Board attributes that increase firm risk - evidence from the UK

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Abstract

Purpose – The aim of the paper is to identify the board attributes that significantly increase firm risk. The study aims to find if board size, percentage of non-executive directors, women on the board, a powerful CEO, equity ownership amongst executive board directors and institutional investor ownership, are associated with firm risk. This is the first study that examines which board attributes increase firm risk using a UK based sample.

Design/methodology/approach – This empirical study collected secondary data from Bloomberg and Morningstar databases. The data sample is an unbalanced panel of 260 companies' secondary data on FTSE 350 index in the UK, from 2005 to 2010. The data was statistically analysed using STATA.

Findings – The study establishes the board attributes that were significantly related to firm risk. The results show that a board which can increase firm risk is one that is small in size, has high equity ownership amongst executive board directors and has high institutional investor ownership.

Research limitations/implications – The governance culture and regulatory system in the UK is different from other countries. Since the data is a UK based sample, the results can lack generalisability.

Practical implications – The results are useful for investors who invest in large firms, to have the knowledge about the board attributes that can increase firm risk. Regulators can also use the results to strengthen regulatory guidelines.

Originality/value – This study fills the gap in knowledge in UK governance literature on the board attributes that can increase firm risk.

Keywords: board composition, UK corporate governance, firm risk, decision making

Introduction:

The financial fraud cases in the early 2000s in the US as well as the geographically broader financial crisis in 2008 fuelled the debate on risk management and the need to control risk. As part of the regulatory reforms, the role of corporate governance and risk management has been highlighted by the Financial Reporting Council (FRC) in the UK. It published a report on *Boards and Risk* (FRC, 2011) which outlines the responsibilities of boards of directors for 'risk decision-making', determining 'the company's approach to risk, setting its culture, risk identification, oversight of risk management, and crisis management'. In the US, corporate governance reforms which form part of the Sarbanes-Oxley Act (2002) provide specific guidance on internal control mechanisms and board attributes to improve corporate accountability and reduce the risk of firm insolvency. This study contributes to the literature by providing empirical based findings on how board attributes may affect firm risk.

Corporate governance deals with identifying potential mechanisms by which shareholders of a corporation exercise control over management such that their interests are protected. The board of a firm is seen as an internal control mechanism to oversee the company and help manage and control the risk facing the firm appropriately on behalf of the investors and stakeholders (Davies, 2011). The board of directors not only advise and monitor managers but make strategic decisions which have inherent risk involved. The ability of board members to provide valuable input and challenge decisions depends on the board composition. The strategic advice is in the shareholders' interest and these decisions can have an effect on the stability of the firm. Poor performance of the board in monitoring the management and inability of giving strategic advice can lead to instability[1] in firm performance.

[1] Instability of firm performance is characterized by high stock volatility increasing the probability of insolvency of a firm.

The Turnbull report (2005) advocates UK directors of large firms to inform investors in the annual reports about risks facing the firm and how it is being managed, making the topic of risk-taking in corporations relevant to study. Previous literature on board composition has mostly investigated the effect of board composition on firm performance[2] and only a few US based studies have examined the effect of some board attributes on firm risk (Cheng, 2008; Pathan, 2009; and Lewellyn and Muller-Kahle, 2012). Since the governance framework and corporate culture is different in the US and UK (Franks and Mayer, 2002; Aguilera *et al.*, 2006), examining board composition in relation to risk-taking (consequently firm risk) using a UK sample will be useful. Specifically, under the US governance framework, boards of directors are important in disciplining management and takeovers initiated by blockholder shareholders are common in poorly performing firms (Franks and Mayer, 2002). On the other hand, power to enforce fiduciary duties of directors are weaker in the UK and disciplinary takeovers are not common (Franks and Mayer, 2002). Furthermore, ownership is less dispersed in the UK and shareholder engagement is higher than in the US (Aguilera *et al.*, 2006).

The aim of the paper is to find how board size, non-executive directors, percentage of women, powerful CEOs, executive shareholders and institutional investor ownership affect firm risk. It contributes to the UK governance literature by empirically investigating the board attributes that can potentially increase firm risk. This was done by analysing archival data of 260 large FTSE 350 firms between the years 2005 to 2010. An econometric model was developed which included the control variables of growth opportunities, financial leverage, firm size and previous firm performance. To analyse the empirical model the most suitable estimation method for the panel data was the generalised least squares, random effects method.

[2] See Adams *et al*. (2010) for a survey of literature on Boards of directors.

The results show that a board which is small in size, has executive directors on the board who hold a high proportion of firm equity and that has institutional investors with substantial ownership, increases firm risk. A small board increases firm risk and this result is consistent with studies that have used a US based data sample. This study also found that the presence of a powerful CEO on the board is linked significantly and positively with one measure of risk, asset return risk. This is the first study that examines the relation between equity ownership of executives at board level as well as ownership by institutional investors in relation with firm risk and the results show a significant positive relationship. This study found that a higher percentage of non-executive directors and presence of women on the board decreases firm risk, though this relationship was not significant. This study contributes to both the board governance and risk literature showing board composition measures that impact on firm risk.

The paper is organised as follows: section 2 discusses the theoretical background for the study and previous literature on board composition, leading to the hypotheses. Section 3 presents the methodology used for this study that includes information on the data sample; the dependent, independent and control variables used; the empirical model and the estimation method chosen. The findings are discussed in section 4, while section 5 presents the robustness tests, and lastly, Section 6 summarises the findings.

2. Hypotheses development

Risk management in firms is not about continuous corporate risk reduction but about how firms select the type of risk and the level of risk that is appropriate to them (Crouhy *et al.*, 2006). In essence, risk management and risk-taking are the 'two sides of the same coin'. Successful companies take risk in relation to the reward and manage the risk (Crouhy *et al.*, 2006).

The board of directors in companies have three main roles which can have an impact on risk-taking in the firm. These include strategic, monitoring and institutional roles (Stiles and Taylor, 2002). The board plays a *strategic role* in setting the direction for the company in line with

organisation and shareholder goals by reviewing strategic proposals, assessing them and advising changes if required (Stiles and Taylor, 2002). The strategic role includes making decisions that firms use to grow, such as mergers and acquisitions, diversification, adopting new technologies or innovating by investing in research and development (Kosnik, 1987; Markides, 1997; Zhu and Weyant, 2003). Such decisions are inherently risk-bearing (Amihud and Lev, 1981).

The board also has a *monitoring function* of managers of the company in the interest of the shareholders. The assumption is that the managers may act in their own self-interest. The control is exerted by the directors who have the power of assessing senior managers, determining incentives and sanctions and setting performance goals. This function also influences the risk-behaviour of the firm (Brick and Chidambaran, 2008).

In an *institutional role*, the board of directors have a statutory and fiduciary responsibility on behalf of the shareholders as well as the ability to anticipate and tackle external forces which may impact the company (Stiles and Taylor, 2002).

The board's decisions and activities should reflect the needs of the shareholders, which for certain classes of investors may include stable growth of a firm with appropriate risk to achieve long term return on equity; while for other investors, this may include high-risk taking to achieve short-term returns (Wood and Zaichkowsky, 2004).[3] Boards should take a comprehensive overall view of firm activities rather than focus on details in order to prevent corporate failure (Bukhvalov and Bukhvalova, 2011). The board's strategic decisions as well as the monitoring function can be influenced by board attributes such as the size of the board, presence of women on the board, chief executives who are powerful, non-executive board members, or the ownership structure. Based on the framework that firm risk is related to board attributes, the following hypotheses are developed.

[3] Investor types include long-term investors, risk-tolerant traders, confident traders and loss-averse young traders who have different risk appetites (Wood and Zaichkowsky, 2004).

2.1. Size of the board

One of the roles of the board of directors is to monitor the managers of the firm who are in charge of the day to day running of the business. Since all important decisions are approved by the board, the performance of the firm depends on the quality of monitoring and decision-making by the board of directors (Yermack, 1996). The number of board members represents the breadth of expertise, experience and knowledge of the board (Chaganti *et al.*, 1985). Also, a larger number of board members can better represent shareholders in monitoring management (Yermack, 1996). Due to these reasons, board size becomes an important determinant of how the firm performs.

