THE IMPACT OF FEMALE DIRECTORS ON FIRM RISK: A STUDY IN THE CONTEXT OF G6 COUNTRIES

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Abstract

The main objective of this study is to assess the impact of female directors on firm risk in the G6 countries (all G7 countries except Italy, since data for Italy are not available). A total of 4617 firm-year observations were collected from six countries: the United States, Japan, Germany, the United Kingdom, France, and Canada. The firm risk measures (*risk1* and *risk2*) are calculated as the ratio of a firm profitability to volatility of profitability. These risk measures capture the risk-seeking behavior of the firm. These ratios are a comprehensive measure of risk-seeking behavior since they capture the decisions made by the incumbent management related to the firm's operations. The results show that the presence of female directors beyond a threshold point reduces firm risk in the total dataset as well as in individual countries. Interestingly, Europe as a continent and all European countries individually have the highest impact of the presence of female directors above the threshold. In the case of Japan, the presence of female directors has the least influence on firm risk.

Keywords: Female Directors, Firm Risk, G6 Countries, Threshold Point

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1. INTRODUCTION

The board of directors has a significant role to play in a company's governance framework, serving as an important monitoring mechanism to resolve agency conflicts (Agrawal & Knoeber, 1996). Researchers have conducted significant research on the composition of corporate boards in recent years. In the 1980s and 1990s, the focus was primarily shifted to the role of independent directors in firm performance (Fama & Jensen, 1983; Adams & Funk, 2012).

However, over the past two decades, the topic of board diversity has gained momentum, particularly concerning the inclusion of female directors. This subject has generated considerable debate, driven by the belief that female directors can bring particular behavioral differences and core values to the board (Tuhus-Dubrow, 2009; Manzoni et al., 2010; Kellaway, 2011; Smith et al., 2006). Proposals for corporate governance reform have advocated measures to enhance women's representation on boardrooms, and previous research has provided numerous reasons to support this initiative.

Existing literature reveals that female directors offer unique perspectives, work styles, and experiences as compared to their male counterparts (Baysinger & Butler, 1985). Their more participative and process-oriented communication style can positively impact board deliberations and decision-making processes. Women's representation on boards encourages consideration of a broader range of strategic options and takes into account the diverse interests and needs of customers. In addition, the inclusion of women on boards can improve an organization's overall brand image and potentially lead to a positive impact on customer behavior (Light, 2011; Adams, 2016). Their presence also facilitates more nuanced boardroom discussions (Daily & Dalton, 2003).

The presence of female directors in firms can influence corporate governance and reduce the agency problem. The education, experience, and values of female director add new dimensions to the decision-making process (Pathan, 2009). They bring new skills and expertise to the company (Mathew et al., 2017). They are risk-averse and better decision makers than their male counterparts (Rossi et al., 2017; Suryandari et al., 2024). For instance, they believe in making proper records, take board meeting seriously, and make decisions that are less risky (Adams & Ferreira, 2009).

The promotion of women on corporate boards is a global trend, with some countries implementing quota rules or codes. Norway, in 2003, was the first country to introduce a gender balance quota, mandating at least 40% female representation on the board of directors of their public limited company (Terjesen et al., 2015). Iceland and France followed suit and made it mandatory to have a 40% quota of independent female directors in their publicly traded firms, while Belgium implemented a quota of 33% for its listed companies and state-owned enterprises. Several other countries, including Australia, the UK, and Sweden, encourage gender diversity on corporate boards through voluntary measures (The Economist, 2014). In India, a law was introduced in 2013. It requires all companies listed on the stock exchange to have at least one woman on their board of directors, which has led to an increase in female representation from 5.1% in 2012 to 10.2% in 2016. To address concerns about authenticity, the Securities and Exchange Board of India (SEBI) implemented an additional requirement in 2018, mandating the selection of at least one independent women director.

Despite not having a predetermined stance on promoting gender equality, some countries have still taken measures to increase the number of women directors on their corporate boards. For instance, Kenya introduced a mandatory quota of 33% female directors in its state-owned enterprises to improve gender representation. This has led to a significant increase in the proportion of female directors in these companies, above the global average (Deloitte, 2017).

