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**Corporate Governance and Firm Risk**

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## Corporate Governance and Firm Risk

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Corporate Governance

## Corporate Governance and Firm Risk

### ABSTRACT

**Purpose:** This study explores the relationship between the board governance structure and firm risk. Specifically, we develop a ‘Governance index’ based on four different aspects of the board: 1. Board composition, 2. Board leadership structure, 3. Board member characteristics and 4. Board processes, and examine how the overall index relates to firm risk.

**Design:** The study is conducted using a sample of 268 UK firms from the FTSE 350 index, over the period 2005 to 2010. An index is constructed to capture the overall governance structure of the firm. Regressions of the index on three risk measures are examined.

**Findings:** We find that the governance index that aggregates the four sets of board attributes is significantly negatively related to firm risk. Robustness tests confirm this result.

**Research Implications:** A large number of studies have explored the relationship between the attributes of corporate boards and firm performance, with mixed results. A much smaller number of studies have looked at board attributes and firm risk, but these have either focused on financial sector firms alone, or have included only a single or a limited number of attributes. This study, utilizing a broad agency framework, seeks to extend the work on firm risk and board attributes, by both expanding industry sectors examined and employing a comprehensive set of board attributes.

**Originality:** The findings have policy and practical implications for investors, regulators, and chairmen of boards of governors to the extent that they inform these constituencies about the set of board attributes that are associated with firm risk. This study is the first to utilize a comprehensive measure of governance and relate it to firm risk.

**Keywords:** Corporate Governance, Board Attributes, Governance Index, Firm Risk

**Paper Type:** Research paper

**JEL codes:** M14; G31; G34

## 1. INTRODUCTION

The purpose of this study is to utilise a comprehensive set of corporate governance attributes focusing on the board of directors to determine an overall ‘Governance Index’ representing governance effectiveness; and investigate how this relates to firm risk. The role of corporate governance and risk management has been highlighted following recent regulatory reforms. For example, the Financial Reporting Council (FRC) in the UK, published *Boards and Risk* (FRC, 2011) outlining 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.

Prior research on governance indices typically measure areas such as shareholder rights (Gompers *et al.*, 2003; Brown and Caylor, 2006; Bebchuk *et al.*, 2009), ownership and leadership structures (Anlin *et al.*, 2007), or the severity of agency conflicts (Renders and Gaeremynck, 2012). Following Zahra and Pearce (1989), we focus on the internal structure of governance and group board attributes into four factors: 1. Board composition, 2. Board leadership structure, 3. Board member characteristics and 4. Board processes. We construct a *Governance Index* based on the above attributes and examine its relationship with different measures of firm risk. The governance index can potentially indicate to investors the boards that are more risk-seeking or risk-averse based on their composition, leadership structure, characteristics and the processes they follow. This index differs from those in prior studies given that the former tend to focus on external and stakeholder factors and not so

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2  
3 much on internal board attributes. Furthermore, no prior studies have examined an overall  
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5 index based on the board attributes of governance in relation to firm risk.  
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9 Prior empirical literature on the composition of boards and the attributes of board members  
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11 has tended to focus on the relationship between these factors and firm performance (Dalton *et*  
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13 *al.*, 1998; Bhagat and Black, 2002; Van der Walt *et al.*, 2006; Bhagat and Bolton, 2008;  
14  
15 Brown and Caylor, 2009; Adams *et al.*, 2010; Bozec *et al.*, 2010; Mangena *et al.*, 2012;  
16  
17 Bhagat and Bolton, 2013; Upadhyay *et al.*, 2014) or other dimensions such as firm innovation  
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19 (Zona *et al.*, 2013); or they focus on the factors that make boards effective (Minichilli *et al.*,  
20  
21 2009; Ben-Amar *et al.*, 2013). However, limited prior research shows that certain  
22  
23 attributes of corporate governance are linked to the variability in performance, or  
24  
25 firm risk. These studies are typically based on US samples in the financial sector  
26  
27 (Pathan, 2009; Llewellyn and Muller-Kahle, 2012) and/or involve only a limited set of board  
28  
29 attributes such as board size, independence, CEO power and board equity ownership (Brick  
30  
31 and Chidambaran, 2008; Cheng, 2008; Delgado-García *et al.*, 2010; Geppert *et al.*, 2013)  
32  
33 rather than an overall governance index.  
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37  
38 Using a sample of 267 non-financial firms, drawn from the FTSE 350 index over the years  
39  
40 2005 to 2010, we find that the *Governance index* is significantly associated with measures  
41  
42 of firm risk. Specifically, we find that a larger value of the *Governance Index* is associated  
43  
44 with lower firm risk. The *Governance index* is composed of four attributes: 1. *Board*  
45  
46 *Composition*, which consists of variables relating to board size, the proportion of non-  
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48 executive directors and gender diversity, 2. *Board Leadership Structure* which indicates the  
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50 power of the chief executive officer (hereafter, CEO) and executives' equity ownership, 3.  
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52 *Board Characteristics* which includes the average age and tenure of board members, and 4.  
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3 *Board Process* which includes variables related to percentage of board attendance and  
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5 frequency of audit meetings.  
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8 We contribute to the corporate governance literature in two ways. First, we examine how a  
9  
10 comprehensive set of board attributes are associated with firm risk; the lack of studies in the  
11  
12 literature that examine this relationship is significant because firms' long-term shareholders  
13  
14 are not only concerned with the size and growth in their investment, but also the volatility  
15  
16 in the returns, which is a measure of firm risk (Luo and Bhattacharya, 2009). Second, we  
17  
18 measure an overall board index or *Governance Index*, which represents the internal  
19  
20 structure and process of the board of directors, rather than external factors related to  
21  
22 governance or how the board interacts with stakeholders. This index can be used by  
23  
24 shareholders and other stakeholders to gauge the level of risk-taking in firms based on the  
25  
26 governance structure.  
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30  
31 The remainder of the paper is organized as follows. The next section presents the  
32  
33 theoretical context for our study and reviews the empirical literature on board attributes and  
34  
35 governance indices from which we develop the hypothesis to be tested. In section three, we  
36  
37 outline the methodology employed and present the development of the *Governance index*,  
38  
39 along with the sample selection. In section four, we present and discuss the empirical  
40  
41 findings and robustness tests, followed by concluding remarks in the final section.  
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44