The Combined code (2003)[4] does not stipulate what the board size should be and this is reflected in how companies form the board – usually the board size is proportionate to the size and complexity of the firm. Adams and Mehran (2003) and Lehn *et al.*, (2009) find that organizational structure has an important influence on board size. They explain that board size changes when there are mergers or acquisitions; for example when an acquisition takes place, directors of the acquired firm are added to the board; or if the firm has many subsidiaries then a director representing each subsidiary are present on the board. Raheja (2005) finds that an optimal board size is a function of the directors' and the firm's characteristics. Adams *et al.* (2010) also find that every firm has an optimal size for the board depending on its own characteristics and complexity. Controlling for firm complexity and firm size, most of the previous literature has found that smaller board size relates to higher firm risk (Cheng, 2008; Pathan, 2009).

A few studies such as Jewell and Reitz (1981), O'Reilly *et al.* (1989), Goodstein and Boeker, (1991), Lipton and Lorsch (1992), and Jensen (1993) argue, that within large boards,

[4] The Combined code (2003) is quoted, since it is the relevant guideline for the sample period of the study which is between 2005 and 2010.

communication and coordination can become difficult, allowing the chief executive to free ride; therefore reducing the effectiveness of the board.

However, large boards can provide an increased pool of expertise and resources for the organisation (Pfeffer, 1972; Dalton *et al.,* 1998); large boards can provide the inclusion of a wide variety of perspectives (Zahra and Pearce, 1992); and, firms that require more advice derive greater value from having larger boards (Coles *et al*., 2006).

In decision theory, it is suggested that diversified opinions within large groups could lead to a compromise in the final decision (Sah and Stiglitz, 1986, 1991). Experimental research findings show that a group judgement represents the average of the prior individual judgements when a consensus is reached through group discussions of the prior judgements (Kogan and Wallach, 1966). There is a greater likelihood that a risky project is rejected, since the investment has to be considered good by many directors, before it is accepted by the group.

Cheng (2008) reports an inverse relationship between board size and variability of firm performance (firm risk), using a data sample of 2980 US corporations between 1996 and 2004. The results show that board size is negatively associated with the variability of firm performance measured as monthly stock returns, annual accounting return on assets and Tobin's Q. The results are the same when variability of firm performance is replaced by the level of research and development expenditures and the frequency of acquisition and restructuring activities. In other words, a larger board is related to less firm risk. Pathan (2009) also finds a significant negative relationship between board size and firm risk using a sample of 212 large US bank holding companies over the period 1997–2004. These studies argue that within larger boards, due to varied opinions and influence of a large number of individuals less extreme decisions would be made leading to less risky decisions (Cheng, 2008; Pathan, 2009).

A more recent study by Nakano and Nguyen (2012) used a Japanese data sample of corporations to find that larger boards are related to lower performance volatility as well as

lower bankruptcy risk. They also find that the effect of board size is less significant when firms have many investment opportunities and more significant when firms have fewer growth opportunities. No studies were found that associated board size to firm risk using a UK data sample.

The existing literature supports an inverse relation between board size and firm risk. Therefore, it can be hypothesized that a small board size relates to lower firm risk.

H1: Board size is inversely related to firm risk.

2.2. Non-executive directors

A board of directors consists of executive members of the firm and non-executive members; and the Combined Code (2003) recommends that at least half the board, excluding the chairperson, should comprise of non-executive directors (NEDs). Most firms in the FTSE 350 follow these guidelines.

The argument for the need of non-executive directors is based on agency theory. Shareholders do not have control over managing the day to day operations of the firm (Mizruchi, 1983) while managers are seen to have firm specific knowledge and managerial expertise. This can result in the appointed managers behaving in a self-interested manner which they will gain from instead of maximising the shareholders' investment (Jensen and Meckling, 1976; Eisenhardt, 1989). Agency theorists argue that the management could make decisions which misuse the shareholders' capital (Jensen and Meckling, 1976; Eisenhardt, 1989). The potential for this conflict of interest requires monitoring mechanisms which are designed to protect the shareholders who are the owners of the company (Jensen and Meckling, 1976; Fama and Jensen, 1983; Williamson, 1985). One of the primary duties of the board of directors is this monitoring role (Hambrick and Finkelstein, 1987; Fleischer *et al.*, 1988). Prior literature generally argues that a high proportion of non-executive directors on the board provides effective monitoring and control of firm activities leading to better performance of the firm

(Jensen and Meckling, 1976; Fama and Jensen, 1983; Williamson, 1985; Dalton et al., 1998). In the literature, there is consensus that effective boards will be comprised of greater proportions of outside directors (Mizruchi, 1983; Lorsch and MacIver, 1991; Zahra and Pearce, 1989). Regulators, institutional investors and shareholder activists also hold the same view.

Some NEDs are appointed to the board because they had some pre-existing business connection with the firm (e.g. former executives or suppliers or customers), and other NEDs have no other contractual relationship with the business other than their fees and their ownership of shares (Keasey *et al*., 2005). NEDs could be chosen to be on the board because they can provide access to valued resources and information that is in the interest of the firm (Pfeffer and Salancik, 1978). In their task of monitoring and controlling firm activities NEDs may make decisions that include - replacing the CEO, responding to takeover bids, acquiring another company, providing takeover defences to protect the firm, deciding on diversification, establishing executive compensation, reporting financial fraud, and providing capital for research and development, among other duties.

There is an assumption in the literature that the NED will behave differently from the executive director. The motivation for the NED to monitor the executives is to build a reputation for themselves as being expert monitors (Fama, 1980; Fama and Jensen, 1983). If they do not monitor the managers effectively, then they risk not finding employment again. Also, the NED may have more expertise than the executive director, and therefore, be able to better monitor the top management team.

On the other hand, NEDs may not have the incentive to monitor management due to the following reasons. First, the reputation of an NED who does not make trouble for the CEO can be seen as valuable (Holmstrom, 1999). Secondly, NEDs are part time directors and spend minimum amount of time in the firm compared to the executive who are at the firm full time. Due to the part time nature of the job, NEDs may find it difficult to gather firm-related

information from the executives; and the executives may not divulge all the financial and strategic information (McNulty and Pettigrew, 1999). Lastly, the NEDs may not have the incentive to question the CEO in order to protect their job and collect the director fees (Ezzamel and Watson, 1993).

Most of the literature argues that NEDs make the boards more effective. NEDs are not homogeneous and can contribute in terms of expertise, function or affiliation (Keasey *et al*., 2005). Kosnik (1990) argues that the diverse backgrounds of the NEDs can bring different perspectives to the table and reduce complacency and narrow mindedness in approving executive proposals. Byrd and Hickman (1992) suggest that non-executive independent directors contribute expertise and objectivity that minimizes managerial entrenchment and expropriation of firm resources. McNulty and Pettigrew (1999) interviewed 108 UK directors and their results show that NEDs have an influence on decision making. The study finds that NEDS have the ability not only to shape ideas but to change methods and processes in how these ideas take shape. They note that the influence of NEDs depends upon the history of the organisation and its performance, how good the communication is between directors, and evolving governance regulation. Their results show that outsider board members enhance the monitoring ability of the board over the management therefore reducing agency costs.

Additionally, Dahya and McConnell (2005) analyse data from 914 UK firms for the period 1988 to 1999, and find that NEDs influence board decisions such as the appointment of an external CEO and this decision is viewed favourably by investors. They suggest that a greater number of outside directors will lead to different and better board decisions. Hardwick *et al.* (2011) using a sample of UK insurers also find that the proportion of NEDs on the board exhibits a significant effect on the profit efficiency. Linck *et al.* (2008) argue that by adding an NED to the board, firms incur costs as well as benefits. They propose that NEDs bring benefits in terms of skill, knowledge and expertise, but there is a direct cost of compensation as well as

the cost of co-ordination and communication. There can be a failure of communication, since firm specific information may not be passed on to NEDs by the executives.

A few studies have shown that there may not be an association between proportion of non-executive directors and risk of firm insolvency. Chaganti *et al*. (1985) compare 21 matched pairs of US firms that failed between 1970 and 1976 and match them with non-failed firms. They find no significant difference in board composition between failed and non-failed firms, and no significant tendency for failed firms to increase their proportion of outside directors in the five years before failure. Cheng (2008) in a study of US corporations, also, does not find a significant relationship between non-executive independent directors and firm risk.