According to Denis (2022), affirmative action in terms of gender quotas increased women's representation on boards of French companies from 13% in 2011 to 44.3% in 2019. The same phenomenon is observed in the context of German companies, where women's representation increased from 3% in 2009 to 36.5% in 2019. However, according to Rigolini and Huse (2021), an increase in the proportion of women on company boards may not lead to an increase in the number of women in management positions; rather, it may be an example of a few women serving as directors in multiple firm boards. This is termed the 'golden skirts' effect.

Previous studies have examined female directors and firm performance in the Norwegian context (Yang et al., 2019). Other studies have focused on topics such as women in corporate leadership positions and their relationship with corporate performance (Jane Lenard et al., 2014); female director and risk in banks (Birindelli et al., 2020); the impact of female directors in the context of technology companies (Mukarram et al., 2018); the impact of female directors on the financial performance of listed companies in the UK (Nadeem et al., 2019); gender diversity and firm risk in the US (Sila et al., 2016); women director and financial performance in India (Kumar et al., 2020); women director and their impact on performance in private firms in the UK (Sattar et al., 2023), in the case of Spain (Safiullah et al., 2022), Finland, Sweden, and Denmark (Yang et al., 2019); then women directors and carbon emissions in the context of Japan (Fan et al., 2023).

Hence, it is important to conduct the present study. This research aims to fill this gap in the existing literature by providing a holistic assessment of the influence of female directors on firm risk within the G6 economic bloc. No previous study has examined this relationship in full for all G6 countries. A total of 4617 firm-year observations were conducted from six countries: the US, Japan, Germany, the UK, France, and Canada. In addition, the firm's risk measures (*risk1* and *risk2*) are consistent with Faccio et al. (2016). According to this framework, the ratio of a firm's profitability to the volatility of profitability depicts the risk-seeking behavior of a firm. The ratio is a comprehensive measure of risk-seeking behavior as it depicts the decisions taken by incumbent management related to the firm's operations. The results show that the presence of female directors above the threshold reduces firm risk both in the overall dataset and in individual countries. It is interesting to find that Europe as a continent and all European countries on a stand-alone basis have the highest impact of the presence of female directors beyond the threshold. This phenomenon is in accordance with "critical mass theory" with respect to the presence of women in decision-making positions in corporate organizations.

This paper is structured as follows. Section 2 presents the literature review. Section 3 details the research methodology. Section 4 consists of data analysis and interpretation. Section 5 discusses the results. Section 6 concludes the paper.

2. LITERATURE REVIEW

Existing empirical studies on female director participation on boards provide mixed and inconclusive results, with some studies showing positive, negative, or impact on performance (Pletzer et al., 2015; Lundeberg et al., 1994).

Psychological studies consistently demonstrate that women take less risk than men (Levin et al., 1988). Additionally, women have been shown to

exhibit less overconfidence than men in various aspects (Joecks et al., 2013; Martin et al., 2009). As a result, female directors typically approach investment and risk-related decisions, such as acquisitions, leverage, dividend payout, capital expenditure, research and development (R&D) investment, and overall risk exposure with greater caution (Banerjee et al., 2018; Chen et al., 2016).

These studies suggest that female directors can act as a counterbalance to a potentially overconfident and risk-seeking male-dominated management team (Graham et al., 2013; Banerjee et al., 2018), fostering a more balanced and prudent approach to decision-making (Eckel & Grossman, 2008).

The presence of female directors is critical to improving risk assessment through their monitoring and advisory roles (Faccio et al., 2016). Their vigilance helps prevent managers from engaging in excessive risk-taking behaviors, such as overinvestment (Byrnes et al., 1999). In addition, female directors' risk-averse tendencies provide a vital counterbalance to male-dominated management teams that may exhibit excessive risk-taking behavior (Levi et al., 2014).

Gender equality plays a significant role in enabling female directors to gain expertise in risk assessment and to ensure that their dissenting viewpoints are respected and taken into account on boards (Saeed & Sameer, 2017). Concerns about gender diversity on corporate boards often revolve around the possibility of women directors being overly risk-averse and hesitant to take necessary risks (Powell & Ansic, 1997). However, these concerns are less pronounced in countries with higher levels of gender equality (Post & Byron, 2015).

