes the use of panel data and a system GMM estimator. By using this estimator, we avoid problems associated with unobserved heterogeneity and potential endogeneity of regressors. The system GMM estimator is also considered as more efficient

[2] See The Wall Street Journal – Business: "U.K. Unveils Plan on Executive Pay", 20 June, 2012, available at http://online.wsj.com/news/articles/SB10001424052702304765304577478172485959522

[3] "There is compelling evidence of a disconnect between pay and performance in large UK listed companies", UK Business Secretary Vince Cable told Parliament; David Cameron, the UK Prime Minister, also criticised boardroom cronies who helped each other "fill their boots" while the country was forced to tighten its belt. "We've got to deal with the merry-go-round where there are too many cases of remuneration committee members sitting on each other's boards, patting each other's backs and handing out each other's pay rises," he said. "We need to redefine the word 'fair'. We need to try to give people a sense that we have a vision at the end of this, of a fairer, better economy, a fairer, better society, where if you work hard and do the right thing you get rewarded" , 7 January, 2012, http://www.theguardian.com/business/2012/jan/07/david-cameron-fat-cat-pay

[4] Section D: Remuneration. Main Principle: "Levels of remuneration should be sufficient to attract, retain, and motivate directors of the quality required to run the company successfully, but a company should avoid paying more than is necessary for this purpose. A significant proportion of executive directors' remuneration should be structured so as to link rewards to corporate and individual performance." (The UK Corporate Governance Code, June 2010: p.22).

[5]Section C2: Risk Management and Internal Control. Main Principle: "The board is responsible for determining the nature and extent of the significant risks it is willing to take in achieving its strategic objectives. The board should maintain sound risk management and internal control systems."

than other instrumental variable techniques in controlling for the possible endogeneity of explanatory variables (see Almeida et al., 2010).

Throughout our analysis, we find consistent support for the proposition that higher CPS and board busyness are associated with higher stock price crash risk. Our results strongly support the *expropriation* and *busyness* arguments[6]. Thus, a high CPS level could be due to an agency problem in firms with powerful and influential CEO, who is able to stockpile negative information from the market for financial (expropriation of rents through the compensation arrangements)[7] or non-financial reasons (e.g., empire building with a view to expropriating future rents)[8]. However, upon the realization of this (negative) information by the market, company's stock price crashes (Jin and Myers, 2006; Hutton et al., 2009). In addition, high CPS could demotivate other executive directors, destroy team cooperation within the boardroom, and lead to poor board and firm performance (the so-called *social comparison* effect, which is especially pronounced on the British boards[9]). In turn, busy boards are associated with weak corporate governance and also contribute to high agency problems.[10] Therefore, companies with busy corporate boards are likely to experience high stock price crash risk. Our results indicate that CPS and board busyness can provide a useful tool for research on stock price crash risk, which is an important issue to be considered in the UK context.

Our study is related to different streams of the literature. First, extent research shows that proportion of compensation received by CEOs has been trending up over time (Bebchuk and Grinstein, 2005; Frydman, 2005, Frydman and Saks, 2010 among others). We add to this

[6] See Section 4.2 of this chapter for detailed discussion of theories.
[7] See Kothari et al., 2009.
[8] See Ball, 2001.
[9] See Zalewska (2014a,b) for detailed discussion of UK board mechanisms and structures.
[10] See Gilson (1990); Lipton and Lorsch (1992); National Association of Corporate Directors (NACD) (1996); Beasly (1996); Cotter et al. (1997); Core et al. (1999); Brown and Maloney (1999); Shivdasni and Yermack (1999); Miwa and Ramseyer (2000); Bohren and Strom (2001); Ferris et al. Pritchard (2003); Fich and Shivdasani (2006); and Cooper and Uzun (2012).

literature stream by investigating the relationship between CPS and stock price crash risk in the UK. Second, we contribute by analyzing the association between different corporate governance characteristics and stock price crash risk. Thus, scholars discuss impact of large shareholders and institutional investors (An and Zhang, 2013), the opacity of financial reports (Hutton et al., 2009), and CEO incentives and power (Kim et al., 2011a). We contribute to this literature by considering other aspects of governance arrangement, the CPS and board busyness, and their impact on stock price crash risk. Finally, our work enhances the literature that analyzes different CEO qualities and characteristics and their effect on firm outcomes. We highlight CPS and board busyness as important features which can provide additional insight into understanding the link between corporate governance characteristics and stock price crash risk. This is the first study that we are aware of, highlighting the above mentioned aspects using the UK-based sample.

The reminder of this chapter is organized as follows. We provide theoretical background and develop hypothesis in Section 4.2. Section 4.3 contains the sample description and summary statistics. Section 4.4 outlines the methodology used for the analysis. Section 4.5 examines the relationship between CPS, board busyness and stock price crash risk. Section 4.6 provides results of additional tests. Section 4.7 concludes.

## Related literature and hypothesis development

### Corporate Governance and Stock Price Crashes: The Existing Evidence

An extensive body of literature suggests that corporate governance mechanisms can help to prevent sub-optimal managerial behavior (Shleifer and Vishny, 1997; Healy et al., 1999). Good corporate governance practices discipline investments (Masulis et al., 2007), prevent earnings management (Xie et al., 2003), improve information disclosure process (Armstrong et al., 2012; Karamanou and Vafeas, 2005), and align interests of managers and shareholders

(Benmelegh et al., 2010 among others). Ironically, the structure of executives' compensation - which is supposed to align interests of managers and shareholders - may also trigger agency problems. Accordingly, Healy (1985), Beneish (1999), Ke (2005), Burns and Kedia (2006), Johnson et al. (2009), Kedia and Philippon (2010) argue that stock-based compensation leads to accounting fraud, misreporting, and earnings mismanagement, followed by the stock price overvaluation and collapse.

Benmelegh et al. (2010) demonstrate that stock-based CEO compensation can cause stock price crashes. They identify conditions under which stock-based compensation leads to suboptimal investment, misreporting, and a subsequent sharp decline in equity prices. Benmelegh et al. (2010) argue that CEOs of medium – to high-growth firms initially have to invest intensively in order to make a better use of growth opportunities. When growth rates slow down, CEOs can camouflage growth decline by making suboptimal investment decisions, resulting in subsequent stock price collapse. Kim et al. (2011b) provide empirical evidence supporting results of Benmelegh et al. (2010).

An and Zhang (2013) explore the relationship between institutional investors' ownership and stock price crash risk, and conclude that strong monitoring by dedicated institutional investors attenuates managers' bad-news hoarding, and so prevents rapid stock price drop. Andreou et al. (2013) consider several corporate governance characteristics and their effects on firm-specific future stock price crashes. They find that future stock price crashes are positively related to institutional ownership, percentage of directors who hold company's shares, and opacity of financial reports. Conversely, the percentage of independent directors on the audit committee and auditor's industry experience are negatively related to stock price crashes.

Gormley et al. (2013) consider unanticipated changes in firm's business environments, which lead to increased stock price crash risks. Gormley et al. (2013) examine managers'

reaction to increases in business risks as a function of their pre-existing equity-based incentives. They find that structure of managerial compensation has an important effect on managerial motivation to induce firm's level of risk and firm's response to stock price crash risks[11]. These findings are consistent with those in Gormley and Matsa (2011), who argue that agency conflicts can be mitigated by reducing managers' exposure to firm risk[12].