One study found a positive relation between proportion of non-executive directors on the board and firm risk. Pathan (2009) in a study of US bank holding firms finds that more NEDs on the board positively affected firm risk. He explains that shareholders in wanting to maximise their returns on their investment would like the NEDs to be risk-seekers. He argues that more non-executive independent directors on the board would act in the interest of the shareholder and make investment decisions in line with the firms contracting environment. His study finds that strong boards consisting of more non-executive independent directors positively affected bank risk.

No studies were found that examined the effect of the proportion of non-executive directors on the board on firm risk using a UK data sample. Most of the literature argues that more non-executives on the board facilitates better decision making, leading to effective monitoring of management (Kosnik, 1990; Byrd and Hickman, 1992; McNulty and Pettigrew, 1999). This argument is supported by Dalton and Daily (1994) in their study of matched bankrupt firms and survivor firms. They find that bankrupt firms have a higher proportion of affiliated directors (NEDs with some affiliation to the firm) than survivor firms; which is to say that boards with fewer non-executives are associated with higher risk of insolvency. Linck *et al*.

(2008) find that in large firms high stock return volatility is associated with smaller boards with fewer NEDs on the board. Most recently, Christy *et al*. (2013) in their study of 800 Australian firms, between 2001 and 2007, find that in large firms, a board with a higher proportion of NEDs generates positive net benefits in the form of lower equity risk.

Even though previous findings are mixed in relating the proportion of NEDs to firm risk, agency theory argues that a higher proportion of NEDs on the board can reduce self-interested behaviour of executives, leading to fewer agency costs (Eisenhardt, 1989; McNulty and Pettigrew, 1999; Hermalin and Weisbach, 2003) and less firm risk. NEDs bring their knowledge to the board and are able to provide an independent opinion which enables better decision making (Dalton *et al.*, 1998). Based on this theory, this study predicts that a higher proportion of NEDs will be more effective monitors and reduce high firm risk.

H2: The percentage of non-executive directors on the board is negatively related to firm risk.

2.3. Presence of Women

Most boards in the UK have board members, with similar backgrounds, education and networks. This homogeneity among directors is seen to produce similar thinking. In February 2011, the Davies report found that even though women had a long record of achieving the highest qualifications and leadership positions in many walks of life, there was poor representation of women on boards in FTSE companies relative to their male counterparts. They found that in FTSE 100 boards the representation of women is only 12.5%. According to the Davies report (2011), gender diversity at board level matters because ‘inclusive and diverse boards are more likely to be effective boards, better able to understand their customers and stakeholders and to benefit from fresh perspectives, new ideas, vigorous challenge and broad experience. This in turn leads to better decision making.’

In Norway and France, there is legislation as to female board representation, where 40% of board places are to be filled by women. The Netherlands and Belgium have passed laws

requiring large firms to have females in at least 30% of executive positions in a firm. Recently, the European Parliament passed a non-legislative resolution that required 40% of supervisory and executive positions of large European firms to be filled by women. The Davies Report (2011) recommends that FTSE 350 companies should target for achieving 25% female representation on the board by 2015. Gender diversity is being approached as a value driver in corporate governance (Davies Report, 2011). The regulatory movement towards gender quotas is based on the desire to establish a higher proportion of women in the top management team. Even though this report was published after the time period of the sample which is between 2005 and 2010, this study can indicate if women on the board are effective. How this legislation may affect firm performance or firm risk is not known.

Most of the existing literature in this field generally argues that gender diversity provides better governance. Izraeli (2000) and Huse and Solberg (2006) explain that women take their NED roles more seriously and prepare more conscientiously for meetings. They find that women ask the awkward questions more often, decisions are less likely to be nodded through and so are likely to be better. They find that gender diversity is effective in changing the group dynamics when there is at least 30% female representation. Adams and Ferreira (2009) find that the attendance records for meeting are better for females leading to better monitoring. They find that the likelihood that a female director has attendance problems is lower than for a male director; furthermore, male directors have fewer attendance problems the greater the fraction of female directors on the board. They also find that firms with more diverse boards provide their directors with more pay performance incentives, and firms with more diverse boards have more board meetings. This suggests that gender diversity brings strengthened governance (Adams and Ferreira, 2009).

In addition, Brennan and McCafferty (1997) explain that female directors may have a better understanding of consumer behaviour, the needs of the customers, and the opportunities for

companies in meeting those needs. A survey commissioned by recruitment consultancy Heidrick and Struggles (2012) finds that women appear to be more assertive on certain important governance issues such as evaluating the board's own performance and supporting greater supervision on boards. Erhardt *et al*. (2003) suggest that women bring a new perspective on the board that is value enhancing. The literature generally argues that stronger governance would increase shareholder value (Adler, 2001; Hermalin and Weisbach, 2003; Carter *et al*., 2003; Erhardt *et al*., 2003; Lückerath-Rovers, 2013). On the other hand, Adams and Ferreira (2003, 2009) and Ahern and Dittmar (2010) find that the average effect of gender diversity on both market valuation and operating performance is negative which they suggest is due to tougher monitoring. They argue that when there is gender diversity on the board, directors (both male and female) attend more meetings, and schedule more meetings leading to tougher monitoring.

A review of gender studies shows that women can have a different risk preference in financial decisions they make. Powell and Ansic (1997) in their experimental study on gender differences in risk preferences, find that females are less risk-seeking than males in financial decision making. Two reviews conducted by Croson and Gneezy (2009) and Eckel and Grossman (2008) on experimental work on risk attitudes show that published findings are broadly consistent with women being more risk-averse than men. Studies in the field of decision making literature have also found that risk-taking behaviour of women with respect to investment decisions is more risk-averse than men (Barsky *et al*., 1997; Jianakoplos and Bernasek, 1998; and Sunden and Surette, 1998). The risk-averse behaviour could be due to the fact that women are less overconfident than men (Barber and Odean, 2001; Niederle and Vesterlund, 2007). It can also be due to the fact that women invest more in information acquisition (Goel and Thakor, 2008) and therefore have a better knowledge of the risks involved in making a particular decision.

On the other hand, other studies show that women on the board may be risk-seeking, and have associated women on boards positively with firm risk. Adams and Funk (2011) show in their survey of Swedish women, who have risen through the ranks and are, now on boards, are more prone to take risks than men. But women who are on the board to fulfil regulation needs decrease the level of firm risk. They suggest that having women on the board need not lead to more risk-averse decision-making. Berger *et al*. (2012) find in a sample of German banks, the proportion of female board members and firm risk are positively and significantly related. They explain that women are not marginalised by male dominated board culture and they have a significant impact on governance of banks.

The existing risk-related literature mostly supports the argument that gender diversity on the board is related to better monitoring of management. Adams and Ferreira (2003) find a significant negative relation between variability in stock returns and the proportion of women on the board. A recent study by an asset management firm in conjunction with the Observer newspaper (TCAM, 2009) has shown that female directors exercise strong oversight and are more likely to pay attention to managing and controlling risk. An unpublished study conducted in Leeds University recently, and quoted by the Davies report (2011), used a sample of UK firms over the period 2007-09. Their study shows that having at least one female director on the board, cut a company's chances of going bankrupt by 20%, and that having two or three female directors lowers the chances of bankruptcy even further (Wilson and Altanlar, 2009). They argue this association can be the result of the difference in risk preference and attitudes towards debt management between genders. They find that companies with female directors take on less debt and have a better cash flow.

No published studies were found that associated presence of women on the board to firm risk using a UK data sample. The empirical literature that relates gender diversity to firm risk is mixed, but the literature based on experiments, consistently shows that women are risk-averse

in financial decision making. Based on the arguments presented in this section that women will provide more effective governance - due to the fresh perspectives they bring to the table, the vigorous challenge they provide, better understanding of customer needs, better attendance record, investing time in acquiring more information - it can be hypothesized that a higher representation of women on the board will lower firm risk.

H3: The percentage of women on the board is negatively related to firm risk.

2.4. Powerful CEO

The CEO is the highest ranked officer in the firm and is in charge of the management of the whole firm. The position of CEO is at the apex of power, having the expertise, ownership of the firm, and status, to exert control over strategic decisions (Finkelstein, 1992). A CEO holds firm-relevant information and by sharing this information can enhance or reduce board involvement. A powerful CEO can withhold information and not allow active involvement of board directors.