Research has shown that any potential over risk-aversion among female directors can be mitigated by financial knowledge and education (Hibbert et al., 2013; Kirsch, 2018). Female directors understand the importance of risk return trade-off and approach risk assessments with a more cautious and less overconfident mindset (Dwyer et al., 2002; Daidai & Alami, 2024). This way, they contributed to a more balanced risk-taking approach by moderating excessive risks, particularly in countries with larger gender equality (Niederle & Vesterlund, 2007; Ghofar et al., 2024). Their ability to provide a prudent and thoughtful perspective on risk management can be a valuable asset for decision-making in the boardroom.

Existing empirical research on women's participation on boards of directors shows that female directors are better decision makers.

A substantial body of research conducted by researchers and consulting firms has examined the relationship between the presence of female directors on boards and corporate performance. Credit Suisse Research Institute (2019), Hunt et al. (2018), and Deloitte (2019) have notably underscored the significance of diversity, emphasizing that it is not only an ethical imperative but also contributes to 'smarter decision-making' that significantly impacts the earnings of an organization. These studies highlight the important role played by the women director on the board, highlighting the positive impact of diverse perspectives on decision-making processes and financial performance.

Research consistently argues that female directors have a distinct set of knowledge, ability, and understanding to corporate boards (Terjesen et al., 2016). They also demonstrate a greater ability than men to establish connections with diverse stakeholders (Hillman et al., 2007). A study conducted by Bank of America Merrill Lynch (2018) suggests that gender diversity in boards leads to a variety of opinions, enabling companies to compete effectively and adapt to industry changes. Bilimoria and Wheeler (2000) emphasize that women contribute a 'competitive advantage' to firms by effectively managing labor and product market dynamics. Moreover, compelling evidence suggests that women's board experience provides a deeper understanding of consumers in certain markets compared to men (Arfken, 2004).

Carter et al. (2003) has emphasized that gender diversity brings creativity and innovation, fostering a more dynamic and forward-thinking approach to decision-making. Forbes' (2018) study also advocates that gender diversity brings more understanding of its customer and the business landscape, leading to improved decision-making processes and outcomes. Brennan (1997) emphasized that women understand better consumer behavior and gives firms a competitive edge when they are adequately represented on boards. By including women directors, the board gains a valuable diversity of perspectives, leading to a broader representation of the company's diverse customer base (The Economist, 2014).

Research consistently highlights several advantages of having female directors on corporate boards. Kim and Starks (2016) have emphasized that female directors have skill and knowledge that add value to the board's decision-making process. Additionally, studies suggest that female directors tend to uphold high moral values (Collins, 2000) and display a more risk-averse approach (Byrnes et al., 1999).

Moreover, female directors are generally accepted as being more effective supervisors (Adams & Ferreira, 2009), leading to positive outcomes for the company. Their presence can result in more benefits to an organization (Srinidhi et al., 2011) with fewer risks (Levi et al., 2014), contributing to a more stable and sustainable business environment. Ultimately, greater female director representation has been linked to higher overall firm performance (Carter et al., 2003).

Based on the existing literature, it is clear that the representation of women directors on corporate boards leads to lower risks in companies.

3. RESEARCH METHODOLOGY

3.1. Variables and econometric models

In this study, we examine how corporate governance framework — specifically, female representation on a firm's board of directors — affects the risk of listed firms in the context of the G6 countries (all G7 countries, except Italy). In this study, the firm risk measures (*risk1* and *risk2*) are in accordance to Faccio et al. (2016). According to this framework, the ratio of a firm's profitability to the volatility of profitability depicts the risk-seeking behavior of a firm. The ratio is a comprehensive measure of risk-seeking behavior since it reflects the decisions made by the current management regarding the firm's

operations. In this study, we measure firm profitability in two forms: 1) return on assets (ROA), and 2) return on equity (ROE). In accordance with John et al. (2008), Faccio et al. (2016), and Vo (2016), the standard deviations of ROA and ROE measure the volatility of these two profitability variables and indicate a measure of corporate risk.