CEO's management style can also influence firm risk. Managerial style affects corporate risk management throughout the impact that personal CEO characteristics have on vital corporate decisions and policies. Bertrand and Schoar (2003) find that all investment, financing, and other organizational policies depend on specific managerial attributes. They argue that older managers are more conservative, while managers who hold an MBA degree are more aggressive. Malmendier et al. (2011) find that CEO's previous experience and his/her personal expertise gained over the prior crises (the "Depression baby" effect), influence companies' financing and investment policies. Malmendier et al. (2011) also state that overconfident CEOs believe that all their decisions are value maximizing, and boards have to use various tools in order to constrain such CEOs. They argue that executives' compensation packages need to account for the particular managerial style (conservative or aggressive) arising from managers' past experience to make financial incentives effective.

Ellul and Yerramilli (2013) investigate the importance of risk control for bank holding companies (BHC). They hypothesize that company's risk culture[13] determines both the risk appetite and the strength of the risk management system. Ellul and Yerramilli (2013) differentiate between risk cultures that follow "business model channel" or "hedging

[11] Gormley et al. (2013) recommend that, in designing executives' compensation packages, boards should consider the potential changes in companies' risk environment and how executives will respond given their compensation levels.

[12]Gormley and Matsa (2011) advise that executives' exposure to firm risk can be reduced if the stock-based component in their compensation packages is reduced.

[13] Kimbrough and Componation (2009) argue that company's organisational culture plays an important role in areas such as implementation of new initiatives, its reaction to changes in the market and its ability to navigate major changes in its business environment.

channel"[14]. Conservative (aggressive) companies with "business model channel" culture take lower (higher) risk and have stronger (weaker) risk management in place; in contrast, under the "hedging channel" culture, aggressive (conservative) companies undertake high (low) risk coupled with a strong (weak) risk management. By evaluating companies' response to unexpected losses during the 1998 Russian crisis, they find evidence supporting the business model channel culture, i.e., companies with high tail risk had a weaker risk management system in place. This result is consistent with findings in Fahlenbrach et al. (2012), who find that financial institutions which performed worst during the 1998 crisis also demonstrated the worst performance during the 2007- 2008 crisis.

CPS and Stock price crash risk.

Weak corporate governance can result in CEO-dominated firms (Jiraporn et al., 2005). The importance of a "dominant player" in corporate decision making cannot be underestimated (Bebchuk et al., 2011). However, there is a risk that influential CEO can hide problems from the board (Jiraporn et al., 2005; Walkling, 2010). If board does not have all necessary information, board becomes less effective and problems are likely to remain hidden until "revealed by a disaster" (Walkling, 2010: p.17). There is also an exposure to expropriation risk, which results from rent extractions by dominant CEOs (Walkling, 2010). Rent extraction by company insiders, including CEOs affects corporate investment, cost of funds, company growth, and stock returns (see Becht et al., 2003).

To identify CEO dominancy, Bebchuk et al. (2011) use 'CEO pay slice (CPS)' - the proportion of the aggregate salary of top five executive directors that goes to the CEO. High CPS level signals agency problems in companies with dominant CEO and weak corporate governance. A powerful and authoritative CEO is able to influence the structure of his/her

[14] The latter so called because it is consistent with the main predictions of hedging theories in Smith and Stulz (1985);and in Froot, Scharfstein, and Stein (1993) (see Ellul and Yerramilli, 2013).

own compensation contract in a way that allows him/her to expropriate rents at the expense of shareholders (Bebchuk and Fried, 2003; Jiraporn et al., 2005). Studies by Blanchard et al. (1994), Yermack (1997) and Bertrand and Mullainathan (2001) determine that some features of compensation packages reflect rent-seeking by executives. Jiraporn et al. (2005) - investigate the relationship between CEO compensation and corporate governance[15], and also find evidence supporting the rent expropriation argument.

We follow Bebchuk et al. (2011) and interpret a high CPS as a sign of a CEO centrality. A dominant CEO could influence decision making processes within a board room according to his/her own managerial style and risk preferences. CEO managerial style (conservative or aggressive) influences important corporate decisions (Malmendier et al. 2011) and firm performance (Bertrand and Schoar, 2003). Hence, CPS might be connected directly to the stock price crash risk, which emerges as a result of implementation of certain corporate policies. High CPS magnifies agency problems, and might incentivize a CEO to take on decisions (e.g., financing, investment and dividend decision) that enable him/her to extract rents and so expropriate shareholders' wealth. Thus, for example, a dominant CEO could prioritize short-term price maximization to secure his/her own private benefits, and hide true information from the board of directors, so increasing company's exposure to stock price crash risk. These arguments lead us to the following (expropriation) hypothesis:

*Hypothesis 1:* CPS is positively associated with stock price crash risk.

Busy Boards and Stock price crash risk

The agency theory literature suggests that directors who overstretch themselves and accept additional seats on more boards due to the associated extra personal perquisites, tend to spend less time on each individual board, so compromising their responsibilities and

[15] Jiraporn et al. (2005) use shareholder rights as a measure of the corporate governance standard.

neglecting their duties (Ferris et al., 2003)[16]. Holding multiple directorships might negatively affect monitoring and advisory capacity of the board. Shivdasani and Yermack (1999) and Core et al. (1999) argue that directors with multiple seats "cater for CEOs", and that multiple board appointments correlate with excess CEO compensation, implying that such directors serve an inadequate check on management. Busy directors have a higher propensity to be absent from board meetings neglecting their duties by not taking part in the strategic decisions-making processes (Jiraporn et al., 2008). Beasly (1996) provides evidence that the number of board seats held by supervisory directors exhibits positive correlation with accounting fraud, and points to the lack of attention from these directors. Busy directors tend to take care of their own reputation and to leave underperforming companies, suggesting that the presence of overstretched directors may be endogenous to firm performance (Brown and Maloney, 1999; Fich and Shivdasani, 2006).

Despite the fact that busy directors are proficient and knowledgeable in their field, they are not able to use these skills to their full advantage, because their multiple responsibilities can create high levels of distraction. Cooper and Uzun (2012) find that directors who are less distracted in terms of other directorships and high-level corporate responsibilities tend to monitor banks better. Banks with less busy directors are less risky than banks with busy directors. Christy et al. (2009) also examine the links between corporate governance and equity risk, focusing on the board of directors, and find a negative relationship between the market risk of equity and multiple directorships held by independent board members.

Information asymmetry[17] might be especially pronounced in the presence of busy

[16] See also Gilson (1990); Lipton and Lorsch (1992); National Association of Corporate Directors (NACD) (1996); Beasly (1996); Cotter, Shivdasani and Zenner (1997); Core et al.(1999); Brown and Maloney (1999); Shivdasni and Yermack (1999); Miwa and Ramseyer (2000); Bohren and Strom (2001); Ferris et al. (2003); Fich and Shivdasani (2006); Cooper and Uzun (2012) who challenge the wisdom of holding too many directorships by examining busy boards' effectiveness.

