Board Gender Diversity and Firm Risk in UK Private Firms

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ABSTRACT

We investigate the effect of board gender diversity on private firm risk. Using a sample of 26,045 UK private firms for the period 2005-2017, we report a negative association between board gender diversity and firm risk. Lower director busyness in gender diverse boards is the channel that enables female directors to reduce firm risk by directing more attention to fiduciary responsibilities. Additional analysis reveals that more risky, small to medium-sized firms benefit the most from gender diverse boards. Considering female director nationality, firm risk is lower (higher) for boards with local (foreign) female directors as local market knowledge is more valuable for private firms. Our findings are robust to alternate risk measurements and endogeneity corrections.

KEYWORDS

UK private firms, Board gender diversity, Female directors, Firm risk, Female director nationality

JEL CLASSIFICATION

G30; G34; M14

1. Introduction

Risk is inherent in all businesses and the role of the board in firm risk-taking is crucial in today's dynamic and uncertain business environment (Jizi & Nehme, 2017). Previous literature provides evidence[1] of the importance of board gender to risk in listed firms (Gulamhussen & Santa, 2015; Jizi et al., 2017; Nadeem, Suleman, & Ahmed, 2019). While results from studies on listed firms are insightful, qualitative differences between public and private firms require additional verification of the role of female directors in private firms (Ball & Shivakumar, 2005; Brav, 2009; Michaely & Roberts, 2011). For example, private firms (i) do not have access to capital markets; (ii) are usually held by a few large shareholders; and (iii) frequently suffer from higher information asymmetry between insiders and outsiders. Unlike listed firms, extensive financial statements of private firms are often not published due to regulatory flexibility arising from a weak market demand for information (Ball et al., 2005). Consequently, private firms are often not as scrutinised by regulators and market participants and their director selection criteria and appointment process are likely to be opaque (Sealy, Doldor, & Vinnicombe, 2009). Despite these differences and the economic significance of privately held firms,[2] studies examining the effect of female directors on private firm risk are rare.[3] Consequently, the underlying motivation for this study is to address unanswered questions about private firms. Specifically, we investigate the relationship between board gender diversity and firm risk while shedding light on how female directors contribute to the board using data from private firms in the UK (United Kingdom) during the period 2005-2017.

The vibrant private sector of the UK provides an interesting research setting. In 2020, there were around 6 million private firms with a contribution of 4.42 trillion pounds to the economy

[1] However, the evidence is inconclusive, associating board gender diversity with both positive and negative outcomes.
[2] Over 99% of all registered firms are private which contributes to roughly half of the UK GDP (Department for Business, Energy & Industrial Strategy, 2020).
[3] The lack of evidence can be partially attributed to limited data availability for private firms.

(Department for Business, Energy & Industrial Strategy, 2020). This provides a large sample that includes small and medium-sized operations.[4] Although the UK doesn't have mandatory gender quota, gender diversity is highly recommended by the regulators. Female participation on boards is 33% in top public firms (Goodley, 2020) and 17.5% in SMEs (Shehata, Salhin, & El-Helaly, 2017).[5] High female board participation irrespective of a mandated quota can be attributed to a more women friendly ambience which makes the UK an interesting country to study the impact of female directors.

Our main findings, from a sample of 26,045 firms, show that female directors reduce private firm risk in the UK. Additional tests report no evidence of a critical mass effect meaning even a token percentage of female directors (as low as 20%) is able to yield a beneficial impact. An examination of director proximity indicates that local female directors reduce risk and this is attributed to their in-depth market knowledge. Conversely, foreign female directors increase firm risk. The effect of female directors is most pronounced in more risky, small and medium-sized firms. Further tests reveal that in gender diverse boards directors are less busy on average which enables them to dedicate more time to monitoring and advisory responsibilities. We argue that this serves as a channel to reduce firm risk in gender diverse boards. Finally, our results are robust to alternative risk measures and endogeneity checks.

This paper contributes to the extant literature in multiple ways. First, it contributes new evidence to our understanding of the gender-risk relationship in private firms using multiple measures of risk and female board representations. Rather than appointing female directors in order to simply 'check a box', firms need to factor in female directors' background and experience to increase board efficiency. Second, we contribute to the understanding of a diverse

[4] Brav (2009) and Michaely et al. (2011) analyse private firms samples that exclude small firms, however, 99% of private firms in the UK are small and medium sized (Department for Business, Energy & Industrial Strategy, 2020).
[5] In the US, female percentage on board is 26% in top listed firms and only 7% in private firms (Rivera, Shepherd, & Teare, 2019).

and inclusive set of private firms. Unlike the majority of extant literature about private firms (Brav, 2009; Michaely et al., 2011), our sample does not exclude small firms or have any restriction on asset size. The unbalanced panel dataset also translates into a lower chance of survivorship bias. Third, our research contributes to the importance of considering firm size and risk as female director impact is more pronounced in small and medium-sized firms with greater risk exposure.

The rest of the paper is organized as follows. Section 2 discusses the literature and develops the hypotheses. Section 3 explains the research methods and defines the variables used in the study. The empirical results are discussed in Section 4. Finally, Section 5 summarizes the main findings and concludes the study.

2. Literature Review and Hypothesis Development

Various economics and socio-psychological studies suggest that there are inherent differences in the risk-taking behaviour between men and women, and how they interpret information to make decisions (Powell & Ansic, 1997; Croson & Gneezy, 2009; Charness & Gneezy, 2012; Czibor, Claussen, & Praag, 2019). Analysing an online card game dataset, Czibor et al. (2019) show that despite the possibility of adapting to a male environment, women persistently choose a lower risk option than men. According to Resource Dependence Theory (RDT), greater board heterogeneity can bring more resources (Ulrich & Barney, 1984; Hillman, Withers, & Collins, 2009) and the cognitive diversity of female directors can generate alternative solutions to the same problems (Dutton & Duncan, 1987). Since independent directors are not common in private firms, the fresh perspective of female directors is analogous to independent director appointments because female directors do not belong to the "old boys club" (Adams & Ferreira, 2009). However, diversity may cause friction and disrupt board functions making consensus harder to achieve (Arrow, 2012). As a result, decisions of a gender diverse board may become more erratic and lead to greater firm risk. The theoretical underpinnings suggest that incorporating female directors has both costs and benefits.

Empirical evidence shows that gender diverse boards have improved meeting attendance (Adams et al. 2009) and better corporate governance practice (Carter, Simkins, & Simpson, 2003; Chen, Gramlich, & Houser, 2019). Female directors are more committed in general and more inclined to sustainable investments than their male counterparts (Huse & Solberg, 2006; Charness et al., 2012). Female directors are found to reduce firm risk through improved board dynamics in the non-financial UK listed firms (Jizi et al., 2017; Nadeem et al., 2019). However, different female director perspectives can potentially increase conflict among board members and lengthen the decision making process. Moreover, the costs of board gender diversity can offset or outweigh the benefits for non-complex firms (Anderson, Reeb, Upadhyay, & Zhao, 2011). In addition, Hughes and Turrent (2019) find that the impact of board gender diversity differs depending on the type of firm risk. Therefore, empirical evidence suggests that there are inherent trade-offs to having board gender diversity and the type of firm needs to be considered when appointing women to the board.

Reverse causality and self-selection bias are also important factors to consider while examining the relationship between women on board and firm risk. Firms with higher stock return volatility have less gender diversity. This can be due to the preference for group homogeneity during periods of high uncertainty (Adams & Ferreira 2004). Consistent with this result, Farrell and Hersch (2005) report a higher probability of female board appointments in less risky firms. The authors also note that the probability of appointing a female director increases significantly when an existing female director departs the board. However, the negative relationship between risk and female directors can be driven by unobservable firm specific factors (Sila, Gonzalez, & Hagendorff, 2016).