The two measures of the corporate risk profile are defined as follows:

$$risk1_{it} = \frac{ROA_{it} - ROA_{mt}}{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(ROA_{it} - ROA_{mt})^2}}; \quad where, \rightleftarrows ROA_m = \frac{1}{n}\sum_{i=1}^{n} ROA_i \tag{1}$$

$$risk2_{it} = \frac{ROE_{it} - ROE_{mt}}{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(ROE_{it} - ROE_{mt})^2}}; \quad where, \rightleftarrows ROE_m = \frac{1}{n}\sum_{i=1}^{n} ROE_i \tag{2}$$

The measure $risk1_{it}$ depicts risk arising out of inefficient utilization of assets of a firm *i*, at the end of financial year *t* for the market *m* and indicates business risk. Similarly, $risk2_{it}$ depicts risk arising out of the inefficient deployment of equity capital of firm *i* at the end of financial year *t* for market *m* and indicates financial risk.

In both cases, a positive increase in the value of the risk measure indicates either that the firm is earning more returns than the market, or it has less volatility than the market, or both (and vice-versa). As a result, the higher the value of *risk1* and *risk2* lower the risk and indicates better utilization of the firm's resources.

We formulate the relationship between women directors (the corporate governance mechanism) and the risk-seeking behavior of corporate entities as below:

$$Risk\ 1_{it} = \beta_0 + \beta_1 WD\_Proportion_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \varepsilon_{it} \tag{3}$$

$$Risk\ 2_{it} = \beta_0 + \beta_1 WD\_Proportion_{it} + \beta_2 Size_{it} + \beta_3 Leverage_{it} + \varepsilon_{it} \tag{4}$$

$WD\_Proportion_{it}$ is the proportion of the women directors on the board of firm *i* at the end of the financial year *t*. We use $Size_{it}$ and $Leverage_{it}$ of the firm as the control variables.

The extant literature discusses the linkage between presences of women directors at firm board level and firm's risk appetite, we explored this relationship by using panel fixed effect model. The aforementioned model is comparable to Vo (2016).

We further investigate the possibility of a non-linear relationship, based on the relationship as depicted by Eq. (3) and (4). In that direction, a fixed-effect panel threshold model based on Hansen's (1999) framework is explored in order to identify optimum thresholds based on information criteria (Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Hannan-Quinn Information Criterion (HQIC) and Schwarz Information Criterion (SIC)). The threshold regression model identifies the non-linear relationship between the independent and dependent variables and delineates one state/regime from another. The resultant of a threshold regression is identifying one set of coefficients up to the threshold level and another set of coefficients beyond the threshold level.

$$\begin{aligned} Risk\ 1_{it} = \beta_0 + \beta_{11} WD\_Proportion_{it} * I\left(\beta_{11} WD\_Proportion_{it} \le \gamma\right) + \beta_{12} WD\_Proportion_{it} \\ * I\left(\beta_{12} WD\_Proportion_{it} > \gamma\right) + \alpha CV_{it} + \varepsilon_{it} \end{aligned} \tag{5}$$

$$\begin{aligned} Risk\ 2_{it} = \beta_0 + \beta_{11} WD\_Proportion_{it} * I\left(\beta_{11} WD\_Proportion_{it} \le \gamma\right) + \beta_{12} WD\_Proportion_{it} \\ * I\left(\beta_{12} WD\_Proportion_{it} > \gamma\right) + \alpha CV_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

We use $Size_{it}$ and $Leverage_{it}$ of the firm as the control variables. The firm's size ($Size_{it}$) is determined using the natural logarithm of its total assets. The firm size is an indicator of bigger businesses that are better equipped to set market prices; as they have a more significant market share, they can hold onto those prices and, as a result, keep their profits consistent. Furthermore, more prominent firms typically have superior risk management and corporate governance procedures (Boubakri et al., 2013; Vo, 2016). Similarly, 'leverage' refers to a company's financial leverage, which is determined by dividing total liabilities by total assets. The financial risk profile of a company greatly depends on its financial leverage because it is one of the main factors determining how volatile earnings can be (Boubakri et al., 2013; Vo, 2016).