[17] By hiding bad information from shareholders and prospective investors, CEO magnifies information

boards, due to the inability of busy directors to provide thorough monitoring and to identify problems in a timely manner. Busy boards with overcommitted directors could result in severe agency problems, due to poor monitoring. This might result in CEO's and top executives' short-termism and might increase company's exposure to stock price crash risk. A CEO with a busy board might be incentivized to camouflage real situation in the company in order to protect himself/herself from job loss and to secure private benefits, at least for a time. However, upon the release of negative firm-specific information, company faces a shock, which leads to the increase in its stock price crash risk. Considering the above arguments and results from previous research, we hypothesize that in the presence of busy boards, firms are more exposed to the stock price crash risk and propose the following (busyness) hypothesis:

*Hypothesis 2:* Busy boards are positively associated with stock price crash risk.

## 1.0 The effect of industry competition and financial crisis on the relationship between CPS, board busyness and stock price crash risk

Giroud and Mueller (2010) argue that effect of corporate governance on agency problem depends on industry competition. When competition is high, 'bad' managers are penalized by the market and the importance of the monitoring element of corporate governance is reduced.

Johnson et al. (2000), Mitton (2002), and Lemmon and Lins (2003) among others, advise that stock prices of companies with weak corporate governance drop more when the economy contracts because the extraction of private benefits by executives may be greater during recessions, when the expected rate of return on investment falls. Companies with higher CPS and busier boards might be exposed to higher stock price crash risk during

asymmetry.

periods of market instability.

Considering the above arguments, we hypothesize that effect of CPS and board busyness on stock price crash risk might be stronger in the industries with low competition and especially pronounced when markets are turbulent.

*Hypothesis 3a*: The impact of CPS and board busyness on stock price crash risk is stronger in industries with lower level of competition.

*Hypothesis 3b:* The effect of CPS and board busyness on stock price crash risk is more pronounced during the recession periods.

## Sample Selection and Data Description

### The Sample

We use a large sample of non-financial companies listed on the London Stock Exchange. We collect firms' financial and market information from the Thompson Datastream, whereas corporate governance and directors' compensation information is from the BoardEx database. The sample period is from 1997 to 2010 and includes all firms whose information is available from these two sources.

The BoardEx database consists of directors' information, including name, role title and description, indication of whether director is executive or supervisory director, the number of years each director served on the board and in his/her current role, director's total, cash/direct and equity compensation, and the number of quoted companies' boards on which each director currently sits. From this database, we obtain data for non-financial firms for which there is information available for at least two executive board members and a company has a CEO.

We collect accounting and stock market data necessary to calculate risk measures and

to control for firm characteristics from the Thompson Datastream, including weekly prices,[18] book value of assets, market value of equity, and value of total debt at the end of each year. We merge data from BoardEx and Datastream, and select companies with at least five consecutive years of data[19]. After all, we have an unbalanced panel of 692 firms over the 1997 – 2010 time period.

Variable definition

We use three proxies for stock price crash risk in our study: *Tail Risk, Negative Conditional Skewness*, and *Extreme Sigma.* We follow Andreou et al. (2013), and Ellul and Yerramilli (2013) in our definitions of crash risk proxies. Our first measure is *Tail Risk*. In a given year *Tail Risk* is defined as the negative of the average return on the company's stock over the 5% of its worst return weeks (Ellul and Yerramilli, 2013).

Our second measure is the *Extreme Sigma.* It is defined as a negative of the worst deviation of firm-specific weekly returns from the average firm-specific weekly returns divided by the standard deviation of firm-specific weekly returns (see Andreou et al., 2013). For a given firm *i* in a year *t*, the extreme sigma is computed as:

$$EXTR\_SIGMA_{i,T} = -Min\left[\frac{W_{i,t}-\bar{W}_{i,T}}{\sigma_{Wi,T}}\right] \quad (7)$$

Where $W_{i,t}$is the firm-specific weekly return; $\bar{W}_{i,t}$ is the average firm-specific weekly return in the fiscal year, and $\sigma_{Wi,T}$ is the standard deviation of firm-specific weekly returns. The firm-specific weekly return for firm *i* in the week *t* defined as $W_{i,t=}$ ln(1+$\varepsilon_{i,t}$), where $\varepsilon_{i,t}$ represents the residuals from the expanded index model regression (8):

$$r_{i,t} = \alpha_i + \beta_{1,i}r_{m,t-2} + \beta_{2,i}r_{m,t-1} + \beta_{3,i}r_{m,t} + \beta_{4,i}r_{m,t+1} + \beta_{5,i}r_{m,t+2} + \varepsilon_{i,t} \quad (8)$$

Where $r_{i,}t$ is the return on stock *i* in the week *t*, and $r_{m,t}$ is the return on the FTSE All-share index in the week *t*. We follow Andreou et al. (2013) and include lead and lag variables

[18] We use weekly prices for the computation of our risk proxies.
[19] We use system GMM estimator for our analysis, which requires having at least five consecutive years of data.

for the market index in a regression which separates market-wide return movements from firm returns, so that residuals capture weekly firm-specific returns.

The third measure is the *Negative conditional skewness (NCSKEW).* Following Kim (2011a, 2011b), An and Zhang (2013) and Andreou (2013) we calculate *NCSKEW* by taking the negative of the third central moment of firm-specific deviations of weekly returns from the company's annual mean return, scaled by the sample variance of firm-specific weekly return raised to the power of 3/2. Specifically, we compute *NCSKEW* for the firm *i* in fiscal year *t* as:

$$NCSKEW_{I,T} = -\frac{\left[n(n-1)^{\frac{3}{2}}\sum_{T=1}^{n}\left(W_{i,t}-\bar{W}_{i,T}\right)^{3}\right]}{\left[(n-1)(n-2)\left(\sum_{T=1}^{n}\left(W_{i,t}-\bar{W}_{i,T}\right)^{2}\right)^{\frac{3}{2}}\right]} \qquad \textbf{(9)}$$

where $W_{i,t}$ is the firm-specific weekly return, $\bar{W}_{i,T}$ is the average firm-specific weekly return in the fiscal year, and *n* is the number of observations in the year *t*.

Scaling the raw third moment by cubed standard deviation is a standard normalization employed for skewness in statistics that allows for a comparison across returns with different variances. We follow the literature by putting a minus sign in front of the skewness so that an increase in *NCSKEW* corresponds to more crash risk, i.e., a more negatively-skewed stock return distribution.

Our definition of CPS is marginally different from that in Bebchuk et al. (2011). We compute CPS as a fraction of the total compensation of a group of top executives (minimum two and maximum five), that is received by the CEO[20]. We follow Ferris et al. (2003) in our definition of busy boards, and consider directors busy if they have seats on boards of three or more listed companies. We control for other influences on crash risk, found to be important in the previous studies (see Andreou et al., 2013; Ellul and Yerramilli, 2013 among others),

[20]British corporate boards are, on average smaller than American boards. Only 16% of our sample companies have five or more executive directors at the board level.

and include firm size, capital expenditures, and leverage in our models. We also collect information about each firm's governance structure, such as board size, board composition, CEO tenure, CEO duality, whether the CEO is insider or outsider (i.e. was/was not a firm employee before being appointed to the CEO position). Variable definitions are provided in Table 4.1. Tables 4.2 and 4.3 give sample calculation examples for CPS and Board Busyness.