## 45 **2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT**

### 46 *2.1 Board attributes and risk*

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49 Prior empirical studies that have examined the relationship between board  
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51 attributes and firm risk typically examine only a limited number of board attributes.  
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54 For example, Pathan (2009) finds, in a sample of 212 US banks over 1997-2004 that firm risk  
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3 is negatively associated with board size, the number of independent directors and CEO power  
4  
5 but is positively associated with CEO equity ownership. Cheng (2008) also finds, in a US  
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7 sample over the period 1996-2004, that board size is negatively associated with variability  
8  
9 of firm performance, or firm risk. Platt and Platt (2012) examine several board attributes  
10  
11 in relation to insolvency and find that bankrupt firms have less independent directors,  
12  
13 smaller board sizes, higher equity ownership by directors, and smaller audit,  
14  
15 compensation and nomination committees. This implies that these factors are related to  
16  
17 firm risk. Mathew *et al.* (2015) find a significant relationship between firm risk and board  
18  
19 size, as well as executive and institutional ownership using a UK-based sample.  
20  
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23  
24 Other studies that study board attributes in relation to firm risk include those that examine  
25  
26 board independence which find this to be negatively related to firm risk (Brick and  
27  
28 Chidambaran, 2008; Djerbi and Anis, 2015) and CEO power which is positively related to  
29  
30 firm risk (Adams *et al.*, 2005; Llewellyn and Muller-Kahle, 2012; Djerbi and Anis, 2015).  
31  
32 Furthermore board ownership is found to be related to firm risk (Saunders *et al.*, 1990);  
33  
34 specifically, family ownership vs. diversified ownership leads to different risk profiles and  
35  
36 managerial risk-taking in the context of international acquisitions (Geppert *et al.*, 2013).  
37  
38 Harjoto *et al.* (2014) also find that boards with diversity in terms of gender, race, age,  
39  
40 experience, tenure and expertise are more risk averse. Callen and Fang (2013) find that  
41  
42 transient institutional investor ownership increases firm risk. Gender diversity in top  
43  
44 management levels is also associated with lower firm risk (Perryman *et al.*, 2016). Sun and  
45  
46 Liu (2014) ascertain that banks with long board tenure audit committees have lower total and  
47  
48 idiosyncratic risk. Furthermore, Bennett (2013) confirm that increased monitoring, through  
49  
50 increased board attendance as well as other factors, is associated with less risk-taking.  
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54 Therefore, empirical evidence shows that specific board attributes are associated with firm  
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3 risk. However, governance attributes do not exist in isolation and the combination of these  
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5 attributes can lead to different risk-taking behaviour. The following section discusses prior  
6  
7 empirical research that has developed indices to capture overall governance structures.  
8  
9

## 10 2.2 Governance indices

11  
12 Prior research that has examined a combination of board attributes typically forms an index  
13  
14 that represents board effectiveness. Some well-known indices such as the Governance Risk  
15  
16 indicator (GRId) formulated by Institutional Shareholders Services Inc. combine variables  
17  
18 representing board composition and independence, compensation, ownership, audit process  
19  
20 and shareholder rights/takeover defences (ISS, 2012). However, many of the indices used in  
21  
22 prior research measure only external factors such as shareholder rights. For example,  
23  
24 Gompers *et al.* (2003) use the incidence of twenty four governance rules to construct a  
25  
26 governance index to proxy for the level of shareholder rights. They find that firms with  
27  
28 stronger shareholder rights have higher firm value, higher profits, higher sales growth, lower  
29  
30 capital expenditures, and make fewer corporate acquisitions. Bebchuk *et al.* (2009) provide an  
31  
32 entrenchment index based on six shareholder rights provisions and find that this index is  
33  
34 associated with firm value.  
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39 Other research measuring an overall governance index include Brown and Caylor (2006),  
40  
41 who examine a set of 51 firm-specific provisions representing both internal and external  
42  
43 governance and test how these relate to firm valuation. They include shareholder rights factors  
44  
45 (e.g. whether the board is staggered and if there are poison pill agreements) as well as some  
46  
47 internal factors (e.g. independence of board members and attendance at board meetings).  
48  
49 Anlin *et al.* (2007) provide an index representing ownership and leadership structures and  
50  
51 examine how this relates to share price in Taiwanese firms. The index includes factors related  
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53 to: CEO duality, size of the board of directors, management's holdings and block  
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3 shareholders' holdings. They find that the index can proxy for effective governance and is  
4 associated with firm value. Renders and Gaeremynck (2012) construct a measure of the  
5 severity of the principal-principal conflict which includes variables that increase majority  
6 shareholders' ability to extract private benefits. They use the index to measure governance  
7 effectiveness and relate to firm value. Therefore, prior studies presenting governance  
8 indices tend to focus on external and stakeholder factors and focus on how the index  
9 relates to firm value and performance.  
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### 18 *2.3 Hypothesis development*

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20 In terms of overall governance factors that relate to firm risk, it is likely that internal factors  
21 related to the board will be more relevant. According to agency theory, the separation of  
22 ownership and control has the potential to create agency problems, which can result in agents  
23 employing strategies to promote their self-interest to the detriment of principals (Jensen and  
24 Meckling, 1976; Fama and Jensen, 1983). Therefore, boards of directors are needed to  
25 monitor the firm's activities in the interest of stakeholders including shareholders, creditors,  
26 employees and society (Mallin, 2013). Utilising an agency perspective, Zahra and Pearce  
27 (1989) propose four attributes of the board, namely composition, structure, characteristics  
28 and process that influence how boards carry out their roles as seen in Figure 1. These  
29 attributes represent a mix of attributes specific to board members as well as the overall  
30 functioning of the board. Board composition refers to the size of the board and the mix of  
31 board members e.g. in terms of independence. Board structure refers to board organization  
32 and division of labor among committees. Board characteristics refer to directors' experience  
33 and factors that influence the performance of their tasks. Finally, board process refers to the  
34 decision-making related activities (Zahra and Pearce, 1989, p. 292). The mix of attributes  
35 therefore determines how the board carries out the roles of control, service and strategy  
36 which influence strategic outcomes and hence firm performance (Zahra and Pearce, 1989). It  
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3 is expected that the board attributes will be related to firm risk through their impact on the  
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5 strategic direction of management and control function.  
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8 (Figure 1)  
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10  
11 Based on the categories of board attributes discussed in Zahra and Pearce (1989), namely  
12  
13 board composition, leadership structure, board characteristics and board processes, it is  
14  
15 expected that a single *Governance Index* that forms a measure of the overall governance  
16  
17 environment and monitoring effectiveness based on these attributes will be related to firm  
18  
19 risk. Therefore, our hypothesis is as follows:  
20  
21