3.2. Data and sample

The study investigates data from six developed countries: the USA, Japan, Germany, the UK, France, and Canada. All these countries are part of the G7 group of most industrialized and advanced countries. We used Bloomberg and Thomson Reuters database for data. This study does not consider only one G7 country, Italy, due to a lack of consistent data. Only non-financial firms are considered for analysis, as the business model of financial firms differs.

A total of 4617 firm-year observations accounted for 124 firms from Canada, 32 from France, 21 from Germany, 193 from Japan, 66 from the UK, and 77 from the USA (see Figure 1 and 2). Cumulatively there are 513 firms from the G6 countries, and the data covers a 9-year period (2011–2019).

Figure 1. Country-wise distribution of firms

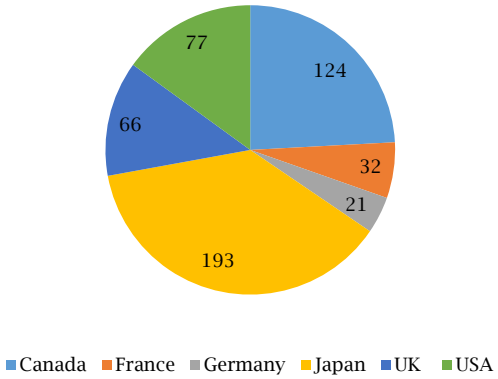
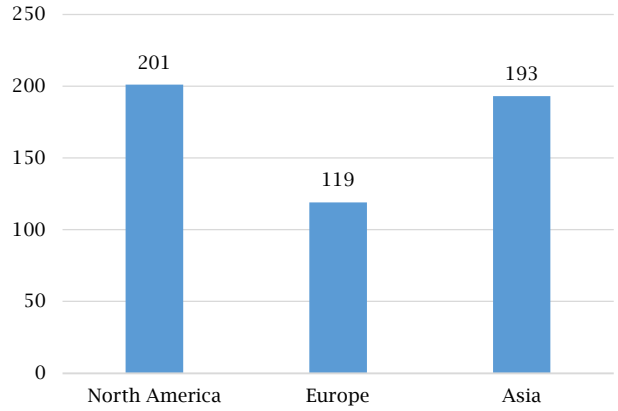


Figure 2. Continent-wise distribution of firms



Source: Authors' elaboration.

4. DATA ANALYSIS AND INTERPRETATION

Table 1 depicts various descriptive statistics parameters of the variables studied in this research paper. Table 2 illustrates correlation matrix of all the variables studied.

Table 1. Descriptive statistics

Variable parameter	*Risk1*	*Risk2*	*Size*	*Leverage*	*WD_Proportion*
Mean	0.0554	0.0701	11.2555	26.4028	0.1511
Standard error	0.0137	0.0163	0.0392	0.2351	0.0020
Median	-0.0082	-0.0071	11.0415	25.1059	0.1429
Mode	-1.3525	-0.1565	10.6682	0.0000	0.0000
Standard deviation	0.9317	1.1082	2.6606	15.9720	0.1331
Sample variance	0.8681	1.2280	7.0786	255.1046	0.0177
Kurtosis	15.7945	53.5475	-0.8833	0.2539	-0.5380
Skewness	1.0332	2.5665	-0.0093	0.4607	0.5197
Range	16.0485	27.1501	14.1137	103.1960	0.6364
Minimum	-8.2415	-12.0727	3.6518	0.0000	0.0000
Maximum	7.8071	15.0774	17.7655	103.1960	0.6364
Sum	255.8834	323.7352	51966.6419	121901.6108	697.4064
Count	4617	4617	4617	4617	4617

Source: Authors' elaboration.

Table 2. Correlation matrix

Variables	*Risk1*	*Risk2*	*Size*	*Leverage*	*WD_Proportion*
Risk1	1.0000				
Risk2	0.5985	1.0000			
Size	-0.1235	-0.0609	1.0000		
Leverage	-0.1944	0.0484	0.0346	1.0000	
WD_Proportion	0.0657	0.0564	-0.3940	0.0550	1.0000

Source: Authors' elaboration.