Private firms are generally smaller compared to listed ones and may have unique operational needs. Building on the majority arguments presented above, we argue that female directors can increase board efficiency and incorporating women on private boards will reduce volatility of firm performance. We formulate our first hypothesis as follows:

H1: Firm risk is negatively related to female board representation in private firms.

Female tokenism on boards could exist when women lack the support to influence board decisions with a majority of male directors. Rather than considering only the presence or absence of female directors, examining the relative number or proportion of women can be more informative about board functionality and effectiveness (Kanter, 1977). According to Kanter (1977), a "skewed" director group will have only a few board members different to the numerically dominant group. These few are the "token" appointments while the dominant group have strong control over the final outcome. The second group is labelled "tilted" and refers to a less extreme distribution of board members where the previously dominant group is now just a majority. The last classification is the "balanced" group which are more evenly distributed rather than a majority-minority combination.

Empirical studies investigating female director critical mass (Torchia, Calabrò, & Huse, 2011; Joecks, Pull, & Vetter, 2013; Pandey, Biswas, Ali, & Mansi, 2019) find a minimum representation is required for women on board to make a difference. Conversely, two separate studies based on the US and the South Africa find that even token female directors are enough to create favourable firm level outcomes compared with all-male boards (Gyapong, Monem, & Hu, 2016; Cook & Glass, 2017), negating the critical mass effect. Given the extant literature (Joecks et al., 2013; Strydom, Au Yong, & Rankin, 2016; Pandey et al., 2019), we define a board to be skewed when it consists of up to 20% female directors who might potentially be token members and formulate our second hypothesis as follows:

H2: Private firms with at least 20% female directors have lower risk than firms with all male boards.

Omissions of important director characteristics such as gender, nationality, and age may lead to omitted variable bias. If age affects individual risk-taking preferences (Vroom & Pahl, 1971) then age can also affect a director's risk appetite. Researchers often combine age, gender and other measures of diversity into a single board heterogeneity index (Anderson et al., 2011; Shehata et al., 2017). However, some scholars recommend against aggregating multiple dimensions into a single index so that the factors can be better understood separately (Harrison & Klein, 2007). Moreover, Gull, Nekhili, Nagati, and Chtioui (2018) suggest that female director appointments should be determined by attributes required by the firm. The cultural background and expertise of foreign directors can be valuable when the firm has business operations in foreign markets (Ruigrok, Peck, & Tacheva, 2007). However, director nationality diversity may create communication problems and lengthen the decision making process reducing board effectiveness (Nekhili & Gatfaoui, 2013). Using a sample of listed UK firms, Frijns, Dodd, and Cimerova (2016) show that board cultural diversity is a double edged sword and the cost could outweigh the benefits where firms are non-complex (operate in less than three business segments) and lack foreign operations. Considering private firms mostly have local operations, we argue that female directors' nationality plays a key role in private firm risk and thus the last hypothesis is formulated as follows:

H3: Nationality of female directors is associated with private firm risk.

3. Research Design and Variables Measurement

The initial dataset for this study was sourced from FAME and ORBIS which are leading European databases that contain information for all UK companies including both public and private firms.[6] Financial information is taken from the FAME database and board variables are downloaded from the ORBIS database.[7] These databases are commonly used in the literature to study private companies in the UK (Brav, 2009; Michaely et al., 2011; Clatworthy & Peel, 2016; Shehata et al., 2017). Our dataset contains private companies registered in England, Wales, Northern Ireland and Scotland. Our study examines non-financial private firms therefore the finance (6000s SIC), public (9000s SIC) and utility sectors (4,900s to 4,939s SIC)[8] are excluded due to their unique governance, ownership and operational characteristics. To avoid survivorship bias, an unbalanced panel with no criteria for minimum assets or turnover is used. Firms with missing entity type or unknown SIC number are removed from the sample as their company type or industry status is unknown. Following Ball et al. (2005) and Shehata et al. (2017), further data cleaning removed firm-year observations where accounting numbers were unreasonable (e.g., negative values for total assets, total liabilities and so on) and where the number of months in the fiscal year does not equal to 12. Finally, firms that are controlled subsidiaries[9] are excluded from the analysis since they are heavily influenced by their parent company[10] following Ball et al. (2005) and Clatworthy et al. (2016). After the screening steps, the final sample consisted of 26,045 UK private companies during the period of 2005–2017.

Panel A of Table 1 documents the industry distribution of the sample observations. Firms are classified into 14 distinct industries based on the UK Standard Industrial Classification

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[6] The UK provides access to private firm data via the government managed website of Companies House: (https://www.gov.uk/government/organisations/companies-house). These information are collected by Jordans, a leading legal information provider and then FAME and ORBIS collects data from Jordans (Brav, 2009).
[7] These are both electronic European databases managed by Bureau van Dijk (BvD) that provide information for all UK companies. ORBIS is used to source board variables as it provides more comprehensive board data including director identifiers. Values which are extreme and likely to be erroneous, have been manually checked against financial statement from Companies House website.
[8] US SIC codes have used following Brav (2009)'s paper on non-financial UK private firms.
[9]A company is a controlled subsidiary if 50% or more is owned by the parent company. FAME database reports whether the status of the firm is a controlled subsidiary.
[10] Financial reports of controlled subsidiaries are more like "internal reports" rather than a reflection of a stand-alone entity.

(SIC) 2007 definition.[11] The top three industries based on number of observations are from wholesale and retail trade (18.10%), manufacturing (16.11%) and construction, mining and quarrying (15.47%), respectively.[12] No single industry dominates the sample, so there is no possibility of biasing the results by any particular industry. Panel B of Table 1 reports the breakdown of sample by country. The highest (89.67%) number of observations is from England while the lowest (1.92%) is from Northern Ireland.

[Insert Table 1 here]

Since private firms do not have any market information, three accounting based measures of risk have been used as dependent variables following the extant literature (John, Litov, & Yeung, 2008; Boubakri, Cosset, & Saffar, 2013; Chen, Ni, & Tong, 2016). We include the standard deviation of earnings before interest and taxes (EBIT) deflated by total assets, calculated over the past five years (subject to a minimum of at least three years of non-missing data) as the primary risk measure (RISK1). RISK2 is the difference between maximum ROA and minimum ROA using the prior five-year period. The third measure, RISK3, equals the standard deviation of the difference between the observed firm's ROA and the yearly industry average ROA of all firms.[13] In order to maintain consistency, RISK2 and RISK3 also use a span of five years[14] with at least three years' of non-missing observations similar to the primary measure, RISK1. The analysis for the baseline model is given by Equation (1):

$$RISK_{i,t} = \alpha + \beta_1\, FEM_{i,t} + \beta_2\, LNBOD_{i,t} + \beta_3\, COMPDUM_{i,t} + \beta_4\, DIR\_AGE_{i,t}$$

$$+ \beta_5\, LNTA_{i,t} + \beta_6\, ROA_{i,t} + \beta_7\, LNFIRMAGE_{i,t} + \beta_8\, LEVERAGE_{i,t} + \beta_9\, SICNO_{i,t}$$

[11] The UK SIC is the classification of business entities based on their economic activity (Office for National Statistics, 2007).
[12] No single industry contains more than 20% of the sample observations. Our results remain consistent when the largest industry is removed.
[13] As a robustness check, the same measure is also calculated with all firms' ROA average instead of industry average ROA and results are similar.
[14] The results are qualitatively same using a four years period as well.

$$+ \beta_{10}\, ASSTGRW_{i,t} + \sum_{i=1}^{m} \lambda_i\, INDUSTRY_i + \sum_{t=1}^{n} \Omega_t\, YEAR_t + \varepsilon_{i,t} \quad (1)$$

Our variable of interest is FEM and we have used four proxies to measure board gender diversity. These proxies include a dummy variable that takes the value of one if there is at least one female director on the board or zero otherwise (FEMDUM), proportion of female directors (FEMALE), and three dummy variables indicating different proportion of female board representation. Following the extant literature (Strydom et al., 2016; Pandey et al., 2019), these dummy variables take a value of one for (i) >0-20 percent female directors (FEMSKEW); (ii) >20-40 percent female directors (FEMTILT); and (iii) >40 percent female directors (FEMBAL), respectively. To account for demographic diversity, female directors as a percentage of the board have been sub-divided into three separate groups and used as the fourth proxy of board gender diversity. The first group named "LOCALFEM" contains female directors who are UK nationals. Next, the "FRLINKFEM" contains female directors who hold multiple nationality including the UK and the "FORFEM" consists of the female directors who hold nationality other than the UK.