***Insert Tables 1, 2, and 3 here***

## Summary Statistics

Summary statistics are reported in Table 4.4[21]. We separate our data into variables describing crash risk (Panel A); compensation, director characteristics and board structure (Panel B); and firm characteristics (Panel C). The mean value of *Tail Risk i*s 0.14, and of *Negative Conditional Skewness*, and *Extreme Sigma* are 0.12 and 2.88 respectively, which are in line with those reported in Andreou et al. (2013), Kim et al. (2011a) and Bradshaw et al. (2011). The average CEO pay slice (CPS) based on the total compensation of up to top five executives( including CEO) is 44.98% (minimum 0%, maximum 100%). The average board busyness is 17.11%, i.e. 17.11% of directors held seats on least two other boards at the same time. There are some companies that do not have busy directors at all and some with 66.67% busy directors at the board level. The average board in our sample has 7 directors. The average proportion of executive directors at the board level (*Board Composition*) was 47.89% with a minimum of 20% and a maximum 80% of executives represented at the board. The average CEO tenure is 5.16 years in our sample companies, with minimum 0 and maximum 24.70 years. 53.82% of the companies in our sample have CEOs, who had not previously been company employees (*Outside CEO*). 9% of our sample companies have CEOs who chair the board at the same time.

[21] All variables are winzorized to the 1st /99th percentiles.

Firm size is, on average 4.65. Leverage level in the average company is 17.72%, with maximum leverage equals to 95%, and minimum leverage equals to 0%. The maximum (minimum) ratio of capital expenditures to total assets is 0.34 (0), with the average being equal to 0.05.

*******Insert Table 4*******

## Research design

We use a dynamic generalized method of moments (GMM)[22] estimator in our analysis. The GMM estimator has the following advantages: (1) it allows to include firm fixed effects to account for the firm's unobserved heterogeneity; (2) it considers the impact of previous stock price crashes on the current state of corporate governance in a firm; (3) it accounts for simultaneity by using a combination of variables from a firm's history as valid instruments (Wintoki et al., 2012).

We estimate the effect of governance characteristics on risk, conditional on firm heterogeneity, by using the following empirical model[23]:

$$y_{it} = \alpha + \sum_s k_s y_{it-s} + \beta X_{it} + \gamma Z_{it} + \eta_i + \epsilon_i \qquad s=1,\ldots, p, \qquad (1)$$

Where vectors $\boldsymbol{X}$, $\boldsymbol{Z}$, and $\boldsymbol{y}$ are corporate governance, firm and risk characteristics, respectively; $\beta$ captures the effect of governance on firm's risk; $\eta$ is an unobserved firm effect, and $\epsilon_i$ is a random error term.

The estimation procedure involves two important steps. First, we take the first differences of (1):

$$\Delta y_{it} = \alpha + k_p \sum_p \Delta y_{it-p} + \beta \Delta X_{it} + \gamma \Delta Z_{it} + \Delta \epsilon_{it}, \;\; p > 0 \qquad (2)$$

and eliminate all unobserved time invariant heterogeneity. We use GMM to estimate (2), and

[22] The dynamic panel GMM estimator, which was developed in Holtz-Eakin et al. (1988); Arellano and Bond (1991); Arellano and Bover (1995); and Blundell and Bond (1998), improves on ordinary least squares estimates (OLS) and fixed effects estimates.

[23] We follow Ellul and Yerramilli (2013) and Wintoki et al. (2012) in this approach.

use lagged values of stock price crash risk, corporate governance and firm-specific variables as instruments for these variables. There are two important criteria defining the validity of these instruments: first, they must provide a source of variation for current governance, i.e.,

$X_t = f(y_{t-k}, X_{t-k}, Z_{t-k})$, where *k>p, and X*, *Z*, and *y* are corporate governance, firm, and risk characteristics, respectively. Second, lagged values must be exogenous in order to be valid instruments. For the exogeniety assumptions to be valid, we need the following orthogonality conditions to hold:

$$E(X_{it-s}\epsilon_{it}) = E(Z_{it-s}\epsilon_{it}) = E(y_{it-s}\epsilon_{it}) = 0, \forall s > p \quad (3)$$

We can then estimate (2) using GMM and considering orthogonality conditions (3). However, there are econometric shortcomings associated with this procedure. First, "if [the] original model is conceptually in levels" (Wintoki, 2012: p.588), differencing will reduce the variation in the explanatory variables and consequently, the power of the tests (Beck et al.. 2000). Second, variables in levels may be weak instruments for first-differenced equations (Arrelano and Bover, 1995). Third, first differencing may worsen the impact of measurement errors on the dependent variables (Griliches and Hausman, 1986).

Arrelano and Bover (1995) and Blundell and Bond (1998) argue that it is possible to mitigate these shortcomings and improve the GMM estimator by including the equations in levels in the estimation procedure. It is then possible to use first-differenced variables as instruments for the equations in levels in a "stacked" system of equations that includes equations in both levels and differences, resulting in a *system* GMM estimator that involves estimating the following system:

$$\begin{bmatrix} y_{it} \\ \Delta y_{it} \end{bmatrix} = \alpha + k \begin{bmatrix} y_{it-p} \\ \Delta y_{it-p} \end{bmatrix} + \beta \begin{bmatrix} X_{it} \\ \Delta X_{it} \end{bmatrix} + \gamma \begin{bmatrix} Z_{it} \\ \Delta Z_{it} \end{bmatrix} + \epsilon_{it} \quad (4)$$

To deal with unobserved heterogeneity in level equation, we make a reasonable assumption that correlation between governance/firm characteristics and unobserved effects (such as, for example managerial ability, managerial productivity, etc.) will be constant over

time. This assumption requires additional orthogonality conditions:

$$E[\Delta X_{it-s}(\eta_i + \epsilon_{it})] = E[\Delta Z_{it-s}(\eta_i + \epsilon_{it})] = E[\Delta y_{it-s}(\eta_i + \epsilon_{it})] = 0, \forall s > p \quad (5)$$

We carry out GMM panel estimation considering the orthogonality conditions of (3) and (5), and assume no serial correlation in the error term, $\epsilon$. The orthogonality conditions imply that we can use lagged levels as instruments for the differenced equations and lagged differences as instruments for the level equations, respectively.

To verify a key exogeniety assumption that the firm's historical risk and characteristics are exogenous with respect to current shocks or innovations in risk, we also test for the second-order serial correlation [24] and over-identification [25], as suggested by Arellano and Bond (1991).

As a potential concern with our analysis could be that the relationship between corporate governance and stock price crash risk is dynamically endogenous, i.e. that company's past stock price crash risk determines both current corporate governance arrangements and current risk (see Wintoki et al.(2012) and Ellul and Erramilli (2013)). We follow Ellul and Erramilli (2013), and address this concern by analyzing a relationship between corporate governance and stock price crash risk using a dynamic panel GMM estimator in the following form:

$$\begin{aligned} Crash\ Risk_{it} = {} & \beta_0 + \beta_1 Crash\ Risk_{i,t-1} + \beta_2 CPS_{it} + \beta_3 Board\_Busyness_{it} \\ & + \beta_4 BoardSize_{it} + \beta_5 Board\ Composition_{it} + \beta_6 Duality_{it} \\ & + \beta_7 CEO\ Tenure_{it} + \beta_8 CEO\ Outsider_{it} + \beta_9 Company\ Size_{it} \\ & + \beta_{10} Leverage_{it} + \beta_{11} CapEx_{it} + \sum_{j=2}^{14} \beta_j YearDummy_t + \varepsilon_{it} \end{aligned} \quad (\mathbf{6})$$

Where *Crash Risk* is one of our three proxies for the stock price crash risk defined as *Tail Risk*, *Negative Conditional Skewness*, and *Extreme Sigma*. All variable definitions are

[24] For the GMM estimates, if the assumptions of the specification are valid, by construction the residuals in first differences (AR(1)) should be correlated, but there should be no serial correlation in second differences (AR(2)).
[25] Multiple lags are used as instruments in the dynamic panel GMM model. Hence, the system is over-identified and test of over-identification has to be carried out. The Hansen test provides a J-statistic, which is distributed as $\chi 2$ under the null hypothesis of the validity of instruments.

provided in Table 4.1.