The Combined Code (2003) recommends that there is a clear division of responsibilities at the head of the company and that the roles of chairperson of the board and chief executive of the firm are separate. The reason for the separation of the position of CEO and chairperson is that there will be increased oversight from an independent chair of the board. A powerful CEO can hold dual position of CEO and chairperson of the board and prefer a weak board that does not offer a challenge to the decisions made by the management. Bekiris (2013) finds that, in a sample of large Greek companies, where the CEO is also the chairman of the board the companies have fewer non-executive directors and a smaller percentage of blockholder ownership who could potentially monitor the executive management.

The Combined Code (2003) also recommends that the chairperson of the board be a non-executive. If the chairperson of the board is an executive, then management strategies may not be as well monitored as when a chairperson is independent; making the CEO more powerful.

If the board is chaired by a firm executive, then that firm's CEO does not get challenged by the independent chairperson and makes the board less independent. A powerful CEO could also be a founder of the firm. Founders of firms are seen as controlling and difficult to challenge. Therefore, if there is duality of the CEO-chairperson position or the CEO is the founder of the firm or if the chairperson is an executive, it can make the CEO powerful which can influence the board's decisions towards management's policies and ideas.

The board is required in its control function to evaluate the CEO's performance to ensure corporate growth and protection of shareholder interest (Louden, 1982; Chapin, 1986). Hermalin and Weisbach (1998) explain in their study that the board chooses to hire or fire CEOs and that a powerful CEO with bargaining power would prefer fewer NEDS on the board so as to put his/her strategy through. This result is confirmed by Boone *et al*. (2007) who use the CEO tenure and CEO ownership as the variables to denote the bargaining power of the CEO and find that they are negatively related to the proportion of non-executive directors on the board. These studies suggest that a powerful CEO would like to use their power for their own self-interest (Adams *et al*., 2010).

A powerful person in an organisation is defined by Pfeffer (1997) as one that can demonstrate influence and control and includes the idea of overcoming resistance, to exert their own will (Finkelstein, 1992). Adams *et al*. (2005) define a powerful CEO as one who can consistently influence key decisions in their firms, in spite of potential opposition from other executives. Finkelstein (1992, p. 508) explains that CEOs who can control board activities and 'reduce the uncertainty that arises when boards have the power to influence strategy can gain power within a firm's dominant coalition'.

The separation of the roles of CEO and Chairperson is grounded in agency theory which is concerned with the potential that the management will dominate the board. According to Finkelstein and D'Aveni (1994), duality promotes CEO entrenchment by reducing the

monitoring ability of the board. It can also restrict the information flow to other board directors and reduce the independent oversight of directors (Fama and Jensen, 1983; Jensen, 1993). A study by Rechner and Dalton (1991) find that firms with the separate leadership positions for CEO and chairperson outperformed those firms with the dual role when relating this leadership structure to return on equity, return on investment, and profit margin. On the other hand, some studies have reported that firms that rely on duality of position, benefited from the joint structure, since it could remove conflicting views and remove ambiguity on who is responsible for decisions and outcomes (Donaldson and Davis, 1991). This view is grounded in stewardship theory.

The review of the risk-related literature shows that some studies find powerful CEOs to be related to less firm risk; Amihud and Lev (1981) using a sample of US firms and Pathan (2009) using a sample of US banks, have shown that powerful CEOs engage in risk reducing activities. They argue that employment income of the CEO is closely related to a firm's performance due to profit sharing schemes, bonuses and value of stock options. Poor performance of the firm or bankruptcy can result in managers losing their employment. Due to this 'employment risk', top executives of the firm will back safe projects (less risky) so as not to risk losing their job (Amihud and Lev, 1981). Also, costs of bankruptcy can contribute to managers in levered firms to select less risky projects (Parrino *et al.*, 2005). Therefore, a powerful CEO may take less risk.

However, other studies find that powerful CEOs are related to higher firm risk. Adams *et al.* (2005) provided evidence in their study that firms with more powerful CEOs are associated with high firm risk since the decisions with extreme consequences are likely to be taken by a powerful CEO. Adams *et al*. (2005) measure a powerful CEO as one, who is either the founder, is the only executive on the board, or there is duality of chairperson-CEO position. CEOs who are founders have a long term involvement with the firm and will be powerful and influential.

They find that the variable representing founder CEO is significantly positively related to stock return variability and two other measures representing a powerful CEO, namely, only executive on board and duality of CEO-Chairperson position, are also positively associated with stock return variability. Lewellyn and Muller-Kahle (2012), using a sample of sub-prime lending firms in the US, also find that powerful CEOs are related to high firm risk.

As evidenced from the governance guidelines, regarding avoidance of duality of CEO-Chairperson position, regulators believe that a powerful CEO may act in their own self-interest (Combined Code, 2003). Agency theory also supports the view that a powerful CEO could withhold information from the non-executive directors and this could hinder the boards' ability of monitoring management strategies and plans (Hermalin and Weisbach, 2003). From this perspective and finding from the existing literature, it can be hypothesised that, a powerful CEO is positively related to firm risk.

H4: A powerful CEO is positively related to firm risk.

2.5. Board Ownership Structure

In this study, the executive directors' ownership is measured as the percentage of equity (which represents both capital and voting rights) held by all the executive directors on the board. The voting rights that come with holding equity in the firm make directors with large holdings of firm equity have the ability to influence decisions. Board members with large ownership cannot be easily discharged because they have voting rights and this influence can keep them in their jobs (Wright *et al*., 1996). The Combined Code (2003), does not specify the maximum limit of equity that director/s can hold of the company equity.

Executive directors are compensated in terms of equity, as well as salary, whereas NEDs are compensated with director fees for their work and may be compensated with firm equity. The Combined Code (2003) does not recommend independent NEDs to hold firm equity.

To align the interests of the executive directors with the shareholders (who want maximum returns) they are compensated with firm equity. Agency theorists believe that directors having ownership in the firm can influence them to maximize returns on shares and reduce agency costs (Jensen and Meckling, 1976). Ownership in the firm makes the wealth of executives dependent on firm performance and can encourage executives to invest in value enhancing initiatives (Jenkins and Seiler, 1990). Compensating managers with firm equity would help them to invest in initiatives that increase the long term value of the firm (Hitt *et al*., 1994).

Wright *et al.,* (1996) find in a cross sectional study of US firms, that when executives hold low equity stakes, then the relationship between equity ownership and firm risk is positive and when executive holding is high, the relationship is negative. They explain that usually shareholders prefer growth oriented risk-taking but may want to reduce risk in certain situations. The board of directors approve or reject risky plans depending on a number of reasons: their wealth portfolio, the benefits and costs due to their position, and the potential for entrenchment. If the board member's wealth portfolio consists mainly of the investment in the firm, then they may try to minimise risk by backing non-value maximising projects (Wright *et al.,* 1996). They may want to reduce personal costs in terms of employment and benefits by avoiding uncertainties involved in new ventures.

Many previous studies find a positive relation between managerial ownership and managerial risk-taking. Laeven and Levine (2009) find in their study of banks across countries, that banks with more powerful owners tend to take greater risks. In their analysis, they use a dummy variable to indicate a large shareholder on the board (>10% equity) to find the effect managerial ownership on the board has on risk-taking. They find that large equity holders have stronger incentives to increase risk than non-shareholding managers and debt holders. Large owners with substantial cash flows have the power and incentives to induce the bank's managers to increase firm risk.

In addition, Sanders and Hambrick (2007) find that firms whose CEOs have a high percentage of equity exhibit extreme performance (i.e., very large gains as well as very large losses). While, Rajgopal and Shevlin (2002) propose that managers of Oil and Gas companies whose compensation is more sensitive to stock return volatility, take more exploration risk and maintain lower hedge ratios. Greater sensitivity to stock return volatility in relation with compensation tends to induce riskier investment policies and higher financial leverage (Coles *et al.,* 2006).

No studies were found that associated board executive equity ownership to firm risk using a UK-based data sample. The literature mostly supports the notion that equity ownership by executive directors will be positively related to firm risk. Therefore, it can be hypothesized that high percentage of stock held by executives on the board is related to high firm risk.

H5: Executive directors' shareholding is positively related to firm risk.

2.6. Institutional investors

Institutional investors can be any entity such as a mutual fund, pension fund, investment bank, insurance company or any other company that has a large amount of money to invest. These firms can be very knowledgeable about the firms they invest in and can have a strong voice to influence decisions due to the percentage of stock held in the firm. The majority of stock traded in stock exchanges in recent times, is known to belong to institutional investors (USSEC, 2015).