22 *H<sub>a</sub>: A governance index which consists of board composition, leadership structure,*  
23  
24 *board characteristics and board process is related to firm risk.*  
25  
26

### 27 **3. SAMPLE SELECTION AND METHODOLOGY**

28

29  
30 The sample in this study is comprised of firms in the UK-based FTSE 350 index over the  
31  
32 period 2005-2010. The time period is selected to follow the adoption of International  
33  
34 Financial Reporting Standards (IFRS) in 2005. We exclude utility and financial firms due to  
35  
36 their different regulatory environment and include all firms that were on the index for at least  
37  
38 two consecutive years to reduce survivorship bias. This results in an unbalanced sample of  
39  
40 267 firms over the period or 1,410 observations. Financial data was collected from the  
41  
42 Bloomberg database and data on the board members was hand collected from the  
43  
44 Morningstar database. Table 1 shows the distribution of the sample by industry and year. As  
45  
46 can be seen from the table, the sample ranges from 228 to 242 firm-observations per year.  
47  
48 The majority of the observations are from the industrials and consumer service industries  
49  
50 (N=420+413=833). The next largest industry in terms of sample observations is consumer  
51  
52 goods (N=190) followed by basic materials (N=106) and oil and gas (104). The industrial  
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distribution across years is consistent.

(Table 1)

To analyse the relationship between board attributes and firm risk, we use the following linear regression model based on Adams *et al.* (2005), Cheng (2008) and Pathan (2009):

$$\begin{aligned} \ln(Risk_{it}) = & \alpha_0 + \alpha_1 Governance\ Index_{it} + \alpha_2 Leverage_{it} + \alpha_3 Firm\ Size_{it} + \alpha_4 Growth_{it} + \alpha_4 \\ & Performance_{it-1} + \sum_{j=1-8} \alpha_j (Industry\ Dummies_{it}) + \sum_{t=1-6} \alpha_t (Year\ Dummies_{it}) + \varepsilon_{it} \end{aligned} \quad (1)$$

Where

*Risk<sub>it</sub>* Firm risk for firm i in year t measured as either Total Risk, Asset Return Risk or Idiosyncratic Risk, as described in the next section;

*Governance* the *Governance Index* for firm i in year t, as described in the next section;

*Index<sub>it</sub>*

*Leverage<sub>it</sub>* Average total assets of firm i in year t over average total common equity;

*Firm Size<sub>it</sub>* Market capitalization of firm i in year t measured as total value of issued shares;

*Growth<sub>it</sub>* Capital expenditures of firm i in year t over sales;

*Performance<sub>it-1</sub>* Return on assets for firm i in year t-1 measured as net income over total assets;

*ε<sub>it</sub>* The residual.

We use Generalised Least Squares random effects method to estimate the model since board attributes which are time invariant cannot be estimated with fixed effect regressions. We include several control variables that may impact the level of firm risk in the above regression.

Firstly, we include *Leverage* since high financial leverage is associated with less firm risk due

1  
2  
3 to the burden of repayment (Cheng, 2008). We also include *Firm Size* as large firms  
4  
5 may have more natural hedges against economic fluctuations, better access to capital  
6  
7 markets and can borrow on better terms (Ferri and Jones, 1979). We also include *Growth*  
8  
9 as firms that have more growth opportunities will take this opportunity to expand and take on  
10  
11 new projects which might impact firm risk. Lagged *Performance* is included since firms  
12  
13 can change risk taken in a particular year through investment choices depending on the  
14  
15 previous performance of the firm (Cheng, 2008). Finally, we include industry and year  
16  
17 dummies as control variables.  
18  
19

### 20 21 22 23 *3.1 Measures of risk*

24  
25  
26 Three alternative measures of firm risk are employed based on Laeven and Levine (2009)  
27  
28 and Pathan (2009). Specifically, we use Total Risk, Asset Return Risk and Idiosyncratic  
29  
30 Risk as defined below (firm and year subscripts have been excluded for simplicity):  
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32

33  
34 *Total Risk* Standard deviation of annualised daily stock returns measured as the  
35  
36 natural logarithm of the ratio of equity return series;

37  
38 *Asset Return Risk* Ratio of market value of equity to market value of total assets times the  
39  
40 standard deviation of annualised daily stock returns for a firm\* $\sqrt{250}$ ;

41  
42 *Idiosyncratic Risk* Risk specific to the firm downloaded from Bloomberg database.  
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46  
47 The first measure, *Total Risk*, uses market data and includes both the risk involved in the  
48  
49 particular stock (idiosyncratic risk) and market risk (systematic risk). This reflects the  
50  
51 market's perception about the risks inherent in the firm's assets and liabilities. Both  
52  
53 regulators and firm executives frequently monitor this risk (Pathan, 2009).  
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55

56  
57 *Asset Return Risk* is used as an alternative risk measure which represents the variance of  
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3 asset returns. Following Flannery and Rangan (2008) and Pathan (2009), volatility of  
4  
5 asset returns is computed as the ratio of market value of equity to market value of total  
6  
7 assets multiplied by the standard deviation of the daily stock returns and annualised by  
8  
9 multiplying the resulting value by the square root of the approximate number of trading  
10  
11 days in the year which is 250.

12  
13  
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15 *Idiosyncratic Risk* represents risk specific to the firm which is unrelated to the market and  
16  
17 cannot be diversified away. This data was obtained from the Bloomberg database.