A number of control variables are included to account for variation in firm specific characteristics. Cheng (2008) shows that whether the board makes extreme decisions is dependent upon board size and thus natural log of board size is added. Moreover, a dummy variable (COMPDUM) that takes a value of one if a firm director is not an individual person and zero otherwise.[15] This variable controls for the effect of institutional directors on firm corporate governance.[16] Older directors tend to show more stability and risk aversion than their younger peers (Anderson et al., 2011; Bernile, Bhagwat, & Yonker, 2018). Director age is an important determinant of firm risk and DIR_AGE represents the natural log of average director age. The natural log of total assets (LNTA) is used to control for firm size as small firms tend

[15] For example, the board position may be held by a company or a trust.
[16] The board calculation excludes non individual directors.

to be more risk seeking than large firms. We also control for firm profitability (ROA) because lower profitability can be linked to higher earnings volatility. Firm default risk (LEVERAGE), measured by total liabilities over total assets, controls for higher firm financial risk because of greater leverage. The natural log of firm age (LNFIRMAGE) captures the life stage and experience of the firm. In addition, the growth of total assets from the previous year (ASSTGRW) is included as a proxy for growth opportunities (Saeed & Sameer, 2017). The natural log of the number of firm SIC codes (SICNO) controls for firm complexity because complex firms may require specific board member capabilities (Markarian & Parbonetti, 2007; Clatworthy et al., 2016). All continuous variables except board characteristics are winsorized at the 1% level to minimize potential outlier problems. The models also include year dummy and industry dummy variables to control for differences across years and industries. All variable are defined in Panel A of Table 2. Panel B of Table 2 details the firm size classification criteria used to group the firms into small, medium and large categories.[17]

[Insert Table 2 here]

4. Results and Discussion

Panel A of Table 3 shows descriptive statistics for the continuous variables and Panel B reports the distribution of the dummy variables for the whole sample. The mean percentage of female directors (FEMALE) is 18.4% which is close to the 17% reported by Shehata et al. (2017) for UK SMEs, and corresponds to about one female director for each five person board. However, the sample exhibits variation in female board representation. The first quartile value for FEMALE is zero. One in four firms in the sample has no female director. However, all-female boards of directors (FEMALE max =1) make up only 0.59% of the sample. Local female directors make up the majority representing 16.9% of the board and about 92% of the

[17] Firm size classification is based on the latest amendment to the criteria of the UK Companies Act, 2006 (UK Public General Acts, 2016).

total number of female directors.[18] Female directors holding dual nationalities including British citizenship comprise only 0.3% of the board on average which is about 1.6% of total female on board. Foreign female directors (FORFEM) represent 1.1% of the board on average, corresponding to about 6% of total women on the board. Average RISK1 for our sample is 9.1% whereas RISK2 and RISK3 are 20.4% and 9.1%, respectively. The high value of standard deviation (10.1%, 22.3%, and 10% respectively) suggests that there is considerable variability of risk within the sample. Panel B shows that gender diverse boards (FEMDUM=1) have slightly higher risk than all male boards on average. However, preliminary descriptive statistics can be inconclusive as they do not consider the effect of other variables. Therefore, further analysis is needed before reaching a conclusion.

[Insert Table 3 here]

Panel C of Table 3 reports descriptive statistics for all-male boards and gender diverse boards. Nearly half of the sample have all male boards. From the table, it is evident that there are considerable differences between all male boards and gender diverse boards. For example, gender diverse boards are on average larger than all male. Firms with gender diverse boards are older, smaller, more profitable (ROA), less levered and have less busy directors on average. Panel D summarises the sample according to the number of women on board. Generally, firms with greater female board representation display higher risk. This could be explained as high risk firms appoint female directors to benefit from risk aversion gender difference. Panel E shows that the majority of the sample consists of small size firms whereas large firms make up the smallest number of observations. This is in line with our expectation as private firms in the UK are mostly small and medium size (Department for Business, Energy & Industrial Strategy, 2020). Small firms have higher risk on average than medium and large firms. However, female director representation, measured as a percentage of the board, is the highest in small firms

[18] Calculated from the descriptive statistics in Panel A of Table 3.

probably due to smaller board size. Finally, other firm characteristics also vary by firm size. Thus, the potential impact of female directors may differ as there is considerable variation in firm specific factors among the small, medium and large firms.

Table 4 shows the correlation matrix. The low correlation values suggest that multicollinearity is not present. All correlations between the risk measures and the independent variables are statistically significant at 10% or better except for FRLINKFEM. The different measures of firm risk and female representation are correlated. However, this is not a matter of concern because these measures are used alternatively. Variance inflation factors (VIFs) of less than three for each of the independent factors in the reported models also corroborate that multicollinearity is not a concern.

[Insert Table 4 here]

Table 5 reports the baseline regressions for the overall sample across each of the risk measures. In Model 1, the proxy of board gender diversity is a dummy variable (FEMDUM) indicating the presence of at least one female director. The coefficient of FEMDUM is negative and statistically significant at the 1% level. The result for RISK1 implies that firms with gender diverse boards are associated with 0.004 fewer units of risk compared with an all-male board. In Model 2, we replace FEMDUM with proportion of female directors (FEMALE). Model 2 results suggest that a 1% increase in female board representation (FEMALE) is associated with a 0.005% decrease in RISK1. In other words, given a one standard deviation increase in female percentage, RISK1 decreases by 0.012 units. Therefore, a negative relationship exists between percentage of female directors and firm risk and the results are economically significant. Similar results are reported for RISK2 and RISK3. These findings support H1 and are consistent with the view that the inclusion of female directors on the board reduces firm risk in private UK firms.

[Insert Table 5 here]

For additional insights, we investigate the critical mass effect by using dummy variables to separate out the effect adding additional women to the board of directors. Current literature shows that women often need to hold a minimum percentage of seats on the board to establish a “voice” and make a significant impact (Torchia et al., 2011; Pandey et al., 2019). Three dummy variables namely FEMSKEW, FEMTILT and FEMBAL are added to the regression equation and the results are reported in Models 3, 7, and 11 of Table 5. The significant negative coefficients imply that relative to the reference category of an all-male board, even up to 20% female board representation can decrease private firm risk (RISK1, RISK2 and RISK3). The result is consistent with the Cook et al. (2017) and also confirms H2. Risk is significantly lower for firms with up to 20% female directors so that even token female directors can create an impact.

Next, we examine the results for female director nationality reported in Models 4, 8, and 12 of Table 5. The negative (positive) significant local (foreign) female director coefficient (LOCALFEM and FORFEM, respectively) reduce (increase) firm risk. The results are consistent for all three risk measures. Since private firms are typically smaller and unsophisticated,[19] the market knowledge of local female directors can be more beneficial than the skills and networking benefits of foreign female directors. Foreign female directors may also create communication gaps and impede board decision making (Nekhili et al., 2013). Thus, for private firms the cost of incorporating foreign female directors outweighs the benefit. The coefficient of FRLINKFEM is insignificant as very few female directors have British and other multiple nationalities (only 0.3% of an average board).

[19] 93.26% of the sample are from Small and Medium firms.