Agency theorists predict that institutional investors having substantial holdings of equity in a firm will monitor management to protect their investment and ensure a good return (Monks and Minow, 1995; Shleifer and Vishny, 1997). But, Cheng *et al*. (2011) and Della Croce *et al*. (2011) find that institutional investors may be interested in short-term profits and therefore encourage managers' risk-taking behaviour. Wright *et al.*, (1996) and Hutchinson *et al.* (2014) find that these investors may encourage boards to take higher risks to achieve higher returns.

Callen and Fang (2013) also find that transient institutional investor ownership increases firm risk. According to Manconi *et al.* (2012) one of the reasons for this behaviour can be the cost of monitoring management, because of which the institutional investor would opt to sell the stock. Even the European Union has stated that the recent financial crisis has undermined the assumption of institutional investors as responsible shareholders (European Parliament, 2010). The recent literature mostly supports the positive relationship between the percentage of substantial institutional holdings and firm risk. Therefore the following hypothesis can be made.

H6: The percentage of substantial holding by institutional investors is positively related to firm risk.

3. Methodology

3.1. Sample

Agency problem is most relevant in large UK firms where there is diffused ownership and the executives manage the firm. Therefore, the sample used is an unbalanced panel of 260 large companies from 2005 to 2010 from the FTSE 350 Index with available data. Accounting and market data was collected from Bloomberg database. The data on the board members was hand collected from the Morningstar database. The sample does not include financial and utility firms due to stricter regulation in these sectors.

Survivorship bias has been avoided by including all the FTSE 350 firms over the sample period. Survivorship bias occurs when only firms that have survived over the sample period are included in the sample. Since some firms have joined the index for the first time or been acquired or become insolvent the list is not the same year on year. From the lists of firms in

every year[5], a final list was collated with a condition that firms needed to exist on the FTSE 350 for at least two consecutive years. This sample therefore does not have survivorship bias.

--- Insert Table 1 about here ---

3.2. Independent Variables

The definition of the variables is shown in Table 1. The size of board was measured as the total number of board members. For board size a natural log transformation was used to reduce the heteroskedasticity that is caused by variables that are always in the positive (Wooldridge, 2009). The independence of the board was measured as percentage of independent directors. The percentage of women on the board was used to represent presence of women. In the sample, 50% of the sample had at least one woman on the board and only 8 firms had more than 30% women on the board. Powerful CEO was measured using a dummy variable which takes the value of 1 if the CEO is the founder or there is duality of the CEO as a chairman of the board or if the Chairman is an executive of the firm. Board ownership was measured as percentage of equity held by the executive members of the board. Institutional investor ownership was measured as the total percentage of substantial (greater than 3%) ownership of equity in a firm by institutions such as pension funds, mutual funds, investment banks and companies. Outliers for all independent variables were removed from the final sample.

3.3. Dependent Variable

In this study two alternative measures of the dependent variable which is Firm risk are used. Firm risk is measured using accounting and market data which ensures that the results of the study are robust. Firm risk measures used in this study are total risk (TR) and asset return risk (ARR).

[5] The total number of unique firms which appeared on the FTSE 350 Index over the sample period of 2005-2010 was 599. After excluding firms that appeared only once on the list and excluding utility and financial sector firms the sample was of 260 firms.

Market data has been used to measure total risk[6] which includes both the risk involved in the particular stock (idiosyncratic risk) and market risk (systematic risk) and reflects the market's perceptions about the risks inherent in the firm's assets and liabilities. Total risk can be explained as the extent of the stock volatility and measured by previous studies as the standard deviation of equity returns (R_{it}) for each fiscal year (Laeven and Levine, 2008; Pathan, 2009). The daily stock return is calculated as the natural logarithmic of the ratio of equity return series, i.e. $R_{it} = \ln(P_{it}/P_{it-1})$, where P_{it} is the stock price (Pathan, 2009). The standard deviation of this ratio times the square root of the number of days of trade activity (260 days) gives the annualised volatility of equity return for each stock. Both regulators and firm executives frequently monitor this risk (Pathan, 2009).

Asset return risk is used as an alternative risk measure which represents the variance of the asset returns[7]. Following Flannery *et al*. (2008) and Pathan (2009), volatility of asset returns or Asset Return Risk was computed as the ratio of market value of equity to market value of total assets times the standard deviation of the daily stock returns. This was annualised by multiplying the resulting value by the square root of the approximate number of trading days in the year which is 250.

3.4. Control Variables

Other variables that affect firm risk are used to control for the differences in the sample so that the actual relationship between the independent and dependent variables can be determined. Five variables are included to control for size of the company (market capitalisation of the firm); Growth opportunities (capital expenditures over sales); financial leverage (total debt over assets); Lagged firm performance (lagged ROA); Industry dummies and year dummies.

Firm size is used to control for difference in size of the firms and is measured as market capitalisation of the firm in billions of pounds. It is used as a control variable since large firms

[6] Total risk is a measure of firm risk using market data

[7] Asset return risk is a measure of Firm Risk using accounting data and market data

may have better access to capital markets and borrow at better conditions (Ferri and Jones, 1979) and therefore have a larger leverage ratio (Titman and Wessels, 1988). Due to this, larger firms would be able to diversify and invest more. Due to the large value of assets, even a wrong choice of investment may not affect the volatility of its stock price. Therefore it is predicted that larger firms will be associated with less firm risk.

Myers (1977) argues that high growth firms prefer relatively lower levels of debt in order to avoid the adverse effects of the under investment problem. Such firms use equity to finance growth. It is predicted that if the firm has more growth opportunities then it would be associated with more firm risk. With regards to financial leverage, firms with higher financial leverage will be associated with less firm risk due to the burden of repayment or risk of insolvency[8].

Cheng (2008) used lagged firm performance as a control variable since it is possible that the firms change risk taken depending on the previous performance of the firm. If a firm does not meet the targeted firm performance in the prior year, managers in an attempt to meet targeted performance figures for the current year will take more risk in terms of investment choices.[9] Therefore it is predicted that low performance of the prior year will be associated with higher firm risk.

3.5. Data Analysis

To analyse the relation between board attributes discussed and firm risk[10] a linear regression model was developed. The hypotheses were tested using the econometric model shown below[11].

$\ln(\text{Firm risk})_{it} = \alpha + \alpha_1 \ln(\text{board size})_{it} + + \alpha_2(\text{non-executive directors})_{it} + \alpha_3(\text{percentage of women})_{it} + \alpha_4 (\text{powerful CEO})_{it} + \alpha_5(\text{board executive ownership})_{it} + \alpha_6(\text{institutional}$

[8] Previously used as control variables by Cheng (2008) and Linck, Netter, and Yang (2008)
[9] See Cyert and March (1963) in their book on the behavioural theory of the firm.
[10] Two alternate measures of firm risk that are used are Total Risk and Asset Return risk.
[11] The empirical model that was used in this study is similar to the model used by Adams *et al.* (2005), Cheng (2008) and Pathan (2009).

ownership)+ α_7(lagged performance) $_{it-1}$ + α_8(firm size) $_{it}$ + α_9(growth opportunities) $_{it}$ + α_{10}(financial leverage) $_{it}$ + (industry dummies) + (year dummies) + ε_{it}

- where i stands for the firm and varies from 1 to 260
- t is the year and varies from 2005 to 2010
- α is the constant that does not vary over time
- α_1 _ α_{10} are the coefficients in the regression
- ε_{it} is the residual variable that varies with time
- natural log of firm risk and board size are used.

The estimation method used was generalised least square random effects method (using STATA) due to the following reasons:

- Board attributes which are time invariant cannot be estimated with fixed effect regressions as they would be wiped out in 'within transformation' process of the variables in this estimation method. Fixed effect estimation requires significant within firm variation for the board variables values so as to produce consistent and efficient results. According to Wooldridge (2009) if the independent variables do not vary much over time then estimates will not be precise.
- This study has a sample period 'T' of six years and the number of firms in the sample is 260 (N). Baltagi (2005) mentions that when the N is large and T is small in a panel data set, fixed effect estimation will be inconsistent. Also fixed effect estimation would lead to a large loss of degrees of freedom.