From the Table 3 (see below), which illustrates the fixed effects model, it is evident that in all countries (except Japan), increasing the representation of women on a firm's board of directors reduces the risk of the firm (both in terms of *risk1* and *risk2*). It is consistent with the predominant view in the existing literature. In the case of Japan, firm boards have highly inadequate representation of women directors, as a result their presence fail to influence firm's risk appetite in any meaningful way. For example, companies in the first section of the Tokyo Stock Exchange (comprising approximately 2,000 leading companies) have set a target of 12% women on their boards by 2022. However, according to Denis (2022), as of 2019 (the end year of this study), the combined representation of women in these firms was only 8.4%. Although this was a significant improvement compared to 2017 (5.3%) and 2018 (6.4%). It is pertinent to note that, in our dataset average (mean) percentage of women directors of Canadian firms is 17.57%. It is 33.29% for France, 23.42% for Germany, 4.05% for Japan, 22.88% for the UK and 22.70% for the USA. It is clear from the data that European countries have the best representation of women on boards of firms, followed by North America. In Japan, female representation is significantly lower.

Table 3. Fixed effect models

Parameter	*Model 1 (risk1)*		*Model 2 (risk2)*	
	Coefficient	*p-value*	*Coefficient*	*p-value*
Full dataset				
Constant	0.5774	0.000	0.2796	0.0000
WD_Proportion	0.0014	0.267	0.0020	0.228
Size	-0.1251	0.025	-0.2992	0.488
Leverage	-0.0194	0.0000	-0.0091	0.0000
R-squared	0.0419		0.0052	
Prob. F-statistics	0.0000		0.0001	
Canada				
Constant	-0.3602	0.4120	-0.4964	0.364
WD_Proportion	0.0023	0.266	0.0075	0.133
Size	-0.6896	0.002	0.0837	0.222
Leverage	0.0173	0.082	-0.0024	0.416
R-squared	0.0027		0.0006	
Prob. F-statistics	0.0000		0.5059	
France				
Constant	5.2093	0.001	6.5413	0.003
WD_Proportion	0.006	0.088	0.7551	0.0041
Size	-0.5361	0.000	-0.3877	0.0028
Leverage	0.0076	0.258	0.0772	0.1344
R-squared	0.0906		0.0015	
Prob. F-statistics	0.0144		0.0007	
Germany				
Constant	3.7779	0.122	9.4272	0.005
WD_Proportion	0.0012	0.855	0.0122	0.189
Size	-0.2877	0.221	-0.8778	0.007
Leverage	-0.0239	0.017	-0.0098	0.470
R-squared	0.2015		0.0226	
Prob. F-statistics	0.0273		0.0411	
Japan				
Constant	1.3876	0.129	1.9918	0.263
WD_Proportion	-0.0149	0.001	-0.0054	0.327
Size	-0.0739	0.472	-0.0710	0.574
Leverage	-0.0434	0.000	-0.0385	0.000
R-squared	0.1933		0.0174	
Prob. F-statistics	0.0000		0.0000	
UK				
Constant	1.3830	0.000	0.5961	0.160
WD_Proportion	0.0037	0.017	-0.0002	0.913
Size	-0.1678	0.000	-0.0806	0.098
Leverage	0.0024	0.236	0.0057	0.032
R-squared	0.2137		0.1053	
Prob. F-statistics	0.0001		0.0589	
USA				
Constant	-1.6333	0.043	-1.5648	0.216
WD_Proportion	0.0105	0.001	0.0081	0.298
Size	0.1976	0.012	0.1523	0.216
Leverage	-0.0196	0.000	0.0011	0.834
R-squared	0.0007		0.0000	
Prob. F-statistics	0.0000		0.1504	

Source: Authors' elaboration.