Among the control variables, board size is insignificant for RISK1 and RISK2[20] but has a positive coefficient for RISK3. Significant positive coefficient of COMPDUM indicates that having a company (non-individual) director on board increases private firm risk. Older directors are more risk averse as shown by the negative and highly significant coefficient of DIR_AGE. The negative firm size coefficient indicates larger firms have lower risk. The effect of ROA is negative for RISK2 but insignificant for the other two measures of risk. Profitable firms may have lower risk. Leverage reduces earnings volatility. However, higher leverage can lead to financial distress, reducing the firm's propensity to engage in risky activities (Friend & Lang, 1988). The proxy for firm complexity (SICNO) is insignificant. There is a negative association between firm age and firm risk. Finally, the positive significant ASSTGRW coefficient means that faster-growing firms experience higher risk.

In order to understand how female board representation affects firm risk, we next inspect the effect of female directors on the average busyness of the board. Following Liu and Paul (2015), board busyness is measured by the percentage of the board holding three or more directorships. The results are reported in Table 6. The negative association between the proportion of female director busyness for small and medium firms is consistent with the descriptive statistics in Panels C and D of Table 3. Busy directors may lack the time required to perform their advisory role effectively (Johnson, Schnatterly, & Hill, 2012). Since our results suggest that compared to an all-male board, gender diverse boards tend to have fewer busy directors, we conclude that less director busyness within gender diverse boards works as a channel to reduce private firm risk.

[Insert Table 6 here]

[20] This is consistent with the finding by Sila et al. (2016) where the authors find board size does not have any effect on standard deviation of ROA in UK listed firms.

Panel A of Table 7 shows the impact of female directors before and after the UK Equality Act 2010.[21] The results show that the effect of female directors is significant after the introduction of this act which likely minimized discrimination against women on board. In addition, Panel B divides the sample into above and below median risk groups. The firm-year observations that display risk levels greater than the annual median risk for all firms are included in the HIGH RISK group and vice versa. Moreover, different firms may require different skillsets to function optimally. It is important to consider firm characteristics when studying the impact of female directors as any potential impact may be sensitive to firm characteristics (Anderson et al., 2011). We further classify firms into small, medium and large size[22] within each risk group. The results show that female directors have a significant negative coefficient in small and medium-sized firms with high risk. This finding suggests that the benefit of female directors depends on firm risk and size. Moreover, Panel C of Table 7 shows the impact of female directors in high and low risk firms before and after the introduction of the Equality Act. Consistent with the results in Panel B, female directors benefit high risk firms and the magnitude of the benefit is greater following the introduction of the Equality Act. Finally, Panel D of Table 7 further breaks down high risk firms by size to see the effect of the Equality Act. Consistent with earlier results, we find that small firms benefit the most from female directors especially after the Equality Act. Small firms typically have smaller boards[23] and female directors can have a greater impact in such firms.

[Insert Table 7 here]

To understand the impact of past governance variables on current firm characteristics, one-year lagged independent variables are used in the estimation as shown in Table 8. The

[21] The Equality Act is a parliamentary Act in the UK formed to diminish discrimination based on gender, sex, religion etc. (UK government, 2010)

[22] Firm size is defined in Table 2 Panel B.

[23] Please refer to the descriptive statistics in Panel E of Table 3.

proportion of female directors may be simultaneously associated with firm risk. Estimating the relationship with lagged explanatory variables mitigates simultaneity concerns to some extent, by changing the channel through which endogeneity can bias the variables (Renders, Gaeremynck, & Sercu, 2010). Table 8 shows that the key results still hold and confirm the benefit of greater board gender diversity using the three risk measures.

[Insert Table 8 here]

Firms may customize board characteristics to suit specific operational needs (Wintoki, Linck, & Netter, 2012). Hence, the apparent significant relationships between board characteristics and risk may be due to unobserved firm specific heterogeneous factors. Female directors may have self-selected onto lower risk firms because of their higher risk aversion (Farrell et al., 2005). Endogeneity may also be due to simultaneity so that gender diversity is related to firm risk as well (Sila et al., 2016). To address different forms of endogeneity, the Heckman two-stage selection model (Heckman, 1979), and a three-stage least squares (3SLS) model (Ferreira, 2011) are estimated. Finding a valid instrument in gender diversity research is a challenge and we rely on prior literature to identify two instruments in the context of this study. Chen, Leung, and Goergen (2017) used the female to male labour force participation in each US state as an instrument for board gender diversity. The authors argue that firms are more likely to find qualified female candidates in the states which have a higher female to male labour force participation ratio and vice-versa. Following this notion, we use the yearly female to male employment ratio in each of the 12 regions[24] of the UK as an instrument. The rationale behind taking yearly regional data is that female employment rates vary among regions annually independent of firm risk. Big metropolitan areas might attract more business firms

[24] The UK is divided into 12 regions: North East, North West, East Midlands, West Midlands, Yorkshire and The Humber, East, London, South East, South West, Wales, Scotland, and Northern Ireland (Office for National Statistics, 2020).

but they do not necessarily have the highest female participation. For example, one third of the private firms are situated in London or the South East region (Department for Business, Energy, & Industrial Strategy, 2019) but the highest female to male employment ratios (94% on average) are in Scotland (Office for National Statistics, 2020). Moreover, there is yearly variation in the female to male employment ratio. For example, in 2006 London's ratio was 81.49% and South East was 86.40% but in 2017, the ratios were 84.13% and 90.06%, respectively (Department for Business, Energy & Industrial Strategy, 2019; Office for National Statistics, 2020). Therefore, it can be reasonably inferred that if a region has a higher proportion of female to male employment then it is more likely that a firm located in that region would have a more suitable pool of women for director-level appointments. We have also used the yearly industry average of female directors as the second instrument. A firm is likely to have high female board participation when the industry average of female director participation is high.

In the first part of the Heckman two-stage model, the decision to appoint a female director is analysed using the following Probit model with FEMDUM as the dependent variable:

$$\begin{aligned} PROBIT\ (FEMDUM{=}1) = \alpha & + \beta_1\ FEM2MAL_{i,t} + \beta_2\ INDMEAN\_FEM_{i,t} + \beta_3\ LNBOD_{i,t} \\ & + \beta_4\ COMPDUM_{i,t} + \beta_5\ DIR\_AGE_{i,t} + \beta_6\ LNTA_{i,t} + \beta_7\ ROA_{i,t} \\ & + \beta_8\ LEVERAGE_{i,t} + \beta_9\ LNFIRMAGE_{i,t} + \beta_{10}\ SICNO_{i,t} \\ & + \beta_{11}\ ASSTGRW_{i,t} + \textstyle\sum_{t=1}^{n} \Omega_t\ YEAR_t + \varepsilon_{i,t} \qquad (2) \end{aligned}$$

Following the standard Heckman methodology, we obtain the inverse mills ratio (MILLS) from the first-stage regression. The results of the first-stage regression are given in Model 1 of Table 9. The FEM2MAL coefficient is significant and positive, indicating that a firm is likely to have a higher percentage of female directors if it is located in a region with a higher female to male employment ratio. The female percentage industry average has a significant positive association with the probability of having a gender diverse board. Therefore, a firm in a female intensive industry is likely to have higher female participation on board and vice versa, however, both the instruments are not likely to be correlated with firm risk. We examine the second-stage regressions with firm risk (RISK1) as the dependent variable and MILLS as an additional control variable along with the explanatory variables. The positive highly significant coefficient for MILLS and the negative significant coefficient of female percentage in Model 2 are consistent with our baseline results. Even after controlling for self-selection bias, we report that female directors reduce risk, consistent with H1.