--- Insert Table 2 about here ---

Table 2 shows the descriptive statistics for the board attributes, risk measures and control variables. The mean board size is 9 board members, mean percentage of non-executive independent directors is 62 per cent, the mean value for percentage of women is 7.65%, the mean value of existence of a powerful CEO is 19.2 %, the mean value of board ownership is

5.96% and the mean value of percentage of substantial institutional investor holdings is 34.14%.

--- Insert Table 3 about here ---

Table 3 shows the Pearson's pair-wise correlation matrix between the independent variables. All the correlation coefficients between the variables is below 0.48 which is between firm size and board size. Therefore multicollinearity between the regressors is not of concern. The correlations are consistent with the predictions.

4. Results

Table 4 presents the results of the generalised least squares random effects estimation of the empirical model. The pre-sign indicates the prediction as made in the hypotheses. The results of the regression using total risk and asset return risk as the dependent variable are shown in the table. The overall model fit with total risk is 59.93% and asset return risk is 60.20%. From Table 4, it can be seen that the direction of the relationship between the independent and alternative dependent variables is consistent. Therefore the results are discussed using total risk which is most often used by firms and regulators alike as a significant risk measure.

--- Insert Table 4 about here ---

Board size is negatively related to all measures of risk which means that a large board relates to lower firm risk. If the board size increases by one standard deviation (2.39), then total risk will decrease by (ln2.39*.0782/ln0.399=-0.0829) 7.42 per cent (where 0.399 is the mean total risk). Previous studies by Cheng (2008) used a sample of 2980 US firms over the period 1996 to 2004 and Pathan (2009) used a sample of 212 bank holding companies in the US over the period 1997 to 2004, and both found that board size is inversely related to the firm risk. The interpretation of the results is that a larger board would make less extreme decision since there would be more compromises made in a larger board and vice versa a small board could increase firm risk. This is the first study that has associated board size to firm risk using a UK data

sample. The empirical findings of this study show that a large board reduces firm risk. This result is consistent across countries and it can be argued that judgements made by a large group would be the average of individual prior judgements (Kogan and Wallach, 1966). This result can inform large UK firms in using board size as an internal risk control mechanism.

The findings show that the proportion of non-executive directors on the board reduces firm risk but is not significantly related. Cheng (2008) and Lewellyn and Muller-Kahle (2012) using a sample of US corporations and a US based data sample of the sub-prime lending industry, respectively, found that non-executive directors did not significantly influence firm risk. Even though the average board in UK firms has more than 50% of the board who are non-executives they do not have a significant effect on firm risk. The monitoring role of non-executive directors to provide a challenge to the executive decisions made at board level is not significant. This may be because the part time non-executive directors do not have enough relevant information to mount a challenge to the executive directors in decisions made at board level.

The results show that the percentage of women on the board is inversely related to firm risk though the relation is not significant. Similar to Van der Walt *et al*. (2006), this study did not find support for the view that gender diversity may have a significant impact on corporate decision quality. Wilson and Altanlar (2009) found that in newly formed firms in the UK, the proportion of women on the board reduced the risk of bankruptcy. There has been no other study which examines gender diversity on boards and their influence on firm risk. Only 50% of the firms have at least one woman on the board and the mean percentage of women on the board is 7.65, most of the women on boards are non-executive directors. Since there is strength in numbers, it may be that for women to provide a challenge at board level there needs to be higher proportion of women on boards to have any significant effect on monitoring the managers.

A powerful CEO on the board is found to be associated positively with all risk measures which is to say that a powerful CEO at the apex of the firm increases firm risk. The presence of a powerful CEO increases total firm risk by 3.8% and asset return risk by 4.44%. However, only the association between powerful CEO and asset firm risk is significant. Previous studies show a mixed relationship between powerful CEOs and firm risk. Lewellyn and Muller-Kahle (2012) in their study of sub-prime lending firms in the US found that powerful CEOs increase firm risk. They propose that powerful CEOs of sub-prime lending firms in the US contributed to the global financial crisis by engaging in risky lending practices. Adams *et al*. (2005) using a sample of Fortune 500 firms also found that powerful CEOs are more likely to make extreme decisions. This study has found that in large UK firms a powerful CEO increases asset return risk, which could be due to the aspiration level of the CEO. This result rejects the explanation of agency theorists that executives may only be risk-averse (Fiegenbaum, 1990; Wiseman and Bromiley, 1996). The results of this finding informs regulators to encourage firms to comply with the guidelines regarding not having duality of CEO-Chairman position at the helm of the firm and having non-executives holding the position of chairman.

It is found that higher board executive equity ownership is related positively and significantly with total risk. If the proportion of equity ownership on the board increases by ten per cent then the total firm risk increases by 0.39%. Saunders *et al*. (1990) found that during the period 1979-1982 in US banks where managers held a higher proportion of equity there was significantly higher risk-taking behaviour. The finding of this study shows that in UK corporations a higher proportion of equity held by board executives is associated with higher firm risk. It may be that executive directors with a higher proportion of holding have the incentive to increase firm risk to try and maximise returns for themselves.

The percentage of equity held by institutional investors is positively and significantly related to both total risk and asset return risk. This result confirms hypothesis H6 and shows that if the

proportion of institutional investors' ownership increases by ten per cent then the total firm risk increases by 0.23%. This result confirms findings from previous literature which argue that institutional investors may be trying to avoid the cost of monitoring management by selling the stock (Manconi *et al*., 2012; Callen and Fang, 2013). This short termism in investing can encourage risk taking behaviour of management (Cheng *et al*., 2011; Hutchinson *et al.*, 2014); therefore institutional investor ownership is related positively to firm risk.

The results also show that larger firms are associated significantly with less risk particularly total risk. It may be that for very large firms a wrong choice in investment may not affect the stock price. Also, higher growth opportunities for firms are related with greater firm risk across all risk measures. This result shows that if there are opportunities for growth for firms they take the risk. Firms with higher financial leverage take less risk; this can be due to the fact that firms are facing the burden of repayment and therefore taking lesser risk.

The previous performance of the firm is found to be inversely related to firm risk. If the previous performance of the firm was poor and not as expected, managers would attempt to meet the targeted performance for the current year by taking on more risk in terms of investment choices.

Overall the results show that a large board decreases firm risk, whereas a board high executive board ownership and institutional investor ownership would increase firm risk. In the following section, robustness tests are carried out to validate the results.

5. Robustness tests

Hermalin and Weisbach (2003) and Adams and Ferreira (2007) in their study of board variables propose that board size and the proportion of NEDs are endogenously formed; for instance, they argue that when firm performance increases, board size and number of NEDs on the board decreases. This reverse causality where the dependent variable influences the explanatory

variables causes a bias in the estimation. Therefore, robustness tests are conducted in this section. First, a test to check for reverse causality is conducted. Next, following the methods used by Pathan (2009), the instrumental variable technique, using the three stage least squares estimation method, is used to estimate the endogenous variables of board size and the percentage of NEDs.

5.1. Test for reverse causality

In an empirical model, when the dependent variable predicts independent variables, then there is reverse causality. In the presence of reverse causality, estimations produce biased results, therefore to check for the extent to which endogeneity (due to reverse causality) is a problem, the following test is conducted.

To confirm that causation runs from board attributes to firm risk, the board variables on the right hand side of empirical model are replaced by their lagged values. The equations are re-estimated using ordinary least squares with lagged explanatory variables and dependent variable of total firm risk. This test to check for reverse causality has been previously used by Pathan (2009) in his study of how board composition relates to bank risk. The argument for using lagged independent variables is that, current values may be endogenous but it is unlikely that past values are subject to the same problem. These results are shown in Table 5. The results show that the estimations using lagged independent variables are similar to the estimation using contemporaneous independent variables. Even though the significance of the relationship is not similar to the estimates using current independent variables, the direction of the relationships are the same. This shows that endogeneity is not a cause for concern in the empirical model used in this study. Another test to check for endogeneity is conducted next using instrumental variables estimation method.