### 21 22 3.2 Construction of Governance Index

23  
24  
25 The Governance Index is a proxy for governance effectiveness and focuses on the internal  
26  
27 mechanism and attributes of the board of directors. It is composed of factors related to: 1.  
28  
29 Board composition, 2. Board leadership structure, 3. Board characteristics and 4. Board  
30  
31 processes. The specific variables included for each board attribute is guided by prior  
32  
33 empirical research as included in the literature review. All variables included in the index  
34  
35 are constructed by using indicator variables taking the value of 1 when the value of the  
36  
37 variable is either above or below the median. In our choice of the direction of the indicator  
38  
39 variables, we rely on prior research in determining whether the variable is expected to be  
40  
41 positively or negatively related to firm risk.<sup>1</sup> We therefore propose a proxy which we expect  
42  
43 to measure board effectiveness in terms of risk behavior; specifically, we expect this proxy  
44  
45 to be negatively related to firm risk.

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49  
50 Our first attribute, *Board Composition* is composed of board size, the proportion of non-

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55 \_\_\_\_\_  
56 <sup>1</sup> In untabulated results, we also regress firm risk on each board attribute separately to confirm the direction of  
57 the association.

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3 executive directors (NEDs) and the percentage of women on the board. As shown in the  
4 literature a large board size, a higher percentage of NEDs and higher percentage of women on  
5 the board is related to low firm risk (e.g. Pathan, 2009; Harjoto *et al.*, 2014) and better  
6 monitoring (Adams and Ferreira, 2009). Therefore board size that is equal and larger than the  
7 median value in the sample is assigned the value 1, otherwise it takes the value 0 (*I-Board*  
8 *Size*). Similarly, the percentage of NEDs and percentage of women on the board that have a  
9 value equal to or greater than the median take the value of 1 (indicative of low risk),  
10 otherwise they take the value 0 (*I-Percentage of NEDs* and *I-Percentage of Women*).  
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20  
21 The second factor, *Board Leadership Structure*, consists of three variables – Powerful CEO,  
22 Board executive ownership and Block ownership. The first variable, *I-Powerful CEO* takes the  
23 value 0 if the CEO is also the chairperson, the chairperson is an executive, or the CEO is a  
24 founder of the firm, and 1 otherwise; given that powerful CEOs are positively related to risk  
25 (e.g. Adams *et al.*, 2005). The second variable *I-Board Executive Ownership* takes the value 0  
26 when board ownership is greater than the median value and 1 otherwise. This is in line with  
27 prior research that finds that board ownership is positively related to firm risk (Pathan,  
28 2009) and negatively related to earnings quality in line with the management entrenchment  
29 theory (Pergola and Joseph, 2011). Lastly, *I-Block Ownership* takes the value 0 when  
30 percentage of equity owned by institutional investors is greater than the median value and 1  
31 otherwise, given that there is a positive relationship between institutional investor  
32 ownership and firm risk (Callen and Fang, 2013).  
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48 The third attribute, *Board Characteristics*, consists of variables related to board member  
49 age and tenure. The first variable, *I-Board Age* is created which takes the value 1 when  
50 board age is greater than the median, 0 otherwise. Also *I-Board Tenure* takes the value 1  
51 when board tenure is greater than the median and 0 otherwise given that higher age and  
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3 tenure are linked with lower firm risk (Harjoto et al., 2014, Sun and Liu, 2014).

4  
5 The final attribute, *Board Process*, consists of the variables related to board meetings  
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7 attendance and frequency of audit committee meetings. *I-Board Attendance* takes the value 1  
8  
9 when board attendance of the board members is greater than the median, 0 otherwise. Also  
10  
11 *I-Frequency of Audit Meetings* takes the value 1 when total number of audit committee  
12  
13 meetings is greater than the median, 0 otherwise. Since board meetings are found to be  
14  
15 negatively related to firm risk (Bennett, 2013), these variables are constructed in this way.  
16  
17

18  
19 The overall measure of governance related to board attributes, the *Governance Index*, is  
20  
21 constructed by combining all the variables described above in the four categories. The index  
22  
23 can range from 0 to 10 given that it includes 10 indicator variables taking on the value 0 or 1.  
24  
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26  
27 
$$\text{Governance Index} = I\text{-Board Size} + I\text{-Proportion of NEDs} + I\text{-Percentage of Women} + I\text{-}$$
  
28  
29 
$$\text{Powerful CEO} + I\text{-Board Equity Ownership} + I\text{-Block Ownership} + I\text{-Board Age} + I\text{-}$$
  
30  
31 
$$\text{Board Tenure} + I\text{-Board Attendance} + I\text{-Frequency of Audit Meetings}$$
  
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#### 34 **4. DESCRIPTIVE STATISTICS AND RESULTS**

##### 35 36 37 *4.1 Descriptive statistics*

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40 We begin by presenting descriptive statistics for all board variables as well as the index,  
41  
42 dependent and control variables in Table 2. The results show that the mean board size of the  
43  
44 sample is 8.95 ranging from a minimum of 5 to a maximum of 19; the mean percentage of  
45  
46 NEDs is 62% and the percentage of women on boards is about 8%. Furthermore, the  
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48 percentage of firms with a powerful CEO is 18% and the mean value of board ownership  
49  
50 is 4%, ranging from 0% to 72%. The mean percentage of block ownership held by  
51  
52 institutional investors is 34%, while the mean tenure of the board is about 5 years  
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3 and mean age of the board members is about 56 years. Average board attendance is 95%  
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5 per year while the mean frequency of audit meetings is 4 times per year.  
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8 (Table 2)  
9

10  
11 In terms of the descriptive statistics of the board index, we find that the *Governance index*  
12 ranges from 0 to 9 with a mean of 4.34 and standard deviation of 1.75.  
13  
14