## Results

In this section we discuss our empirical results concerning the association between corporate governance characteristics such as CPS and board busyness and *Crash Risk,* measured by three different proxies, i.e., *Tail Risk, Negative Conditional Skewness,* and *Extreme Sigma*. Our models include the standard controls used in the literature. Thus, we control for firm size (log of firm's market value), firm capital expenditures and leverage; we also control for the board size, board composition, CEO-Chairman duality, CEO tenure, whether the CEO is insider (i.e., was a company employee before being appointed CEO) or outsider, and year dummy. We run few tests to check for the potential misspecification of our estimation model. First, we use the Hansen J statistics of overidentification restrictions to check for the validity of our chosen instruments and, second, we use $m_2$ statistics, developed by Arellano and Bond (1991) to test for the lack of second-order serial correlation in the first-differenced residuals, and find no such problem in our model.

The results are displayed in Table 4.5, and provide consistent evidence that corporate governance mechanisms are significantly associated with stock price crashes. Specifically, we find that coefficients on CPS are positive and statistically significant (at the 1% level) in all our models, indicating that stock price crash risk is higher when CPS is high. High CPS magnifies the agency problem, and is a form of rent extraction by a dominant CEO. It might incentivize a CEO to prioritize short-term goals in order to secure his/her own private benefits and expropriate wealth from shareholders. In addition, a CEO can hide problems from the board for some time until bad news is "revealed by disaster" (Walkling, 2010: p.17). CEO's short-termism combined with bad news hoarding, increases company's exposure to stock price crash risk. These results support the *Expropriation Hypothesis* (H1), and are in

line with results from existing theoretical and empirical literature (see Jiraporn et al., 2005; Ellul and Yerramilli, 2010; and Andreou et al., 2013 among others). There is also strong evidence that board busyness is positively related to stock price crashes. Multiple responsibilities of busy directors create a high level of distraction. Information asymmetry is especially pronounced in the presence of busy boards due to inability of busy directors to perform comprehensive monitoring and to identify problems. As a result, a company's exposure to stock price crash risk increases. The coefficients on board busyness are positive and statistically significant (at the 1% level) supporting the *Busyness Hypothesis* (H2), and consistent with the view that companies with busy directors are more at risk of their stock price crashing (Cooper and Uzun, 2012; Christy et al., 2009).

Moving to control variables included in the regressions, we find some interesting results. *Board Composition*, our measure of board independence, has negative and statistically significant (at 1% and 5% levels) coefficients. These results support the view that higher level of board independence is beneficial to the company, i.e., companies with such boards face lower *Stock price crash risk. Board size* has positive and statistically significant (at the 1% level) coefficients, supporting the view that small boards are more efficient and perform better than their larger counterparts when it comes to managing company risks. *CEO tenure* is positive and statistically significant (at 1% and 5% levels) in all models, indicating that CEOs with longer tenure may be entrenched, and more likely to use their power to camouflage bad news, enhancing companies' *Stock price crash risk.* We find a negative relationship between the CEO - Chairman *Duality* and our proxies for the stock price crash risk. CEO-Chairman duality results in a higher level of power concentration in hands of one person, who can influence a board of directors. The reason for the negative relation between duality and stock price crash risk could be that such duality will result in better CEO knowledge and expertise, and might affect his/her level of risk aversion. More

powerful CEOs may be more likely to protect the company and themselves from future possible financial inconveniences and make relatively safe investments, associated with lower risk levels. Our results reveal a negative relation between *Outside CEOs* and firms' crash risk. To protect their own reputational capital, outside CEOs may avoid opportunistic behavior and bad news hoarding, so minimizing stock price crash risk.

We also find firm *Size* (measured as natural logarithm of market value of equity) is negatively related to stock price crash risk with all coefficients being statistically significant at the 1% level. The reason for this negative relation might be that larger firms are more stable and less exposed to such a risk. Our analysis also reveals that leverage and capital expenditures positively affect crash risk. These results are in line with our expectations and are in agreement with findings from previous literature (see Kim et al., 2011a, An and Zhang, 2013).

***Insert Table 5 here***

## Further tests

### Effect of industry competition on the stock price crashes

In accordance with agency theory, effective corporate governance helps to alleviate managerial opportunism by reducing the information asymmetry that exists between managers and shareholders (Jensen and Meckling, 1976). Effect of corporate governance on agency problem depends on industry competition (Giroud and Mueller, 2010). When competition is high, 'bad' managers are penalized by the market and the importance of the monitoring element of corporate governance is reduced. We follow Andreou et al. (2013) and measure industry competition by the Herfindahl-Hirschman Index (HHI). The HHI is calculated as the sum of squared market shares as follow:

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

Where $S_{i,j,t}$ is the market share of firm *i* in industry *j* in year *t*. Market share is calculated using firm sales. We estimate industry competition for each of the 15 FTAG3 industry classifications. High values of HHI values indicate weaker industry competition.

We split our sample in two groups, high and low competition, based on the value of HHI at year t-1 (HHI value lower than the median identifies the high competition group, and HHI value higher than the median identifies the low competition group). We re-estimate our baseline models from Table 4.5 for the two subsamples separately to identify the impact of corporate governance on stock price crashes in the different regimes. The results are shown in Table 4.6. The results are consistent with the results from the baseline models from Table 4.5. However, we find that the influence of corporate governance on stock price crashes is stronger in industries with low competition. These findings are in line with findings of Giroid and Mueller (2010), who stress on the importance of effective corporate governance for companies in industries where competition is low.

***Insert Table 6 here***

The effect of corporate governance characteristics during the 2007-08 financial crisis

Johnson et al. (2000); Mitton (2002); and Lemmon and Lins (2003) among others, argue that stock prices of companies with weak corporate governance drop more when economy contracts. This is due to the extraction of private benefits by executives, which may be greater during recessions, when the expected rate of return on investment falls. We investigate the effect of corporate governance on stock price crashes during the recent financial crisis. We follow An and Zhang (2013) in identify years 2007 and 2008 as the crisis years. We use a dummy variable for the crisis years, and include it in our baseline model from Table 4.5. We also check whether CPS and board busyness have more pronounced

effects on the stock price crashes during these years by including the interaction variables, *CPS* x *Crisis* and *Board_Busyness* x *Crisis.* The results are represented in Table 4.7.