--- Insert Table 5 about here ---

5.2. Testing endogenous variables using instrumental variables estimation

Instrumental variable estimation method is used to estimate the empirical model by finding exogenous instruments which replace the endogenous variables. Then the exogenous instruments are regressed on the dependent variables to find unbiased results. From previous studies, board size and proportion of NEDs are the known endogenous variables, therefore, these variables are instrumented (Pathan, 2009). Instrumental variable estimation eliminates simultaneity bias (when two variables are co-determined), if there is any. Existing literature by Linck *et al*. (2008) developed the variables that explain board size and NEDs on the board, which are adapted for this study and are shown below.

$$\begin{aligned}\text{Board size} = {} & \text{Proportion of NEDs} + \text{firm risk} + \text{percentage of women} \\ & + \text{board executive ownership} + \text{powerful CEO} + \text{firm size} \\ & + \text{lagged performance} + \text{financial leverage} \\ & + \text{growth opportunities} + \text{industry dummies} + \text{year dummies}\end{aligned} \quad \text{(A)}$$

$$\begin{aligned}\text{Proportion of NEDs} = {} & \text{board size} + \text{firm risk} + \text{percentage of women} \\ & + \text{powerful CEO} + \text{board executive ownership} \\ & + \text{institutional ownership} + \text{firm size} + \text{financial leverage} \\ & + \text{industry dummies} + \text{year dummies}\end{aligned} \quad \text{(B)}$$

$$\begin{aligned}\text{Firm risk} = {} & \text{board size} + \text{Proportion of NEDs} + \text{percentage of women} \\ & + \text{powerful CEO} + \text{board executive ownership} \\ & + \text{institutional ownership} + \text{lagged performance} + \text{firm size} \\ & + \text{industry dummies} + \text{year dummies}\end{aligned} \quad \text{(C)}$$

Equation C is similar to equation 1 estimated earlier in the study except that in this estimation, board size and NEDs have been estimated using equation A and B. The equations A, B and C are estimated using the three stage least squares (3SLS) estimation method and the equations are shown below the table. The 3SLS estimation method is used by employing the command ‘reg3’ in STATA statistical software. The results from the estimation are shown in Table 6.

--- Insert Table 6 about here ---

On examining the determinants of board size in Table 6 (equation A) it is found that the size of the board is significantly associated with the proportion of NEDs on the board, and firm size. Equation B shows that the percentage of NEDs on the board depends on firm size, board size, the percentage of women, equity ownership on the board, institutional ownership, firm risk, lagged firm performance and growth opportunities. With regards to causality, the estimation shows that firm risk is not significantly associated with the variables of board size and the proportion of NEDs.

The results of the estimation for equation C show that total firm risk is determined by three significant factors, namely board size, institutional ownership and lagged firm performance. The results are qualitatively similar to the estimation done using the GLS-RE method (in section 8.3.1). This confirms that after controlling for endogeneity, board size and the level of institutional ownership are associated with firm risk.

6. Conclusion

This empirical study has provided evidence that certain board composition attributes can significantly affect firm risk. Using a sample of 260 FTSE 350 UK firms between the years 2005 to 2010, the results show that a decrease in board size can significantly increase firm risk. The percentage of women on the board is consistently negatively related to firm risk, this could be due to the fact that women have an input in better monitoring of management, though the association is not significant. Independent directors are associated with less firm risk but this relation is not significant. Powerful CEO was found to be significantly and positively related to only asset return risk. While, higher board executive equity ownership and the percentage of institutional investors holding firm equity significantly increases firm's total risk. Therefore a board with a small board size, high equity ownership by executive board members, and high

institutional investor ownership can increase firm risk. The policy implication of the findings is that they can inform regulators in the use of board attributes as internal risk control mechanisms. Investors can also consider using the board attributes to assess firm risk.

The findings are reliable since the results are robust across two measures of firm risk and valid since the sample that was selected did not have any survivorship bias. The robustness tests addressed the concern of endogeneity and found that there is no reverse causality. The limitation of the study is that the results can be generalised to only large UK firms. Also, the study does not consider the influence of other board attributes such as age, tenure, and cross directorships on firm risk, which are topics that can be studied in the future in relation with firm risk. The findings show that board composition and structure has a significant impact on firm risk. The study fills a gap in UK governance literature and shows that board attributes association with firm risk are different in the US and UK.

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Table 1: Definition of the variables

This table provides the measures for the independent and control variables used in the empirical model. There are two dependent variables which are used alternately in the empirical model for robustness checks.

Variables	**Measures**
Independent Variables	
Board size	The number of directors on the firms board
Non-executive directors	The percentage of non-executive independent board directors
Percentage of women	Percentage of women on the board
Powerful CEO	Dummy variable which takes the value 1 if there duality of CEO-chairman position, CEO is founder or Chairman is an executive.
Board executive ownership	Equity ownership of all the executive board members as a percentage of the outstanding shares
Institutional ownership	Percentage of total of substantial institutional investors holding more than 3% of shares in the firm
Dependent Variables	
Total risk	The standard deviation of the daily stock returns in each year
Asset return risk	The standard deviation of the daily stock returns times the ratio of the market value of equity to market value of total assets times square root of 250
Control Variables	
Lagged performance	The return on assets for the firm for the previous year
Firm size	The market capitalisation of the firm in billions
Growth opportunities	Capital expenditures by sales
Financial leverage	Total debt over assets
Industry dummies	Seven dummy variables that are either 1 or 0 for each of the seven industries
Year dummies	Six dummy variables that are either 0 or 1 for each of the six years from 2005 to 2010

Table 2: Descriptive statistics

This table presents the descriptive statistics of all the variables used in the empirical model from the data sample of 260 firms between the years 2005 to 2010. Min stands for the minimum value, max for the maximum value and SD stands for the standard deviation. Board size is the total number of board members, natural log is used. Non-executive directors are the percentage of non-executive directors on the board. Percentage of women is represented by the percentage of women on the board. Powerful CEO is a dummy variable which takes the value 1 if there duality of CEO-chairman position, CEO is founder or Chairman is an executive. Board executive ownership is the equity ownership of all the executive board members as a percentage of the outstanding shares. Institutional ownership is measured as the percentage of total of substantial institutional investors holding more than 3% of shares in the firm. Total risk is the standard deviation of the daily stock returns in each year Asset return risk is the standard deviation of the daily stock returns times the ratio of the market value of equity to market value of total assets times square root of 250. Lagged performance is the accounting profit for the firm in the previous year and is measured as return on assets. Firm size is measured as market capitalisation of the firm in billions of pounds. Growth opportunities are measured as capital expenditures over sales and financial leverage is calculated as total debt over assets.

Variables	**Mean**	**SD**	**min**	**1st Quartile**	**Median**	**2nd Quartile**	**Max**
Independent variables							
Board size (No)	8.98	2.39	5	7	9	10	19
Non-executive directors (%)	62.61	11.83	28.57	55.56	62.5	71.43	93.33
Percentage of women (%)	7.65	9.20	0	0	7.14	12.50	57.14
Powerful CEO	0.192	0.394	0	0	0	0	1
Board executive ownership (%)	5.96	14.13	0	0.11	0.36	2.58	90.5
Institutional ownership (%)	34.14	22.06	0	17.94	31.06	47.39	100
Dependent Variables							
Total risk	0.399	0.203	0.135	0.261	0.346	0.473	1.62
Asset return risk	0.391	0.189	0.134	0.259	0.345	0.468	1.54
Control Variables							
Lagged performance (millions)	7.63	12.31	-175.74	3.39	6.59	10.78	175.92
Firm size (billions)	5.316	15.604	.010	.490	.981	2.607	138.68
Growth opportunities	11.38	57.61	0.016	1.829	3.468	7.482	1555.21
Financial leverage	4.80	39.01	-217.86	1.86	2.55	3.66	1010.32

Table 3: Correlations matrix

This table shows the Pearson's pairwise correlation between all the independent variables used in the empirical model. Board size is the total number of board members, natural log is used. Non-executive directors are the percentage of non-executive directors on the board. Percentage of women is represented by the percentage of women on the board. Powerful CEO is a dummy variable which takes the value 1 if there duality of CEO-chairman position, CEO is founder or Chairman is an executive. Board executive ownership is the equity ownership of all the executive board members as a percentage of the outstanding shares. Institutional ownership is measured as the percentage of total of substantial institutional investors holding more than 3% of shares in the firm. Lagged performance is the accounting profit for the firm in the previous year and is measured as return on assets. Firm size is measured as market capitalisation of the firm in millions of pounds. Growth opportunities are measured as capital expenditures over sales and financial leverage is calculated as total debt over assets. * denotes that correlation is significant at the 0.05 level (2-tailed).