15  
16 In terms of the risk variables, the mean value for *Total Risk* is 0.4 with a standard deviation  
17 of 0.2. *Asset return risk* had a mean of 0.39 and standard deviation of 0.19 while  
18  
19 *Idiosyncratic Risk* has a mean of -0.57 and standard deviation of 0.50.  
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23  
24 In terms of the control variables, *Leverage* has a mean of 5.01 with a standard deviation of  
25 39.69 which shows that the variation in leverage across the sample is high. The smallest *Firm*  
26 *Size* is £10 million and the largest of £138 billion while *Growth* has a minimum value of 0.02  
27 and a maximum of 1,555. Finally, *Lagged Performance* has a mean of 7.57 and ranges from -  
28 175.74 to 175.92.  
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34  
35 Table 3 presents the Pearson correlation coefficients between the board variables, with  
36 significant correlations (at the 10% level or less) shown in bold. The highest correlation is  
37 between *Firm Size* and *Board Size* which is 0.48; all other correlations are below this value.  
38  
39 Therefore, multicollinearity between the independent variables is not of concern. The  
40 *Percentage of NEDs* is negatively correlated to the presence of a *Powerful CEO*, ( $\beta=-0.42$ ,  
41  $p<0.05$ ) indicating that powerful CEOs may want less challenge by having more NEDs on  
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43 board.  
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52 (Table 3)  
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3 The *Frequency of Audit Meetings* and *Firm size* are positively correlated ( $\beta = 0.41$ ,  $p < .05$ ),  
4  
5 showing that larger firms require more attention from the audit committee and for such firms  
6  
7 the board size is also large. *Powerful CEO* is also positively and significantly correlated with  
8  
9 *Board Ownership* with a value of 0.33.  
10

11  
12 The correlation between the dependent variables and the explanatory variables are also  
13  
14 presented and even though many coefficients are significant, no correlation coefficient  
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16 exceeds the value of 0.2.  
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#### 19 20 4.2 Main Results 21

22  
23 Table 4 shows the results using the *Governance index* as the independent variable with all  
24  
25 three risk measures. The results in the table show that the *Governance index* is  
26  
27 significantly and negatively related to *Total Risk* ( $\beta = -0.020$ ,  $p < .001$ ), *Asset Return Risk*  
28  
29 ( $\beta = -0.019$ ,  $p < .001$ ) and *Idiosyncratic Risk* ( $\beta = -0.037$ ,  $p < .001$ ).  
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33 As discussed above, the *Governance Index* is a sum of indicator variables related to the  
34  
35 aforementioned governance attributes and can vary from 0 to 9. The results show that an  
36  
37 increase in the *Governance Index* by 1 unit reduces total firm risk by 2%, which is a decrease  
38  
39 in its stock price volatility. To further investigate the impact of changes in the governance  
40  
41 attributes on the *Governance Index*, we consider some firms where the index has  
42  
43 increased/decreased by one unit. For example, BT Group PLC, in the telecommunications  
44  
45 sector, had a *Governance Index* of 3 in year 2007 and 4 in 2008. Examination of the reasons  
46  
47 behind this change shows that it was due to an increase in the percentage of NEDs on the  
48  
49 board from 62% to 67%. Furthermore, the index increased from 4 to 5 between 2008 and  
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51 2009. This was due to an increase in the audit committee meetings from 4 to 5 over that  
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53 period. Another example is Electrocomponents PLC, from the technology sector. The  
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3 *Governance Index* for this firm decreased from 5 to 4 between 2008 and 2009. This was due  
4  
5 to a decrease in the average age of the board of director members from 57 to 54 due to the  
6  
7 retirement of a board member. Therefore, small changes by firms can result in a one-unit  
8  
9 change in the index and therefore a significant reduction in firm risk.  
10

11  
12 The findings above indicate that lower firm risk is associated with a higher value of the  
13  
14 governance index which on average represents firms with large boards, more NEDs and  
15  
16 more women on the board; firms that have a leadership structure that does not have a  
17  
18 powerful CEO, the equity held by executive board members is not large and equity held  
19  
20 by institutional investors is not large. Also, the boards with lower risk have members who  
21  
22 are older and have longer tenure with the firm. Moreover, they have more audit  
23  
24 committee meetings and better board meeting attendance. Specifically, a unit increase in  
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26 *Governance index* is associated with a 2% lower *Total Risk*.  
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31 The *Governance index* can be used by shareholders and regulators to identify firms that  
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33 have boards with lower firm risk. We make no assumptions regarding the relationship  
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35 between the level of risk and current or future performance. However, untabulated results  
36  
37 show that there is a negative relationship between risk in the current year and future  
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39 performance.  
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43 (Table 4)  
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46 In terms of the results for the control variables, we find that larger firms are associated  
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48 significantly with less risk, particularly *Total Risk*. On the other hand, firms with higher  
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50 growth opportunities are associated with greater firm risk across all risk measures. Firms  
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52 with higher financial leverage also have lower risk. Finally, the previous performance of  
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54 the firm is found to be inversely related to firm risk, implying that if the previous  
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3 performance of the firm is poor, managers take on more risk in the current period.  
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6 *4.3 Robustness Tests:*  
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9 In an empirical model, when the dependent variable predicts independent variables, then  
10 there is reverse causality. In the presence of reverse causality, estimations produce biased  
11 results. Therefore to check for the extent to which endogeneity (due to reverse causality) is a  
12 problem, the following test is conducted.  
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18 To confirm that causation runs from board index to firm risk, the explanatory variables on the  
19 right hand side of empirical model are replaced by their lagged values. The equations are re-  
20 estimated using generalised least squares with lagged explanatory variables and dependent  
21 variable of total firm risk. This test to check for reverse causality has been previously used by  
22 Pathan (2009) in his study of how board composition relates to bank risk. The argument for  
23 using lagged independent variables is that current values may be endogenous but it is unlikely  
24 that past values are subject to the same problem. The results for the *Governance index* with  
25 lagged explanatory variables are shown in Table 5. The results show that the estimations are  
26 similar to the estimation using contemporaneous independent variables. The significance of  
27 the relationship is similar to the estimates using current independent variables and the  
28 direction of the relationship is the same. This shows that endogeneity is not a cause for  
29 concern in the empirical model used in this study.  
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46 (Table 5)  
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49 Additional analysis using Instrumental variable estimation was conducted as a robustness test  
50 to address the endogeneity concern (using *xivreg* in STATA). The instruments used were the  
51 board attributes that form the board governance index. The results (as shown in Table 6) are  
52 similar to the results using the random effects methodology. Specifically, the *Governance*  
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3 *index* coefficient is -0.020, -0.019 and -0.036 (all significant at the 1% level) using *Total*  
4 *Risk*, *Asset Return Risk*, and *Idiosyncratic Risk* as dependent variables. This indicates that  
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endogeneity is not a cause for concern in the model used for the study.