When *Tail Risk* is used as a proxy for the stock price crash, the *Crisis* variable is positive and statistically significant (at the 1% level), indicating the increased stock price crash risk of firms during the financial crisis. Other variables of interest are the interaction variables *CPS* x *Crisis* and *Board_Busyness* x *Crisis*. The impact of *CPS* during the crisis becomes negative and statistically significant when *Tail risk* is used as a measure of stock price crash. A plausible explanation is that high CPS motivates CEO to perform better during turbulent periods, i.e., if CEO with high CPS can manage to reduce stock price crash risk during the crisis years, he/she continues to enjoy career benefits in form of high CPS. However, *Board_Busyness* x *Crisis* is not significant at the conventional level, which suggests that the association between board busyness and stock price crash risk is not significantly different during the financial crisis. When *Negative Conditional skewness* is used as a proxy for stock price crash risk, the *Crisis* variable is also positive and statistically significant (at the 10% level) indicating that stock price crash during the financial crisis increases. The impact of *CPS* during the crisis becomes negative, but is not statistically significant, while *Board_Busyness* x *Crisis* is positive and significant (at the 1% level), suggesting that firms with busy boards were more exposed to stock price crash risk during the crisis years. When *Extreme Sigm*a is used as a proxy for stock price crash risk, the impact of CPS during the crisis becomes negative but is not statistically significant. *Board_Busyness* x *Crisis* is also positive and significant (at the 5% level), which suggests that firms with busy boards face higher stock price crash risks during the crisis years. Overall, the results from Table 4.7 provide some indication that the financial crisis affects stock price crash risks in a positive way. The results are also suggest that during the crisis years, CPS could have a negative impact on stock price crash risk of firms; whereas, board busyness affects stock

price crash risk in a positive way.

***Insert Table 7 here***

## Conclusion

We investigate how governance characteristics affect firms' risk of experiencing a stock price crash. In our analysis, we use governance variables that capture board busyness and so-called CEO centrality. We use CEO pay slice (CPS) as a proxy for the CEO centrality and estimate board busyness as a proportion of busy directors on a firm's board. We offer new insights by evaluating the role of CPS and Board Busyness on the stock price crash risk by analyzing *Expropriation* and *Busyness Hypotheses.*

High CPS magnifies agency problems and might incentivize a CEO to take on decisions that enable to extract rents and expropriate shareholder wealth. A dominant CEO could prioritize short-term price maximization to secure his/her own private benefits and hide true information from the board of directors increasing company's exposure to stock price crash risks. In turn, busy boards with overcommitted directors could result in the severe agency problem; they (busy boards) might be unable to monitor management effectively. Weak corporate boards encourage CEO's opportunistic behaviors and short-termism and company's exposure to stock price crash risks increase.

Our analysis reveals a positive association between CPS, board busyness and stock price crash risk. Companies with high CPS and busy boards tend to be more exposed to stock price crash risks. The results of our study are robust when controlling for various firm, board and CEO characteristics, including board composition, board size, CEO/Chairman duality, CEO tenure and whether CEO was previously a company employee, as well as firm size, value of capital expenditures, and leverage; and to different regime specifications, including different levels of industry competition. Our findings are in line with findings in Andreou et

al. (2013), An and Zhang (2013), and Ellul and Yerramilli (2013). However, this is the first study that we are aware of which investigates the governance – stock price crash risk relationship using the UK-based sample.

Motivated by the changes in remuneration practices introduced by the UK Corporate Governance Code (2010) and the "say on pay" law (2013), we find that CPS is an important aspect of firm governance and management, that deserves attention of both researches and policy makers. The fact that CPS positively impacts on stock price crash risk has a strong implication for the on-going debate about how to reform executive remuneration so that it provides the right incentives. Our findings highlight the importance of considering remuneration issues at the board, rather than just at the CEO level, and support The UK Corporate Governance Code (2010) principles[26]. Even if a CEO compensation package is perfectly structured and implemented, it does not guarantee that it will lead to improvements in the firm riskiness, as it may provoke resistance of other board members. As corporate governance reforms move towards increasing boards' responsibilities for risk and performance, it is important to consider board-wide remuneration issues without narrowing them to the CEO's compensation.

There is also a direct implication for the public debate on limitation of the number of directorships held by executives from our findings. While the National Association of Corporate Directors (1996) put forward a threshold of three directorships, and the Council of Institutional Investors (2003) argues that directors with full-time jobs should not participate in more than two other boards in order to guarantee that they can give adequate service, we argue that board effectiveness depends also on its overall level of busyness, i.e. on the proportion of busy directors at the board level.

[26] "The performance-related elements of executive remuneration… should be sensitive to pay and employment conditions elsewhere in the group" (Supporting principle, Section D: Remuneration, The UK Corporate Governance Code, 2010: p. 22).

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**Table 1**
**Variable Definitions**

All data variables in this table refer to the corresponding compensation and corporate governance variable identifiers in the BoardEx annual database and to the corresponding risk and firm characteristics variables identifiers in the Tomson Datastream database.

| Variable | Definition |
|---|---|
| *Crash Risk* | |
| *Tail Risk* | The negative of the average return on the company's stock over the 5% worst return weeks for the company's stock |
| *Extreme Sigma* | The negative of the worst deviation of firm-specific weekly returns from the average firm-specific weekly returns divided by the standard deviation of firm-specific weekly returns<br>$EXTR\_SIGMA_{i,T} = -Min\left[\frac{W_{i,t}-\bar{W}_{i,T}}{\sigma_{W\,i,T}}\right]$ |
| *Negative conditional skewness* | The negative conditional skewness. we calculate negative conditional skewness by taking the negative of the third central moment of firm-specific deviations of weekly returns from the company's annual mean return scaled by the sample variance of the same raised to the power of 3/2.<br>$NCSKEW_{I,T} = -\left[n(n-1)^{3/2}\sum_{T=1}^{n}(W_{i,t}-\bar{W}_{i,T})^3\right] / \left[(n-1)(n-2)\left(\sum_{T=1}^{n}(W_{i,t}-\bar{W}_{i,T})^2\right)^{3/2}\right]$ |
| *Corporate Governance* | |
| *CEO pay slice (CPS)* | The fraction of the total compensation to the group of minimum top-two and maximum top-five executives, including CEO that is received by the CEO. |
| *Board busyness* | The proportion of busy directors at the board level. Busy directors are defined as directors holding three or more directorships, including the "home" company, in the public companies at the same time. |
| *Board composition* | The proportion of executive directors on the board. Total number of supervisory directors divided by the total number of all directors on the board. |
| *Board size* | The natural logarithm of the total number of all directors on the board. |
| *CEO tenure* | The number of years directors have served on the board |
| *Duality* | Indicator variable: equals one if CEO and Chairman is the same person |

| | |
|---|---|
| *CEO outsider* | CEO Outsider is a dummy equal to one, if CEO was working at the firm for less than one year before becoming CEO. |
| *Firm characteristics* | |
| *Size* | Natural logarithm of market value: Ln (*MV)* |
| *Leverage* | Total debt/total assets *WC03255*/ *WC02999* |
| *Capital expenditures* | Capital expenditures/ total assets: *WC04601*/ *WC02999* |

**Table 2**
**Calculation of CPS variables**
This is an example calculation for our measures of CEO pay slice (CPS) using BoardEx database data for the AEGIS GROUP PLC (ISIN GB00B4JV1B90) for the year 1997. Total compensation is a total compensation including salary, bonuses, and equity-based compensation per executive director. The Rank is an executives' rank by total compensation. The proportion of CEO compensation to the total compensation of total five executives

including CEO (CPS) is the total compensation of CEO to the sum of total compensations of top five executives..