Table 4. Threshold model (*risk1*) — Country-wise

Parameter	*USA*	*Canada*	*UK*	*France*	*Germany*	*Japan*	*All countries*
Threshold estimates							
WD_Proportion	0.1539	0.0833	0.1811	0.2167	0.1909	0.1250	0.1539
SIC	673.4506	463.8108	449.3215	195.3434	141.3778	1374.3762	3790.615
Impact of WD_Proportion							
$\widehat{\beta_{11}}$	2.2566***	0.2093*	2.3756*	3.6742**	3.6532**	1.3419*	0.6836***
$\widehat{\beta_{12}}$	2.8141***	0.3111**	2.8486***	4.0199***	3.8940***	1.5843***	0.7867***
Impact of covariates							
Size	-0.2132***	0.0483**	-0.2882***	-0.4230***	-0.3183***	-0.0498**	-0.0335***
Leverage	-0.0057**	-0.0009	-0.0055**	-0.0192***	-0.0141**	-0.0263***	-0.0113***
AIC	-11.8304	-971.8809	-157.8095	-103.8	-46.8688	-398.7531	-902.5503
BIC	6.3337	-951.8109	-140.2620	-89.1502	-33.9018	-376.8955	-876.8003
HQIC	-4.8057	-964.2936	-150.9755	-97.9305	-41.6156	-390.6588	-893.4888
N	**693**	**1116**	**594**	**288**	**189**	**1737**	**4617**

*Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively; ^ denotes zero (0) thresholds were found using the corresponding information criteria.*
Source: Authors' elaboration.

Table 5. Threshold model (*risk2*) — Country-wise

Parameter	*USA*	*Canada*	*UK*	*France*	*Germany*	*Japan*	*All countries*
Threshold estimates							
WD_Proportion	0.1429	0.0833	0.2500	0.1875	0.2778	0.1250	0.1500
SIC	1924.7400	731.7228	481.7420	255.9698	174.2895	1693.3996	5617.1066
Impact of WD_Proportion							
$\widehat{\beta_{11}}$	0.7033	0.2955*	0.8570*	0.9822	1.2802	0.0256	0.1130
$\widehat{\beta_{12}}$	1.4551**	0.4097***	2.4492***	2.3013***	1.5043**	0.1533	0.2407***
Impact of covariates							
Size	-0.1579**	0.0346*	-0.2409***	-0.2375***	-0.1196	0.0125	-0.0168**
Leverage	0.0250***	0.0063***	-0.0005	0.0093*	-0.0028	-0.0084***	0.0033***
AIC	715.9107	-463.0686	-116.4255	-26.0224^	-7.3145	-36.1570	913.2624
BIC	734.0748	-442.9985	-98.8780	-11.3037	5.6526	-14.3173	939.0124
HQIC	722.9354	-455.4813	-109.5916	-20.0839	-2.0613	-28.0806	922.3239
N	**693**	**1116**	**594**	**288**	**189**	**1737**	**4617**

*Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively; ^ denotes zero (0) thresholds were found using the corresponding information criteria.*
Source: Authors' elaboration.

Table 6. Threshold model (*risk1*) — Geography & Geo-politics

Parameter	*America (USA + Canada)*	*Europe (UK + France + Germany)*	*Asia (Japan)*	*All countries*
Threshold estimates				
WD_Proportion	0.1539	0.3077	0.1250	0.1539
SIC	1190.5268	859.7348	1374.3762	3790.615
Impact of WD_Proportion				
$\widehat{\beta_{11}}$	0.1332	2.3966***	1.3419*	0.6836***
$\widehat{\beta_{12}}$	0.3092**	2.7263***	1.5843***	0.7867***
Impact of covariates				
Size	-0.0010	-0.2515***	-0.0498**	-0.0335***
Leverage	-0.0034***	-0.0022	-0.0263***	-0.0113***
AIC	-748.8464	-227.3245	-398.7531	-902.5503
BIC	-726.8442	-207.4191	-376.8955	-876.8003
HQIC	-740.7266	-219.7843	-390.6588	-893.4888
N	**1809**	**1071**	**1737**	**4617**

*Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*
Source: Authors' elaboration.