[Insert Table 9 here]

The percentage of female directors may influence firm risk but there is also a likelihood that low risk firms have better corporate governance and may select more women directors. We address this reverse causality issue with a 3SLS model that accounts for cross equation correlation (Pindyck & Rubinfeld, 1988; Ferreira, 2011). The relationship is stated in Equations 3 and 4:

$$\begin{aligned} RISK_{i,t} = {} & \alpha + \beta_1\, FEMALE_{i,t} + \beta_2\, LNBOD_{i,t} + \beta_3\, COMPDUM_{i,t} + \beta_4\, DIR\_AGE_{i,t} \\ & + \beta_5\, LNTA_{i,t} + \beta_6\, ROA_{i,t} + \beta_7\, LNFIRMAGE_{i,t} + \beta_8\, LEVERAGE_{i,t} + \beta_9\, SICNO_{i,t} \\ & + \beta_{10}\, ASSTGRW_{i,t} + \beta_{11}\, INDMEAN\_RISK_{i,t} + \sum_{t=1}^{n} \Omega_t\, YEAR_t + \varepsilon_{i,t} \qquad (3) \end{aligned}$$

$$\begin{aligned} FEMALE_{i,t} = {} & \alpha + \beta_1\, FEM2MAL_{i,t} + \beta_2\, INDMEAN\_FEM + \beta_3\, LNBOD_{i,t} + \beta_4\, DIR\_AGE_{i,t} \\ & + \beta_5\, COMPDUM_{i,t} + \beta_6\, LNTA_{i,t} + \beta_7\, ROA_{i,t} + \beta_8\, LEVERAGE_{i,t} \\ & + \beta_9\, LNFIRMAGE_{i,t} + \beta_{10}\, SICNO_{i,t} + \beta_{11}\, ASSTGRW_{i,t} + \beta_{12}\, VOLATILITY_{i,t} \\ & + \sum_{t=1}^{n} \Omega_t\, YEAR_t + \varepsilon_{i,t} \qquad (4) \end{aligned}$$

Equation 3 has the same independent variables as the baseline regression except for the addition of yearly industry average of RISK (INDMEAN_RISK) following Lee (2008) to ensure that the simultaneous equations are identified. Models 3 and 4 of Table 9 report the 3SLS results. The coefficients for female directors' percentage, firm risk and both instruments, FEM2MAL and INDMEAN_FEM, in the 3SLS estimation are highly significant confirming the presence of simultaneity. The results suggest that a 1% increase in female participation is associated with a 0.085% decrease in RISK1, even after accounting for simultaneity. The finding confirms the robustness of our results to endogeneity and strengthens our claim for the benefits of female directors in private firms.

5. Conclusion

Although board characteristics and corporate risk taking is a fundamental research question, extant literature in this area is limited to only public firms and it is not clear how much the fragmented evidence from public firms can be generalized to private firms.[25] Absence of literature combined with the opaqueness of the director selection criteria and appointment process in private firms (Sealy et al., 2009), contributes to the lack of understanding of the effect of female directors in private firms. This research aims to address the gap by examining the role of board gender on private firm risk using 26,045 UK firms for the period 2005-2017. We selected UK private firms for their economic significance in the UK economy and data availability to create a diverse sample inclusive of all firm size. Given the focus on greater board gender diversity in the UK[26] and poor female board participation in private firms[27], it is important for practitioners to understand how incorporating female directors affects private firm risk.

[25] Brav (2009) and Michaely et al. (2011) show that public and private firms in UK contains such fundamental differences in characteristics that without careful consideration the results of one cannot be extended to the other.
[26] The Department for Business Energy & Industrial Strategy (BEIS) together with the Government Equalities Office in the UK have placed increasing emphasis on advancing diversity in business leadership.
[27] Female participation on board in listed UK firms is 33% (Goodley, 2020) and in our sampled private firms it is only 18.4%.

Our findings suggest that women on board reduce the volatility of private firm performance and these results are robust to alternative risk measurements and endogeneity corrections. We also shed light on the impact of female director nationality and find that firm risk is lower (higher) for boards with local (foreign) female directors. Market knowledge of local female director could have greater value for private firms which are mostly small and unsophisticated in nature. Furthermore, we find that gender diverse boards have lower director busyness which enables the board to direct more attention at fiduciary responsibilities and thus reduce performance variability. Finally, we point out that all types of private firms do not similarly benefit from female directors and more risky, small to medium sized firms benefit the most.

By examining private firms in the UK, our research paves the way for understanding how private firms in other developed countries with similar organizational and governance structures may behave. Our findings also provide regulators with important insights. For example, whether private firms should be monitored and encouraged in maintaining non-binding board gender quotas. We recommend that practitioners in private firms should consider increasing board gender diversity based on firm size and risk. Lastly, due to data limitations many aspects of private firms cannot be investigated. In the spirit of better understanding the impact of board gender diversity on private firms, our research encourages future studies to examine the link between board gender diversity and other observable firm outcomes such as family connections and access to capital.

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Table 1: Composition of the sample

Panel A: Industry composition of the sample

UK SIC codes	Industry name	Observations	Percent	Firms
55100-56302	Accommodation and food service	6,107	5.30	1,266
97000-98200	Activities of households as employers	472	0.41	86
77110-82990	Administrative and support service	14,783	12.83	3,864
01110-03220	Agriculture, Forestry and Fishing	2,602	2.26	493
90010-93290	Arts, entertainment and recreation	4,635	4.02	903
05101-09900 & 41100-43999	Construction, Mining and Quarrying	17,834	15.47	4,472
85100-85600	Education	1,537	1.33	348
86101-88990	Human health and social work activities	2,839	2.46	720
58110-63990	Information and communication	7,812	6.78	2,048
10110-33200	Manufacturing	18,566	16.11	3,624
94110-96090	Other service activities	4,048	3.51	962
69101-75000	Professional, scientific and technical activities	8,440	7.32	2,161
49100-53202	Transportation and storage	4,713	4.09	944
45111-47990	Wholesale and retail trade	20,860	18.10	4,155
	Total	115,248	100.00	26,045

Panel B: Country composition of the sample

Country	Observations	Percent	Firms
England	103,341	89.67	23,640
Northern Ireland	2,206	1.92	370
Scotland	7,023	6.09	1,438
Wales	2,666	2.31	594
Total	115,236	100.00	26,045

Table 2: Variable and firm size definitions

Panel A: Variable definition and acronyms

Variable	Definition
Dependent variables	
RISK1	Standard deviation of ROA (EBIT/Total Assets) for the previous 5 years
RISK2	The difference between maximum ROA minus minimum ROA for the previous 5 years
RISK3	Standard deviation of the difference between firm's ROA minus industry average ROA for the previous 5 years
Independent variables	
LNBOD	Natural log of total number of directors
DIR_AGE	Natural log of average age of directors
BUSY	The percentage of directors who holds three or more directorships
FEMDUM	1 if there is at least one female director and 0 otherwise
FEMALE	Number of female directors divided by board size
FEMSKEW	>0-20 percent women on board
FEMTILT	>20-40 percent women on board
FEMBAL	>40 percent women on board

LOCALFEM	Percentage of female directors who have only UK nationality
FRLINKFEM	Percentage of female directors who have UK and any other nationality
FORFEM	Percentage of female directors who have only foreign nationality
Control variables	
LNTA	Natural log of total assets
ROA	EBIT divided by total assets
LEVERAGE	Total liability divided by total assets
LNFIRMAGE	Natural log of number of years since the date of incorporation
SICNO	Natural log of one + yearly number of UK SIC codes of each firm
COMPDUM	Dummy if non-individual (company) director on board
ASSTGRW	Growth of total assets from previous year
INDRISK	Industry average of RISK1
Instrumental variables	
INDMEAN_FEM	Industry average of female percentage of directors on board
FEM2MAL	Yearly number of females employed divided by males employed in each region of the UK

Panel B: Firm size classification

Criteria	Small firm	Medium firm	Large firm
Number of employee	<50	51 ~ 250	>250
Turnover in millions GBP	<10.2	10.2 ~ 36	>36
Balance Sheet total in millions GBP	<5.1	5.1 ~ 18	>18

Note: Any two out of the three criteria must be met to be considered in each classification.