| Director | Rank | Total Compensation |
|---|---|---|
| Sir Crispin Henry Davis (CEO) | 1 | 971 |
| Kai Hiemstra | 2 | 793 |
| Eryck Rebbouh | 3 | 483 |
| Bruno Kemoun | 4 | 476 |
| Colin Richard Day | 5 | 432 |
| Raymond (Ray) F Kelly | 6 | 341 |
| ***Total Compensation of top five executives*** | | 3,155 |
| ***Total CEO Compensation*** | | 971 |
| ***CPS*** | | 971/3,155=0.3078 |

**Table 3**
**Calculation of Board Busyness variables**
This is an example calculation for our measures of director busyness using BoardEx database data for the SAFEWAY PLC (ISIN GB0000492412) for the year 1997. Total number of directorships counts the number of directorships (total number of current quoted boards including the "home" company) held by all directors serving on the board. Directorships per director are estimated as the total number of directorships held by the directors of the board

divided by board size. Board Busyness is the number of directors holding three or more board seats divided by board size.

| Director | Total Directorships |
|---|---|
| Colin Deverell Smith | 1 |
| David Gordon Webster | 3 |
| Gordon Wotherspoon | 1 |
| Patricia (Pat) Anne O'Driscoll | 1 |
| Robert George Charters | 1 |
| Simon Timothy Laffin | 1 |
| Sir Alistair Grant | 4 |
| Doctor Neville Clifford Bain | 4 |
| Julia Ann Burdus | 4 |
| Michael John Allen | 2 |
| ***Total Directorships*** | 22 |
| ***Directorships per Director*** | 22/10 = 2.2 |
| ***Board busyness*** | 4/10 = 0.4 (40%) |

**Table 4**
**Summary Statistics**
This table presents summary statistics for the sample of 692 firms for 1997- 2010 time period, excluding financial firms. All variables are winzorized to the 1st /99th percentiles. All variable definitions are in the Table 1.

| | Mean | Min | Max | Observation |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| *Panel A: Crash Risk* | | | | |
| Tail risk | 0.14 | 0.01 | 2.24 | 5312 |
| Negative conditional skewness | 0.12 | -7.15 | 7.18 | 5312 |
| Extreme sigma | 2.88 | 0.37 | 6.97 | 5312 |
| *Panel B: Compensation/Director/ Board characteristics* | | | | |
| CPS | 0.45 | 0.00 | 1.00 | 5038 |
| Board busyness | 0.17 | 0.00 | 0.67 | 5312 |
| Board composition | 0.48 | 0.20 | 0.80 | 5312 |
| Board size | 1.93 | 1.10 | 2.71 | 5312 |
| Board duality | 0.09 | 0.00 | 1.00 | 5312 |
| CEO tenure | 5.16 | 0.00 | 24.70 | 5312 |
| CEO outsider | 0.54 | 0.00 | 1.00 | 5312 |
| *Panel C: Firm characteristics* | | | | |
| Size | 4.65 | -1.90 | 11.97 | 5310 |
| Capex/Total Assets | 0.05 | 0.00 | 0.34 | 5302 |
| Leverage | 0.18 | 0.00 | 0.95 | 5311 |

**Table 5**
**Corporate Governance Characteristics and Stock price crash risk**

This table reports results from an analysis of crash risk measured by tail risk, negative conditional skewness and extreme sigma in our sample of 692 firms (4374 observations) for which corporate governance and financial data are available for at least five consecutive years between 1997 and 2010. All variable definitions are in Table 1. $m_i$ is a serial correlation test of order $i$ using residuals in first differences, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Hansen $J$ is a test of the over-identifying restrictions, asymptotically distributed as $\chi^2$ under the null hypothesis of no correlation between the instruments and the error term. Standard errors are in parentheses beneath each coefficient estimate. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | **Tail Risk** | **Neg.Cond Skewness** | **Extreme Sigma** |
|---|---|---|---|
| Crash Risk$_{t-1}$ | 0.1515*** | 0.0760*** | 0.0547*** |
| | (0.0064) | (0.0092) | (0.0096) |
| CEO Pay Slice (CPS) | 0.0585*** | 0.3576*** | 0.3150*** |
| | (0.0058) | (0.1001) | (0.0826) |
| Board busyness | 0.0922*** | 0.5389*** | 0.6166*** |
| | (0.0118) | (0.1563) | (0.1256) |
| Board composition | -0.0577*** | -1.1851*** | -0.3803** |
| | (0.0158) | (0.2453) | (0.1850) |
| Board size | 0.1469*** | 1.6762*** | 1.1753*** |
| | (0.0058) | (0.0991) | (0.0834) |
| Duality | -0.0019*** | -0.0524*** | -0.0332*** |
| | (0.0006) | (0.0089) | (0.0078) |
| CEO tenure | -0.0017*** | 0.0107** | 0.0156*** |
| | (0.0003) | (0.0049) | (0.0038) |
| CEO outsider | -0.0019*** | -0.0211*** | -0.0215*** |
| | (0.0004) | (0.0053) | (0.0042) |
| Size | -0.0618*** | -0.4682*** | 1.0200*** |
| | (0.0014) | (0.0184) | (0.0424) |
| Capex | 0.0900*** | 1.5913*** | 1.1100*** |
| | (0.0305) | (0.3893) | (0.2700) |
| Leverage | 0.0565*** | 0.6342*** | 0.4718*** |
| | (0.0113) | (0.1389) | (0.1101) |
| Constant | 0.1986*** | -0.2751 | 2.3460*** |
| | (0.0187) | (0.2854) | (0.2225) |
| m1 | 0.000 | 0.000 | 0.000 |
| m2 | 0.561 | 0.163 | 0.849 |
| Hansen $J$ | 0.149 | 0.208 | 0.270 |
| Year dummy | Yes | Yes | Yes |
| Number of observations | 4374 | 4374 | 4374 |