(Table 6)

## 5. CONCLUDING REMARKS

Using a sample of 267 FTSE 350 UK firms between the years 2005 to 2010, our results show that a *Governance index* constructed from the composition, leadership structure, members' characteristics and board process is negatively related to firm risk. This finding is important for shareholders, regulators, and academicians as it identifies the factors that are significantly related to firm risk. Specifically, boards that are associated with lower firm risk have larger values of the *Governance index* which on average indicates they are larger boards, have more NEDs and more women on the board; these boards also have a leadership structure that does not have a powerful CEO and the equity held by executive board members as well as institutional investors is not large. Also, the board members are older and have longer tenures with the firm. Moreover, these boards have more audit committee meetings and better board meeting attendance.

As a robustness check, we check for endogeneity of the independent variables by estimating lagged independent variables with firm risk and find that there is no concern regarding endogeneity issues. We also find the same results when using the instrumental variable method.

The policy implications of the findings come from the identification of the board attributes that represent the effectiveness of the board which are associated with firm risk. The use of a *Governance index* can inform regulators of which firms have effective boards in relation to

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2  
3 firm risk. Furthermore, the current study is significant in that it examines firm risk and  
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5 governance attributes in a longitudinal, cross-sectional study. Previous studies focus on the  
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7 financial sector, especially following the financial crisis of 2007/8 (e.g. Pathan, 2009;  
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9 Llewellyn and Muller-Kahle, 2012). Therefore, we document that findings in previous  
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11 research in the financial sector apply to other sectors as well.  
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14 As with all research, this study has limitations. One potential limitation is the  
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16 generalizability of the results. Since this study covers only UK firms, it is possible that  
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18 the findings would not hold in different regulatory markets. Furthermore, the sample of  
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20 firms consists of large firms in the UK market and therefore the results may not hold for  
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22 smaller firms. Finally, the *Governance index*, while it is comprehensive and includes several  
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24 governance attributes, does exclude some attributes such as board member experience,  
25  
26 qualifications, and expertise. Although these are captured in some of the attributes used such  
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28 as age and tenure, it may be useful to include them in a governance measure.  
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## Appendix - Definition and Measurement of variables

Variables	Measures
Board size	The number of directors on the firm's 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
Block ownership	Percentage of total of substantial institutional investors holding more than 3% of shares in the firm
Board Age	Average age of the board members in the firm
Board Tenure	Average tenure of the board members in the firm in years
Board meeting attendance	Average board attendance of the board members
Audit Committee meeting	The total number of audit committee meeting during the year
<b>Index Variables</b>	
<b>Board Composition</b>	
<i>I-Board Size</i>	Indicator variable that takes the value 1 when board size is greater than the median value, 0 otherwise
<i>I-Percentage of NEDs</i>	Indicator variable that takes the value 1 when proportion of NEDs is greater than the median value, 0 otherwise
<i>I-Percentage of Women</i>	Indicator variable that takes the value 1 when percentage of women is greater than the median value, 0 otherwise
<b>Board Leadership Structure</b>	
<i>I-Powerful CEO</i>	Indicator variable that takes the value 0 if the CEO is also the chairperson, the chairperson is an executive, or the CEO is a founder of the firm, and 1 otherwise
<i>I-Board Executive Ownership</i>	Indicator variable that takes the value 0 when board ownership is greater than the median value, 1 otherwise
<i>I-Block Ownership</i>	Indicator variable that takes the value 0 when percentage of equity owned by institutional investors is greater than the median value, 1 otherwise
<b>Board Characteristics</b>	
<i>I-Board Age</i>	Indicator variable that takes the value 1 when board age is greater than the median value, 0 otherwise
<i>I-Board Tenure</i>	Indicator variable that takes the value 1 when board tenure is greater than the median value, 0 otherwise
<b>Board Process</b>	
<i>I-Board Attendance</i>	Indicator variable that takes the value 1 when average board attendance of the board members is greater than the median value, 0
<i>I-Frequency of Audit Meetings</i>	Indicator variable that takes the value 1 when total number of audit committee meeting is greater than the median value, 0 otherwise
<b>Governance index</b>	$I\text{-Board Size} + I\text{-Proportion of NEDs} + I\text{-Percentage of Women} + I\text{-Powerful CEO} + I\text{-Board Executive Ownership} + I\text{-Block Ownership} + I\text{-Board Age} + I\text{-Board Tenure} + I\text{-Board Attendance} + I\text{-Frequency of Audit Meetings}$
<b>Risk Measures</b>	
<i>Total risk</i>	Standard deviation of the daily stock returns (annualised)
<i>Asset Return risk</i>	Standard deviation of the daily stock returns times the ratio of the market value of equity to market value of total assets* $\sqrt{250}$
<i>Idiosyncratic risk</i>	Firm specific risk from Bloomberg database

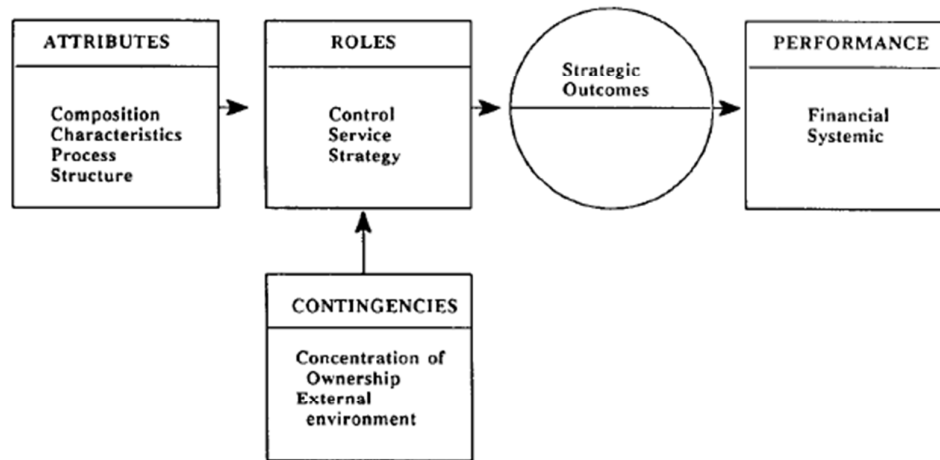
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<b>Control Variables</b>	
<i>Leverage</i>	Average total assets over average total common equity
<i>Firm Size</i>	The market capitalisation of the firm in billions measured as the total value of issued shares
<i>Growth</i>	Capital expenditures over sales
<i>Lagged Performance</i>	The lagged return on assets for the firm measured in millions
<i>IND</i>	Indicator variable that takes the value 1 if observation belongs to a particular industry, 0 otherwise
<i>YEAR</i>	Indicator variable that takes the value 1 if the observation is in a particular year, 0 otherwise.