Table 3: Descriptive statistics

Panel A: Descriptive statistics of continuous variables for whole sample (N=115,248)

Variable	Mean	SD	Min	P25	P50	P75	Max
RISK1	0.091	0.101	0.000	0.025	0.054	0.117	0.566
RISK2	0.204	0.223	0.000	0.058	0.123	0.265	1.571
RISK3	0.091	0.100	0.000	0.026	0.053	0.116	0.898
BOARDSIZE	4.488	1.921	3.000	3.000	4.000	5.000	20.000
LNBOD	1.433	0.350	1.099	1.099	1.386	1.609	2.996
FEMALE	0.184	0.218	0.000	0.000	0.125	0.333	1.000
LOCALFEM	0.169	0.213	0.000	0.000	0.000	0.333	1.000
FRLINKFEM	0.003	0.030	0.000	0.000	0.000	0.000	0.667
FORFEM	0.011	0.059	0.000	0.000	0.000	0.000	1.000
DIR_AGE	3.972	0.144	3.068	3.882	3.973	4.068	4.525
LNTA	7.402	2.480	0.000	5.808	8.061	9.091	17.848
ROA	0.087	0.183	-0.725	0.007	0.059	0.140	0.846
LEVERAGE	0.507	0.295	0.000	0.265	0.528	0.751	2.000
FIRMAGE	24.974	22.382	2.000	9.000	18.000	32.000	161.000
LNFIRMAGE	2.941	0.795	1.099	2.303	2.944	3.497	5.088
SICNO	0.731	0.286	0.000	0.693	0.693	0.693	2.079
ASSTGRW	0.087	0.434	-1.000	-0.061	0.023	0.151	4.393
BUSY^	0.486	0.373	0.000	0.125	0.500	0.800	1.000

All variables are defined in Table 2.

^: BUSY is based on 109,774 observations.

Panel B: Descriptive statistics for dummy variables

Variable	N	Value	%	RISK1	*t*-Test
FEMDUM	56,173	0	48.743	0.090	-3.957***
	59,075	1	51.257	0.092	
FEMSKEW	103,593	0	89.887	0.093	21.480***
	11,655	1	10.113	0.072	
FEMTILT	86,492	0	74.429	0.091	-2.248**
	28,756	1	25.571	0.092	
FEMBAL	96,584	0	83.805	0.089	-20.309***
	18,664	1	16.195	0.105	
COMPDUM	114,100	0	99.004	0.091	-10.144***
	1,148	1	0.996	0.121	

All variables are defined in Table 2. *** indicate significance at the 1% level of significance.

Panel C: Descriptive statistics of continuous variables for all male boards (N= 56,173) vs. gender diverse boards (N=59,075)

Variable	All Male Boards			Gender Diverse Boards			*t*-Test
	Mean	SD	Median	Mean	SD	Median	
RISK1	0.090	0.098	0.054	0.092	0.104	0.053	-3.957***
RISK2	0.201	0.214	0.124	0.207	0.230	0.121	-5.003***
RISK3	0.090	0.097	0.055	0.092	0.103	0.052	-4.335***
BOARDSIZE	4.171	1.564	4.000	4.790	2.164	4.000	-55.455***
LNBOD	1.374	0.312	1.386	1.489	0.374	1.386	-56.343***
ROA	0.082	0.181	0.058	0.091	0.185	0.060	-7.635***
LNTA	7.704	2.283	8.212	7.115	2.623	7.833	40.543***
LEVERAGE	0.526	0.292	0.558	0.488	0.296	0.500	22.010***
FIRMAGE	23.095	22.138	16.000	26.761	22.466	20.000	-27.881***
LNFIRMAGE	2.855	0.793	2.833	3.024	0.789	3.045	-36.249***
SICNO	0.734	0.286	0.693	0.728	0.287	0.693	3.373***
ASSTGRW	0.086	0.449	0.022	0.088	0.419	0.024	-0.744
BUSY^	0.563	0.371	0.625	0.414	0.360	0.333	67.589***

All variables are defined in Table 2. *** indicate significance at the 1% level of significance.
^: BUSY is based on 53,009 and 56,765 observations for the two groups, respectively.

Panel D: Further descriptive statistics of gender diverse boards with one female (N=34,787), two females (N=16,526) and three or more females on board (n = 7,762)

Variable	One Female			Two Females			Three or More Females		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
RISK1	0.089	0.099	0.051	0.094	0.106	0.054	0.104	0.119	0.056
RISK2	0.198	0.219	0.118	0.212	0.234	0.125	0.237	0.268	0.128
RISK3	0.088	0.098	0.051	0.095	0.105	0.055	0.105	0.118	0.056
BOARDSIZE	4.312	1.734	4.000	4.804	1.910	4.000	6.902	2.984	6.000
LNBOD	1.400	0.331	1.386	1.506	0.340	1.386	1.847	0.407	1.792
LOCALFEM	0.234	0.105	0.250	0.431	0.171	0.500	0.548	0.210	0.500
FRLINKFEM	0.005	0.037	0.000	0.009	0.049	0.000	0.008	0.043	0.000
FORFEM	0.019	0.071	0.000	0.027	0.097	0.000	0.023	0.082	0.000
DIR_AGE	3.980	0.145	3.983	3.988	0.155	3.989	3.997	0.161	3.998
LNTA	7.356	2.476	8.025	6.941	2.637	7.623	6.407	3.039	7.177
ROA	0.092	0.183	0.062	0.096	0.189	0.060	0.073	0.181	0.049
LEVERAGE	0.512	0.289	0.530	0.476	0.294	0.481	0.406	0.313	0.385
FIRMAGE	25.738	21.878	19.000	27.131	22.133	21.000	30.557	25.181	23.000
LNFIRMAGE	2.988	0.782	2.996	3.042	0.787	3.091	3.143	0.809	3.178
SICNO	0.734	0.288	0.693	0.721	0.279	0.693	0.719	0.296	0.693
ASSTGRW	0.087	0.423	0.026	0.082	0.407	0.021	0.101	0.428	0.023
BUSY^	0.456	0.369	0.400	0.378	0.349	0.333	0.305	0.307	0.250

All variables are defined in Table 2.

^: BUSY is based on 33,205, 15,949 and 7,762 observations for the three groups, respectively.

Panel E: Descriptive statistics in small, medium, and large firms

	Small Firms (N=63,814)			Medium Firms (N= 27,933)			Large Firms (N=9,449)		
Variable	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
RISK1	0.113	0.113	0.074	0.056	0.055	0.039	0.048	0.052	0.032
RISK2	0.251	0.249	0.166	0.130	0.125	0.091	0.113	0.118	0.076
RISK3	0.112	0.112	0.073	0.056	0.054	0.039	0.049	0.051	0.033
BOARDSIZE	4.222	1.804	4.000	4.753	1.853	4.000	5.610	2.391	5.000
LNBOD	1.376	0.333	1.386	1.496	0.341	1.386	1.645	0.391	1.609
FEMALE	0.208	0.233	0.200	0.158	0.190	0.000	0.130	0.171	0.000
LOCALFEM	0.192	0.228	0.100	0.146	0.187	0.000	0.116	0.168	0.000
FRLINKFEM	0.003	0.031	0.000	0.003	0.027	0.000	0.004	0.030	0.000
FORFEM	0.012	0.063	0.000	0.009	0.049	0.000	0.010	0.046	0.000
DIR_AGE	3.975	0.155	3.977	3.976	0.124	3.978	3.967	0.120	3.967
LNTA	6.082	2.104	6.410	9.119	0.540	9.060	10.781	0.959	10.563
ROA	0.097	0.216	0.059	0.083	0.116	0.067	0.083	0.109	0.068
LEVERAGE	0.476	0.309	0.480	0.565	0.231	0.580	0.605	0.229	0.628
FIRMAGE	22.298	20.620	16.000	30.018	23.559	23.000	31.995	27.492	23.000
LNFIRMAGE	2.837	0.778	2.833	3.162	0.759	3.178	3.155	0.853	3.178
SICNO	0.717	0.264	0.693	0.749	0.322	0.693	0.794	0.356	0.693
ASSTGRW	0.078	0.464	0.009	0.101	0.321	0.052	0.122	0.337	0.066
BUSY^	0.411	0.372	0.333	0.525	0.347	0.500	0.666	0.300	0.714

All variables are defined in Table 2.