## Table 6
## Corporate Governance and Stock Price Crashes: The effect of Industry Competition

This table reports results from an analysis of crash risk measured by tail risk, negative conditional skewness and extreme sigma in our sample of 692 firms (4374 observations) for which corporate governance and financial data are available for at least five consecutive years between 1997 and 2010. All variable definitions are in Table 1. $m_i$ is a serial correlation test of order $i$ using residuals in first differences, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Hansen $J$ is a test of the over-identifying restrictions, asymptotically distributed as $\chi^2$ under the null hypothesis of no correlation between the instruments and the error term. Standard errors are in parentheses beneath each coefficient estimate. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | **Tail Risk** | | **Neg.Cond. Skewness** | | **Extreme Sigma** | |
|---|---|---|---|---|---|---|
| **Industry competition** | **Low** | **High** | **Low** | **High** | **Low** | **High** |
| **Information asymmetry** | **High** | **Low** | **High** | **Low** | **High** | **Low** |
| Crash Risk$_{t-1}$ | 0.1782*** | 0.0583*** | 0.0886*** | 0.0166*** | 0.0599*** | -0.0327*** |
| | (0.0032) | (0.0035) | (0.0048) | (0.0092) | (0.0051) | (0.00536) |
| CEO Pay Slice (CPS) | 0.0625*** | 0.0218*** | 0.6400*** | 0.0826 | 0.4107*** | 0.0329*** |
| | (0.0041) | (0.0030) | (0.0455) | (0.0564) | (0.0348) | (0.0495) |
| Board busyness | 0.0970*** | 0.0807*** | 0.8334*** | 0.4435*** | 0.5200*** | 0.6478*** |
| | (0.0054) | (0.0053) | (0.0508) | (0.1019) | (0.0557) | (0.0741) |
| Board composition | 0.0060 | -0.0416*** | -0.6668*** | -0.1813 | -0.6788*** | 0.1566 |
| | (0.0066) | (0.0050) | (0.1011) | (0.2453) | (0.0793) | (0.0962) |
| Board size | 0.1163*** | 0.1271*** | 1.6667*** | 1.6249*** | 1.1538*** | 1.1511*** |
| | (0.0026) | (0.0033) | (0.0448) | (0.0618) | (0.0272) | (0.0561) |
| Duality | 0.0019*** | -0.0042*** | -0.0177*** | -0.0792*** | -0.0038 | -0.0460*** |
| | (0.0003) | (0.0003) | (0.0035) | (0.0048) | (0.0031) | (0.0043) |
| CEO tenure | 0.0022*** | -0.0025*** | 0.0321** | -0.0212** | 0.0332*** | -0.0125*** |
| | (0.0001) | (0.0002) | (0.0020) | (0.0033) | (0.0018) | (0.0024) |
| CEO outsider | -0.0016*** | -0.0014*** | -0.0319*** | -0.0267*** | -0.0264*** | -0.0199*** |
| | (0.0002) | (0.0002) | (0.0022) | (0.0026) | (0.0018) | (0.0022) |
| Size | -0.0638*** | -0.0638*** | -0.3830*** | -0.4851*** | -0.3377*** | -0.4226*** |
| | (0.0007) | (0.0007) | (0.0068) | (0.0112) | (0.0065) | (0.0092) |
| Capex | 0.1798*** | 0.1282*** | 0.7245*** | 3.3722*** | 1.0732*** | 1.9189*** |
| | (0.0109) | (0.0118) | (0.1194) | (0.1872) | (0.0846) | (0.1800) |
| Leverage | 0.0364*** | 0.0752*** | 0.1733*** | 0.5840*** | 0.0171*** | 0.2194*** |
| | (0.0042) | (0.0054) | (0.0740) | (0.0850) | (0.0500) | (0.0734) |
| Constant | 0.2479*** | 0.2528*** | -1.1722 | -0.3828* | 2.2268*** | 2.8838*** |
| | (0.0068) | (0.0086) | (0.1120) | (0.1966) | (0.0611) | (0.1581) |
| m1 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| m2 | 0.539 | 0.226 | 0.100 | 0.194 | 0.376 | 0.256 |
| Hansen $J$ | 0.882 | 0.766 | 0.868 | 0.708 | 0.866 | 0.602 |
| Year dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of observations | 1989 | 2019 | 1989 | 2019 | 1989 | 2019 |

## Table 7
## Corporate Governance and Stock Price Crashes: The effect of the Financial Crisis 2007/2008

This table reports results from an analysis of crash risk measured by tail risk, negative conditional skewness and extreme sigma in our sample of 692 firms (4374 observations) for which corporate governance and financial data are available for at least five consecutive years between 1997 and 2010. Crisis is a dummy variable, which is equal to one for years 2007 and 2008, and zero otherwise. All other variable definitions are in Table 1. $m_i$ is a serial correlation test of order $i$ using residuals in first differences, asymptotically distributed as N(0,1) under the null hypothesis of no serial correlation. Hansen $J$ is a test of the over-identifying restrictions, asymptotically distributed as $\chi^2$ under the null hypothesis of no correlation between the instruments and the error term. Standard errors are in parentheses beneath each coefficient estimate. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

| | **Tail Risk** | **Neg.Cond.Skewness** | **Extreme Sigma** |
|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Crash Risk$_{t-1}$ | 0.1518*** | 0.1532*** | 0.0753*** | 0.0729*** | 0.0553*** | 0.0579*** |
| | (0.0063) | (0.0063) | (0.0092) | (0.0088) | (0.0094) | (0.0536) |
| CEO Pay Slice | 0.0650*** | 0.0568*** | 0.4651*** | 0.3634*** | 0.4003*** | 0.3323*** |
| (CPS) | (0.0062) | (0.0063) | (0.1024) | (0.0973) | (0.1006) | (0.0851) |
| Crisis | 0.0316*** | 0.0532*** | 0.1034 | 0.1182* | 0.1508 | 0.0170 |
| | (0.0068) | (0.0039) | (0.1288) | (0.0653) | (0.0966) | (0.0517) |
| CPS x Crisis | -0.0385*** | | -0.1770 | | 0.1766 | |
| | (0.0130) | | (0.2558) | | (0.1955) | |
| Board busyness | 0.0834*** | 0.1592*** | 0.5638*** | 1.2173*** | 0.6401*** | 0.9006*** |
| | (0.0054) | (0.0107) | (0.1570) | (0.1207) | (0.1323) | (0.1127) |
| Board Busyness x | | 0.0091 | | -0.4796* | | -0.3373** |
| Crisis | | (0.0126) | | (0.2574) | | (0.1843) |
| Board composition | -0.0710 | -0.0654*** | -1.2638*** | -1.2055*** | -0.4636 | -0.3428* |
| | (0.0145) | (0.0142) | (0.2410) | (0.2257) | (0.1879) | (0.1956) |
| Board size | 0.1474*** | 0.1453*** | 1.6700*** | 1.7064*** | 1.1864*** | 1.1648*** |
| | (0.0058) | (0.0059) | (0.0964) | (0.0965) | (0.0739) | (0.0759) |
| Duality | -0.0018*** | -0.0016*** | -0.0527*** | -0.0439*** | -0.0309 | -0.0290*** |
| | (0.0006) | (0.0006) | (0.0089) | (0.0085) | (0.0077) | (0.0074) |
| CEO tenure | -0.0019*** | -0.0021*** | 0.0107** | 0.0097** | 0.0158*** | 0.0149*** |
| | (0.0003) | (0.0003) | (0.0048) | (0.0048) | (0.0037) | (0.0038) |
| CEO outsider | -0.0019*** | -0.0016*** | -0.0206*** | -0.0202*** | -0.0220*** | -0.0216*** |
| | (0.0004) | (0.0004) | (0.0052) | (0.0052) | (0.0041) | (0.0041) |
| Size | -0.0614*** | -0.0602*** | -0.4674*** | -0.4737*** | -0.3927*** | -0.4226*** |
| | (0.0058) | (0.0014) | (0.0183) | (0.0151) | (0.0077) | (0.0092) |
| Capex | 0.0815*** | 0.0814*** | 1.5624*** | 1.8559*** | 1.1087*** | 1.1770*** |
| | (0.0303) | (0.0304) | (0.3883) | (0.3348) | (0.2718) | (0.2544) |
| Leverage | 0.0615*** | 0.0577*** | 0.6429*** | 0.4965*** | 0.0503*** | 0.4555*** |
| | (0.0115) | (0.0110) | (0.1406) | (0.1476) | (0.1292) | (0.1306) |
| Constant | 0.2027*** | 0.1767*** | -0.2744 | -0.4972* | 2.3411*** | 2.1834*** |
| | (0.0180) | (0.0172) | (0.2764) | (0.2854) | (0.2274) | (0.2189) |
| m1 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| m2 | 0.568 | 0.519 | 0.161 | 0.194 | 0.817 | 0.856 |
| Hansen *J* | 0.151 | 0.100 | 0.208 | 0.708 | 0.278 | 0.311 |
| Year dummy | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of observations | 4374 | 4374 | 4374 | 4374 | 4374 | 4374 |