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Corporate Governance

Figure 1: An agency theory model that links board variables and company performance



Source: Zahra and Pearce, 1989, p. 294

**Table 1: Industry distribution of sample by year**

<b>Industry sector</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Total</b>
Oil and Gas	17	18	16	19	18	16	104
Basic materials	14	16	15	19	21	21	106
Industrials	70	72	72	70	70	66	420
Consumer goods	33	35	31	31	31	29	190
Healthcare	9	8	8	8	8	8	49
Consumer service	65	68	69	70	72	69	413
Telecommunications	4	5	5	5	5	5	29
Technology	16	16	17	17	17	16	99
Number of Observations	228	238	233	239	242	230	1,410

**TABLE 2: Descriptive statistics**

N = 1,410

	Mean	Q1	Median	Q3	Min	Max	SD
<b>Board Variables</b>							
<i>Board Size</i>	8.95	7.00	9.00	10.00	5.00	19.00	2.35
<i>Percentage of NEDs</i>	62.63	55.56	62.50	71.43	28.57	92.31	11.76
<i>Percentage of women</i>	7.69	0.00	6.68	12.5	0.00	17.54	9.36
<i>Powerful CEO</i>	0.18	0.00	0.00	0.00	0.00	1.00	0.39
<i>Board Executive Ownership</i>	3.63	0.07	0.21	1.11	0.00	71.60	10.29
<i>Block Ownership</i>	34.14	17.94	31.06	47.39	31.06	100	22.06
<i>Board Age</i>	56	53.65	56.08	58.24	45.24	70.52	3.41
<i>Board Tenure</i>	5.45	3.67	4.91	6.57	0.26	17.54	2.62
<i>Board Attendance</i>	94.82	93.00	96.00	98.50	51.00	100.00	5.68
<i>Frequency of Audit Meetings</i>	4.03	3.00	4.00	4.00	1.00	15.00	1.50
<i>Governance Index</i>	4.34	3	4	6	0	9	1.75
<b>Risk Measures</b>							
<i>Total Risk</i>	0.40	0.26	0.35	0.47	0.14	1.62	0.20
<i>Asset Return Risk</i>	0.39	0.26	0.34	0.47	0.13	1.54	0.19
<i>Idiosyncratic Risk</i>	-0.57	-0.85	-0.55	-0.28	-2.88	4.97	0.50
<b>Control Variables</b>							
<i>Leverage</i>	5.01	1.89	2.58	3.70	-217.86	1,010.33	39.69
<i>Firm Size</i>	5.36	0.49	0.98	2.59	0.01	138.69	15.88
<i>Growth</i>	11.40	1.82	3.45	7.29	0.02	1,555.21	58.55
<i>Lagged Performance</i>	7.57	3.38	6.56	10.64	-175.74	175.92	12.26

All variables are defined in the appendix.

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**TABLE 3: Correlation Coefficients**

No	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	<i>Board size</i>	1												
2	<i>Proportion of NEDs</i>	<b>0.12</b>	1											
3	<i>Presence of Women</i>	<b>0.14</b>	<b>0.15</b>	<b>1</b>										
4	<i>Powerful CEO</i>	0.02	<b>-0.42</b>	<b>-0.12</b>	<b>1</b>									
5	<i>Board Ownership</i>	<b>-0.11</b>	<b>-0.24</b>	<b>-0.13</b>	<b>0.33</b>	1								
6	<i>Block ownership</i>	<b>-0.13</b>	-0.01	<b>-0.09</b>	<b>0.07</b>	0.02	<b>1</b>							
7	<i>Board Age</i>	<b>0.19</b>	<b>0.29</b>	<b>-0.18</b>	-0.02	-0.06	-0.04	1						
8	<i>Board tenure</i>	-0.01	<b>-0.25</b>	<b>-0.09</b>	<b>0.19</b>	0.01	-0.02	<b>0.20</b>	<b>1</b>					
9	<i>Board Attendance</i>	<b>-0.09</b>	-0.05	-0.01	-0.06	0.02	-0.06	0.04	0.07	1				
10	<i>Frequency of Audit Meetings</i>	<b>0.36</b>	<b>0.28</b>	0.04	<b>-0.09</b>	<b>-0.12</b>	<b>-0.14</b>	<b>0.24</b>	<b>-0.17</b>	-0.05	1			
11	<i>Leverage</i>	-0.00	0.02	0.03	-0.04	0.01	-0.05	0.01	0.04	0.03	-0.01	1		
12	<i>Firm Size</i>	<b>0.48</b>	<b>0.26</b>	<b>0.10</b>	<b>-0.09</b>	<b>-0.09</b>	<b>-0.19</b>	<b>0.25</b>	<b>-0.08</b>	-0.01	<b>0.41</b>	-0.01	1	
13	<i>Growth</i>	-0.01	-0.01	-0.01	0.02	<b>0.13</b>	0.05	-0.01	-0.05	0.01	-0.04	-0.01	-0.01	1
14	<i>Lagged Performance</i>	0.00	0.01	-0.03	0.01	<b>0.07</b>	0.05	-0.04	0.02	0.02	-0.01	0.01	0.06	-0.05

All correlation coefficients in bold are significant at the 10% level or below.  
All variables are defined in the appendix.