Table 7. Threshold model (*risk2*) — Geography & Geo-Politics

Parameter	*America (USA + Canada)*	*Europe (UK + France + Germany)*	*Asia (Japan)*	*All countries*
Threshold estimates				
WD_Proportion	0.1429	0.2778	0.1250	0.1500
SIC	275.9400	943.9591	1693.3996	5617.1066
Impact of WD_Proportion				
$\widehat{\beta_{11}}$	-0.4125**	1.6722***	0.0256	0.1130
$\widehat{\beta_{12}}$	-0.2387	1.9414***	0.1533	0.2407***
Impact of covariates				
Size	0.0135	-0.1862***	0.0125	-0.0168**
Leverage	0.0122***	0.0012	-0.0084***	0.0033***
AIC	769.5607	-127.2300	-36.1570	913.2624
BIC	791.5628	-107.3246	-14.3173	939.0124
HQIC	777.6805	-119.6898	-28.0806	922.3239
N	**1809**	**1071**	**1737**	**4617**

Source: Authors' elaboration.
*Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

The results show that the presence of female directors above a threshold reduces a company's risk both across countries and across continents.

From the results, it is pertinent to note that, the three European countries (i.e. UK, France and Germany) and Europe as a continent have higher threshold as far as proportion of women director is concerned. From this we can infer that the proportion of women director is higher in European context beyond which there is an impact on firm risk. This should be understood in the socio-cultural context of different countries as well as continents. It is no coincidence that in Europe a lot of discussion, activism as well as legislation took place with respect to women's representation in board (Yang et al., 2019; Adams, 2016). From the tables above, it is evident that female directors have the least impact on corporate risk in Japan. In this context, it is noteworthy that according to the OECD (2021), women's representation is the lowest (among the G6 countries) on the boards of directors of Japanese firms. As the women have inadequate representation, they also have negligible power to influence the risk-taking behaviour of firms.

The novelty of this study lies in using the panel threshold regression method to analyze board gender diversity and firm risk. This study is also unique as it throws light on the issue of how the societal structure of different countries acts as a determinant of influence of women's presence in firm boards as far as firm risk is concerned.

5. DISCUSSION

The findings of previous research are consistent with our findings that the presence of women on boards can reduce risk and improve profitability (Nadeem et al., 2019; Sattar et al., 2023).

In the case of Japan, the presence of women directors has the least influence on the firm's risk. As the women's representation is lowest (among G6 countries) on boards of Japanese firms, they also have negligible power to influence the risk-taking behaviour of firms. The results of the previous studies do not match with our studies, which say that the presence of women directors reduces a firm's risk (Nakagawa & Schreiber, 2014; Tanaka, 2019).

Moving ahead to the USA, our study suggests that the presence of women directors reduces firms' risk. The results align with the previous studies as well (Shahzad et al., 2020; Liu & Wu, 2023).

Finally, in Canada, the same results were also obtained, that the presence of female directors on the board of directors reduces the risk of the firm. This is consistent with the results of previous studies (Chakraborty et al., 2019).

6. CONCLUSION

It is found that the presence of female directors beyond the threshold point reduces firm risk in all the countries analyzed here. It is further evident from the analysis that, in the context of European countries, the reduction in firm risk is highest if the proportion of female directors crosses the threshold point. This phenomenon should be understood in light of the societal structure of Europe. European society today is driven by egalitarianism (Knight & Brinton, 2017). As a result, the presence of female directors above the threshold influences the direction of the firm according to their thought processes. It is also pertinent to note that since the threshold is higher in the context of Europe, the presence of female directors beyond this point indicates substantial representation. So, they will have a bigger voice on the firm board. This finding is in support of critical mass theory (Kanter, 1987). Any agenda for change at the corporate board level requires a critical mass of women directors. The presence of a single woman director is mere token in nature, it is only the presence of two or more women directors that put them in a position to shape the boards' opinion (Kristie, 2011). Women directors feel more at ease and free to voice their opinions when at least another female director is present (Terjesen et al., 2009). The study by Post et al. (2011) provided further support for the critical mass theory since it was determined that the presence of two or more female directors was essential to influencing the board's viewpoint. In the advanced European countries taken into account in this paper, beyond the threshold point ensures the presence of at least two women directors.

Future research could consider additional control variables to understand this phenomenon. Additionally, how different sectors influence this phenomenon needs to be studied further. These may be considered as the limitations of the present study.

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