^: BUSY is based on 60,207, 27,334 and 9,199 observations for the three groups, respectively.

Table 4: Correlation matrix

	RISK1 [1]	RISK2 [2]	RISK3 [3]	FEMALE [4]	LOCALFEM [5]	FRLINKFEM [6]	FORFEM [7]	DIR_AGE [8]	LNBOD [9]	LNTA [10]	ROA [11]	LEVERAGE [12]	LNFIRMAGE [13]	ASSTGRW [14]	SICNO [15]
[1]	1.000														
[2]	0.983***	1.000													
[3]	0.994***	0.983***	1.000												
[4]	0.063***	0.065***	0.064***	1.000											
[5]	0.052***	0.054***	0.053***	0.952***	1.000										
[6]	0.011***	0.012***	0.011***	0.118***	-0.025***	1.000									
[7]	0.039***	0.042***	0.040***	0.195***	-0.076***	0.017***	1.000								
[8]	-0.101***	-0.086***	-0.099***	0.081***	0.095***	-0.018***	-0.035***	1.000							
[9]	-0.088***	-0.077***	-0.082***	0.004	0.007*	0.004	-0.011***	0.056***	1.000						
[10]	-0.400***	-0.390***	-0.402***	-0.223***	-0.223***	0.001	-0.021***	-0.050***	0.200***	1.000					
[11]	0.038***	0.026***	0.045***	0.032***	0.035***	-0.001	-0.007*	-0.114***	-0.067***	-0.027***	1.000				
[12]	-0.118***	-0.126***	-0.118***	-0.097***	-0.096***	0.001	-0.011***	-0.179***	-0.002	0.252***	-0.010***	1.000			
[13]	-0.213***	-0.186***	-0.209***	0.060***	0.072***	-0.015***	-0.033***	0.352***	0.186***	0.198***	-0.099***	-0.166***	1.000		
[14]	0.066***	0.056***	0.070***	0.001	-0.001	0.005	0.007*	-0.050***	0.022***	0.048***	0.195***	0.085***	-0.056***	1.000	
[15]	-0.040***	-0.041***	-0.039***	-0.023***	-0.021***	-0.005	-0.004	-0.015***	0.024***	0.084***	-0.005	0.035***	0.073***	0.003	1.000

All variables are defined in Table 2. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 5: The effect of female directors on private firm risk

Variables	RISK1				RISK2				RISK3			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FEMDUM	-0.004***				-0.008***				-0.004***			
	(0.001)				(0.002)				(0.001)			
FEMALE		-0.005**				-0.010*				-0.006**		
		(0.003)				(0.006)				(0.002)		
FEMSKEW			-0.005***				-0.011***				-0.005***	
			(0.002)				(0.004)				(0.002)	
FEMTILT			-0.003***				-0.008***				-0.003***	
			(0.001)				(0.003)				(0.001)	
FEMBAL			-0.003**				-0.005				-0.003*	
			(0.002)				(0.0043				(0.001)	
LOCALFEM				-0.008***				-0.017***				-0.009***
				(0.003)				(0.006)				(0.003)
FRLINKFEM				0.018				0.048				0.021
				(0.015)				(0.035)				(0.015)
FORFEM				0.029***				0.072***				0.038***
				(0.009)				(0.021)				(0.009)
LNBOD	0.002	0.002	0.003*	0.002	0.006	0.004	0.007*	0.004	0.006***	0.005***	0.003***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
COMPDUM	0.016***	0.016***	0.016***	0.016***	0.040***	0.040***	0.040***	0.041***	0.018***	0.018***	0.014***	0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.012)	(0.012)	(0.012)	(0.012)	(0.005)	(0.005)	(0.005)	(0.005)
DIR_AGE	-0.058***	-0.058***	-0.058***	-0.057***	-0.120***	-0.121***	-0.120***	-0.119***	-0.060***	-0.060***	-0.055***	-0.060***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.009)	(0.009)	(0.009)	(0.009)	(0.004)	(0.004)	(0.004)	(0.004)
LNTA	-0.015***	-0.015***	-0.015***	-0.015***	-0.032***	-0.032***	-0.032***	-0.033***	-0.015***	-0.015***	-0.015***	-0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
ROA	-0.005	-0.005	-0.005	-0.005	-0.020***	-0.021***	-0.020***	-0.020***	-0.000	-0.000	-0.001	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.007)	(0.007)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)
LEVERAGE	-0.022***	-0.022***	-0.022***	-0.022***	-0.051***	-0.051***	-0.051***	-0.051***	-0.021***	-0.022***	-0.021***	-0.021***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)
LNFIRMAGE	-0.012***	-0.012***	-0.012***	-0.012***	-0.020***	-0.021***	-0.020***	-0.020***	-0.014***	-0.014***	-0.011***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
SICNO	0.001	0.001	0.001	0.001	0.003	0.003	0.003	0.003	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)

ASSTGRW	0.018***	0.018***	0.018***	0.018***	0.036***	0.036***	0.036***	0.036***	0.019***	0.019***	0.018***	0.019***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
CONSTANT	0.464***	0.465***	0.464***	0.463***	0.981***	0.983***	0.980***	0.977***	0.494***	0.495***	0.448***	0.491***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.038)	(0.038)	(0.038)	(0.038)	(0.017)	(0.017)	(0.017)	(0.017)
Tilt–Skew			1.64				1.48				1.08	
Balance–Tilt			0.14				0.54				0.26	
Balance–Skew			1.92				2.66				1.69	
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. *R*-squared	0.210	0.210	0.210	0.210	0.196	0.196	0.196	0.196	0.198	0.197	0.198	0.198
F-statistic	176.97	176.66	167.81	167.77	152.24	151.90	144.41	144.32	250.25	249.54	229.71	230.58
Observations	115,248	115,248	115,248	115,243	115,248	115,248	115,248	115,243	115,096	115,096	115,096	115,091

This table reports the baseline models using the firm risk measures as dependent variable using robust firm-clustered standard errors. All variables are defined in Table 2. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 6: The effect of female directors on board busyness

Variables	BUSY					
	SMALL		MEDIUM		LARGE	
	(1)	(2)	(3)	(4)	(5)	(6)
FEMDUM	-0.113***		-0.056***		-0.013	
	(0.006)		(0.009)		(0.014)	
FEMALE		-0.270***		-0.168***		-0.108**
		(0.013)		(0.026)		(0.043)
LNBOD	-0.049***	-0.070***	-0.100***	-0.114***	-0.169***	-0.170***
	(0.008)	(0.008)	(0.013)	(0.013)	(0.018)	(0.018)
COMPDUM	0.083***	0.077***	-0.010	-0.010	-0.014	-0.008
	(0.021)	(0.021)	(0.047)	(0.047)	(0.062)	(0.057)
DIR_AGE	0.062***	0.057***	0.198***	0.201***	0.139**	0.146**
	(0.020)	(0.020)	(0.039)	(0.039)	(0.062)	(0.062)
LNTA	0.052***	0.050***	0.106***	0.105***	0.049***	0.048***
	(0.002)	(0.002)	(0.008)	(0.008)	(0.007)	(0.007)
ROA	-0.135***	-0.136***	-0.076***	-0.079***	-0.023	-0.025
	(0.010)	(0.010)	(0.027)	(0.027)	(0.047)	(0.047)
LEVERAGE	-0.021**	-0.024**	0.109***	0.104***	-0.035	-0.039
	(0.010)	(0.010)	(0.022)	(0.022)	(0.032)	(0.032)
LNFIRMAGE	-0.075***	-0.074***	-0.066***	-0.066***	-0.048***	-0.048***
	(0.004)	(0.004)	(0.006)	(0.006)	(0.008)	(0.008)
SICNO	-0.028**	-0.027**	-0.002	-0.003	-0.016	-0.018
	(0.013)	(0.013)	(0.016)	(0.016)	(0.019)	(0.019)
ASSTGRW	-0.009***	-0.009**	-0.022***	-0.022***	-0.029***	-0.029***
	(0.003)	(0.003)	(0.007)	(0.007)	(0.010)	(0.010)
RISK1	-0.019	-0.016	0.315***	0.314***	0.067	0.058
	(0.023)	(0.023)	(0.065)	(0.065)	(0.103)	(0.103)
CONSTANT	0.198**	0.258***	-0.933***	-0.910***	0.058	0.063
	(0.083)	(0.083)	(0.173)	(0.172)	(0.254)	(0.254)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.179	0.184	0.105	0.107	0.126	0.128
F-statistic	119.47	125.71	29.42	30.09	11.90	12.24
Observations	60,207	60,207	27,334	27,334	9,199	9,199