**TABLE 4: Results from the regressions of *Governance index* with firm risk**

The table presents coefficients (t-statistics) from model of the form:

$$\ln(Risk_{it}) = \alpha_0 + \alpha_1 Governance\ Index_{it} + \alpha_2 Leverage_{it} + \alpha_3 Firm\ Size_{it} + \alpha_4 Growth_{it} + \alpha_4 Performance_{it-1} + \sum_{j=1-8} \alpha_j (Industry\ Dummies_{it}) + \sum_{t=1-6} \alpha_t (Year\ Dummies_{it}) + \varepsilon_{it}$$

The regression is estimated using Generalized Least Square – Random effects methodology.

Independent Variables	Predicted sign	Total Risk	Asset Return Risk	Idiosyncratic Risk
<i>Governance Index</i>	-	-0.020 (-3.79)***	-0.019 (-3.72)***	-0.037 (-4.30)***
<i>Leverage</i>	-	0.000 (-1.38)	0.000 (-1.44)	0.000 (-0.26)
<i>Firm Size</i>	-	0.000 (-5.21)***	0.000 (-5.35)***	0.56 (-0.31)
<i>Growth</i>	+	0.000 (0.62)	0.001 (0.71)	0.000 (1.11)
<i>Lagged Performance</i>	-	-0.001 (-1.99)*	-0.001 (-1.73)†	-0.000 (-0.21)
<i>Industry Dummies</i>		yes	yes	yes
<i>Year Dummies</i>		yes	yes	yes
<i>Constant</i>		-0.875 (-16.63)***	-0.885 (-7.62)***	2.066 (-0.54)***
No of observations		1,410	1,410	1,410
Model fit:				
Within R <sup>2</sup>		0.683	0.680	0.1062
Between R <sup>2</sup>		0.485	0.504	0.3311
Overall R <sup>2</sup>		0.584	0.588	0.1857
Wald Chi <sup>2</sup> (17)		2,664.73	2,649.12	256.23

†p<.10, \*p<.05, \*\*p<.01, \*\*\* p<.001.

All variables are defined in the appendix.



**TABLE 5: Results from the regressions of *Governance index* using lagged independent variables with firm risk**

The table presents coefficients (t-statistics) from model of the form:

$$\ln(\text{Risk}_{it}) = \alpha_0 + \alpha_1 \text{Governance Index}_{it} + \alpha_2 \text{Leverage}_{it} + \alpha_3 \text{Firm Size}_{it} + \alpha_4 \text{Growth}_{it} + \alpha_4 \text{Performance}_{it-1} + \sum_{j=1-8} \alpha_j (\text{Industry Dummies}_{it}) + \sum_{t=1-6} \alpha_t (\text{Year Dummies}_{it}) + \varepsilon_{it}$$

The regression is estimated using Generalized Least Square – Random effects methodology.

The empirical model is estimated using lagged explanatory variables to correct for endogeneity.

Independent Variables	Predicted sign	Total Risk	Asset Return Risk	Idiosyncratic Risk
<i>Governance Index</i>	-	-0.017 (-2.85)**	-0.019 (-3.24)***	-0.029 (-3.34)***
<i>Leverage</i>	-	0.000 (-0.13)	0.000 (-0.19)	0.000 (0.72)
<i>Firm Size</i>	-	0.000 (-4.12)***	0.000 (-4.19)***	0.56 (-0.71)
<i>Growth</i>	+	0.000 (0.19)	0.001 (0.19)	-0.000 (-0.47)
<i>Lagged Performance</i>	-	-0.001 (-1.42)*	-0.001 (-1.23)†	-0.000 (-0.20)
<i>Industry Dummies</i>		yes	yes	yes
<i>Year Dummies</i>		yes	yes	yes
<i>Constant</i>		-0.922 (-16.13)***	-0.920 (-16.85)***	0.522 (-6.81)***
No of observations		1,143	1,143	1,143
Model fit:				
Within R <sup>2</sup>		0.657	0.651	0.146
Between R <sup>2</sup>		0.344	0.368	0.317
Overall R <sup>2</sup>		0.517	0.522	0.208
Wald Chi <sup>2</sup> (17)		1,774.46	1,744.32	257.06

†p<.10, \*p<.05, \*\*p<.01, \*\*\* p<.001.

All variables are defined in the appendix.

**TABLE 6: Results from the regressions of *Governance index* with firm risk – Instrumental variables**

The table presents coefficients (t-statistics) from model of the form:

$$\ln(Risk_{it}) = \alpha_0 + \alpha_1 \text{Governance Index}_{it} + \alpha_2 \text{Leverage}_{it} + \alpha_3 \text{Firm Size}_{it} + \alpha_4 \text{Growth}_{it} + \alpha_5 \text{Performance}_{it-1} + \sum_{j=1-8} \alpha_j (\text{Industry Dummies}_{it}) + \sum_{t=1-6} \alpha_t (\text{Year Dummies}_{it}) + \varepsilon_{it}$$

The regression is estimated using Generalized Least Square – Random effects methodology.

Instrumental variables using xtivreg in STATA was used to estimate the model above using the board attributes as the instruments.

Independent Variables	Predicted sign	Total Risk	Asset Return Risk	Idiosyncratic Risk
<i>Governance Index</i>	-	-0.020 (-3.67)***	-0.019 (-3.59)***	-0.036 (-4.08)***
<i>Leverage</i>	-	0.000 (-1.44)	0.000 (-1.50)	0.000 (-0.33)
<i>Firm Size</i>	-	0.000 (-4.96)***	0.000 (-5.11)***	0.000 (-0.44)
<i>Growth</i>	+	0.000 (0.49)	0.001 (0.61)	0.000 (0.07)
<i>Lagged Performance</i>	-	-0.001 (-1.96)*	-0.001 (-1.72)†	-0.000 (-0.09)
<i>Industry Dummies</i>		yes	yes	yes
<i>Year Dummies</i>		yes	yes	yes
<i>Constant</i>		-0.876 (-16.02)***	-0.887 (-16.80)***	2.066 (-0.53)***
No of observations		1,358	1,358	1,358
Model fit:				
Within R <sup>2</sup>		0.677	0.674	0.105
Between R <sup>2</sup>		0.488	0.496	0.298
Overall R <sup>2</sup>		0.579	0.582	0.184
Wald Chi <sup>2</sup> (17)		2,505.18	2,485.93	237.95

†p<.10, \*p<.05, \*\*p<.01, \*\*\* p<.001.

All variables are defined in the appendix.