	board size	**neds**	**women**	**powerful CEO**	**executive ownership**	**institutional ownership**	**lagged performance**	**financial leverage**	**firm size**	**growth opportunities**
board size	1									
neds	0.1232*	1								
women	0.1361*	0.1502*	1							
powerful CEO	0.0192	-0.4208*	-0.1222*	1						
executive ownership	-0.11*	-0.2414*	-0.1257*	0.328*	1					
institutional ownership	-0.1061*	-0.0177	-0.0953*	0.0846*	0.0142	1				
lagged performance	0.0045	0.0172	-0.0318	0.0098	0.0706*	0.0477	1			
financial leverage	-0.0041	0.0172	0.0304	-0.0388	0.0066	-0.0473	-0.0049	1		
firm size	0.4785*	0.2585*	0.1086	-0.0896*	-0.0869*	-0.1852*	0.0633*	-0.0115	1	
growth opportunities	-0.015	-0.0085	-0.014	0.0244	0.1373*	0.0278	-0.046	-0.0076	-0.006	1

Table 4: Generalised Least square Random effects estimation of the empirical model

This table shows the results from the estimation of the empirical model using Generalised least square – random effects method. The dependent variables of Total risk and Asset Return risk are used alternatively in the empirical model and the results are presented in column 1, and 2 respectively. Total risk is the standard deviation of its daily stock returns over a year. Asset Return Risk (ARR) is computed as the standard deviation of the daily stock returns times the ratio of market value of equity to market value of total assets times square-root of 250 in a year. The pre-sign is the predicted relation between the independent and dependent variable. Board size is the total number of board members, natural log is used. Non-executive directors are the percentage of non-executive directors on the board. Percentage of women is represented by the percentage of women on the board. Powerful CEO is a dummy variable which takes the value 1 if there duality of CEO-chairman position, CEO is founder or Chairman is an executive. Board executive ownership is the equity ownership of all the executive board members as a percentage of the outstanding shares. Institutional ownership is measured as the percentage of total of substantial institutional investors holding more than 3% of shares in the firm. Lagged performance is the accounting profit for the firm in the previous year and is measured as return on assets. Firm size is measured as market capitalisation of the firm in millions of pounds. Growth opportunities are measured as capital expenditures over sales and financial leverage is calculated as total debt over assets. Industry and year dummies are included. The constant value in the regression is also reported. The model fit is also reported. Along with the coefficient the t-statistic is reported in parentheses. The superscripts of *, **, *** indicate statistical significance to 10%, 5% and 1% respectively.

	Pre-sign	Total Risk	Asset Return Risk
Board size	-	-0.0782* (-1.84)	-0.0849** (-2.06)
Non-executive directors	-	0.0000 (0.01)	0.0001 (0.17)
Percentage of women	-	0.0009 (0.92)	0.0010 (0.98)
Powerful CEO	+	0.0380 (1.48)	0.0444* (1.77)
Board executive ownership	+	0.0039*** (3.48)	0.0040*** (3.60)
Institutional ownership	+	0.0023*** (5.95)	0.0021*** (5.43)
Lagged performance	-	-0.0015** (-2.40)	-0.0013** (-2.17)
Firm size (billions)	-	-0.0041*** (-4.06)	0.0040*** (-4.17)
Growth opportunities	+	0.0000 (0.44)	0.0000 (0.50)
Financial leverage	-	-0.0002 (-1.33)	-0.0002 (-1.39)
Year dummies		yes	yes
Industry dummies		yes	yes
No of observations		1364	1364
Model fits: Within R2 Between R2 Overall R2 Wald Chi2 stats (22)		 0.6858 0.5139 0.5993 2619.74	 0.6819 0.5317 0.6020 2593.63

Table 5 – Results from the OLS estimation of lagged board variables on firm risk

This table presents the results of the GLS-RE estimation of equations 1, 2, 3, and 4 with lagged independent variables. The dependent variable is firm risk. Total firm risk is the standard deviation of its daily stock returns over a year. Board size is the total number of board members, natural log is used. Proportion of NEDs is the percentage of non-executive directors on the board. Percentage of women is represented by the percentage of women on the board. Powerful CEO is a dummy variable which takes the value 1 if there duality of the CEO-chairperson position, the CEO is founder or the chairperson is an executive. Executive directors' ownership is the equity ownership of all the executive board members as a percentage of the outstanding shares. Institutional ownership is measured as the percentage of total of substantial institutional investors holding more than 3% of shares in the firm. Lagged performance is the accounting profit for the firm in the previous year and is measured as return on assets. Firm size is measured as market capitalisation of the firm in billions of pounds. Growth opportunities are measured as capital expenditures over sales and financial leverage is calculated as total debt over assets. Industry and year dummies are included. Along with the coefficient the t-statistic is reported in parentheses. The superscripts of *, **, *** indicate statistical significance to 10%, 5% and 1% respectively.

Lagged explanatory variables	**Pre-sign**	**Total Risk**
Board size (No)	-	-0.104** (-2.25)
Proportion of NEDs (%)	-	-0.0004 (-0.49)
Percentage of women	-	0.0017 (1.43)
Powerful CEO	+	0.0005 (.02)
Board Executive ownership	+	0.0033*** (2.79)
Institutional ownership	+	0.0019*** (4.57)
Lagged performance	-	-0.0011* (-1.74)
Firm size (billions)	-	-0.0000*** (-3.17)
Financial leverage	-	-0.0001 (-.06)
Growth opportunities	+	-0.0001 (-0.08)
Industry dummies		yes
Year dummies		yes
Model fit:		
R^2 overall		.5362

Table 6 – Results from the 3SLS estimation of equations A, B and C

The table presents the results of 3SLS estimates of equation A, B and C shown below in Column 1, 2, and 3 respectively.

Board size = Proportion of NEDs + firm risk + percentage of women + powerful CEO
+ board executive ownership + firm size + lagged performance + financial leverage
+ growth opportunities + industry dummies + year dummies

(A)

Proportion of NEDs = board size + firm risk + percentage of women + powerful CEO
+ board executive ownership + institutional ownership + firm size + financial leverage
+ industry dummies + year dummies

(B)

Firm risk = board size + Proportion of NEDs + percentage of women + powerful CEO
+ board executive ownership + institutional ownership + lagged performance + firm size
+ industry dummies + year dummies

(C)

Board size is the total number of board members. Proportion of NEDs is the percentage of non-executive directors on the board. Percentage of women is represented by the percentage of women on the board. Institutional ownership is measured as the percentage of total of substantial institutional investors holding more than 3% of shares in the firm. Lagged performance is the accounting profit for the firm in the previous year and is measured as return on assets. Firm size is measured as market capitalisation of the firm in billions of pounds. Growth opportunities are measured as capital expenditures over sales and financial leverage is calculated as total debt over assets. Industry and year dummies are included. The constant value in the regression is also reported. The model fit is also reported. Along with the coefficient the t-statistic is reported in parentheses. The superscripts of *, **, *** indicate statistical significance to 10%, 5% and 1% respectively.

	Board Size (A)	**Proportion of NEDs (B)**	**Total Risk (C)**
Board size (No)	-	-91.94 (-.50)	-3.94* (-1.84)
Firm risk (Total risk)	-.2978 (-0.73)	-25.57 (-.36)	-
Proportion of NEDs (%)	-.001 (-1.90)	-	-.017 (-0.10)
Percentage of women	.0016** (2.17)	.237 (0.58)	0.007 (0.25)
Powerful CEO	0.149** (2.30)	-8.13 (1.46)	1.994 (0.20)
Board executive ownership	.0017 (1.29)	-0.329 (-0.71)	0.140 (1.56)
Institutional ownership	-	-0.0306 (-0.19)	0.0044* (1.70)
Lagged performance	-.0008 (-1.49)	-	-.0014** (-2.13)
Firm size (billions)	.0000*** (4.50)	.0006 (0.59)	-.0007 (-.42)
Financial leverage	-0.0003 (-0.09)	.0035 (.19)	-
Growth opportunities	-.0002 (-0.47)	-	-
Industry dummies	yes	yes	yes
Year dummies	yes	yes	yes
Model fit: R squared	.0573	-2.6904	-3.3027
Chi square-stats	348.30***	110.38***	190.89***

No of observations	1364	1364	1364