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 7: Sub sample analysis

Panel A: Sub sample with before and after introduction of Equality Act

	RISK1			
VARIABLES	BEFORE	AFTER	BEFORE	AFTER
	(1)	(2)	(3)	(4)
FEMDUM	-0.002*	-0.005***		
	(0.001)	(0.001)		
FEMALE			-0.003	-0.008**
			(0.003)	(0.003)
Control Variables	Yes	Yes	Yes	Yes
Year Dummy	No	No	No	No
Industry Dummy	Yes	Yes	Yes	Yes
Adj. *R*-squared	0.184	0.232	0.184	0.232
F-statistic	160.87	149.45	160.84	148.66
Observations	56,015	59,233	56,015	59,233

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Panel B: Subsample with different firm size in high and low risk groups

	RISK1					
Variables	HIGH RISK			LOW RISK		
	SMALL	MEDIUM	LARGE	SMALL	MEDIUM	LARGE
	(1)	(2)	(3)	(4)	(5)	(6)
FEMALE	-0.016***	-0.015***	-0.007	0.001	0.000	-0.003
	(0.004)	(0.005)	(0.010)	(0.001)	(0.001)	(0.002)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Adj. *R*-squared	0.187	0.098	0.111	0.125	0.091	0.115
F-statistic	85.80	10.96	5.60	51.32	25.30	10.93
Observations	37,422	9,961	2,715	26,392	17,972	6,734

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Panel C: Subsample of high and low risk groups in before and after Equality Act

	RISK1			
	HIGH RISK		LOW RISK	
Variables	BEFORE	AFTER	BEFORE	AFTER
	(1)	(2)	(3)	(4)
FEMALE	-0.015***	-0.018***	0.001*	-0.000
	(0.004)	(0.004)	(0.001)	(0.001)
Control Variables	Yes	Yes	Yes	Yes
Year Dummy	No	No	No	No
Industry Dummy	Yes	Yes	Yes	Yes
Adj. *R*-squared	0.170	0.246	0.056	0.069
F-statistic	91.79	114.12	34.96	38.00
Observations	27,101	28,948	28,914	30,285

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Panel D: Subsample of high risk firms before and after Equality Act in small, medium and large size groups

	RISK1					
	SMALL		MEDIUM		LARGE	
VARIABLES	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
	(1)	(2)	(3)	(4)	(5)	(6)
FEMALE	-0.013***	-0.019***	-0.021**	-0.014**	-0.005	-0.006
	(0.005)	(0.005)	(0.010)	(0.006)	(0.020)	(0.012)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	No	No	No	No	No	No
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Adj. *R*-squared	0.159	0.215	0.076	0.066	0.075	0.088
F-statistic	67.88	72.75	4.60	7.84	2.06	3.43
Observations	19,799	17,623	2,681	7,280	885	1,830

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. All the firms in this table have higher than median yearly risk.

Table 8: Lagged independent variables

VARIABLES	RISK1 (1)	(2)	(3)	(4)
L.FEMDUM	-0.004***			
	(0.001)			
L.FEMALE		-0.007***		
		(0.003)		
L.FEMSKEW			-0.006***	
			(0.002)	
L.FEMTILT			-0.004***	
			(0.001)	
L.FEMBAL			-0.004**	
			(0.002)	
L.LOCALFEM				-0.009***
				(0.003)
L.FRLINKFEM				0.015
				(0.015)
L.FORFEM				0.028***
				(0.010)
L.LNBOD	0.005***	0.004***	0.006***	0.004***
	(0.002)	(0.002)	(0.002)	(0.002)
L.COMPDUM	0.016***	0.016***	0.016***	0.016***
	(0.005)	(0.005)	(0.005)	(0.005)
L.DIR_AGE	-0.050***	-0.051***	-0.050***	-0.050***
	(0.004)	(0.004)	(0.004)	(0.004)
L.LNTA	-0.015***	-0.015***	-0.015***	-0.015***
	(0.000)	(0.000)	(0.000)	(0.000)
L.ROA	0.016***	0.016***	0.016***	0.017***
	(0.003)	(0.003)	(0.003)	(0.003)
L.LEVERAGE	-0.022***	-0.022***	-0.022***	-0.022***
	(0.002)	(0.002)	(0.002)	(0.002)
L.LNFIRMAGE	-0.011***	-0.011***	-0.011***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
L.SICNO	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
L.ASSTGRW	0.016***	0.016***	0.016***	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)
CONSTANT	0.422***	0.423***	0.421***	0.421***
	(0.017)	(0.017)	(0.017)	(0.017)
Year Dummy	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes
Adj. R-squared	0.208	0.208	0.208	0.208
F-statistic	185.81	185.36	175.79	175.83
Observations	110,425	110,425	110,425	110,421

The models are estimated using robust firm-clustered standard errors as reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 9: Endogeneity tests

Variables	Heckman Selection Model		3SLS	
	FEMDUM	RISK1	RISK1	FEMALE
	(1)	(2)	(3)	(4)
FEM2MAL	1.665***			0.198***
	(0.254)			(0.019)
INDMEAN_FEM	3.861***			0.804***
	(0.165)			(0.013)
FEMALE		-0.005**	-0.085***	
		(0.003)	(0.007)	
MILLS		0.036***		
		(0.012)		
LNBOD	0.651***	0.015***	0.002***	0.013***
	(0.025)	(0.005)	(0.001)	(0.002)
DIR_AGE	0.205***	-0.054***	-0.057***	0.020***
	(0.055)	(0.004)	(0.002)	(0.006)
LNTA	-0.092***	-0.017***	-0.016***	-0.022***
	(0.004)	(0.001)	(0.000)	(0.001)
ROA	0.320***	0.002	0.000	0.046***
	(0.026)	(0.004)	(0.002)	(0.003)
LEVERAGE	0.019	-0.021***	-0.022***	-0.014***
	(0.025)	(0.002)	(0.001)	(0.003)
LNFIRMAGE	0.159***	-0.008***	-0.010***	0.022***
	(0.011)	(0.001)	(0.000)	(0.001)
SICNO	-0.000	0.002	0.002*	-0.002
	(0.032)	(0.002)	(0.001)	(0.003)
COMPDUM	-0.222***	0.011**	0.012***	-0.039***
	(0.074)	(0.005)	(0.003)	(0.006)
ASSTGRW	-0.007	0.018***	0.018***	0.008***
	(0.006)	(0.001)	(0.001)	(0.002)
INDMEAN_RISK			0.453***	
			(0.012)	
RISK1				-0.218***
				(0.061)
CONSTANT	-3.801***	0.409***	0.457***	-0.134***
	(0.308)	(0.026)	(0.009)	(0.042)
Industry Dummy	No	Yes	No	No
Year Dummy	Yes	Yes	Yes	Yes
Adj. *R*-squared		0.210	0.180	0.099
Chi Square			28,373	14,797
Observations	147,679	115,155	115,155	115,155

This table reports the robust models used to test for endogeneity. Robust firm-clustered standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.